



Confirmatory factor analysis of the SLEEP-50 Questionnaire in Trichotillomania (Hair-Pulling Disorder) and Excoriation (Skin-Picking) Disorder[☆]



Emily J. Ricketts^{a,*}, Michelle Rozenman^{a,b}, Ívar Snorrason^{c,d}, Jocelyn B. Pérez^a, Micalla G. Peng^a, Jessica Kim^a, John Piacentini^a

^a Division of Child and Adolescent Psychiatry, University of California, Los Angeles, CA, USA

^b Department of Psychology, University of Denver, Denver, CO, USA

^c Division of Clinical Therapeutics, New York State Psychiatric Institute, New York, NY, USA

^d Department of Psychiatry, Columbia University Medical Center, New York, NY, USA

ARTICLE INFO

Keywords:

Sleep
Hair pulling
Skin picking
Internet

ABSTRACT

The study objective was to perform a confirmatory factor analysis of the SLEEP-50 Questionnaire (SLEEP-50) in Trichotillomania (Hair-Pulling Disorder) and Excoriation (Skin-Picking) Disorder and compare sleep complaints in adults with Trichotillomania, Excoriation Disorder and non-affected controls. Participants were 234 adults with Trichotillomania, 170 with Excoriation Disorder, and 146 non-affected controls. Participants rated sleep using the SLEEP-50 and Pittsburgh Sleep Quality Index (PSQI). Confirmatory factor analysis was used to assess fit of the originally-proposed SLEEP-50 factors within Trichotillomania and Excoriation Disorder. Findings revealed acceptable to good fit of the original factors. Internal consistency was excellent in Trichotillomania and good in Excoriation Disorder for the total score and poor to good for subscales. Convergent validity was strong for the total and weak to strong for subscales in both groups. Findings suggest greater sleep complaints in Trichotillomania and Excoriation Disorder than in the general population. Trichotillomania and Excoriation Disorder groups reported greater rates of sleep apnea, narcolepsy, restless leg syndrome/periodic limb movement disorder, circadian rhythms sleep disorder, and sleep-related affective disorder relative to controls. There were no significant differences for insomnia, sleep state misperception, sleepwalking, nightmares, or hypersomnia. Results underscore the importance of clinical assessment of sleep disorders in Trichotillomania and Excoriation Disorder.

1. Introduction

Trichotillomania (Hair-Pulling Disorder) and Excoriation (Skin-Picking) Disorder are body-focused repetitive behavior disorders classed within the Obsessive-Compulsive and Related Disorders section of the Diagnostic and Statistical Manual of Mental Disorder – 5th edition (APA, 2013). Trichotillomania and Excoriation Disorder involve recurrent pulling out of one's hair and picking, scratching, and/or squeezing of one's skin, respectively. Prevalence estimates suggest these disorders occur at rates of 0.6%–2.4% for Trichotillomania (Christenson et al., 1991; Duke et al., 2009, 2010; Grzesiak et al., 2017; King et al., 1995; Rothbaum et al., 1993), and 1.4–5.4% for Excoriation Disorder

(Bohne et al., 2002; Hayes et al., 2009; Keuthen et al., 2000, 2010). Trichotillomania and Excoriation Disorder are impairing conditions, associated with interference in interpersonal functioning, recreational activities, occupational and academic productivity, and quality of life, as well as increased emotional distress (i.e., feelings of embarrassment, shame, anxiety, depression; Odlaug et al., 2010; Tucker et al., 2011; Woods et al., 2006).

Individuals with Trichotillomania and Excoriation Disorder report disturbed sleep quality and patterns (i.e., poorer sleep quality, sleep disturbances, disruption due to daytime sleepiness, and need for sleep medications) at elevated levels relative to case controls. Additionally, poorer sleep functioning is associated with greater hair pulling and skin

[☆] The research reported in this publication was supported by the National Institute of Mental Health T32MH073517 research support and K23MH113884 grant funding to Dr. Ricketts, and UL1TR000124 grant funding to Dr. Rozenman. The content is the responsibility of the authors and is not necessarily representative of the views of the National Institutes of Health.

* Corresponding author.

E-mail address: ERicketts@mednet.ucla.edu (E.J. Ricketts).

<https://doi.org/10.1016/j.psychres.2019.01.022>

Received 13 June 2018; Received in revised form 17 December 2018; Accepted 5 January 2019

Available online 07 January 2019

0165-1781/ © 2019 Published by Elsevier B.V.

picking symptom severity (Ricketts et al., 2017a,b; Singareddy et al., 2003). Further, sleep may be a key contextual variable in symptom maintenance, as pulling and picking are reported to occur at bedtime or even during the sleep period in some (Ricketts et al., 2017a). Nevertheless, research on sleep in body-focused repetitive behavior disorders is sparse and the degree to which sleep difficulties reach diagnostic threshold within these populations has yet to be investigated.

There has been increasing awareness of the importance of sleep monitoring and intervention as part of comprehensive clinical assessment and treatment (Grandner and Pack, 2011). However, the general public may lack awareness of their own sleep problems (Perry et al., 2013; Wells and Vaughn, 2012), and existing knowledge gaps in sleep education among practicing health and mental health professionals are a barrier to providing appropriate assessment and care of patients with sleep complaints (Meltzer et al., 2009; Perry et al., 2013; Wells and Vaughn, 2012). Moreover, although measures of general sleep functioning (i.e., sleep timing, quality, duration, disturbance, etc.) such as the Pittsburgh Sleep Quality Index (Buysse et al., 1989) are widely used, the availability of validated measures assessing multiple types of sleep complaints (e.g., sleep apnea, insomnia, etc.) is quite limited (Klingman et al., 2017).

The SLEEP-50 Questionnaire (Spormaker et al., 2005) is a comprehensive self-report questionnaire assessing a range of sleep complaints and disorders, including sleep apnea, insomnia, narcolepsy, restless leg syndrome/periodic limb movement disorder, circadian rhythm sleep disorder, sleep walking, and nightmares, in addition to factors which may disrupt sleep, and the impact of sleep complaints on daily functioning. The scale has been used to assess sleep complaints in college student samples (Gaultney, 2010; Jain and Verma, 2016). Additionally, in the original psychometric investigation in healthy volunteers, sleep clinic patients, college students, and individuals with nightmares, the scale demonstrated good internal consistency, adequate to good test-retest reliability, and preliminary evidence for predictive validity with respect to clinical diagnosis (Spormaker et al., 2005). Further, a principal component analysis produced a ten-factor structure, explaining approximately 68% of the variance, with between factor correlations no higher than 0.30 (Spormaker et al., 2005). These findings provided initial support for the validity of the SLEEP-50 as a measure of sleep complaints and disorders. However, further psychometric analysis of this scale is needed, particularly with regard to other conditions (i.e., Trichotillomania, Excoriation Disorder) in which sleep problems may occur and influence disorder severity.

To date, no self-report measures of sleep complaints have been validated in individuals with body-focused repetitive behavior disorders, and research has yet to investigate rates of sleep complaints in individuals with body-focused repetitive behavior disorders. Therefore, the objective of the present study was to (1) perform a confirmatory factor analysis of the SLEEP-50 Questionnaire in Trichotillomania and Excoriation Disorder to assess the measure's psychometric properties in these affected groups and (2) compare the rate of sleep complaints by subjective report between adults reporting Trichotillomania, Excoriation Disorder, and a non-affected comparison group.

2. Methods

2.1. Participants and procedures

Participants were drawn from an internet survey assessing sleep functioning in adults with Trichotillomania, Excoriation Disorder and a healthy comparison sample (Ricketts et al., 2017a, b). Participants with Trichotillomania and/or Excoriation Disorder were recruited via a range of hair pulling and skin picking support and advocacy websites across a 4-month period from May 2015 to August 2015. The non-affected comparison sample was recruited through Amazon Mechanical Turk (<https://www.mturk.com/>), a website through which individuals can earn small monetary payment for completing tasks and surveys,

across a 7-day period between May and June 2015. Participants accessed the survey through a web link hosted by SurveyMonkey (<https://www.surveymonkey.com>). Participants recruited through hair pulling and skin picking websites read an institutional review board-approved study information form. Participants then completed eligibility questions assessing for English fluency, appropriate age (18 years or older), and presence of recurrent hair pulling or skin picking. Eligible participants were prompted to indicate study agreement. Those agreeing were directed to a 30-min sleep survey (described below) and did not receive monetary compensation. Only participants meeting DSM-5 diagnostic criteria for Trichotillomania and Excoriation Disorder (i.e., yes/no responses to separate questions corresponding with each criterion) were included in the original sample (Ricketts et al., 2017a).

The healthy comparison sample received \$0.05 through Amazon Mechanical Turk for completing a brief eligibility screen. Users viewed a posting advertising a 7-question survey to assess eligibility for a 30-minute sleep quality survey. The eligibility screen assessed for female status, English fluency, age 18 years or older, and absence of mental health problems or disorders, current/past recurrent hair pulling, and intellectual disability. Further, the posting was set to be viewable only by Amazon Mechanical Turk users residing in the United States with a 95% approval rating who had completed at least 50 prior tasks or surveys on the website. Those passing the eligibility screen were directed to an institutional review board-approved information form on SurveyMonkey. The form explained that the survey purpose was to assess sleep quality, patterns, and behavior in adults free of significant mental health problems or disorders; and the results of the study would be used to understand differences in sleep quality and patterns between those who are free of significant mental health problems or disorders, and those with mental health difficulties, including significant hair pulling and skin picking symptoms. After reading the consent enrollees were prompted to indicate study agreement or disagreement via checkboxes. Those agreeing to participate in the study continued on to the 30-minute sleep survey and received \$1.50 for completion. Any respondents who endorsed lifetime diagnosis of a psychiatric disorder by a health professional, current use of medications for mental health concerns, or any hair pulling or skin picking symptoms [i.e., a score of greater than zero on the Massachusetts General Hospital Hairpulling Scale (Keuthen et al., 1995) or Skin Picking Scale – Revised (Snorrason et al., 2012b)] during the survey were excluded. Additionally, failure to complete survey items following the consent, or failure of either of two attention check items resulted in exclusion from the final sample. See Ricketts et al. (2017a, b) for further information on methodology.

For the present analysis participants included 234 adults with Trichotillomania, 170 with Excoriation Disorder, and 146 non-affected controls who provided demographic information and at least partially completed the SLEEP-50 Questionnaire. The sample was 97.1% female and 11.6% racial/ethnic minority, age 35.7 on average (SD = 12.8) and 35.8% of married status. With respect to medication status, 22.4% of the entire sample reported taking medication to address sleep problems; and 27.8% and 22.6% of the Trichotillomania and Excoriation Disorder groups, respectively, reported taking psychotropic medication to address hair pulling/skin picking symptoms. See Table 1 for a comparison of demographic and clinical characteristics among the three groups.

2.2. Measures

2.2.1. Demographics and medical history

The survey assessed demographics (e.g., age, race, education, income level, marital status) in addition to medical and psychiatric history. We assessed self-report of lifetime psychiatric diagnosis (i.e., *Have you ever been diagnosed with a psychiatric disorder?*) and lifetime sleep diagnosis by a health professional (i.e., *Have you ever been diagnosed with a sleep disorder by a health professional?*) using a yes/no checklist of specific disorders generated through literature review by the authors

Table 1
Demographic and clinical characteristics of sample by group.

	Trichotillomania (n = 234)	Excoriation Disorder (n = 170)	Control (n = 146)	Test statistic	Overall sig.
Demographics					
Age M (SD)	32.30 (12.50) ^{c,f}	36.40 (13.60) ^d	38.60 (12.38) ^d	11.85 ^a	<0.001
Female n (%)	227 (97.0%)	162 (95.3%)	145 (99.3%)	4.59 ^c	0.08
Racial/Ethnic minority n (%)	27 (11.5%)	12 (7.1%) ^f	25 (17.1%) ^e	7.74 ^b	0.02
Married n (%)	67 (28.8%) ^f	60 (35.3%) ^f	70 (47.9%) ^{d,e}	14.40 ^b	0.001
Household income M (SD)	3.25 (1.78)	3.17 (1.65)	3.00 (1.54)	1.01 ^a	0.37
Medication for sleep n (%)	51 (22.4%) ^{e,f}	54 (32.0%) ^{d,f}	18 (12.6%) ^{d,e}	16.55 ^b	<0.001
Medication for Trichotillomania/Excoriation Disorder n (%)	63 (27.8%) ^f	38 (22.6%) ^f	0 (0.0%) ^{d,e}	47.58 ^b	<0.001
Self-report of lifetime diagnosis of co-occurring Sleep disorders given by a health professional n (%)					
Insomnia	27 (11.5%) ^f	22 (12.9%) ^{d,f}	3 (2.1%) ^e	12.94 ^b	0.002
Hypersomnia	2 (0.9%)	5 (2.9%)	0 (0.0%)	4.93 ^c	0.048
Bruxism	16 (6.8%)	19 (11.2%) ^f	4 (2.7%) ^e	8.53 ^b	0.01
Obstructive sleep apnea	12 (5.1%)	11 (6.5%)	2 (1.4%)	5.03 ^b	0.08
Delayed sleep phase syndrome	2 (0.9%)	2 (1.2%)	0 (0.0%)	1.45 ^c	0.58
Advanced sleep phase syndrome	0 (0.0%)	0 (0.0%)	0 (0.0%)	–	–
Narcolepsy	0 (0.0%)	1 (0.6%)	0 (0.0%)	2.03 ^c	0.58
Nocturia	0 (0.0%)	2 (1.2%)	0 (0.0%)	3.01 ^c	0.17
Night terror	3 (1.3%)	3 (1.8%)	0 (0.0%)	2.31 ^c	0.30
Restless leg syndrome	9 (3.8%)	7 (4.1%)	2 (1.4%)	2.35 ^c	0.30
Periodic limb movement disorder	0 (0.0%)	1 (0.6%)	0 (0.0%)	2.03 ^c	0.56
Rapid eye movement behavior disorder	0 (0.0%)	0 (0.0%)	0 (0.0%)	–	–
Sleep walking	1 (0.4%)	1 (0.6%)	1 (0.7%)	0.61 ^c	>0.99
Self-report of lifetime diagnosis of co-occurring psychiatric disorder by a health professional n (%)					
Trichotillomania (Hair-Pulling) Disorder	165 (70.5%) ^{c,f}	13 (2.4%) ^{d,f}	0 (0.0%) ^{d,e}	272.88 ^b	<0.001
Excoriation (Skin-Picking) Disorder	22 (9.4%) ^{c,f}	55 (32.4%) ^{d,f}	0 (0.0%) ^{d,e}	75.44 ^b	<0.001
Obsessive Compulsive Disorder	49 (20.9%) ^f	32 (18.8%) ^f	0 (0.0%) ^{d,e}	34.68 ^b	<0.001
Body dysmorphic disorder	5 (2.1%)	8 (4.7%) ^f	0 (0.0%) ^e	7.74 ^c	0.02
Anxiety disorder	105 (44.9%) ^f	91 (53.5%) ^f	0 (0.0%) ^{d,e}	113.27 ^b	<0.001
Mood disorder	77 (32.9%) ^{c,f}	74 (43.5%) ^{d,f}	0 (0.0%) ^{d,e}	80.80 ^b	<0.001
Posttraumatic stress disorder	23 (9.8%) ^f	24 (14.1%) ^f	0 (0.0%) ^{d,e}	20.89 ^b	<0.001
Attention deficit/Hyperactivity disorder	26 (11.1%) ^f	22 (12.9%) ^f	0 (0.0%) ^{d,e}	19.42 ^b	<0.001
Tourette syndrome/Persistent motor/Vocal tic disorder	1 (0.4%)	0 (0.0%)	0 (0.0%)	1.39 ^c	>0.99
Eating disorder	16 (6.8%) ^f	12 (7.1%) ^f	0 (0.0%) ^{d,e}	10.67 ^b	0.01
Alcohol/Substance use disorder	11 (4.7%) ^f	9 (5.3%) ^f	0 (0.0%) ^{d,e}	7.60 ^b	0.02
Schizophrenia	0 (0.0%)	0 (0.0%)	0 (0.0%)	–	–
Difficulties with Emotion Regulation Scale M (SD)					
Total	93.55 (24.50) ^f	95.20 (73.74) ^f	73.74 (20.32) ^{d,e}	33.78 ^a	<0.001

Note. Household income was rated on a scale of 1 through 6 where 1 = \$20,000 or less, 2 = \$20,001–\$40,000, 3 = \$40,001–\$60,000, 4 = \$60,001–\$80,000, 5 = \$80,001–\$100,000, 6 = \$100,000.

^a F statistic.

^b Chi-square test of independence.

^c Fisher's exact test.

^d Significantly different from Trichotillomania.

^e Significantly different from Excoriation Disorder.

^f Significantly different from controls.

(see Table 1 for a group comparison of percentage rates). In addition, we assessed for current use of psychiatric and sleep medications via yes/no items. Dimensional measures used in the current study are described below.

2.2.2. SLEEP-50 Questionnaire

The SLEEP-50 Questionnaire (SLEEP-50; Spormaker et al., 2005), as described above, is a self-report measure used to detect sleep complaints and disorders as classified in the Diagnostic and Statistical Manual of Mental Disorders – Fourth Edition, Text Revision (DSM-IV-TR; American Psychiatric Association, 2000). The SLEEP-50 includes nine subscales: sleep apnea, insomnia, narcolepsy, restless leg syndrome/periodic limb movement disorder, circadian rhythm sleep disorder, sleep walking, nightmares, factors influencing sleep, and impact of sleep complaints on daily functioning. Items are rated on a 4-point likert scale using the following anchors: 1 ('not at all'), 2 ('somewhat'), 3 ('rather much'), and 4 ('very much'). Items are summed to yield subscale totals and an overall total score, with higher scores indicative of poorer sleep functioning. Cutoff scores for each sleep subscale in conjunction with the impact subscale (i.e., greater than or equal to a

score of 15) are used to establish the presence of sleep disorder (i.e., whether symptoms reach a diagnostic threshold), with scoring also available for affective disorder, sleep state misperception and hypersomnia. However, in the absence of diagnostic interview we have instead used the term sleep complaints meeting clinical threshold. The SLEEP-50 has demonstrated high internal consistency, adequate to good test-retest reliability, acceptable construct validity, and preliminary support for predictive validity or sensitivity and specificity with respect to SLEEP-50 subscale scores and clinically-obtained sleep disorder diagnosis (Spormaker et al., 2005).

2.2.3. Pittsburgh Sleep Quality Index

The Pittsburgh Sleep Quality Index (PSQI; Buysse et al., 1989) is a 19-item self-report measure of sleep quality over a one-month period. It yields composite scores for subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction, in addition to a total score. It also features five supplemental items on the rater's sleep from the perspective of the bed partner or roommate. The PSQI has shown acceptable to good internal consistency (Beck et al., 2004; Carpenter and

Table 2
Factor loadings for SLEEP-50 Questionnaire items for Trichotillomania and Excoriation Disorder groups.

	Trichotillomania			Excoriation Disorder		
	Estimate	Standard error	p	Estimate	Standard error	p
Sleep apnea						
(1) I am told that I snore.	0.41	0.08	<0.001	0.32	0.08	<0.001
(2) I sweat during the night.	0.52	0.08	<0.001	0.49	0.08	<0.001
(3) I am told that I hold my breath when sleeping.	0.80	0.05	<0.001	0.66	0.09	<0.001
(4) I am told that I wake up gasping for air.	0.89	0.08	<0.001	0.80	0.10	<0.001
(5) I wake up with a dry mouth.	0.68	0.06	<0.001	0.62	0.07	<0.001
(6) I wake up during the night while coughing or being short of breath.	0.56	0.09	<0.001	0.71	0.09	<0.001
(7) I wake up with a sour taste in my mouth.	0.55	0.08	<0.001	0.57	0.08	<0.001
(8) I wake up with a headache.	0.67	0.08	<0.001	0.66	0.08	<0.001
Insomnia						
(9) I have difficulty in falling asleep.	0.88	0.03	<0.001	0.75	0.05	<0.001
(10) Thoughts go through my head and keep me awake.	0.90	0.02	<0.001	0.83	0.03	<0.001
(11) I worry and find it hard to relax.	0.84	0.03	<0.001	0.76	0.04	<0.001
(12) I wake up during the night.	0.70	0.05	<0.001	0.74	0.04	<0.001
(13) After waking up during the night, I fall asleep slowly.	0.66	0.05	<0.001	0.78	0.04	<0.001
(14) I wake up early and cannot get back to sleep.	0.54	0.05	<0.001	0.63	0.06	<0.001
(15) I sleep lightly.	0.50	0.06	<0.001	0.70	0.06	<0.001
(16) I sleep too little.	0.82	0.04	<0.001	0.74	0.05	<0.001
Narcolepsy						
(17) I see dreamlike images when falling asleep or waking up.	0.52	0.08	<0.001	0.54	0.07	<0.001
(18) I sometimes fall asleep on a social occasion.	0.69	0.09	<0.001	0.79	0.07	<0.001
(19) I have sleep attacks during the day.	0.60	0.08	<0.001	0.56	0.08	<0.001
(20) With intense emotions, my muscles sometimes collapse during the day.	0.68	0.10	<0.001	0.83	0.09	<0.001
(21) I sometimes cannot move when falling asleep or waking up.	0.37	0.10	<0.001	0.69	0.08	<0.001
Restless legs/Periodic limb movement disorder						
(22) I am told that I kick my legs when I sleep.	0.73	0.07	<0.001	0.64	0.09	<0.001
(23) I have cramps or pain in my legs during the night.	0.81	0.05	<0.001	0.75	0.07	<0.001
(24) I feel little shocks in my legs during the night.	0.77	0.06	<0.001	0.92	0.06	<0.001
(25) I cannot keep my legs at rest when falling asleep.	0.95	0.06	<0.001	0.77	0.08	<0.001
Circadian rhythm sleep disorder						
(26) I would rather go to bed at a different time.	0.73	0.06	<0.001	0.66	0.10	<0.001
(27) I go to bed at very different times (more than 2 hr difference).	0.72	0.06	<0.001	0.70	0.09	<0.001
(28) I do shift work.	0.49	0.11	<0.001	0.44	0.14	0.002
Sleepwalking						
(29) I sometimes walk when I am sleeping.	0.79	0.09	<0.001	0.86	0.10	<0.001
(30) I sometimes wake up in a different place than where I fell asleep.	0.56	0.11	<0.001	1.12	0.10	<0.001
(31) I sometimes find evidence of having performed an action during the night I do not remember.	0.84	0.09	<0.001	0.59	0.10	<0.001
Nightmares						
(32) I have frightening dreams (if not, go to Item 37).	0.61	0.06	<0.001	0.49	0.06	<0.001
(33) I wake up from these dreams.	0.49	0.07	<0.001	0.58	0.08	<0.001
(34) I remember the content of these dreams.	0.39	0.07	<0.001	0.36	0.10	<0.001
(35) I can orientate quickly after these dreams.	-0.30	0.08	<0.001	-0.14	0.12	0.27
(36) I have physical symptoms during or after these dreams (e.g., movements, sweating, heart palpitations, shortness of breath).	0.65	0.07	<0.001	0.48	0.08	<0.001
Factors influencing sleep						
(37) It is too light in my bedroom during the night.	0.43	0.08	<0.001	0.33	0.11	0.266
(38) It is too noisy in my bedroom during the night.	0.49	0.10	<0.001	0.27	0.10	0.002
(39) I drink alcoholic beverages during the evening.	0.09	0.09	.288	-0.22	0.11	0.010
(40) I smoke during the evening.	0.37	0.12	0.002	0.25	0.10	0.042
(41) I use other substances during the evening (e.g., sleep or other medication).	0.49	0.09	<0.001	0.17	0.10	0.087
(42) I feel sad.	0.80	0.04	<0.001	0.87	0.04	<0.001
(43) I have no pleasure or interest in daily occupations.	0.83	0.04	<0.001	0.85	0.04	<0.001
Impact of sleep complaints on daily functioning						
(44) I feel tired at getting up.	0.77	0.04	<0.001	0.84	0.04	<0.001
(45) I feel sleepy during the day and struggle to remain alert.	0.84	0.03	<0.001	0.79	0.04	<0.001
(46) I would like to have more energy during the day.	0.81	0.03	<0.001	0.86	0.03	<0.001
(47) I am told that I am easily irritated.	0.59	0.05	<0.001	0.69	0.05	<0.001
(48) I have difficulty in concentrating at work or school.	0.72	0.04	<0.001	0.72	0.05	<0.001
(49) I worry whether I sleep enough.	0.77	0.04	<0.001	0.72	0.05	<0.001
(50) Generally, I sleep badly.	0.94	0.03	<0.001	0.81	0.04	<0.001

Andrykowski, 1998; Grandner et al., 2006), good test-retest reliability (Backhaus et al., 2002), adequate convergence with measures of sleep problems, sleep restlessness, energy, and sleep diary (Backhaus et al., 2002; Grandner et al., 2006), fair to adequate divergence from unrelated measures (i.e., mood, depression, nausea, vomiting, taste change; Carpenter and Andrykowski, 1998; Grandner et al., 2006). The PSQI was used in this investigation to assess convergent validity.

2.2.4. Difficulties in Emotion Regulation Scale

The Difficulties in Emotion Regulation Scale (Gratz and

Roemer, 2004) is a 36-item measure of emotion dysregulation across multiple dimensions, yielding a total score and subscale scores for sub dimensions. Items are rated on a scale from 1 to 5, with higher scores indicative of greater emotion regulation difficulties. The scale demonstrates good test-retest reliability, adequate to high internal consistency, and adequate convergent and adequate predictive validity (Gratz and Roemer, 2004; Ritschel et al., 2015). The total score was used in the present study to clinically characterize the three groups (see Table 1).

2.3. Analytic plan

Confirmatory factor analysis (CFA) was performed in two separate analyses for Trichotillomania and Excoriation Disorder groups, respectively based on the original nine subscales derived by Spooormaker et al. (2005): sleep apnea, narcolepsy, restless legs/Periodic limb movement disorder, circadian rhythm sleep disorder, sleepwalking, nightmares, factors influencing sleep, and impact of sleep complaints on daily functioning. The CFAs were conducted in MPlus 7.1 (Muthén and Muthén, 2012) for ordinal data using weighted least squares estimation. Modification indices were not used to alter the model as an *a priori* test of the original structure supported in Spooormaker et al. (2005). Acceptability of model fit was determined with Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Tucker Lewis Index (TLI). CFI and TLI values greater than 0.90 suggest the model is a plausible fit for the data (Bentler, 1990). RMSEA values less than 0.08 suggest acceptable model fit, with values less than 0.05 indicating good model fit (Hu and Bentler, 1999). For interpretation of model fit, we relied on both chi-square and descriptive indices. Internal consistency was examined in each diagnostic group using Cronbach's alphas for the full scale and for each subscale. Cronbach's alpha values greater than or equal to 0.90 indicated excellent internal consistency, 0.80 to 0.89 were in the good range, 0.70 to 0.79 were in the fair range and <0.70 were in the poor range (Cicchetti, 1994). Finally, convergent validity was examined with bivariate correlations between individual SLEEP-50 and PSQI subscales based on the theoretical constructs assessed by individual subscales. SPSS 24.0 was used to conduct chi-squared analyses in order to compare rates of sleep complaints meeting clinical threshold as determined by SLEEP-50 cut-off scores between Trichotillomania, Excoriation Disorder, and the healthy comparison sample. For significant overall findings, follow-up chi-squared analyses were performed to assess between group differences.

3. Results

3.1. Confirmatory factor analysis of the Sleep-50 in Trichotillomania

For the Trichotillomania group, across three descriptive fit indices, the nine-factor model demonstrated good fit for the RMSEA (0.051), and CFI (0.88) and TLI (0.87) values fell slightly below the acceptable range of 0.90. The chi-square test indicated a statistically significant difference between the nine-factor model and the data (χ^2 [1139, $N = 228$] = 1816.64, $p < 0.001$). The majority of standardized factor loadings were moderate to high, although two items (item 35 “I can orientate quickly after these dreams [nightmares]”; item 39 “I drink alcoholic beverages in the evening”) did not load onto their intended factors (Item 35 on factor 7 = -0.302 ; item 39 on factor 8 = 0.092 ; see Table 2). Standardized inter-factor correlations were variable, ranging from negative and/or non-significant to high and statistically significant (see Table 3).

3.2. Internal consistency of the SLEEP-50 in Trichotillomania

Cronbach's alpha for the full scale (items 1–32 and 44–50) in the Trichotillomania group was (0.91). Alphas for the individual subscales were: sleep apnea (0.70), insomnia (0.85), narcolepsy (0.47), restless legs/PLMD (0.74), circadian rhythm sleep disorder (0.55), sleepwalking (0.39), nightmares (0.65), factors influencing sleep (0.56), and impact of sleep complaints on daily functioning (0.87).

3.3. Convergent validity between the SLEEP-50 and PSQI subscales in Trichotillomania

Large and statistically significant correlations were found between SLEEP-50 overall complaints ($r = 0.71$, $p < 0.001$) and SLEEP-50

impact ($r = 0.63$, $p < 0.001$) subscales and the PSQI Total. Similarly, large and statistically significant correlations were found between SLEEP-50 overall complaints ($r = 0.62$, $p < 0.001$) and SLEEP-50 impact ($r = 0.60$, $p < 0.001$) subscales and PSQI overall sleep quality subscale. As anticipated, correlations between the SLEEP-50 and PSQI differed across subscales, but overall were statistically significant and ranged from small to large depending on the subscales (see Table 4).

3.4. Confirmatory factor analysis of the SLEEP-50 in Excoriation Disorder

Similar to the Trichotillomania group, for the Excoriation Disorder group, the nine-factor model demonstrated good fit for RMSEA (0.05), with CFI (0.83) and TLI (0.82) values falling below the acceptable range of 0.90. The chi-square test indicated a statistically significant difference between the nine-factor model and the data (χ^2 [1139, $N = 164$] = 1699.28, $p < 0.001$). As with the Trichotillomania group, the majority of standardized factor loadings were moderate to high, although again two items did not load onto their intended factors (Item 35 on Factor 7, item 39 on Factor 8; see Table 2). Standardized inter-factor correlations were variable, ranging from negative and/or non-significant to high and statistically significant (see Table 3).

3.5. Internal consistency of the SLEEP-50 in Excoriation Disorder

Cronbach's alpha for the full scale in the Excoriation Disorder group was 0.89. Alphas for the individual subscales were: sleep apnea (0.67), insomnia (0.85), narcolepsy (0.63), restless legs/PLMD (0.74), circadian rhythm sleep disorder (0.47), sleepwalking (0.66), nightmares (0.66), factors influencing sleep (0.41), and impact of sleep complaints on daily functioning (0.86).

3.6. Convergent validity between the SLEEP-50 and PSQI subscales in Excoriation Disorder

Large and statistically significant correlations were found between SLEEP-50 overall complaints ($r = 0.58$, $p < 0.001$) and impact ($r = 0.56$, $p < 0.001$) subscales and the PSQI Total. Similarly, medium-to-large and statistically significant correlations were found between SLEEP-50 overall complaints ($r = 0.44$, $p < 0.001$) and impact ($r = 0.60$, $p < 0.001$) subscales and PSQI overall sleep quality subscale. As anticipated, correlations between the SLEEP-50 and PSQI differed across other subscales, but overall were statistically significant and ranged from small to large depending on the subscale (see Table 4).

3.7. Comparison of rates of SLEEP-50 sleep complaints meeting clinical threshold in Trichotillomania, Excoriation Disorder and a healthy comparison group

Both Trichotillomania and Excoriation Disorder groups exhibited significantly higher rates of sleep apnea, narcolepsy, restless leg syndrome/periodic limb movement disorder, circadian rhythms sleep disorder, affective disorder, and one or more sleep complaints meeting clinical threshold relative to the control group (see Table 5). No significant overall group differences were found for insomnia, sleep state misperception, sleepwalking, nightmares, or hypersomnia.

4. Discussion

In the present study, we confirmed the factor structure of a sleep questionnaire in Trichotillomania and Excoriation Disorder and compared rates of sleep complaints meeting clinical threshold among adults with Trichotillomania, Excoriation Disorder and healthy controls. Consistent with the original psychometric analysis of the SLEEP-50 (Spooormaker et al., 2005), present results support the original nine-factor model in both the Trichotillomania and Excoriation Disorder samples. In contrast to original findings, the item “I can orientate

Table 3
SLEEP-50 Questionnaire inter-factor correlations for Trichotillomania and Excoriation Disorder.

Factor	Trichotillomania								Excoriation Disorder									
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
(1) Sleep apnea	–									–								
(2) Insomnia	0.43***	–								0.41***	–							
(3) Narcolepsy	0.54***	0.62***	–							0.81***	0.37***	–						
(4) Restless legs/ PLMD	0.55***	0.46***	0.51***	–						0.54***	0.41***	0.56***	–					
(5) CRSD	0.32***	0.57***	0.73***	0.28**	–					0.10***	0.26**	0.33*	0.28*	–				
(6) Sleepwalking	–0.21**	0.52***	0.733***	0.47***	0.58***	–				0.41**	0.12	0.23***	0.48***	–0.81***	–			
(7) Nightmares	0.71***	0.76***	0.61***	0.70***	0.50***	0.53**	–			0.71***	0.61***	1.21***	0.66***	0.10	0.28***	–		
(8) Factors influencing sleep	0.40***	0.63***	0.68***	0.34***	0.59***	0.12	0.46***	–		0.50***	0.55***	0.57***	0.43***	0.35**	0.50***	0.46***	–	
(9) Impact	0.44***	0.69***	0.72***	0.39***	0.73***	0.56***	0.68***	0.75***	–	0.50***	0.62***	0.70***	0.38***	0.38***	0.33***	0.58***	0.75***	–

Note. Trichotillomania (Hair-Pulling Disorder); Excoriation (Skin-Picking) Disorder; CRSD = Circadian rhythm sleep disorder; Impact = Impact of sleep complaints on daily functioning

* $p < 0.0$.
** $p < 0.01$.
*** $p < 0.001$.

Table 4
Inter-correlations between SLEEP-50 Questionnaire and Pittsburgh Sleep Quality Index Subscales.

Pittsburgh Sleep Quality Index Subscales and Total Score Trichotillomania										
		Overall Sleep quality	Sleep latency	Sleep duration	Sleep efficiency	Sleep disturbance	Needs meds to sleep	Daytime dysfunction due to sleepiness	Total score	
SLEEP-50 Questionnaire Subscales and Total Score	(1) Sleep apnea	0.35***	0.21**	0.09	0.23***	0.50***	0.20**	0.26***	0.40***	
	(2) Insomnia	0.63***	0.65***	0.05	0.55***	0.42***	0.29***	0.42***	0.75***	
	(3) Narcolepsy	0.39***	0.22**	0.07	0.27***	0.34***	–0.01	0.51***	0.41***	
	(4) Restless leg syndrome/PLMD	0.42***	0.35***	0.08	0.24***	0.31***	0.10	0.31***	0.43***	
	(5) CRSD	0.36***	0.28***	0.07	0.29***	0.22**	0.05	0.37***	0.42***	
	(6) Sleepwalking	0.19**	0.16*	0.06	0.16*	0.08	0.0002	0.28***	0.25**	
	(7) Nightmares	0.34***	0.18**	0.12	0.19**	0.39***	0.08	0.34***	0.39***	
	(8) Factors influencing sleep	0.43***	0.37***	0.05	0.34***	0.24***	0.40***	0.47***	0.57***	
	(9) Impact	0.60***	0.39***	0.10	0.38***	0.28***	0.20**	0.63***	0.63***	
	(10) Overall complaints	0.62***	0.49***	0.12	0.46***	0.54***	0.21**	0.52***	0.71***	
Pittsburgh Sleep Quality Index Subscales and total score Excoriation (Skin-Picking) Disorder										
		Overall sleep quality	Sleep latency	Sleep duration	Sleep efficiency	Sleep disturbance	Needs meds to sleep	Daytime dysfunction due to sleepiness	Total score	
SLEEP-50 Questionnaire Subscales and Total Score	(1) Sleep apnea	0.23**	0.12	0.12	0.02	0.41***	0.22**	0.26**	0.39**	
	(2) Insomnia	0.60***	0.59***	0.01	0.35***	0.45***	0.22**	0.33***	0.65***	
	(3) Narcolepsy	0.17*	0.04	0.11	0.08	0.37***	0.02	0.50***	0.31***	
	(4) Restless leg syndrome/PLMD	0.29***	0.12	0.05	0.05	0.33***	–0.001	0.12	0.23**	
	(5) CRSD	0.16*	0.23**	0.03	–0.002	0.03	–0.08	0.17*	0.15	
	(6) Sleepwalking	0.06	0.02	0.03	0.08	0.03	0.21**	0.12	0.17*	
	(7) Nightmares	0.06	0.17*	0.03	0.06	0.35***	0.07	0.24**	0.23**	
	(8) Factors influencing sleep	0.39***	0.19*	0.10*	0.15	0.29***	0.31***	0.43***	0.51***	
	(9) Impact	0.60***	0.34***	0.02	0.21**	0.33***	0.07	0.64***	0.56***	
	(10) Overall complaints	0.44***	0.41***	0.08	0.20*	0.56***	0.18*	0.43***	0.58***	

Note. PLMD = Periodic limb movement disorder; CRSD = Circadian rhythms sleep Disorder; Impact = Impact of sleep complaints on daily functioning

* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

quickly after these dreams” did not load onto the nightmares scale, and the item “I drink alcoholic beverages in the evening” did not load onto the factors influencing sleep scale. This may be partially attributed to the original study having an increased ratio of participants with clinically significant sleep problems relative to our sample. The original

study included nightmare sufferers, and clinical sleep disorder patients in addition to college students and healthy volunteers. Further, there may be decreased applicability of these particular items to the corresponding subscales. For example, although becoming oriented quickly following a nightmare is part of the diagnostic criteria for nightmare

Table 5
Sleep complaints based on SLEEP-50 Questionnaire cut-off scores.

	Trichotillomania (n = 234)	Excoriation Disorder (n = 170)	Control (n = 146)	χ^2	Overall sig.
Sleep apnea	17.1% ^c	19.7% ^c	6.5% ^{a,b}	11.18	0.004
Insomnia	38.5%	35.7%	26.1%	5.77	0.06
Affective disorder	32.1% ^c	31.0% ^c	12.9% ^{a,b}	18.53	<0.001
Sleep state misperception	1.9%	1.3%	0%	2.55	0.28
Narcolepsy	32.9% ^c	36.3% ^c	16.1% ^{a,b}	16.61	<0.001
Restless leg syndrome/Periodic limb movement disorder	19.7% ^c	24.4% ^c	11.4% ^{a,b}	8.24	0.02
Circadian rhythm sleep disorder	13.8% ^c	12.1% ^c	5.1% ^{a,b}	6.95	0.03
Sleepwalking	0.9%	1.3%	0%	1.64	0.44
Nightmares	19.8%	13.4%	5.3%	4.63	0.10
Hypersomnia	3.6%	5.5%	2.4%	1.33	0.52
> = 1 Sleep disorder	63.6% ^c	66.5% ^c	39.0% ^{a,b}	28.34	<0.001

Note.

^a Significantly different from Trichotillomania.

^b Significantly different from Excoriation Disorder.

^c Significantly different from controls.

disorder, the average respondent may be less likely to perceive this particular symptom as hallmark of nightmares relative to the other symptoms listed in the subscale (i.e., frightening dreams, waking up from these dreams, recalling content of these dreams, physical symptoms). Additionally, although alcohol consumption can interfere with sleep, consumption of alcoholic beverages in the evening may be less specifically linked to sleep compared to other factors in this subscale (e.g., light, noise, sadness, etc.). With respect to internal consistency, values were similar between Trichotillomania and Excoriation Disorder groups and comparable to those found in the initial investigation (Spoomaker et al., 2005). Consistent with the original study, several subscale alphas in the present study were poor. This may be related to the presence of a small number of items (i.e., 3 or 4) in those subscales (Graham, 2006) or variation in the conceptual ties among subscale items. Overall, the internal consistency for the full SLEEP-50 scale was excellent in Trichotillomania and good in Excoriation Disorder, with moderate to strong convergent validity found between the SLEEP-50 Total and PSQI Total. These findings are consistent with the original psychometric analysis (Spoomaker et al., 2005) and support the psychometric properties of the SLEEP-50 in Trichotillomania and Excoriation Disorder samples.

Findings showed Trichotillomania and Excoriation Disorder groups exhibited sleep complaints meeting clinical threshold at significantly higher rates (i.e., 63.6% for Trichotillomania and 66.5% for Excoriation Disorder) relative to the control group (39.0%). Trichotillomania and Excoriation Disorder groups showed higher rates of sleep apnea, narcolepsy, restless leg syndrome/periodic limb movement disorder, circadian rhythms sleep disorder, and affective disorder symptoms relative to the control group. Findings only approached significance for differences in rates of insomnia, which may be due to the sizeable number of controls (26.1%) meeting cutoff for insomnia. Except for rates of insomnia and presence of one or more sleep complaints meeting clinical threshold, rates in the control group were comparable to those reported in prior college student samples using the SLEEP-50 (Gaultney, 2010; Jain and Verma, 2016). Thus, although the SLEEP-50 does not replace or parallel a diagnostic interview with a trained clinician, these rates indicate elevated sleep complaints in the control group that are consistent with prior investigations.

Despite a lack of prior research on sleep disorders in Trichotillomania and Excoriation Disorder from which to compare present findings, a recent study showed adults with Obsessive-Compulsive Disorder exhibited increased rates of self-reported insomnia, parasomnia, circadian rhythms sleep disorders, hypersomnia, and sleep breathing disorder relative to healthy controls, with no significant differences in restless leg syndrome/periodic limb movement disorder (Donse et al., 2017). This suggests that the presence of sleep complaints is common in other obsessive-compulsive spectrum

disorders.

Of note, affective disorder and narcolepsy were the only sleep complaints for which there was a significant group difference beyond the alpha level of 0.001. Although not an overt sleep problem per se, the higher relative rates of affective disorder (which encompassed worry-related difficulty relaxing, rumination-related sleep disruption, loss of pleasure/interest in daily activities, tiredness upon waking) in Trichotillomania and Excoriation Disorder are not surprising given that these conditions co-occur most frequently with internalizing disorders (Snorrason et al., 2012a). Further, a comparison of clinical characteristics among groups (see Table 1) revealed greater difficulties regulating emotions in Trichotillomania and Excoriation Disorder groups relative to controls. Together, these findings may suggest co-occurring internalizing symptoms and emotion dysregulation are key contributing factors to sleep disturbance in individuals with these conditions. Conversely, disturbed sleep may exacerbate internalizing symptoms or emotion regulation difficulties (Gruber and Cassoff, 2014), which in turn may lead to increased hair pulling or skin picking symptoms (Alexander et al., 2018).

With respect to narcolepsy, the rates of individuals meeting clinical cutoff were high across Trichotillomania (32.9%), Excoriation Disorder (36.3%), and controls (16.1%) relative to its low prevalence (approximately 0.05%) in the general population (Scammell, 2015). However, the rate of narcolepsy in controls in our sample is comparable with the rate of narcolepsy found in a college sample (16.0%; Gaultney, 2010). In the initial validation of the SLEEP-50 (Spoomaker et al., 2005), the authors noted that the narcolepsy subscale was “problematic” with one item (sleep attacks) loading on the impact subscale, and another item (hypnagogic hallucinations) loading on the nightmares subscale. Furthermore, some of the items of this subscale may capture general daytime sleepiness (not narcolepsy per se) yielding high rates of false positives. If such is the case, the presence of general daytime sleepiness may be a function of co-occurring depressive symptoms in those with Trichotillomania and Excoriation Disorder and/or a daytime consequence of insufficient sleep.

Moreover, impaired neurotransmission may play a role in the expression of both body-focused repetitive behaviors and sleep disturbance. For example, elevated levels of glutamate, an excitatory neurotransmitter, which has been implicated in both Trichotillomania (Grant et al., 2009) and Excoriation Disorder (Grant et al., 2016) plays a key role in regulation of wakefulness, arousal and thought processes (Miller and O’Callaghan, 2006). Impaired glutamatergic neurotransmission has been linked with anxiety, hyperarousal, and difficulty falling asleep at bedtime (Durant et al., 2009; Kay and Buysse, 2017). Further, as a portion of the sample were taking psychotropic medication to address hairpulling or skin picking symptoms, one consideration is that side effects (e.g., insomnia, drowsiness) of medication (e.g., SSRIs;

Carvalho et al., 2016; Grant and Chamberlain, 2016) may have accounted for the occurrence of sleep problems in some.

Findings are preliminary and should be interpreted with caution, and future studies are needed to confirm these results. The present study is not without limitations. Trichotillomania and Excoriation Disorder categorization, in addition to self-report of co-occurring lifetime psychiatric and sleep disorder diagnosis, were not confirmed by a clinician or assessed using validated measures. Additionally, sleep complaints were determined by subjective report and clinical cutoff scores. Therefore, the degree to which findings would be consistent with clinical diagnosis is unclear. Additionally, the survey goal was to assess sleep and it was described accordingly to all participants. This description may have resulted in a selection bias (i.e., those with sleep problems may have been more likely to participate in the survey than those without). However, this limitation applies to all study groups. Further, individuals who use AMT may possess distinct behavioral characteristics (e.g., increased social desirability; Behrend et al., 2011) and sleep features from that of the general population. Nevertheless, with the exception of rates of insomnia, and 'one or more sleep complaints' meeting clinical threshold, rates within the comparison group were consistent with those reported for college students in prior studies using the SLEEP-50 (Gaultney, 2010; Jain and Verma, 2016). Additionally, monetary gain potentially increased comparison group motivation to partake in the study.

Despite these limitations, the findings suggest sleep complaints may be relatively common in Trichotillomania and Excoriation Disorder. Findings also provide initial direction as to the types of sleep complaints which may be present in Trichotillomania and Excoriation Disorder if assessed clinically, and underscore the importance of clinical assessment of sleep in these populations. Despite a growing societal awareness of the importance of sleep health, many individuals lack knowledge of their own sleep functioning (Perry et al., 2013; Wells and Vaughn, 2012). Thus, individuals seeking treatment for hair pulling or skin picking may not be likely to report sleep complaints unless explicitly asked by a treatment provider. Further, clinicians may lack the tools to assess for sleep problems. Present findings suggest that the SLEEP-50 is a valid self-report tool, which may serve to facilitate and standardize screening of multiple sleep complaints among individuals with Trichotillomania and Excoriation Disorder.

Declarations of interest

Dr. Ricketts has received research support from the National Institute of Mental Health (NIMH), the Tourette Association of America (TAA), and the TLC Foundation for Body-Focused Repetitive Behaviors.

Dr. Rozenman has received research support from the NIMH.

Dr. Snorrason has no potential conflicts of interest to disclose.

Miss Perez, Miss Peng, and Miss Kim have no potential conflicts of interest to disclose.

Dr. Piacentini has received grant or research support from the NIMH, Pfizer Pharmaceuticals through the Duke University Clinical Research Institute CAPTN Network, Psyadon Pharmaceuticals, and the TAA. He has received financial support from the Petit Family Foundation and the Tourette Syndrome Association Center of Excellence Gift Fund. He has received royalties from Guilford Press and Oxford University Press. He has served on the speakers' bureau of the TAA, the International Obsessive Compulsive Disorder Foundation, and the TLC Foundation for Body-Focused Repetitive Behaviors.

References

- Alexander, J.R., Houghton, D.C., Bauer, C.C., Lench, H.C., Woods, D.W., 2018. Emotion regulation deficits in persons with body-focused repetitive behavior disorders. *J. Affect. Disord.* 227, 463–470.
- American Psychiatric Association, 2000. *Diagnostic and Statistical Manual of Mental Disorders*, fourth ed. Text revision. American Psychiatric Association, Washington, DC.
- American Psychiatric Association, 2013. *Diagnostic and Statistical Manual of Mental Disorders*, fifth ed. American Psychiatric Association, Washington, DC.
- Backhaus, J., Junghanns, K., Broocks, A., Riemann, D., Hohagen, F., 2002. Test-retest reliability and validity of the Pittsburgh Sleep Quality Index in primary insomnia. *J. Psychosom. Res.* 53, 737–740.
- Beck, S.L., Schwartz, A.L., Towsley, G., Dudley, W., Barsevick, A., 2004. Psychometric evaluation of the Pittsburgh Sleep Quality Index in cancer patients. *J. Pain Symptom Manage.* 27, 140–148.
- Behrend, T.S., Sharek, D.J., Meade, A.W., Wiebe, E.N., 2011. The viability of crowdsourcing for survey research. *Behav. Res. Methods.* 43, 800–813.
- Bentler, P.M., 1990. Comparative fit indexes in structural models. *Psychol. Bull.* 107, 238–246.
- Bohne, A., Wilhelm, S., Keuthen, N.J., Baer, L., Jenike, M.A., 2002. Skin picking in German students: prevalence, phenomenology, and associated characteristics. *Behav. Modif.* 26, 320–339.
- Buyse, D.J., Reynolds, C.F., Monk, T.H., Berman, S.R., Kupfer, D.J., 1989. The Pittsburgh sleep quality index (PSQI): a new instrument for psychiatric research and practice. *Psychiatry Res.* 28, 193–213.
- Carpenter, J.S., Andrykowski, M.A., 1998. Psychometric evaluation of the Pittsburgh Sleep Quality Index. *J. Psychosom. Res.* 45, 5–13.
- Carvalho, A.F., Sharma, M.S., Brunoni, A.R., Vieta, E., Fava, G.A., 2016. The safety, tolerability and risks associated with the use of newer generation antidepressant drugs: a critical review of the literature. *Psychother. Psychosom.* 85, 270–288.
- Christenson, G.A., Pyle, R.A., Mitchell, J.E., 1991. Estimated lifetime prevalence of trichotillomania in college students. *J. Clin. Psychiatry.* 52, 415–417.
- Cicchetti, D.V., 1994. Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology. *Psychol. Assess.* 6, 284–290.
- Donse, L., Sack, A.T., Fitzgerald, P.B., Arns, M., 2017. Sleep disturbances in obsessive-compulsive disorder: association with non-response to repetitive transcranial magnetic stimulation (rTMS). *J. Anxiety. Disord.* 49, 31–39.
- Duke, D.C., Bodzin, D.K., Tavares, P., Geffken, G.R., Storch, E.A., 2009. The phenomenology of hairpulling in a community sample. *J. Anxiety Disord.* 23, 1118–1125.
- Duke, D.C., Keeley, M.L., Ricketts, E.J., Geffken, G.R., Storch, E.A., 2010. The phenomenology of hairpulling in college students. *J. Psychopathol. Behav. Assess.* 32, 281–292.
- Durant, C., Christmas, D., Nutt, D., 2010. The pharmacology of anxiety. *Curr. Top. Behav. Neurosci.* 2, 303–330.
- Gaultney, J.F., 2010. The prevalence of sleep disorder in college students: Impact on academic performance. *J. Am. Coll. Health.* 59, 91–97.
- Graham, J.M., 2006. Congeneric and (essentially) tau-equivalent estimates of score reliability. What they are and how to use them. *Educ. Psychol. Meas.* 66, 930–944.
- Grandner, M.A., Kripke, D.F., Yoon, L., Youngstedt, S.D., 2006. Criterion validity of the Pittsburgh Sleep Quality Index: Investigation in a non-clinical sample. *Sleep Biol. Rhythms.* 4, 129–139.
- Grandner, M.A., Pack, A.I., 2011. Sleep disorders, public health, and public safety. *JAMA* 306, 2616–2617.
- Grant, J.E., Chamberlain, S.R., 2016. Trichotillomania. *Am. J. Psychiatry.* 173, 868–874.
- Grant, J.E., Chamberlain, S.R., Redden, S.A., Leppink, E.W., Odlaug, B.L., Kim, S.W., 2016. N-Acetylcysteine in the treatment of excoriation disorder: a randomized clinical trial. *JAMA Psychiatry* 73, 490–496.
- Grant, J.E., Odlaug, B.L., Kim, S.W., 2009. N-Acetylcysteine, a glutamate modulator, in the treatment of trichotillomania: a double-blind, placebo-controlled study. *Arch. Gen. Psychiatry.* 66, 756–763.
- Gratz, K.L., Roemer, L., 2004. Multidimensional assessment of emotion regulation and dysregulation: development, factor structure, and initial validation of the difficulties in emotion regulation scale. *J. Psychopathol. Behav. Assess.* 26, 41–54.
- Gruber, R., Cassoff, J., 2014. The interplay between sleep and emotion regulation: conceptual framework empirical evidence and future directions. *Curr. Psychiatry Rep.* 16, 500.
- Grzesiak, M., Reich, A., Szepietowski, J.C., Hadryś, T., Pacan, P., 2017. Trichotillomania among young adults: prevalence and comorbidity. *Acta Derm. Venereol.* 97, 509–512.
- Hayes, S.L., Storch, E.A., Berlanga, L., 2009. Skin picking behaviors: an examination of the prevalence and severity in a community sample. *J. Anxiety Disord.* 23, 314–319.
- Hu, L.T., Bentler, P.M., 1999. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct. Equ. Model.* 6, 1–55.
- Jain, A., Verma, S., 2016. Prevalence of sleep disorders among college students: a clinical study. *JAMDSR* 4, 103–106.
- Kay, D.B., Buyse, D.J., 2017. Hyperarousal and beyond: New insights to the pathophysiology of Insomnia Disorder through functional neuroimaging studies. *Brain Sci* 7, 23.
- Keuthen, N.J., Deckersbach, T., Wilhelm, S., Hale, E., Fraim, C., Baer, L., O'Sullivan, R.L., Jenike, M.A., 2000. Repetitive skin-picking in a student population and comparison with a sample of self-injurious skin-pickers. *Psychosomatics* 41, 210–215.
- Keuthen, N.J., Koran, L.M., Aboujaoude, E., Large, M.D., Serpe, R.T., 2010. The prevalence of pathologic skin picking in US adults. *Compr. Psychiatry.* 51, 183–186.
- Keuthen, N.J., O'Sullivan, R., Ricciardi, J.N., Shera, D., Savage, C.R., Borgmann, A.S., Jenike, M.A., Baer, L., 1995. The Massachusetts General Hospital (MGH) hairpulling scale: 1. development and factor analyses. *Psychother. Psychosom.* 65, 141–156.
- King, R.A., Zohar, A.H., Ratzoni, G., Binder, M., Kron, S., Dycian, A., Cohen, D.J., Pauls, D.L., Apter, A., 1995. An epidemiological study of trichotillomania in Israeli adolescents. *J. Am. Acad. Child. Adolesc. Psychiatry.* 34, 1212–1215.
- Klingman, K.J., Jungquist, C.R., Perlist, M.L., 2017. Questionnaires that screen for multiple sleep disorders. *Sleep Med. Rev.* 32, 37–44.
- Meltzer, L.J., Phillips, C., Mindell, J.A., 2009. Clinical psychology training in sleep and sleep disorders. *J. Clin. Psychol.* 65, 305–318.

- Miller, D.B., O'Callaghan, J.P., 2006. The pharmacology of wakefulness. *Metabolism* 55 (10 Suppl 2), S13–S19.
- Muthén, L.K., Muthén, B.O., 2012. *Mplus User's Guide*, Seventh ed. Muthén and Muthén, Los Angeles, CA.
- Odlaug, B.L., Kim, S.W., Grant, J.E., 2010. Quality of life and clinical severity in pathological skin picking and trichotillomania. *J. Anxiety Disord.* 24, 823–829.
- Perry, G.S., Patil, S.P., Presley-Cantrell, L.R., 2013. Raising awareness of sleep as a healthy behavior. *Prev. Chronic Dis.* 10, E133.
- Ricketts, E.J., Snorrason, I., Rozenman, M., Colwell, C.S., McCracken, J.T., Piacentini, J., 2017a. Sleep functioning in adults with trichotillomania (hair-pulling disorder), excoriation (skin-picking) disorder, and a non-affected comparison sample. *J. Obsessive Compuls. Relat. Disord.* 23, 49–57.
- Ricketts, E.J., Snorrason, I., Rozenman, M., Colwell, C.S., McCracken, J.T., Piacentini, J., 2017b. Corrigendum to “sleep functioning in adults with trichotillomania (hair-pulling disorder), excoriation (skin-picking) disorder, and a non-affected comparison sample. *J. Obsessive Compuls. Relat. Disord.* 23, 49–57.
- Ritschel, L.A., Tone, E.B., Schoemann, A.M., Lim, N.E., 2015. Psychometric properties of the difficulties in emotion regulation scale across demographic groups. *Psychol. Assess.* 27, 944–954.
- Rothbaum, B.O., Shaw, L., Morris, R., Ninan, P.T., 1993. Prevalence of trichotillomania in a college freshman population. *J. Clin. Psychiatry* 54, 72.
- Singareddy, R., Moin, A., Spurlock, L., Merritt-Davis, O., Uhde, T.W., 2003. Skin picking and sleep disturbances. *Depress. Anxiety.* 18, 228–232.
- Snorrason, I., Belleau, E.L., Woods, D.W., 2012a. How related are hair pulling disorder (trichotillomania) and skin picking disorder? A review of evidence for comorbidity, similarities and shared etiology. *Clin. Psychol. Rev.* 32, 618–629.
- Snorrason, I., Olafsson, R.P., Flessner, C.A., Keuthen, N.J., Franklin, M.E., Woods, D.W., 2012b. The skin picking scale-revised: factor structure and psychometric properties. *J. Obsessive Compuls. Relat. Disord.* 1, 133–137.
- Spoormaker, V.I., Verbeek, I., van den Bout, J., Klip, E.C., 2005. Initial validation of the SLEEP-50 questionnaire. *Behav. Sleep. Med.* 3, 227–246.
- Tucker, B.T.P., Woods, D.W., Flessner, C.A., Franklin, S.A., Franklin, M.E., 2011. The skin picking impact project: phenomenology, interference, and treatment utilization of pathological skin picking in a population-based sample. *J. Anxiety Disord.* 25, 88–95.
- Wells, M.E., Vaughn, B.V., 2012. Poor sleep challenging the health of a nation. *Neurodiagn. J.* 52, 233–249.
- Woods, D.W., Flessner, C.A., Franklin, M.E., Keuthen, N.J., Goodwin, R.D., Stein, D.J., Walther, M.R., Trichotillomania Learning Center-Scientific Advisory Board, 2006. The trichotillomania impact project (TIP): exploring phenomenology, functional impairment, and treatment utilization. *J. Clin. Psychiatry.* 67, 1877–1888.