Practice Parameters for Using Polysomnography to Evaluate Insomnia: An Update

An American Academy of Sleep Medicine Report

Standards of Practice Committee of the American Academy of Sleep Medicine

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Abstract: Insomnia is a common and clinically important problem. It may arise directly from a sleep-wake regulatory dysfunction and/or indirectly result from comorbid psychiatric, behavioral, medical, or neurological conditions. As an important public-health problem, insomnia requires accurate diagnosis and effective treatment. Insomnia is primarily diagnosed clinically with a detailed medical, psychiatric, and sleep history. Polysomnography is indicated when a sleep-related breathing disorder or periodic limb movement disorder is suspected, initial diagnosis is uncertain, treatment fails, or precipitous arousals occur with violent or injurious behavior. However, polysomnography is not indicated for the **routine** evaluation of transient insomnia, chronic insomnia, or insomnia associated with psychiatric disorders.

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INTRODUCTION

INSOMNIA IS CHARACTERIZED BY A COMPLAINT OF DIFFICULTY INITIATING SLEEP, MAINTAINING SLEEP, AND/OR NONRESTORATIVE SLEEP THAT CAUSES CLINICALLY SIGNIFICANT DISTRESS OR IMPAIRMENT IN SOCIAL, OCCUPATIONAL, OR OTHER IMPORTANT AREAS OF FUNCTIONING. Insomnia is associated with a variety of morbidities including decreased quality of life, absenteeism, auto accidents, and increased general health care utilization. The term *insomnia* is used to describe a wide range of alterations in the amount and type of sleep loss or perceived sleeplessness. Etiologies include insomnia provoked directly by intrinsic sleep disorders, extrinsic sleep disorders, or circadian rhythm irregularities. Additionally, insomnia is associated with many psychiatric, medical, and neurological conditions. Insomnia may also be due to the use or misuse of either prescription or over-the-counter medications. In total, 55 of the nosological entities listed in The International Classification of Sleep Disorders[1] can have insomnia as a symptom. Epidemiological research reveals that insomnia afflicts 10-30 percent of the adult population.[2-4]

Overnight polysomnography (CPT 95810) is a standard tool in sleep medicine for evaluating sleep-related pathophysiology, sleep architecture, and sleep integrity. Some etiologies underlying insomnia have specific pathophysiology detectable with polysomnography (e.g. periodic limb movements). Other insomnias may manifest abnormal sleep architectural patterns (e.g. major depressive disorder) that while recognizable are diagnostically nonspecific.[5-7] Finally, sleep integrity can be directly measured with polysomnography. Measures such as latency to sleep onset, total sleep time, number of arousals and awakenings, and sleep efficiency are routinely calculated to characterize a night of sleep.[8,9] Disturbance in such measures objectively verify complaints of difficulty initiating and maintaining sleep. Furthermore, polysomnographic criteria can differentiate physiologically-based sleep disturbances from sleep state misperception and helps to evaluate whether the subject possibly prefers the drug for the wrong reasons (e.g. because of euphoriant properties). For this reason, polysomnography is a component of the standard procedure used to verify insomnia and assess treatment efficacy for research purposes.[10]

Some clinicians in their search for objective diagnostic indices have used polysomnography to evaluate patients with insomnia. Monitoring for specific etiology-related pathophysiologies (e.g. obstructive sleep apnea) can be very useful for making a diagnosis when insomnia is secondary to another condition. By contrast, using sleep integrity measures to diagnose primary insomnia has several potential drawbacks. First, most normal sleepers experience transient insomnia (or some degree of sleep disruption) the first time they sleep in the laboratory. This *first night effect* disappears when the individual acclimates to the novel sleep environment. Second, insomnia typically varies in severity across nights such that a single night may fail to properly characterize the full extent of the sleep problem.[11,12] Third, patients with psychophysiological insomnia often paradoxically sleep well on their first night in the laboratory.[13] Fourth, some patients with insomnia have sleep state misperception; that is, they have the complaint of insomnia in the absence of objective findings from polysomnography.[14-17] These four factors make it difficult to achieve diagnostic specificity with a single night of polysomnography. For these reasons, cost for multiple nights in the laboratory are generally considered prohibitive unless a clear advantage over other procedures is provided.

Thus, using polysomnography to diagnose primary insomnia is fraught with methodological pitfalls detracting from its usefulness. As such, using polysomnography for **routine** clinical evaluation of transient or chronic insomnia is controversial and was not recommended in the 1995 American Sleep Disorders Association Practice Parameter Report.[18,19] By contrast, diagnostic polysomnography was endorsed as sometimes appropriate in cases where a) diagnosis is uncertain, b) sleep-related breathing disorder or periodic limb movement disorder are suspected, c) a patient is refractory to treatment, d) violent behaviors are

comorbid, or e) circadian dysrhythmias complicate the clinical picture.

This update modifies and replaces the 1995 practice parameters.

METHODS

The Standards of Practice Committee appointed a task force to review the role of polysomnography in the evaluation of insomnia. The task force examined the previously published practice parameters and the reviews upon which they were based. Excluding conference abstracts and letters to the editor, the references cited in the Reite et al (1995)[19] review paper were considered in the current literature reassessment. Medline was searched from 1980 through and including articles published up to February 2002. The terms *insomnia, sleeplessness*, and *sleep initiation and maintenance disorders* were crossed with the terms *polysomnography, sleep evaluation, monitoring ambulatory*, or *monitoring physiologic*. Searches were also conducted crossing *Ekbom's syndrome, restless legs syndrome, nocturnal myoclonus, fibromyalgia,* and *depression* with *polysomnography, sleep evaluation, monitoring ambulatory*, or *monitoring physiologic*. The two Medline searches were then combined and limited to human subject and English language publications. Data from the articles were extracted, reviewed, and summarized.

Based on the evidence review, updated practice recommendations were developed by the Standards of Practice Committee. Recommendations are rated as standards, guidelines, or options (Table 1) based on evidence from studies published in peer-reviewed journals that were evaluated and listed in the evidence tables (Tables 3A, 3B, and 3C). However, when scientific evidence is not available, insufficient, or inconclusive, the recommendations were based on consensus opinion of the committee.

These practice parameters define principles of practice that should meet the needs of most patients in most situations. These guidelines are neither inclusive of all proper methods of care nor exclusive of other methods of care reasonably directed toward obtaining the same result. Judgment regarding the propriety of any care strategy ultimately must be made by health care providers with consideration given to individual circumstances presented by the patient, available diagnostic procedures, and extant treatment resources.

The Board of Directors of the American Academy of Sleep Medicine approved these recommendations. All members of the American Academy of Sleep Medicine Standards of Practice Committee and Board of Directors completed detailed conflict-of-interest statements and were found to have no conflicts of interest with regard to this subject.

The American Academy of Sleep Medicine expects these guidelines to have a positive effect on professional behavior, patient outcomes, and possibly health care costs. These practice parameters reflect the state of knowledge at the time of development and will be reviewed, updated, and revised, as new information becomes available.

RESULTS

The Medline search strategy produced 706 citation titles. Two Standards of Practice Committee (SPC) members (MH and MK) reviewed all of the titles, abstracts, and if needed the full publication to determine whether the citation was appropriate for this review. Inclusion criteria were: 1) the study included laboratory polysomnography, 2) a formal diagnosis was rendered, and 3) there appeared to be a focus on insomnia. Exclusion criteria were: 1) reports of treatment outcome studies, 2) reports of ambulatory PSG and specialized waveform analysis, 3) reports that did not present original data (editorials, letters, and reviews), and 4) single case studies. One reviewer (MK) selected 28 papers while the other (MH) selected 34 papers; there were 23 articles selected by both reviewers and these were distributed among 4 SPC members (MH, MK, SK, and MA) for data extraction. One additional article was excluded because it turned out to be a review. Two of the 4 SPC members independently extracted information from each article. Extraction discrepancies were resolved with extraction or grading by another SPC member. Only minimal discrepancies were encountered. Additionally, each article was graded according to criteria [modified from Sackett (1993)[20]] shown in table 2. The extracted data was then summarized in Tables 3A, 3B, and 3C. Of the 8 articles summarized in Table 3A that address diagnostic utility of polysomnography in patients with insomnia, 5 were level III, grade C; 2 were level IV, grade C, and 1 was level V, grade D. Table 3B focuses on polysomnography in psychiatric disorders associated with insomnia. Except for a single paper rated as level III, grade C, the remaining 7 articles on this topic were graded as level IV, grade C. Finally, Table 3C tabulates the 6 other relevant reports. One each was rated as level III, grade C and level V, grade D; the remaining 4 articles were level IV, grade C. It is apparent that there is little rigorous scientific work regarding diagnostic polysomnographic evaluation of insomnia. Most of the studies are un-blinded, cross-sectional, non-randomized with comparisons to historical, opportunistic, or case controls. Sample sizes for comparative or case control work are generally limited; however, a few larger sample case series have been published.

Articles were evaluated to address the utility of polysomnography for the diagnosis of insomnia according to whether there was evidence to answer the following questions. The results are detailed in Tables 3A, B and C.

1. Did polysomnography help in the evaluation of insomnia in this study?
2. Did polysomnography provide information helpful for understanding treatment failure?
3. Did polysomnography differentiate between insomnia of different etiologies?

RECOMMENDATIONS

When possible, practice recommendations are evidence based. New recommendations, as well as those that are the same as, similar to, or expansion of, previous ones are noted in the text.

Table 1—AASM Recommendations (adapted from Eddy[56])

Term	Description
Standard	A *standard* is a generally accepted patient care strategy reflecting a high degree of clinical certainly. The term *standard* generally implies a basis in either Level I evidence directly addressing the clinical issue or overwhelming Level II evidence.
Guideline	A *guideline* is a patent care strategy reflecting a moderate degree of clinical certainty. The term *guideline* implies a basis in Level II evidence or a consensus of Level III evidence.
Option	An *option* is a patient care strategy reflecting uncertain clinical use. The term *option* implies either inconclusive or conflicting evidence, or conflicting expert opinion.

Table 2—AASM classification of evidence (Adapted from Sackett, 1993)[20]

Grades	Evidence Levels	Study Design
A	I	1-Blind, Prospective Study 2-Large sample with a spectrum of patients reviewed 3-Results are compared according to a reference standard
B	II	1-Blind, Prospective Study 2-Limited sample or limited spectrum of patients included 3-Results are compared according to a reference standard
C	III	1-Not blind, randomized, or prospective 2-Methodologically limited 3-Results are compared according to a reference standard
C	IV	1-Not blind, randomized, or prospective 2-Methodologically limited 3-Results not compared according to a reference standard
D	V	1-Not blind, randomized, or prospective 2-Methodologically limited 3-Results not compared to any reference

1. Insomnia is an important public-health problem that requires accurate diagnosis and effective treatment. (Standard)

Insomnia is a symptom of an underlying disorder or condition. The insomnia may be a problem directly related to the sleep-wake regulatory system and/or it might be associated with a comorbid psychiatric, behavioral, medical, or neurological condition. This recommendation is similar to the one made previously and is based on committee consensus. [2,18,19,21,22]

2. Insomnia is primarily diagnosed by clinical evaluation through a careful, detailed medical, psychiatric, and thorough sleep history (which includes assessment of sleep patterns and waking processes). (Standard)

This recommendation is similar to the one previously made and is based on committee consensus.[18,19,21,23] The change from previous recommendation is that there is a greater emphasis on the sleep history.

3. Polysomnography is indicated when sleep-related breathing disorders or periodic limb movement disorder is suspected. (Standard)

This recommendation is similar to one previously made (differing primarily in wording) and is based on 4 level III (grade C) studies, [24-27] 1 level IV (grade C) study, [28] work cited in the previous practice parameter, [22,29,30] and committee consensus.

4. Polysomnography is indicated when initial diagnosis is uncertain, treatment fails (behavioral or pharmacologic), or precipitous arousals occur with violent or injurious behavior. (Guideline)

This recommendation was made previously and is based on work cited in the previous practice parameter [31-38] and committee consensus.

5. Polysomnography is not indicated for the routine evaluation of transient or chronic insomnia. (Guideline)

This is the same recommendation as made previously[18,39] (with minor wording changes) and is based on committee consensus.

6. Polysomnography is not indicated for the routine evaluation of insomnia due to psychiatric disorders. (Guideline)

This recommendation modifies the one previously made and is based on 1 level III (grade C) study, [40] 7 level IV (grade C) studies [41-49] and committee consensus.

7. Polysomnography is not clinically useful in differentiating the insomnia associated with dementia from other forms of insomnia, including insomnia associated with depression. (Guideline)

This recommendation is the same as one previously made and is based on 1 level IV (grade C) study,[50] 1 level V (grade D) study, [51] work cited in the previous practice parameter [34-38] and committee consensus.

8. Polysomnography is not useful in establishing the diagnosis of insomnia associated with fibromyalgia or chronic fatigue syndrome because the alpha-delta sleep pattern described in fibromyalgia syndrome is a nonspecific finding. (Guideline)

This recommendation is the same as one previously made and is based on 1 level IV (grade C) study, [52] work cited in the previous practice parameter, [53-55] and committee consensus.

FURTHER RESEARCH

This evidence based review revealed significant weakness in the published literature concerning the diagnostic utility of polysomnography for clinically evaluating patients with insomnia. More methodologically sound research, with attention to diagnostic sensitivity and specificity is needed. Large scale, prospective, controlled studies are needed to assess the sensitivity and specificity of polysomnographic metrics to diagnose insomnia. Such studies must assure blind data recording, scoring, and interpretation. Computerized microarchitectural analysis, if directed specifically at improving diagnostic discrimination may be helpful in difficult cases. Furthermore, blind, prospective, controlled studies are needed to evaluate polysomnography's ability to differentiate between insomnias differing in etiologies and comorbidities. Well-delineated subgroups for specific secondary insomnias, as well as, subgroups for different insomnias *lumped* together as primary insomnia need to be considered. Issues surrounding perceived sleeplessness without objective findings, so-called *sleep state misperception*, needs particular attention. Progress has already been made in moving research away from using heterogeneous samples labeled *insomnia* and has yielded some progress. Finally, econometric analysis of diagnostic practice should be undertaken. Such research is a priority because insomnia is a serious, prevalent condition that adversely affects productivity, morbidity, mortality, and quality of life. Ultimately, improved diagnostic practice will improve the overall quality of care.

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Table 3A—Evidence Table for Studies of Patients with Insomnia

AUTHOR	GRADE / LEVEL	GROUPS	NUMBER	MALES	FEMALES	AGE	DX CRITERIA	Q1	Q2	Q3	RESULTS &/OR CONCLUSION
Vgontzas[24]	III/C	Insomnia (I) Control (C)	375 150	187 62	188 88	43 44	DSM3R ASDA 1979	N	na	N	1- SRBD and PLMD equally prevalent in I and C 2- REM changes had 21% PPV for depression
Zorick[27]	III/C	Insomnia (I) Normal Controls (C)	84 20	49 9	38 11	51 49	ASDA 1979	Y	na	Y	1- Dx categories within I could be determined by PSG 2- I: ↑ objective PSG evidence or DIMS vs. C
Rosa[60]	III/C	Insomnia (I)[2] Non-insomnia (C)	121 56	82 35	39 21	36 35	none	N	N	N	1- No PSG difference in I vs. C except for S2L 2- I: ↑ subjective SL, WASO, #wakes
Lichstein[25]	III/C	Media-recruited individuals with Primary Insomnia. (excluded likely SRBD, hypnotic Rx use, psychiatric disorder, PLMD, RLS)	80	32	48	69	ICSD DSM4	Y	na	Y	1- 23 patients had SRBD with AHI ≥ 15 (29%) 2- 34 patients had SRBD with AHI ≥ 5 (43%) 3- 3 patients had PLMD with PLMAI ≥ (4%) 4- There is a high incidence of occult sleep apnea in elderly who appear to have primary insomnia
Roehrs[26]	III/C	SRBD with insomnia (I) SRBD with sleepiness (S)	16 65	2 63	14 2	45 47	none	Y	na	Y	1- Patients with insomnia may have SRBD 2- I: ↓ AI, less ↓SaO_2, ↑ central episodes vs. S 3- Sex Differences: ↑♀ with insomnia, ↑♂ with sleepiness
Dorsey[57]	IV/C	Objective insomnia (OI) Subjective insomnia (SI) Control (C)	9 9 13	? ? ?	? ? ?	? ? ?	SL>45 mins[1]	Y	na	N	1- No group differences in PSG measures or MSLT SL 2- SI did not estimate MSLT SL accurately 3- OI did estimate MSLT SL accurately 4- ↑ neuroticism for SI, ↑ introversion for OI
Reynolds[28]	IV/C	Elderly patients with complaints of insomnia and daytime sleepiness	27	18	9	63	ASDA 1979	Y	na	Y	1- DIMS patients have depression (33%) and psychophysiological insomnia 2- DOES patients were more likely to have SRBD 3- ↓REML in patients with depression
Edinger[29]	V/D	Patients with insomnia presenting at sleep clinic	100	46	54	46	ASDA 1979	Y	N	Y	1- PSG provided important Dx info on 65% of sample 2- 34% sample Dx's essentially by PSG (25% PLMD, 3% apnea, 6% subjective insom) 3- PSG ruled out PLMD in 9% and apnea in 7% 4- PSG useful in patients 40 years and older

Notation- Q1: Did polysomnography help in the evaluation of insomnia in this study? Q2: Did polysomnography provide information helpful for understanding treatment failure? Q3: Did polysomnography differentiate between insomnia of different etiologies? PSG- Polysomnography, PLMD- Periodic Limb Movement Disorder, SRBD- Sleep-related Breathing Disorder, SEI- Sleep Efficiency Index, SL- Sleep Latency, WASO- Wake After Sleep Onset, TST- Total Sleep Time, SWS- Slow Wave Sleep, S2- Stage 2 Sleep, S2L- Latency to stage 2 sleep, REML- Latency to REM Sleep, REMD- REM density, ICSD- International Classification of Sleep Disorders, DSM- Diagnostic and Statistical Manual, ASDA 1979- American Sleep Disorders 1979 Sleep-wake disorder nosology. MSLT - multiple sleep latency test, DIMS - disorders of initiation and maintenance of sleep, RLS - restless leg syndrome, PPV- positive predictive value, PLMAI - periodic limb movement arousal index (number of PLMA per hour of sleep), DOES - disorders of excessive somnolence.

[1] These were college students volunteering for credit, they were not a self-selected clinical group seeking treatment

[2] Patients with AI>10 excluded from sample

Table 3B—Evidence Table for Studies of Patients with Psychiatric Disorders

AUTHOR	GRADE / LEVEL	GROUPS	NUMBER	MALES	FEMALES	AGE	DX CRITERIA	Q1	Q2	Q3	RESULTS &/OR CONCLUSION
Thase[40]	III/C	Depressed Outpatients (O) Depressed Inpatients (I) Controls (C)	181 44 44	66 19 16	115 25 28	37 33 32	DSM3R	N	Y	N	1- O and I: ↑REMD, ↓REML, ↓SEI vs. C 2- REM markers readily distinguish depressed from C 3- Abnormal sleep associated with poor treatment response
Merica[47]	IV/C	Depression, Major (M) Dysthymia (D) Insomnia (I) Age-matched controls (C)	48 36 27 ?	? ? ? ?	? ? ? ?	47 43 37 ?	DSM3R	Y	N	N	1- All 3 groups had similar sleep fragmentation 2- REM period duration increase across night blunted in group with Major Depressive Disorder
Arriaga [41]	IV/C	Panic+Agorophobia (P) Age & sex matched normal controls (C)	14 14	6 6	8 8	34 34	DSM4	na	na	na	1- P: ↓SEI, ↑Wake%, ↓S4%, ↓SWS vs. C 2- No group difference for TST, SL, S1%, S2%, S3%, REM%
Lauer[46]	IV/C	Panic Disorder (P) Depression, Major (D) Age-matched controls (C)	22 12 12	8 4 4	14 8 8	33 30 31	DSM3R	Y	na	Y	1- P: ↓ REML, ↑ SL vs. C 2- D: ↓ SEI vs. C 3- P: ↑ SL vs. D
Pecknold[48]	IV/C	Panic+agoraphobia (P) Anxiety Disorder (A) Historical controls (C)	43 11 57	18 ? ?	26 ? ?	33 ? ?	DSM3	N	N	N	1- SEI: A=P, A<C, P<C 2- REM: no differences 3- S2: A=P, A<C, P<C 4- SWS: A=P, A>C, P>C 5- TST: A>P, A=C, P<C
Stein[49]	IV/C	Panic Disorder (P) Control (C)	16 16	5 ?	11 ?	37 37	DSM3R	N	na	N	1- P: ↓ Δ sleep, ↓ TST vs. C 2- C: ↑ S2% vs. P
Hohagen[44]	IV/C	Obsessive Compulsive Disorder (OCD) Age-matched controls (C)	22 22	10 12	12 10	39 39	DSM3R	na	na	na	1- OCD: ↓ SEI, ↑ Wake% vs. C 2- No group difference in sleep macroarchitecture
Hurwitz[45]	IV/C	Combat Vets with PTSD Noncombat Vet controls (C)	18 10	18 10	0 0	45 47	DSM3R	Y	na	na	1- ↑ SL to S2, ↓ arousals/hour from SWS on night2, ↓ subjective estimates of TST, ↑ sleep state misperception in PTSD vs. C 2- No group difference in sleep macroarchitecture

Notation- Q1: Did polysomnography help in the evaluation of insomnia in this study? Q2: Did polysomnography provide information helpful for understanding treatment failure? Q3: Did polysomnography differentiate between insomnia of different etiologies? PSG- Polysomnography, PLMD- Periodic Limb Movement Disorder, SRBD- Sleep-related Breathing Disorder, SEI- Sleep Efficiency Index, SL- Sleep Latency, WASO- Wake After Sleep Onset, TST- Total Sleep Time, SWS- Slow Wave Sleep, S2- Stage 2 Sleep, S2L- Latency to stage 2 sleep, REML- Latency to REM Sleep, REMD- REM density, ICSD- International Classification of Sleep Disorders, DSM- Diagnostic and Statistical Manual, ASDA 1979- American Sleep Disorders 1979 Sleep-wake disorder nosology. MSLT - multiple sleep latency test, DIMS - disorders of initiation and maintenance of sleep, RLS - restless leg syndrome, PPV- positive predictive value, PLMAI - periodic limb movement arousal index (number of PLMA per hour of sleep), DOES - disorders of excessive somnolence

Table 3C—Evidence Table for Studies of Patients with Sleep Disorders, Neurological Disorders, and Other Disorders

AUTHOR	GRADE / LEVEL	GROUPS	NUMBER	MALES	FEMALES	AGE	DX CRITERIA	Q1	Q2	Q3	RESULTS &/OR CONCLUSION
Zucconi [61]	III/C	Parasomnia DOA[3] (A) Parasomnia, Other (O) Control (C)	13 8 6	9 4 6	4 4 0	22 23 25	ICSD	Y	na	N	1- 60% parasomnia events were during a cyclic alternating pattern (CAP) episode 2- Sleep Macroarchitecture did not differ between groups
Allen [50]	IV/C	Demented (D) Non-demented (ND)	30 14	13 7	17 7	80 83	none	na	na	na	1- D: ↓ TST, ↓S2, ↓REM, ↑arousals vs. ND 2- No sleep difference between D subtypes 3- No 1st night effect for D
Ferini-Strambi[58]	IV/C	Multiple Sclerosis (MS) Controls (C)	25 25	13 13	12 12	40 40[1]	DSM3R	na	na	na	1- MS: ↑ PLMD (n=9) vs. C (n=2) 2- MS: ↓ SEI, ↑ #wakes vs. C 3- No group difference in sleep macroarchitecture
Manu[52]	IV/C	Chronic Fatigue (CF)[2] Subgroup with αΔ sleep Subgroup without αΔ sleep	30 8 22	8 2 7	21 6 15	41 44 40	none	Y	na	Y	1- αΔ sleep identified in 8 patients with CF (26%) 2- αΔ sleep more common in CF without depression 3- 10 CF patients other sleep disorders- PLMD (n=6), SRBD (n=4), NS (n=1).
Montplaisir[59]	IV/C	Restless Leg Syndrome	133	63	70	51	ICSD	N	N	N	1- RLS: ↑ SL, ↑ sleep disruption 2- 63% had 1° family member with RLS 3- Comorbid PLMD common
Evans[51]	V/D	Patients with head injury	138	?	?	27	none	N	Y	N	1- Some utility for predicting outcome suggested

Notation- Q1: Did polysomnography help in the evaluation of insomnia in this study? Q2: Did polysomnography provide information helpful for understanding treatment failure? Q3: Did polysomnography differentiate between insomnia of different etiologies? PSG- Polysomnography, PLMD- Periodic Limb Movement Disorder, SRBD- Sleep-related Breathing Disorder, SEI- Sleep Efficiency Index, SL- Sleep Latency, WASO- Wake After Sleep Onset, TST- Total Sleep Time, SWS- Slow Wave Sleep, S2- Stage 2 Sleep, S2L- Latency to stage 2 sleep, REML- Latency to REM Sleep, REMD- REM density, ICSD- International Classification of Sleep Disorders, DSM- Diagnostic and Statistical Manual, ASDA 1979- American Sleep Disorders 1979 Sleep-wake disorder nosology. MSLT - multiple sleep latency test, DIMS - disorders of initiation and maintenance of sleep, RLS - restless leg syndrome, PPV- positive predictive value, PLMAI - periodic limb movement arousal index (number of PLMA per hour of sleep), DOES - disorders of excessive somnolence

[1] Controls were age matched but the group age was not explicitly stated

[2] Consecutive patients in a cohort population

[3] Disorders of Arousal, including Confused Arousals, Sleep Walking, and Sleep Terror