Systematic Review / *Sistematik Derleme*

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Psychobiological Personality Traits Related to Sleep Disorders and Sexual Dysfunction: A Systematic Review and Meta-analysis

Uyku Bozuklukları ve Cinsel İşlev Bozuklukları ile İlgili Psikobiyolojik Kişilik Özellikleri: Sistematik Bir Derleme ve Meta-analiz

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Abstract

Sleep and its disorders are still the least understood phenomena in biology. This systematic review aims to identify four personality psychobiological models related to sleep disorders and sexual dysfunction. The literature search for English-language records was conducted on the Web of Science, Scopus, PubMed, ProQuest and Cochrane databases from January 1990 to April 2019. According to the number of studies available related to research variables and heterogeneous designs, the pooled effect size was calculated separately for both case-control and correlation studies using the random-effects method because of the heterogeneity of the studies and use of the I^2 measure. The numbers of studies on parasomnias, Restless Legs syndrome, sleep breathing disorders, daytime sleepiness and sexual dysfunction were minimal. However, the present meta-analysis on four studies on insomnia showed that the cases and controls in harm avoidance (HA) are significantly different (p=0.001). Another meta-analysis on 11 studies showed that a significant correlation exists between poor sleep quality assessed using the Pittsburgh Sleep Quality index with negative affect (NA) (z=10.437, p<0.001) and positive affect (PA) (z=-6.826, p<0.001). In addition to the few studies on sleep and sexual disorders, the greater challenge is the wide range of these disorders, making it difficult to perform a comprehensive meta-analysis and draw a conclusion. Generally, NA/PA and HA may play critical roles in sleep quality and insomnia, respectively. These findings and limitations are debatable.

Keywords: Character, meta-analysis, personality, sexual dysfunction, sleep disorders, temperament

Öz

Uyku ve bozuklukları halen biyolojide en az anlaşılan fenomenlerden biridir. Bu sistematik derleme, uyku bozuklukları ve cinsel işlev bozukluğu ile ilgili dört kişilik psikobiyolojik modelini tanımlamayı amaçlamaktadır. Ocak 1990'dan Nisan 2019'a kadar olan İngilizce dilindeki kayıtlar için literatür taraması Web of Science, Scopus, PubMed, ProQuest ve Cochrane veri tabanlarında gerçekleştirilmiştir. Araştırma değişkenleri ve heterojen tasarımlarla ilgili mevcut çalışma sayısına göre havuzlanmış etki büyüklüğü, heterojenlik çalışmaları, I^2 ölçüsü nedeniyle rastgele etkiler yöntemi kullanılarak hem olgu-kontrol hem de korelasyon çalışmaları için ayrı ayrı hesaplanmıştır. Parasomniler, Huzursuz Bacak sendromu, uykuda solunum bozuklukları, gündüz uykululuk ve cinsel işlev bozukluğu ile ilgili çalışma sayısı oldukça sınırlıydı. Bununla birlikte, uykusuzluk üzerine dört çalışma üzerine yapılan mevcut meta-analiz, zarardan kaçınma (harm avoidance: HA) olguları ve kontrollerinin önemli ölçüde farklı olduğunu göstermiştir (p=0,001). On bir çalışmanın başka bir meta-analizi, Pittsburgh Uyku Kalitesi indeksi kullanılarak değerlendirilen kötü uyku kalitesi ile negatif duygulanım (negative affect: NA) (z=10,437, p<0,001) ile pozitif duygulanım (positive affect: PA) arasında anlamlı bir korelasyon olduğunu göstermiştir. (z=-6,826, p<0,001). Uyku ve cinsel bozukluklarla ilgili birkaç çalışmaya ek olarak, daha büyük zorluk, kapsamlı bir meta-analiz ve sonuç çıkarmayı zorlaştıran bu bozuklukların geniş yelpazesidir. Genel olarak, NA/PA ve HA sırasıyla uyku kalitesinde ve uykusuzlukta anahtar rol oynayabilir. Bulgular ve kısıtlılıklar tartışmalıdır.

Anahtar Kelimeler: Karakter, meta-analiz, kişilik, cinsel işlev bozukluğu, uyku bozuklukları, mizaç

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Introduction

Sleep disorders and sexual dysfunction are among the most common psychiatric morbidities in various populations around the world (1). Sleep disorders that are common in 0.4-48 percent of the United States population included insomnia, sleep breathing disorders (Central Sleep Apnea syndrome, obstructive sleep apnea, and snoring), central hypersomnolence disorders (hypersomnia and narcolepsy), parasomnias, sleep-related movement disorders, and circadian rhythm sleep-wake disorders (2). Meanwhile, sexual dysfunction includes sexual dysfunction (desire, arousal, orgasm, painful intercourse and vaginismus, and premature ejaculation) and paraphilias. Sexual dysfunction is seen in a significant proportion of men and women, depending on the type of disorder (3).

Attempts to identify predisposing risk factors for sleep disorders and sexual dysfunction have highlighted the role of some demographic and clinical variables (4-8). However, the unstable nature of these risk factors has not been able to help differential diagnoses of the wide range of these disorders. Therefore, it is assumed that the differential diagnosis of sleep disorders and sexual dysfunction requires screening of some relatively stable risk factors such as personality traits (9,10). Recently, some studies have examined the personality correlations of these disorders based on factor analysis approaches that have found contradictory findings (9,10). However, given that sleep and its disorders are still one of the least understood phenomena in biology (11), in the last two decades, the study of personality correlations of these disorders based on psychobiological approaches has accelerated (12-15).

In models based on personality psychobiological theories, temperament (and/or character) abnormalities are the main cause of psychiatric disorders (16,17). The main psychobiological theories of personality include Cloninger's temperament and character model (18,19), the positive and negative affect/temperament model proposed by Watson et al. (20), Akiskal's affective temperaments model (21), and the affective and emotional composite temperament proposed by Lara et al. (22). So far, several studies have examined the relationship between the structures of these theories and sleep disorders and sexual dysfunction (11-14,23-28). However, the findings are very scattered and the integrated interpretation of them is challenging. For example, two studies (29,30) have found dissimilar findings on the relationship between harm avoidance (HA) in Cloninger's theory and insomnia disorder. Other studies have also reported contradictory results on the relationship between positive affect and sleepiness (31,32). On the other hand, some studies have suggested inconsistent results about the relationship between HA and sexual satisfaction (33,34). Thus, the combined findings of previous studies in the form of a comprehensive review could help to the differential diagnosis of sleep disorders and sexual dysfunction using personality psychobiological theories. So, the present review was conducted to identify four personality psychobiological models by Cloninger (18,19), Watson et al. (20), Akiskal et al. (21), and Lara et al. (22) related to sleep disorders and sexual dysfunction.

Materials and Methods

Databases, Search Strategies, and Selection Criteria

The present systematic review and meta-analysis process, including the determination of data sources and databases, search strategies, quality assessment of studies, and data extraction, follows the PRISMA 27-item checklist guidelines. Web of Science, Scopus, PubMed, ProQuest, and Cochrane were searched for English-language records published during January 1990 and April 2019. In the search strategy, first, the keywords related to the purpose of the study were extracted based on previous studies and reviews. Then, the systematic search of keywords in the title/abstract of the records was done by two members of the research team (AH & SK). The list of keywords included ["Temperament" OR "temperament and character inventory (TCI)" OR "TCI-R" OR "tridimensional personality questionnaire (TPQ)" OR "novelty seeking" OR "harm avoidance" OR "reward dependence" OR "persistence" OR "self-directedness" OR "cooperativeness" OR "self-transcendence" OR "affective temperament" OR "TEMPS-A" OR "positive and negative affect schedule (PANAS)" OR "positive affect" OR "negative affect" OR "affective emotional composite temperament" OR "AFECTS"] AND ["sleep-wake disorders" OR "insomnia disorder" OR "hypersomnolence disorder" OR "narcolepsy" OR "obstructive sleep apnea hypopnea" OR "central sleep apnea" OR "sleep-related hypoventilation" OR "circadian rhythm sleep-wake disorders" OR "parasomnias" OR "sleepwalking" OR "sleep terrors" OR "nightmare disorder" OR "harm avoidance" OR "restless legs syndrome" OR "sleepiness" OR "sleep quality"] (OR) ["sexual disorders" OR "sexual dysfunctions" OR "delayed ejaculation" OR "erectile disorder" OR "orgasmic disorder" OR "arousal disorder" OR "penetration disorder" OR "hypoactive sexual desire disorder" OR "premature ejaculation"].

The inclusion criteria for systematic review were: English-language original research containing adults aged 18 and over, publication in academic journals, and coverage of at least two keywords simultaneously. Exclusion criteria included studies containing qualitative methodology, unpublished dissertations and articles, studies with unrelated/unsuitable design, interventions without assessment in the baseline, reviews and meta-analysis, use of non-standard tools without validity and unstructured interviews in evaluating variables, not using TCI, TCI-R, TPQ, TEMPS, PANAS, AFECTS to measure temperament, conference abstracts or without full text, lack of access to the full text of the article, and low-quality reports according to the strengthening the Reporting of observational studies in epidemiology (STROBE). Also, in proportion to the type of sleep disorder or sexual dysfunction, correlation studies without a reported partial correlation coefficient or case-control studies without a reported mean and standard deviation were excluded from the meta-analysis. Studies containing duplicate samples were also excluded (Figure 1).

Quality Assessment of Studies and Data Extraction

The quality of the studies was assessed using a 22-item STROBE checklist used for cross-sectional, case-control, and longitudinal

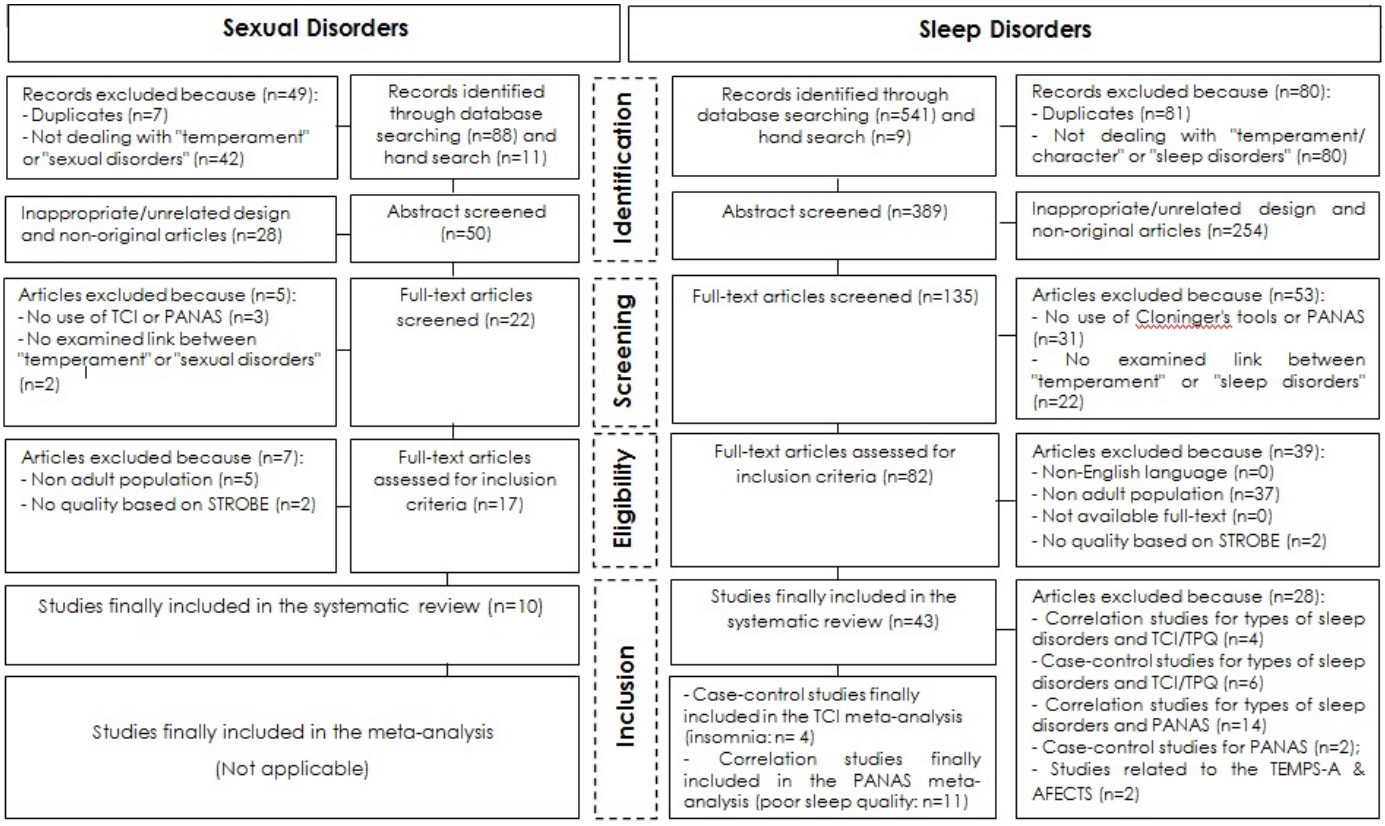

Figure 1. A flow diagram of the study selection process based on the PRISMA

studies. The process of evaluating the quality of studies was performed independently by two members of the research team (AH & SK). The disagreement between the two assessors was resolved using the opinion of a third party (KR). Then, to extract the data, a comprehensive table was designed to record the extracted data. After selecting the appropriate quality articles, the data and information were each entered into the results registration form/table. The process of combining the extracted data was performed by the tabulation method and an accurate description of the findings of each study. The table of results was organized based on the first author and the year of study, country, design, sample size and age mean (or age range) of samples, tools, statistical analysis, related findings, and limitations and level of evidence.

Statistical Analysis

Two meta-analyses were performed to calculate (i) difference in the TCI subscales (novelty seeking=NS, harm avoidance=HA, reward dependence=RD, persistence=P, self-directedness=SD, cooperativeness=C, and self-transcendence=ST) between cases with insomnia and normal controls- 4 studies; and (ii) the correlation coefficients between each of the subscales of PANAS (positive affect=PA, negative affect=NA) and sleep quality assessed by the Pittsburgh Sleep Quality index-11 studies. Case-control studies were combined based on sample size, mean, and standard deviation of the variables in the cases and healthy controls. Pooled effects sizes for standard mean differences (cases vs. controls) are presented with 95% confidence intervals (CI) using a combined forest plot. Cohen's d-values were used for measuring the effect size. Differences between cases and controls were compared using the Z-standard score. Correlation studies were combined based on sample sizes and partial correlation coefficients between variables. The unit of analysis was an individual study and effect sizes in these meta-analyses were obtained by the Fisher z-transformation of correlation coefficients. Estimates of the correlation coefficients in individual studies were graphically presented for each study based on the subscales of TCI or PANAS in pooled forest plots. Heterogeneity was considered in a large number of studies with I^2 higher than 50% (81% of studies related to sleep and 83% studies related to sexual dysfunction). Thus, pooled estimates of standard means difference was calculated for the subscales of TCI and types of sleep disorders using the random-effects method. Also, pooled estimates of correlation coefficients were calculated for the subscales of PANAS and sleep disorders or the subscales of TCI and sexual dysfunction using the random-effects method. We studied the heterogeneity of the study samples using the I^2 statistics for a 95% CI. A p-value <0.05 for I^2 higher than 50% was considered a significant heterogeneity test. Egger's test was used to possible publication bias. All hypotheses were tested at the level of <0.05 and performed using the comprehensive meta-analysis (CMA.2) software.

Results

Studies Included in the Systematic Review

A systematic literature search yielded 469 papers related to sleep disorders and 99 papers related to sexual dysfunction. Finally, 43 (15 in the meta-analysis) papers were entered into the final sample related to sleep disorders, and 10 papers were entered into the final sample related to sexual dysfunction. The process of selecting and excluding studies is shown in Figure 1. Most studies have examined the relationship between the TCI/PANAS and sleep disorders or TCI and sexual dysfunction. Very few studies have been found on the relationship between the TEMPS/AFECTS and sleep disorders or sexual dysfunction. The summary of the methods and results of the studies can be seen in Tables 1 and 2.

Differences Between Cases with Sleep Disorders and Controls in the Subscales of TCI

Table 3 summarizes the systematic review results of TCI and sleep disorders. As can be seen in this table, the number of studies in the field of parasomnias, restless legs syndrome (RLS), and sleep breathing disorders are very limited. Differences between cases with insomnia disorder and healthy controls in the subscales of TCI can be seen in Figure 2. The effect sizes in the pooled forest plot with 95% CI, mean and range are presented. Also, the Z-standard score and its statistical significance are presented for those subscales that have significant differences. As can be seen, HA is significantly higher in patients with insomnia (z=3.346, p=0.001). In other subscales of TCI, there was no difference between the cases and controls (p>0.05). The publication bias was not seen for any of the variables (p>0.05 for Egger's statistic).

Correlations Between the Subscales of PANAS and Sleep Disorders

As can be seen in Table 3, according to the results of all four available studies, NA is the strongest correlates of daytime sleepiness. Also, the relationship between NA and PA with PSQI was confirmed in 87% and 73.9% of studies, respectively. Figure 3 presents the correlations between the subscales of PANAS and sleep quality assessed by PSQI. As can be seen, there is a positive significant relationship between NA and poor sleep quality assessed by PSQI (z=10.437, p<0.001). Besides, PA and poor sleep quality assessed by PSQI are negatively related (z=-6.826, p<0.001). The publication bias was not seen in the relationship between any of the variables (p>0.05 for Egger's statistic).

Correlations Between the Subscales of TCI and Sexual Dysfunctions

Table 3 shows the correlation between the subscales of TCI and sexual dysfunction. As can be seen, according to the results of all three available studies, HA and SD are the strongest correlates of sexual dissatisfaction/dysfunction. Probably, there is a positive significant relationship between HA and sexual dissatisfaction/dysfunction. Also, SD is likely negatively related to sexual dissatisfaction/dysfunction. Because of the limited number of available studies, the relationship between the other subscales of the TCI and sexual dysfunctions is ambiguous. The publication bias was not seen in the relationship between any of the variables (p>0.05 for Egger's statistic).

Discussion

The study aimed to systematically review and meta-analysis the psychobiological theories of personality in sleep disorders and sexual dysfunction. The present study found that, in general, relatively few studies have examined the relationship between personality psychobiological models, particularly TEMPS and AFECTS, and sleep disorders and sexual dysfunction. However, the relationship between insomnia and TCI/TPQ, as well as the relationship between sleep quality and PANAS, has been considered in more studies. In the following, the relationship between each of these models and sleep and sexual disorders is discussed separately.

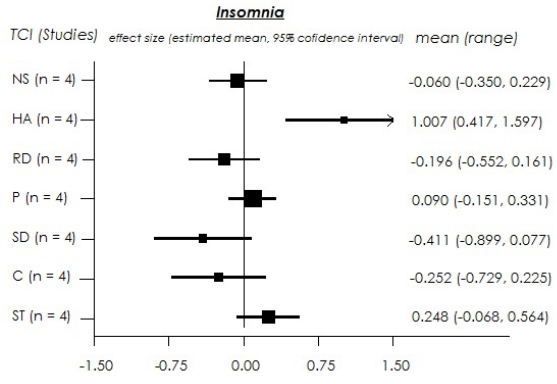

Figure 2. The pooled forest plot for the difference between cases and controls in the TCI subscales. Statistically significant difference for HA (z=3.346, p=0.001)

TCI: Temperament and Character Inventory, HA: Harm avoidance

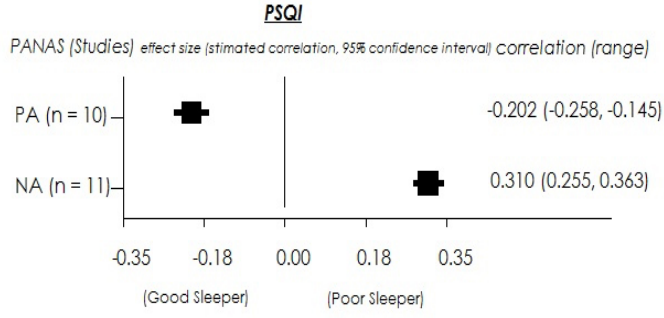

Figure 3. The pooled forest plot for correlations between PANAS subscales and sleep quality assessed using PSQI. Statistically significant correlations for PA (z=-6.826, p<0.001) and NA (z=10.437, p<0.001)

PANAS: Positive and negative affect schedule, PSQI: Pittsburgh Sleep Quality index, PA: Positive affect, NA: Harm avoidance

Table 1. Data extraction of psychobiological models related to sleep disorders

Author (year)	Region and samples	N		Age (mean ± SD or range)	Design	Statistical methods	Instruments		Findings		Level of evidence, limitations
		Cases M:F	Controls M:F				Disorders	Temperament (used)	Disorder	Current symptoms associated with/ differenced in	
An et al. (12)*	South Korean outpatients with insomnia	17:27	13:24	23.6±2.9	CC	t-test; c^2; logistic regression	PSQI; ESS; ISI; DBAS	TCI-226	Insomnia	High HA; high ST	Low, small sample size
Cakmak et al. (13)	Outpatients with RLS in Turkey	16:49	35:74	49.9±9.9	CC	t-test; Pearson r; ANCOVA	IRLS	TCI-240	RLS	High HA; low SD -SD +ST (RLS symptom severity)	Moderate
Fidan et al. (14)*	Patients with OSAS in Turkey	11:7	29:5	50.1±9.1	CC	t-test; Pearson r	AHI; polysomnography	TCI-240	OSAS	Differences were not significant Correlations were not significant	Low, small sample size
Hsu et al. (15)	College students in Taiwan	1412:1507	no	19.4±3.1	CS	Multivariable regression analysis; Bonferroni correction	M-E Scale	TPQ	Chronotypes	All TPQ components were related to types of chronotypes	Moderate
Benham and Charak (24)*	College students in the USA	140:320	no	22.7±5.5	CS	Hierarchical linear regression	PSQI; ESS	I-PANAS-SF (NA only)	Poor SQ Daytime sleepiness	+NA +NA	Low, Non-randomized sampling; Non-clinical sample
Chrobak et al. (25)	Adults in Poland	151:467	no	23.0±4.0	CS	t-test; multiple regression analysis	SWPAQ; CSM	TEMPS-A	Chronotypes	All affective temperaments were significantly related	Low, non-random sampling; web-based data collection
Ottoni et al. (28)	Brazilian adults	1298:3831	no	31.0±10.2	CS	c^2; ANOVA; linear regression; Bonferroni correction	BNSQ	CEATS (AFECTS)	Subjective sleep parameters	Related to several emotional and affective temperaments	Moderate, online survey
Chen et al. (29)	Medical students in Taiwan	94:49	no	23.5±1.9	CS	Linear regression analysis	ISI	TPQ (HA only)	Insomnia	+HA	Low, non-random sampling
Na et al. (30) *	South Korean panic patients with insomnia	20	81	43.5±9.9	CC	t-test; Bonferroni correction	SCID-I; sleep items	TCI	Insomnia	Differences were not significant	Low, small sample size

Table 1. contiuned

Author (year)	Region and samples	N		Age (mean ± SD or range)	Design	Statistical methods	Instruments		Findings		Level of evidence, limitations
		Cases M:F	Controls M:F				Disorders	Temperament (used)	Disorder	Current symptoms associated with/ differenced in	
Rossa et al. (31)	Young adults in Australia	8:12	no	20.2±2.1	CS	ANOVA	KSS; STQ; actigraph	PANAS	Sleep restriction	Low PA	Low, non-random sampling; small sample size
									Sleepiness	-PA +NA	
Wethovens et al. (32)	Belgian patients with rheumatoid arthritis	87:218	no	57.0±12.4	CS	t-test; c^2; Pearson r; linear regression analysis; MLM	PSQI; ESS; AIS	PANAS	Poor SQ	-PA +NA	Low, non-random sampling
									Daytime sleepiness	+NA	
									Insomnia	-PA +NA	
Abe et al. (35)	Outpatients in Japan	34:32	23:25	30.5±8.3	CC	t-test; c^2; Shapiro-Wilk; Mann-Whitney U; logistic regression	ESS; a scale for sleep-related disorders	TCI-240	Sleep bruxism	Differences were not significant	Low, small sample size
Blaxton et al. (36)	Midlife population in the USA	210:342	no	62.2±10.4	56-day cohort	Correlation; Multilevel Models	KSD; PSS	PANAS	Poor SQ	-PA +NA	Low, non-clinical sample
Bouwmans et al. (37)	Depressed patients in the Netherlands	7:20	7:20	34.7±9.9	CC	Correlation; Multilevel Models	Three items from PSQI	PANAS	Poor SQ	-PA +NA	Low, small sample size
Carciofo et al. (38) *	College students in China	74:196	no	18.9±0.8	CS	Pearson r; regression analysis	PSQI; ESS; DF; PS-DD	PANAS	Poor SQ	-PA +NA	Low, non-random sampling
									Daytime sleepiness	-PA +NA	
Cellini et al. (39) *	Italian adults	145:353	no	26.6±7.4	CS	Pearson r; Multiple regression analysis	PSQI	PANAS	Poor SQ	-PA +NA	Low, non-random sampling; online survey
Culnan et al. (40) *	College freshmen in the USA	56:79	no	18.3±0.6	8-week cohort	t-test; Pearson r	PSQI	PANAS	Poor SQ	Correlations were not significant	Low, non-random sampling
De Saint Hilaire et al. (41) *	Patients with chronic insomnia in France	11:21	216	22 to 49	CC	Mann-Whitney U; Spearman rho; linear regression analysis	polysomnography	TCI-226	Insomnia	High HA; low SD	Low, small sample size; non-random sampling
He et al. (42) *	Hemodialysis patients in China	81:37	no	62.9±10.9	CS	t-test; Pearson r; Multiple regression analysis	PSQI	PANAS	Poor SQ	-PA +NA	Low, small sample size; non-random sampling

Table 1. contiuned

Author (year)	Region and samples	N		Age (mean ± SD or range)	Design	Statistical methods	Instruments		Findings		Level of evidence, limitations
		Cases M:F	Controls M:F				Disorders	Temperament (used)	Disorder	Current symptoms associated with/ differenced in	
Hoag et al. (43)*	Low-income women in the USA	0:392	no	18 to 31	CS	c^2; Pearson r; SEM	PSQI	PANAS	Poor SQ	+NA	Low; non-random sampling; limited to women
Kalmbach et al. (44)	Young women in the USA	0:171	no	20.1±3.3	14-day cohort	HLM	PSQI	PANAS-X	Poor SQ and components	-PA +NA	Low, limited to women
Kothari et al. (45)	Outpatients with fibromyalgia in the USA	25:195	no	51.1±11.0	21-day cohort	SEM	Four items from PSQI	PANAS-X	Poor SQ	-PA +NA	Low, non-random sampling
Lee et al. (46)*	South Korean Adults	26:47 (33 primary insomnia; 40 MDD with insomnia)	124:190	51.7±14.0 45.0±10.7	CC	t-test; c^2; Pearson r; ANCOVA; post hoc test	SCID-IV & ICD-10 criteria	TCI	Insomnia	High HA; low RD; low SD, low C	Moderate
Machado et al. (2018) (47)	Brazilian medical students	208:209	no	22.0±3.0	CS	t-test; Pearson r; Multiple regression analysis	Two items from PSQI	PANAS	Poor SQ	-PA	Low, non-random sampling
Marconi et al. (48)	Italian outpatients	0:20 (10 RLS; 10 RLS with NED)	0:10	52.0±6.0 53.0±11.0	CC	c^2; ANOVA; Kruskal-Wallis; Pearson r	IRLS; SRED criteria	TCI-240	RLS	High HA	Low, small sample size; non-random sampling; limited to women
Mauss et al. (49)	Adults in the USA	86:70	no	43.5±3.8	CS	Pearson r; Steiger's Z-test	Single item & 10-point scales	PANAS	Poor SQ	+NA	Low; non-random sampling
Mccrae et al. (2008) (50)	Elderly in the USA	103	no	72.8±7.1	14-day cohort	Pearson r; MLM	SQR; actigraph	PANAS	Poor SQ	-PA +NA	Low, non-random sampling
Park et al. (51)	South Korean outpatients with insomnia	17:27	no	54.3±12.0	CS	Stepwise multiple regression analysis	PSQI; ESS; ISI; DBAS; PSAS; ICSD-2 criteria	TCI-226	Poor SQ	+ST	Low, small sample size
									Insomnia	-NS +HA –RD -C +ST	
									DBAS	-NS +HA	
									PSAS	-SD	
									Daytime sleepiness	Correlations were not significant	

Table 1. contiuned

Author (year)	Region and samples	N		Age (mean ± SD or range)	Design	Statistical methods	Instruments		Findings		Level of evidence, limitations
		Cases M:F	Controls M:F				Disorders	Temperament (used)	Disorder	Current symptoms associated with/ differenced in	
Perogamvros et al. (52)	Patients with parasomnias in Switzerland	8:16	195:98	37.0±11.8	CC	t-test; Pearson r; Spearman rho; Bonferroni correction	ICSD-2 criteria; polysomnography; self-report items	TCI-240	Parasomnia	High NS; low SD (correlations were not significant in 24 patients with parasomnia)	Low, small sample size
Rehman et al. (53)*	Adults in Scotland (two separated studies)	93:308 114:288	no	24.0±8.1 24.0±10.8	CS	Spearman rho; Linear regression; mediation analysis	PSQI	PANAS	Poor SQ (in studies 1 & 2	-PA +NA	Low; non-random sampling; online survey
Sfoza et al. (54)	Patients with sleep-disordered breathing in Switzerland	60	80:16	50.6±1.6	CC	Mann-Whitney U; Pearson r; Bonferroni correction; regression analysis	ESS; structured interview; polysomnography; MWT	TCI-226	sleep-related breathing disorders (snoring & OSA)	High NS	Moderate
Short et al. (55)*	Adults with PTSD in the USA	12:18	no	38.0±15.1	CS	Pearson r; MLM	PSQI; SCID for DSM-5	PANAS	Poor SQ	-PA +NA	Low, small sample size
									Nightmares	+NA	
Simor et al. (56)	College students in Hungary	30:45	no	22.2±3.0	7-day cohort	MLM	GSQS	PANAS	Poor SQ	-PA +NA	Low, small sample size
Simor et al. (57)*	Patients with OCD in Hungary	34:15	9:40	32.2±9.3	CC	Pearson r; ANCOVA	PSQI; MEQ-H; NM	PANAS	Poor SQ	+NA (correlations in patients with OCD)	Low, unmatched groups
Sin et al. (58)	CHD patients in the USA	838:184 (518 low PA; 504 high PA)	no	66.1±11.1 67.6±10.6	5-years cohort	t-test; c^2; logistic regression	PSQI	PANAS (PA only)	Poor SQ	-PA	Low
Sin et al. (59)	Employees in the USA	72:59	5:176	45.1±6.3 38.6±6.4	7-day cohort	t-test; logistic regression; MLM	Items from PSQI	PANAS	Poor SQ	-PA +NA (in the total sample)	Low, telephone interviews
									Sleep duration	-PA +NA (in the total sample)	
St George et al. (60)	Elderly in Australia	81:491	no	79.7±6.4	12-month cohort	Mann-Whitney U; linear regression analysis	SBQ	PANAS	Poor SQ	-PA +NA	Low

Table 1. contiuned

Author (year)	Region and samples	N		Age (mean ± SD or range)	Design	Statistical methods	Instruments		Findings		Level of evidence, limitations
		Cases M:F	Controls M:F				Disorders	Temperament (used)	Disorder	Current symptoms associated with/ differenced in	
Takano et al. (61)	College students in Japan	10:33	no	19.4±1.3	7-day cohort	MLM	Sleep self-reports; actigraph	Items from PANAS	SOL	Correlations were not significant	Low, non-random sampling; mobile-phone-based data collection
									Efficiency	+PA	
									TST	-PA	
Tamagawa et al. (62)	Police officers in New Zealand	43:11	no	31.5±7.0	5-week cohort	Pearson r; factor analysis; multiple regression analysis	SOS	PANAS	Sleep	-PA +NA	Low, non-random sampling; small sample size
									Sleep need	Correlations were not significant	
									Sleep flexibility	Correlations were not significant	
Theadom et al. (63)*	Fibromyalgia patients in England	7:94	no	55.0±11.8	CS	Pearson r; multiple regression analysis	PSQI	PANAS	Poor SQ	+NA	Low, non-random sampling
Van de Laar et al. (64)	Patients with insomnia in the Netherlands	75:143	no	44.0±11.2	7-day cohort	Cluster analysis	ISI; polysomnography; DSM-IV criteria	TCI	Insomnia	High HA; low SD	Low, non-random sampling
Von Kanel et al. (65)	Spousal Alzheimer caregivers in USA	37:89	no	74.2±7.9	4-years cohort	Mixed regression analysis	PSQI; actigraph	PANAS	Poor SQ	-PA +NA	Low, non-random sampling
									TST	Correlations were not significant	
									WASO	Correlations were not significant	
Whitehead and Blaxton (66)	Older adults in	33:94	no	79.4±9.1	14-day cohort	Pearson r; MLM	SQ single-item	PANAS	Poor SQ	Correlations were not significant	Low

ESS: Epworth Sleepiness scale, PSQ: Pittsburgh Sleep Quality index, ISI: Insomnia Severity index, DBAS: Dysfunctional beliefs and attitudes about sleep, PANAS: Positive and negative affect schedule, PSAS: Pre-sleep Arousal scale, I-PANAS-SF: International positive affect and negative affect- short form, PA: Positive affect, NA: Negative affect, SQ: Sleep quality, KSD: Karolinska sleep diary, PSS: Perceived Stress scale, RLS: Restless legs syndrome, IRLS: International Restless Legs syndrome Severity scale, DF: Daydream frequency, PS-DD: Problem solving daydreams, SWPAQ: Sleep wake pattern assessment questionnaire, CSM: Composite scale of morningness, OSAS: Obstructive sleep apnea syndrome, AHI: Apnea Hypopnea index, M-E scale: Morningness-Eveningness scale, SEM: Structural equation modeling, HLM: Hierarchical linear modeling, SRED: Sleep related eating disorder, NED: Nocturnal eating disorder, SQR: Sleep quality rating, MLM: Multilevel modeling, BNSQ: Basic nordic sleep questionnaire, ICSD-2: International classification of sleep disorders, KSS: Karolinska Sleep scale, STQ: Sleep timing questionnaire, MWT: Maintenance Wakefulness test, GSQS: Groningen Sleep Quality scale, MEQ-H: Morningness-eveningness questionnaire, NM: Nightmare frequency, SBQ: Sleep behavior questionnaire, SOL: Sleep-onset latency, TST: Total sleep time, SOS: Survey of shiftworkers, WASO: Wake after sleep onset, AIS: Athens Insomnia scale

Table 2. Data extraction of psychobiological models related to sexual disorders

Author (year)	Region	Main focus of paper	Samples	N		Age (mean or range)	Design	Statistical methods	Instruments		Findings	Level of evidence, limitations
				Cases M : F	Controls M : F				Sexual symptoms	Temperament	Current symptoms associated with/ differenced in	
Adali Aker et al. (23)	Turkey	Sexual life traits/ Temperament & character	Outpatients with chronic pain disorder	7:53	11:49	40.9±10.5	CC	t-test; Pearson r	ASEX	TCI-240	-RD -C	Low, small sample size
Guerim et al. (26)	Brazil	Affective & emotional Temperaments/ sexual orientation	General population	5071:11500	no	29.1±6.3	CS	c^2; MANCOVA	Self reports about sexual orientation	AFECTS	Pure heterosexual: +volition, +control, +coping, +stability, +caution, -sensitivity, -desire, -anxiety	Low, non-standard tools, data gathering by internet
Oliveira et al. (27)	Portugal	Affect and sexual dysfunction	Women with sexual dysfunction	0:54 (37 sub-clinical; 17 clinical patients)	0:167	36.5±12.6 40.6±13.7	CC	Pearson r; MANCOVA; multiple regression; Bonferroni correction	Sexual dysfunction interview (DSM-IV-TR); BSI; FSFI	PANAS	Low PA; High NA +PA (desire, arousal, orgasm, satisfaction, & totally sexual function); -NA (pain & totally sexual function)	Low; convenience sample
Kempner's et al. (33)	Belgium	Functional and Psychological Characteristics	men with premature ejaculation & partners	461:80	no	39.0±11.3	CS	c^2; t-test; Spearman ranks; discriminant analysis	DSM-IV-TR criteria; STAI; SIQ	TCI-R	+HA -SD (sexual dissatisfaction); +NS -SD +ST (sexual distress)	Low, online data gathering
Mico et al. (34)	Italy	personality and sexual motivation	Non-clinical college students	148:162	no	24.2±2.3	CS	Spearman ranks; Pearson r; multiple regression analyses	SAWM; Sexual Excitement and Sexual Satisfaction scales	TCI-240	-HA -RD -P -C -ST (sexual excitement); +HA -SD +ST (sexual dissatisfaction); -HA -RD -P -SD -C (sexual shyness); -SD -C (sexual prudishness); -SD (sexual disgust); -SD -C (neurotic sex)	Low; non-randomized sampling; non-clinical population

Table 2. contiuned

Author (year)	Region	Main focus of paper	Samples	N Cases M : F	N Controls M : F	Age (mean or range)	Design	Statistical methods	Instruments Sexual symptoms	Instruments Temperament	Findings Current symptoms associated with/ differenced in	Level of evidence, limitations
Altunoluk et al. (67)	Turkey	Temperament & character	Patients with premature ejaculation	40:0	40:0	33.0±9.0	CC	c^2; t-test; Pearson r	DSM-IV criteria	TCI-240	High NS; Low HA; Low RD	Low, small sample size
Fassino et al. (68)	Italy	Temperament & character	Couples with fertility disorders	23:23 (couples with functional infertility)	80:80 (fertile couples)	18 to 45	CC	t-test; ANOVA; Bonferroni post hoc; logistic regression	SCID-I (DSM-IV)	TCI	High HA (men) Low SD; Low C (women)	Moderate, consecutive sampling
Konkan et al. (69)	Turkey	Sexual function and satisfaction	Women with Vaginismus	0:40	0:50	24.9	CC	t-test; Mann-Whitney U test	DSM-IV-TR criteria; SCL-90; GRISS	TCI	High RD (only emotionality item)	Low, small sample size
Ozturk and Arkar (70)	Turkey	Temperament/ character and sexual dysfunction	Married couples with sexual problems	101:101	100:100	31.7±8.2	CC	MANOVA	DSM-IV-TR criteria; GRISS; DAS	TCI	High HA; Low SD; High C; High ST	Moderate
Tavares et al. (71)	Portugal	Affect and female orgasm	Premenopausal women	0:926	no	25.2±7.0	CS	Multiple regressions; mediation analyses	SMQ; SDRS	PANAS	+PA	Low, online data gathering

CS: Cross-sectional, CC: Case-control, ASEX: Arizona Sexual Experiences scale, SCID-I: Structured clinical interview for DSM-IV axis I disorders, TCI: Temperament and character inventory, SCL-90-R: Symptom checklist-90-revised, AFECTS: Affective and Emotional Temperament Composite scale, STAI: Spielberger's state-trait anxiety inventory, SIQ: Sexual irrationality questionnaire, GRISS: Golombok-rust inventory of sexual satisfaction, SAWM: Italian version of the sex and the average woman (or man); PANAS: Positive and negative affect schedule, PA: Positive affect, NA: Negative affect, BSI: Brief symptom inventory, FSFI: Female Sexual Function index, DAS: Dyadic Adjustment scale, SMQ: Sexual modes questionnaire, SDRS: Socially desirable response set

Insomnia: The results of the present meta-analysis showed that the HA in patients suffering from insomnia is higher than healthy controls. Although few studies met inclusion criteria for the meta-analysis (12,30,41,46), other studies in the present review have also pointed to the relationship between these two components (29,51). People with high HA have traits such as fear, embarrassment, and pessimistic worries and are easily tired, which can play a role in insomnia (12,41). High HA is strongly associated with anxiety and depressive disorders (17,72) and the symptoms of anxiety and depression can lead to insomnia (73). In fact, insomnia may be a marker for undiagnosed anxiety and depression (41). In addition to the above, the role of genetics and neurobiological mechanisms can also be discussed. Some components of HA, including fatigability (HA4) and anticipatory worry (HA1), are associated with reduced REM sleep duration and REM delay and these REM sleep disorders are biological markers of depression in patients with insomnia (41).

Sleep quality: Considering the very few studies related to sleep quality using TCI, in the present meta-analysis, the relationship between PA/NA evaluated using PANAS with this component was investigated (24,38-40,42,53,55,56,63). The current results showed that there is a positive relationship between NA and poor sleep quality. Also, PA has a negative relationship with poor sleep quality. PA and NA are the most important correlations of neuroticism traits in the five-factor model (74). PA/NA and neuroticism are highly correlated with symptoms of anxiety and depression (74,75). Other studies have suggested a link between NA components including fear, distress, guilt, anxiety, sadness, frustration, fatigue, embarrassment, and hostility with sleep problems (76-78). Therefore, it seems that poor sleep quality, which indicates poor quantity and quality of sleep, is affected by high NA and low PA. This is likely to lead to daytime sleepiness. Some studies have suggested a link between poor sleep quality and daytime sleepiness (24,38,79).

Other sleep disorders: There were very few studies on parasomnias, RLS, sleep breathing disorders, and daytime sleepiness. Only two studies covered RLS (13,48), both of which indicated a positive relationship between HA

and RLS. Therefore, it is uncertain whether high HA is an important component in RLS. Two studies also have noted a significant relationship between low SD and RLS/parasomnias (13,52). Two studies reported a significant relationship between NS and parasomnias/sleep breathing disorders (52,54). On the other hand, several studies have suggested a significant relationship between NA/PA and parasomnias/daytime sleepiness (24,31,32,38,55). Despite the reported relationships between psychobiological models and sleep disorders in the recent section, achieving more accurate results requires meta-analysis on a large number of studies.

Sexual dysfunction: Few studies in this area, as well as the wide range of types of sexual dysfunction, made it difficult to conduct an integrated analysis. Previous studies have sporadically examined the role of personality components in sexual dysfunction/dissatisfaction (33,34,70), sexual distress (33), sexual experiences and arousal (23,34), and premature ejaculation (67). Only three studies covered sexual dysfunction/dissatisfaction, all of which indicated a positive relationship between this component and HA (33,34,70). Also, all three studies reported a significant relationship between sexual dysfunction/dissatisfaction and SD. Therefore, based on the results of the current review, there is an uncertain possibility that HA and SD are two effective components in dysfunction/sexual dissatisfaction. Despite the complexity of the issue, higher levels of HA indicate anxious tendencies, and may this component is a causal factor for sexual dysfunction through a type of serotonergic deficiency (33,34). On the other hand, Cloninger introduces the character as conscious consciousness programs that consist of three individual (SD), social (C), and global (ST) cognitive sets. Unlike the temperaments that are considered as habitual systems and unconscious automatic reactions, characters are the mental and cognitive dimensions that provide a conceptual insight for the individual (80). Disorder in the characters, especially SD, can lead to the development and persistence of mental disorders (81,82).

Study Limitations

Current systematic review and meta-analysis in the field of the relationship between personality psychobiological theories and sleep disorders/sexual dysfunction is a pioneering study. However, there were some limitations. The lack of numerous studies related to TEMPS and AFECTS has prevented us from doing meta-analyses and any summary and scientific conclusion. This limitation should not lead to the neglect of the suggested models by Akiskal et al. (21) and Lara et al. (22) in future studies. Therefore, if researchers have access to studies related to these models, future reviews and meta-analyses can cover them. A small number of studies related to TCI/TPQ and insomnia and examined small sample sizes can be effective in reducing the validity of the results. The wide range of types of sexual dysfunction and related factors such as dissatisfaction, distress, embarrassment, disgust, and sexual arousal also made it difficult to draw an accurate comprehensive conclusion. This heterogeneity between variables and the lack of case-control studies focused exclusively on one special disorder can also be a serious challenge to generalizing the findings to a variety of sexual disorders. If more studies are available in the next decade, analyzes can also take into account age and sex differences. Participants in the studies that were entered into the meta-analysis of sleep quality assessed PSQI were a combination of the clinical and general population. Although PSQI can be used as a dimensional instrument (without a cut-off point), the use of case-control studies containing established poor sleepers can provide more accurate results. Another limitation is related to psychiatric comorbidities with sleep disorders, which were not rule-out in the present meta-analyses. Therefore, repetition of the present study in the coming years, if there are enough case-control studies for meta-analysis, can provide more accurate and valid findings for specialists and clinicians.

Conclusions

Studies of sleep disorders and sexual dysfunctions based on personality psychobiological models, especially case-control studies, are very few. Although, the bigger challenge is the wide range of these disorders (insomnia, sleep breathing disorders and its sub-components, central hypersomnolence disorders, parasomnias, sleep-related movement disorders, circadian rhythm sleep-wake disorders, poor sleep quality, and sexual disorders related to the desire, arousal, orgasm, painful intercourse and vaginismus, premature ejaculation, and paraphilias) that make it difficult to draw a comprehensive meta-analysis and conclusion. The affective and emotional temperaments assessed by TEMPS-A and AFECTS have largely been ignored. Considering the importance of biomarkers in the pharmacotherapy of sleep/sexual disorders, future studies are encouraged to examine the relationship between the two models and the diagnosis of these disorders.

The models measured using TCI and PANAS, especially concerning sleep disorders, have produced relatively more studies. According to the findings of the present meta-analysis, NA/PA and HA may play a key role in sleep quality and insomnia, respectively. At lower levels of confidence from the current review, HA and SD along with NA may be associated with other sleep disorders. Also, HA and SD are likely to be effective components in sexual dissatisfaction/dysfunction.

Although there was no publication bias related to the sleep/sexual disorders in the meta-analyses for insomnia and sleep quality, low evidence levels were seen in approximately 90% of sleep and 80% sexual dysfunction studies. Small sample size, non-randomized sampling, and internet-telephone based assessment were among the main limitations of the studies included in this review. Therefore, although the temperament traits assessed using the TCI and PANAS can potentially be important, to obtain findings with more acceptable validity, a future meta-analysis may provide valuable findings if access to a greater number of case-control studies and a focus on age and sex differences.

Table 3. Summarized results of the systematic review of psychobiological models and sleep/sexual disorders

Sleep/sexual disorders	Proportion of reports (%)	Association of the disorder and temperament (positive relation/ higher if the presence of disorder)	References	Proportion of reports (%)	Association of the disorder and temperament (negative relation/ lower if the presence of disorder)	References	Number of studies qualified for a meta-analysis
Insomnia		NS		1/7 (14.3)	NS	51	4*
	6/7 (85.7)	HA	12,29,41,46, 51,64		HA		4*
		RD		2/7 (28.6)	RD	46,51	4*
		SD		3/7 (42.6)	SD	41,46,64	4*
		C		2/7 (28.6)	C	46,51	4*
	2/7 (28.6)	ST	12,51		ST		4*
		PA		1/1	PA	32	1
	1/1	NA	32		NA		1
Parasomnias	1/2 (50)	NS	52		NS		2
		SD		1/2 (50)	SD	52	2
	1/1 (100)	NA	55		NA		1
Restless legs syndrome (RLS)		NS			NS		2
	2/2 (100)	HA	13,48		HA		2
		SD		1/2 (50)	SD	14	2
	1/2 (50)	ST	13		ST		2
Sleep breathing disorder (SBD)	1/2 (50)	NS	54		NS		2
Pittsburgh Sleep Quality index (PSQI)	1/1 (100)	ST	51		ST		1
		PA		17/23 (73.9)	PA	32,36-39,42, 44,45,47,50,53, 55,57-60,65	10*
	20/23 (87)	NA	24,32,36-39,42-45,49,50,53,55-58,60, 63,65		NA		11*
Sleepiness		PA		2/3 (66.7)	PA	38,31	2
	4/4 (100)	NA	24,38,31,32		NA		3
Sexual dysfunction/ dissatisfaction	3/3 (100)	HA	33,34,70		HA		2
		SD		3/3 (100)	SD	33,34,70	2
		C			C		2
	1/3 (33.3)	ST	70		ST		2
Sexual distress	1/1 (100)	NS	33		NS		1
		SD		1/1 (100)	SD	33	1
	1/1 (100)	ST	33		ST		1
Sexual excitement		HA		1/1 (100)	HA	34	1
		RD		1/1 (100)	RD	34	1
		P		1/1 (100)	P	34	1
		C		1/1 (100)	C	34	1
		ST		1/1 (100)	ST	34	1
Premature ejaculation	1/1 (100)	NS	67		NS		1
		HA		1/1 (100)	HA	67	1
		RD		1/1 (100)	RD	67	1
Sexual experiences		RD		1/1 (100)	RD	23	1
		C		1/1 (100)	C	23	1

HA: Harm avoidance, PA: Positive affect, NS: Novelty seeking, RD: Reward dependence, P: Persistence, SD: Self-directedness, C: Cooperativeness, ST: Self-transcendence

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Ethics

The project was approved and received a code of ethics by the Kurdistan University of Medical Sciences, Sanandaj, Iran (IR.MUK.REC.1398.169).

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Concept: F.R., A.H., K.R., S.K., Design: F.R., A.H., K.R., S.K., Data Collection or Processing: F.R., A.H., K.R., S.K., Analysis or Interpretation: F.R., A.H., K.R., S.K., Literature Search: F.R., A.H., K.R., S.K., Writing: F.R., A.H., K.R., S.K.

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