Evidence Table

Pediatric Non-Respiratory Indications for PSG and MSLT

Article	Study Design	Blinding	No. Eligible	No. Completing	% Males completing	No. Controls	% Males in controls	Age range or Mean age ± SD of cases (years)	Age Range or Mean age ± SD of controls, if applicable (years)	Patient spectrum	Funding	PSG compared to other diagnostic measure	Diagnostic criteria	Were sleep stage scoring methods clearly defined?	If yes what were the methods?	Were respiratory scoring methods defined?	If yes, what were the methods?	PSG Type	PSG Duration
HYPERSOMNIAS (4.1)																			
Normative MSLT values in children and adolescents (4.1.1)																			
Carskadon 1992	Normative	No blinding	16	16	100%	6 adults	33%	ranges: 10-12 (5 subjects), 16-17 (5 subjects)	range: 62-74	Narrow	Government and pharma co.	None	Not applicable	Yes	R&K	Not applicable	-	EEG, EMG, EOG no respiratory	9.5 hours
Carskadon 1998	Normative	No blinding	40	32 (9th grade) 26 (10th grade)	32.5% of original 40 enrolled	n/a	n/a	range: 14-16.2	n/a	Wide	Government	sDMLO	N/A	No	-	No	-	MSLT	Overnight with 4 MSLT
Laberge 2000	Normative	No blinding	6397 children (unknown for young adults)	19	100%	18 young adults	100%	15.7±1.0	24.5±3.5	Wide	Non-US	sDMLO	N/A	Yes	R&K	No	-	MSLT	Overnight with 5-7 MSLT
Gozal 2001	Case control	Not specified	Not specified	54	53.7%	14 with primary snoring and 24 controls	50% in snoring and 58% for controls	6.7±0.3 (range: 3–12)	Snoring - 7.3±0.8 (range: 4–13); Controls - 6.1 ± 0.2 (range: 4.5–7)	Wide	Government and private	PSG compared to MSLT mean sleep latency (a measure of excessive daytime sleepiness)	Other: AI>2 had OSA	Yes	R&K	Yes	ATS and Marcus 1992	Comprehensive PSG	At least 8 hours
Palm 1989	Normative	Not applicable	18	16	50%	n/a	n/a	10.2 ± 1.3 (range: 8-12)	n/a	Wide	Non-US	Not specified	Not applicable	Yes	R&K	Not applicable	-	Ambulatory (unattended); MSLT in lab	50 h
Carskadon 1980	Normative	No blinding	19	19	58%	n/a	n/a	range: 10 - 15	n/a	Narrow	Multiple	None	Not applicable	Yes	R&K	Not applicable	-	not described	Overnight
Clinical utility of PSG and MSLT for the assessment of primary hypersomnias in children (4.1.2)																			
Shin 2008	Normative	Not applicable	20,407	10	20%	20,333; only 9/10 with narcolepsy had PSG	51%	range: 14-19	range: 14-19	Wide	Non-US	None	ICSD	Yes	R&K	Yes	Other: RDI≥5 sleep apnea syndrome	Comprehensive PSG	Not specified
Dauvilliers 2004	Normative	No blinding	Not specified	58	69%	n/a	n/a	<21	n/a	Narrow	Pharma or equip. manufacturer	None	ICSD	Yes	R&K	Not applicable	-	Comprehensive PSG	8 hrs
Guilleminault 1998	Retrospective	No blinding	1051	51	57%	n/a	n/a	7.9±3.1 (range: 2.1-11.8)	n/a	Wide	Not specified	Abbreviated studies	Other developed by authors	Yes	R&K	No	Other: varied over the 20 years	Multiple, specify: Comprehensive and MSLT	Not specified
Huang 2009	Non-randomized treatment trial	Blinded	Not specified	26	54%	13 Baclofen	54%	sodium oxybate: 15.27 ± 1.72	Baclofen: 15.23 ± 1.87	Wide	Non-US	Other, specify: ESS, PDSS, VAS	ICSD	Yes	Other	Yes	Other	Comprehensive PSG	Not specified
Han 2001	Normative	No blinding	29	29	72%	n/a	n/a	10.7±3.0 (range: 4.7-17)	n/a	Wide	Government and pharma co.	None	Other: Aldrich (for narcolepsy)	No	-	No	-	Comprehensive PSG	Not specified; occurred mostly after MSLT (within 1 month)
Reimao 1991	Observational case series	No blinding	14	14	79%	n/a	n/a	13.6 (range: 6-18)	n/a	Wide	Not specified	None	Other: presence of EDS, cataplexy, reduced sleep latency and presence of SOREMP in MSLT	Yes	R&K	No	-	Comprehensive PSG	Not specified
Ivanenko 2003	Retrospective	No blinding	13	13	46%	n/a	n/a	11.0±5.3	n/a	Wide	Not specified	None	ICSD	No	-	No	-	Comprehensive PSG	Not specified
Vendrame 2008	Retrospective	Not applicable	125	20	55%	105	Not specified	13.2 (range: 5.5-19)	Not specified	Wide	Not specified	Other, specify: HLA typing, hypocretin levels	ICSD	No	-	Yes	Other: ICSD-2	Comprehensive PSG	Overnight
Mason 2008	Retrospective case control	Not specified	Not specified	13	77%	98	51%	ranges: 1-10 and >10 to 18	Not specified	Wide	Government, industry and non-US	None	ICSD	Yes	R&K and ASDA EEG 1999	Yes	ATS and Marcus 1992	Comprehensive PSG	Overnight

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Pediatric Non-Respiratory Indications for PSG and MSLT

Article	Study Design	Blinding	No. Eligible	No. Completing	% Males completing	No. Controls	% Males in controls	Age range or Mean age ± SD of cases (years)	Age Range or Mean age ± SD of controls, if applicable (years)	Patient spectrum	Funding	PSG compared to other diagnostic measure	Diagnostic criteria	Were sleep stage scoring methods clearly defined?	If yes what were the methods?	Were respiratory scoring methods defined?	If yes, what were the methods?	PSG Type	PSG Duration
Huang 2008	Observational case series	Partial blinding: Clinical presentation, symptomatic evolution, and sleep recordings were reviewed by a sleep specialist not involved in the initial diagnosis	25	19	88%	n/a	n/a	Not specified	n/a	Wide	Not specified	Other, specify: clinical presentation, symptomatic evolution	ICSD	Yes	R&K and ASDA EEG 1992	No		Multiple, specify: Comprehensive and MSLT	not stated
Shin 2008	Normative	Not applicable	20,407	10	20%	20,333; only 9/10 with narcolepsy had PSG	51%	range: 14-19	n/a	Wide	Non-US	None	ICSD	Yes	R&K	Yes	Other: RDI≥5 sleep apnea syndrome	Comprehensive PSG	Not specified
Dauvilliers 2004	Normative	No blinding	Not specified	58	69%	n/a	n/a	<21	n/a	Narrow	Pharma or equip. manufacturer	None	ICSD	Yes	R&K	Not applicable	-	Comprehensive PSG	8 hrs
Guilleminault 1998	Retrospective	No blinding	1051	51	57%	n/a	n/a	7.9±3.1 (range: 2.1-11.8)	n/a	Wide	Not specified	Abbreviated studies	Other developed by authors	Yes	R&K	No	Other: varied over the 20 years	Multiple, specify: Comprehensive and MSLT	Not specified
Han 2001	Normative	No blinding	29	29	72%	n/a	n/a	10.7±3.0 (range: 4.7-17)	n/a	Wide	Government and pharma co.	None	Other: Aldrich (for narcolepsy)	No	-	No	-	Comprehensive PSG	Not specified; occurred mostly after MSLT (within 1 month)
Reimao 1991	Observational case series	No blinding	14	14	79%	n/a	n/a	13.6 (range: 6-18)	n/a	Wide	Not specified	None	Other: presence of EDS, cataplexy, reduced sleep latency and presence of SOREMP in MSLT	Yes	R&K	No	-	Comprehensive PSG	Not specified
Aran 2010	Retrospective/Prospective	No blinding	51	51	16%	n/a	n/a	11.8±0.5	n/a		Pharma	None	ICSD	No		No		Comprehensive PSG	Not specified
Clinical utility of PSG and MSLT for the assessment of hypersomnias in children with other sleep disorder and medical conditions (4.1.3)																			
Chervin 2006	Prospective, cross-sectional	Blinded	105 children enrolled	78 scheduled for AT for SDB	Not specified	26 scheduled for unrelated surgical care	Not specified	8.1±1.8	9.3±2.0	Wide	Government	Other, specify: PSQ-SS (Pediatric Sleep Questionnaire - Sleepiness Subscale)	Not applicable	Yes	R&K	Yes	Other	Comprehensive PSG	Not specified
Gozal 2001	Case control	Not specified	Not specified	54 with OSA	53.70%	14 with primary snoring and 24 controls	50% in snoring and 58% for controls	6.7±0.3 (range: 3–12)	Snoring - 7.3±0.8 (range: 4-13); Controls - 6.1±0.2 (range: 4.5-7)	Wide	Government and private	PSG compared to MSLT mean sleep latency (a measure of excessive daytime sleepiness)	Other: AI>2 had OSA	Yes	R&K	Yes	ATS and Marcus 1992	Comprehensive PSG	At least 8 hours
Marcus 1996	Prospective cohort	Not specified	35 approached, 23 recruited	22	27%	n/a	n/a	10±5 (range: 2-20)	n/a	Wide	Private funding	Other, specify: pulmonary function tests (PFTs) and a questionnaire on symptoms of OSAS	PSG	Yes	R&K	Yes	Other	Comprehensive PSG with video	Not specified
Ward 2010	Case control	Not specified	135	37	16.20%	32	12.50%	8.9±2.0	8.1±1.8	Narrow	US govt agencies, public university	Multiple: specify: clinical evaluation, self-reported daytime sleepiness, Wechsler Abbreviated Scale of Intelligence, and Cambridge Neuropsychological Test Automated Battery	Other: Schanberg 2003, Labyak 2001	Yes	R&K	Yes	Other: Montgomery-Downs 2006	Multiple, specify: Comprehensive PSG and MSLT	Overnight
Tarasiuk 2003	Case control	of cases' sleep records	20	20	70%	13	54%	10.4±7.3 for β-thalassemia 13.5±5.1 for CDA-1	10±4	Wide	Not specified	Other, specify: hematological evaluation	hematological evaluation: major or intermedia for β-thalassemia, CDA-1	Yes	R&K	Yes	Other	Comprehensive PSG	Overnight, but 14 had MSLT next day
Zamir 1998	Case control	No blinding	16	16	31%	9	33%	12±4	11±3	Wide	Non-US	Other, specify: rheumatological evaluation	Other: criteria for JRA from Am. College of Rheumatology	Yes	R&K	Yes	Other	Comprehensive PSG	Overnight

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PARASOMNIAS (4.2)																			
Clinical utility of PSG in children and adolescents at high risk for parasomnias (4.2.1)																			
Guilleminault 2005	Case control	Blinded	unknown	12	58%	12 matched	58%	8.6±1.7 (range: 5-11)	8.7±1.8 (range: 4.8-11)	Narrow	Other: Equipment company (Compumedics) provided PSG system	Multiple: specify: Pediatric Sleep Questionnaire Sleep Disorders Questionnaire Cyclic Alternating Pattern (CAP)	ICSD	Yes	R&K	Yes	AASM 1999	Comprehensive PSG	475.8±0.5 mins for sleepwalkers 496.5±25.8 for controls
Guilleminault 2003	Case control	Blinded	84	84	54%	36	47%	6.85±3.6 (range: 2.1-11.1)	7.35±3.5 (range: 2.3-10.9)	Narrow	Government	Multiple comparators, specify: Pediatric questionnaire including behavior/school problems as well as sleep problems	Other, specify: Dx of parasomnia made clinically prior to entry into this retrospective study. Pediatric questionnaire confirmed the presence of parasomnias over the previous 6 months All symptomatic children showed evidence of sleep disruption during PSG (e.g.	Yes	R&K	Yes	AASM 1999	Comprehensive PSG with Pes	not specified but had to be at least 8.5 hours to be in the study
Cao 2010	Retrospective clinical series	No blinding	51 adults and children referred for chronic sleepwalking	7 families investigated in detail; 3 females and 5 males (1 set of twins)	62%	n/a	n/a	9.5±5.3	n/a	Wide	not stated	Questionnaires	Not stated	Yes	R&K	Yes	AASM 1999	Comprehensive	Not specified
Video-PSG features of NREM arousal disorders and REM sleep behavior disorder in children (4.2.2)																			
Guilleminault 2003	Case control	Blinded	84	84	54%	36	47%	6.85±3.6 (range: 2.1-11.1)	7.35±3.5 (range: 2.3-10.9)	Narrow	Government	Multiple comparators, specify: Pediatric questionnaire including behavior/school problems as well as sleep problems	Other, specify: Dx of parasomnia made clinically prior to entry into this retrospective study. Pediatric questionnaire confirmed the presence of parasomnias over the previous 6 months All symptomatic children showed evidence of sleep disruption during PSG (e.g. confusional arousal, sleep	Yes	R&K	Yes	AASM 1999	Comprehensive PSG with Pes	not specified but had to be at least 8.5 hours to be in the study
Thirumalai 2002	Observational case series	No blinding	Not specified	11	82%	n/a	n/a	5±2	n/a	Wide	Private funding	None	DSMIV criteria for autism	Yes	R&K	Yes	Other: ICSD-R 1997	Comprehensive PSG	Overnight
Clinical utility of PSG in children with suspected or known sleep-related seizures or epilepsy (4.2.3)																			
Kaleyias 2008	Cohort with retrospective analysis	Not specified	Not specified	40 patients with sleep disorders; 8 with OSA	52%	11 uncomplicated OSA patients	Not specified	9.5 (range: 6-14)	Not specified	Wide	Not described	Epilepsy diagnosis not described	N/A	No	-	Yes	Author defined	Comprehensive	Overnight
Maganti 2005	Case control	Not specified	11	11	45.4%	8	50%	13.36 (range: 9-17)	14.25 (range: 13-17)	Narrow	Private funding	Behavioral scales CPT test of attention CBCL behavior	Other: Diagnosis of primary generalized epilepsy with normal EEG while receiving treatment	Yes	R&K	Yes	AASM	Comprehensive PSG: One thoracic piezoelectric belt One nasal thermister No etCO2	min 7 hrs; 2 consecutive nights
Miano 2010	Case control	Not specified	Not specified	11 mentally retarded children with epilepsy	55%	10 age matched	40%	13±3.75	12.7	Wide	Non-US	None	MR diagnostic criteria described	Yes	R&K	Yes	ATS	Comprehensive on cases; no respiratory or tibialis anterior EMG on controls	Overnight

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Nunes 2003	Case control, retrospective assessment of previously collected clinical data	Not specified	17	17	47%	11	73%	range: 4.7-16.2	range: 7.17-18.8	Narrow	Non-US	Not specified	Other: Dx of epilepsy made by clinical and EEG criteria. No sleep Dx made in this study, seizure diagnosis according to international classification of seizures	Yes	R&K	Not applicable	-	Comprehensive PSG: Epilepsy patients were studied in the epilepsy unit; controls in sleep lab for two nights, Et CO2 not measured and O2 sats not included in analysis due to "technical difficulties"	12-48 hours (cases) and overnight for controls. Time in bed was 355.33+/-90.5 mins for cases with seizure observed during PSG, 437.13+/-84.3 mins for cases without seizure observed during PSG and 559.9+/-46 mins for controls
Bruni 1995	Case control	No blinding	Not specified	10/10	10%	10/10	40%	11 (range: 2-17.1)	9.6 (range: 2.10-17)	Wide	Non-US	Multiple: specify: Tuber topography/MRI and parent report	Other	Yes	R&K	Not applicable	-	Comprehensive PSG	Sleep recordings were started at the patients' habitual bedtime and continued until spontaneous awakening.
Becker 2004	Prospective cohort	Not specified	32	30	53%	None	n/a	10.3±2.1 (range: 7.0-14.0)	n/a	Wide	Private funding	Multiple: specify Sleep Questionnaire, Behavioral assessments	PSG	No	-	Yes	Not specified	Comprehensive PSG	Not reported
Hofstra 2009	Retrospective observational study	Not specified	Not specified	76	57.9%	n/a	n/a	8.3 (range: 1–15)	n/a	Wide	Christelijke Vereniging voor de Verpleging van Lijders aan Epilepsie	Not stated	Not stated for diagnosis;For seizure inclusion: Only clinico-electrographic seizures were included - seizures with clinical symptoms (visible on video), as well as with simultaneous ictal activity on EEG (duration of at least 2 s).	Yes	AASM 2007	Yes	AASM 2007	Comprehensive	22h+
Pruvost 2006	Clinical series	Not specified	Not specified	10	60%	n/a	n/a	12±3	n/a	Wide	Non-US	None	Not stated	No	-	No	Unconventional methods	lab	Not stated
Silvestri 2007	Prospective cohort	No blinding	Not specified	42	83%	None	n/a	8.9±2.8	n/a	Wide	Non-US	Behavioral scales Neuropsychological assessment: cognitive, memory, intellectual ability, visual perception, attention	Other : DSMIV for ADHD	No	-	No		Comprehensive PSG	Not stated
Zaaimi 2007	Prospective cohort	No blinding	Not specified	10	40%	n/a	n/a	11.6±3.4	n/a	Wide	Non-US	None	Other	No	-	Yes	Other	Comprehensive PSG	Not stated
Zaaimi 2009	Prospective cohort	No blinding	Not specified	10	40%	n/a	n/a	11.6	n/a	Wide	This study was supported by grants from Universit of Picardie Jules Verne, Amiens North University Hospital, La Fondation de l'Avenir (France) and Cyberonics@, EU.Boubker Zaaimi has received support from Cyberonics.	None	Other	No	-	Yes	Other	Comprehensive PSG	Overnight
Zaaimi 2005	Clinical series	No blinding	Not specified	10	40%	n/a	n/a	Not specified	n/a	Wide	Non-US	None	Not stated	No	-	No	-	Comprehensive	Not stated
Clinical utility of PSG to evaluate sleep architecture in children with enuresis (4.2.4.2)																			
Neveus 1999	Prospective cohort study with subgrouping of case/control with desmopressin response	No blinding	25	25	88%	Subcomparison of response to desmopressin: 7 DFR; 16 DNR; 2 intermediate	n/a	10.9	n/a	Wide	Non-US	Other, specify: Micturition latency	Not stated	Yes	R&K	Not applicable	-	Limited sleep study: EEG, EMG, EOG, no respiratory, enuresis detector	Not specified

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Sans Capdevila 2008	Prospective cohort	Blinded	58,117 questionnaires sent out 378 with HS underwent PSG	69 with enuresis	65%	309 without enuresis	44%	6.5±1.2 (range: 5.5–7.8)	6.7±0.7 (range: 5.5-7.8)	Wide	Government	Other, specify: Plasma BNP level	Other	Yes	R&K	Yes	ATS	Comprehensive PSG	≤ 12 hours
Dhondt 2009	Prospective cohort	Not specified	32	29	68.96%	n/a	n/a	12.1±2.7	n/a	Narrow	Not specified	Other: clinical history, clinical examination, estimated maximal functional bladder volume recorded in a bladder diary for 3 days and nocturnal diuresis volume	Other: International Children's Continence Society	Yes	R&K and AASM	Yes	2007 AASM	Comprehensive PSG	Overnight
Inoue 1987	Case control	No blinding	Not specified	15 cases	73%	10	Not stated	8 yrs 11 mo (range: 5 y 5 mo-12)	6-12	Wide	Non-US	N/A	Not stated	Yes	R&K	No	-	Comprehensive PSG	Overnight; 2 nights
Wolfish 1999	Case control	Not specified	Not specified	15 cases, 18 controls	100%	18	100%	9.9	10.6	Wide	Non-US	No	Not stated	No	-	No	-	"Standard"	Overnight
Reimao 1993	Prospective cohort	Not specified	18	18	55.55%	n/a	n/a	8.2 (range: 5–12)	n/a	Wide	Not specified	Other, specify: enuresis sensor	Other: pediatric, urologic, and neurological workup	Yes	R&K	No	-	Comprehensive PSG	Overnight
Clinical utility of PSG in correlating enuresis to habitual snoring and/or OSA (4.2.4.3)																			
Sans Capdevila 2008	Prospective cohort	Blinded	58,117 questionnaires sent out 378 with HS underwent PSG	69 with enuresis	65%	309 without enuresis	44%	6.5±1.2 (range: 5.5-7.8)	6.7±0.7 (range: 5.5-7.8)	Wide	Government	Other, specify: Plasma BNP level	Other	Yes	R&K	Yes	ATS	Comprehensive PSG	≤ 12 hours
Brooks 2003	Prospective cohort	Not specified	160	160	56.25%	n/a	n/a	9.6±3.58	n/a	Wide	Not specified	Multiple: specify: Parental report, questionnaire	Other developed by authors: severity of enuresis defined by the following criteria: frequently (≥3×/wk), sometimes (1 to 2×/wk), rarely (<1×/wk), or never	No	-	Yes	Other:Central apnea was defined as a 10-second period without air flow or respiratory effort. Obstructive apnea was defined as cessation of air flow for at least 10 seconds with paradoxic respiratory effort. Partial obstruction was defined as reduction in air flow with paradoxic chest wall and abdominal motion, resulting in either an arousal or an oxyhemoglobin desaturation of at least 4%. Hypopnea was defined as a reduction in air flow with synchronous chest wall and abdominal motion, resulting in either arousal or oxyhemoglobin desaturation of least 4%. The type, number, and duration of respiratory events were noted, as well as the median and minimum oxyhemoglobin	Comprehensive PSG	Overnight
Barone 2009	Case control	Blinded	Not specified	149	Not specified	139	Not stated	range: 5-15	range: 5-15	Wide	Not stated	Clincal	For OSA, clinical charts and PSG	No	-	Yes	Author described	Comprehensive	Not described
Wang 1998	Retrospective chart review	Not specified	82	82	56%	n/a	n/a	6.7 (range: 18 months-15 years)	n/a	Wide	Not stated	Clinical evaluation; signs and symptoms	PSG - RDI result	No	-	Yes	Author described	Comprehensive	6-7 hours
Silvestri 2009	Prospective cohort	No blinding	55	55	85%	20	Not stated; gender-matched controls	8.9±2.7	Not stated; age-matched controls	Wide	Not stated	Structured sleep interview	Sleep interview and PSG	Yes	AASM 2007	No	-	Video PSG	Minimum of one night
SLEEP RELATED MOVEMENT DISORDERS (4.3)																			
Clinical utility of PSG in Children with RLS (4.3.1)																			
Chervin 2001	Prospective cohort	Not specified	113	29	76%	84	61%	10.4±4.3	9.6±4.0	Wide	Government	Other, specify: Pediatric Sleep Questionnaire	Other developed by authors	Yes	R&K	Yes	Other	Comprehensive PSG	Not specified
Chervin 2001	Prospective cohort	Not specified	113	59 had SDB	66%	54 did not have SDB	63%	9.6±3.7	10.1±4.4	Wide	Government	Behavioral scales	Other developed by authors	Yes	R&K	Yes	Other	Comprehensive PSG	Not specified
Martin 2008	Retrospective review	Not applicable	235 eligible, 101 included	Excessive leg movements: 50%; restlessness 73%; PLMS≥5 was 10%; PLMD 4%	PLMS≥5 : 80%	PLMS<5 :91	PLMS<5 :57%	PLMS≥5: 9.0±5.7	PLMS<5: 6.2±3.9	Wide	Pharma or equip. manufacturer and private	Parental observations	ICSD	Yes	R&K	Yes	Other	Comprehensive PSG	Not stated

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Picchietti 1998	Prospective cohort	Not specified	69 eligible ADHD patients; 27 with positive response to possible PLMD and agreed to sleep study	18 had PLMD and 9 did not	67%	38 matched without ADHD	50%	8.7 (range: 2-15)	range: 2-16	Broad	Government	None	Other: DSM III-R for ADHD	Uncertain	Other: Guilleminault 1982	Uncertain	Other: Guilleminault 1982	Comprehensive PSG	Not stated
Picchietti 1999	Case control	Not specified	16	14	93%	10	50%	8.2 (range: 5–12)	11.1 (range: 9.9-12.7)	Narrow	Government and private	None	Other: DSM III-R for ADHD ICSD for clinically significant PLMS	Yes	Other: Guilleminault 1982 and The Atlas Task Force 1992	No	-	Comprehensive PSG	Not stated
Picchietti 1999	Retrospective review	Not specified	129	129	Not specified	None	n/a	Not specified	n/a	Wide	Government	Other, specify: IRLS	ICSD	No	-	Not applicable	-	Comprehensive PSG	Not specified
Picchietti 2008	Retrospective review	Not specified	18	17	Not specified	None	n/a	Not specified	n/a	Wide	Government	Other, specify: NIH diagnostic criteria for pediatric RLS	Other	No	-	No	-	Comprehensive PSG	Not stated
Picchietti 2009	Retrospective review	Not specified	204	37 (10-RLS, 27-PLMD)	68%	None	n/a	9.8 (0.8-19)	n/a	Wide	Government	None	ICSD for PLMD and NIH or IRLS for RLS	No	-	No	-	Comprehensive PSG	Not specified
Rajaram 2004	Case control	Not specified	11	10	60%	10	60%	10.4	9.7±2	Narrow	Not specified	None	Other: growing pains diagnosed by clinical interview and physical examination; RLS by NIH	Yes	R&K	Yes	ATS	Comprehensive PSG	Not specified
Normative values for PLMS in children, by age (4.3.2.1)																			
Martinez 2004	Prospective cohort	Blinded	252; 62% male	58	60%	194	40%	8y, 1mo±3y, 5mo	Not specified but not significantly different from PLM group	Wide	Government and Non-US	Other, specify: Questionnaire	PSG	Yes	R&K	Yes	Other: AASM 1999 and those listed by authors	Comprehensive PSG	At least 8.5 hrs
Crabtree 2003	Case control	Not specified	570 for chart review 351 community sample	PLMD/ADHD 40 PLMD 50	80%; 68%	52	50%	7.81±1.9 7.14±1.5	6.65±0.5	Wide	Government	Parental observations	PLMD: ICSD ADHD: author's own criteria based on Conner's or parental report of previous diagnosis	Yes	R&K	Yes	ATS and Marcus 1992	Comprehensive PSG	Overnight up to 12 h
O'Brien 2007	Prospective cohort	Not specified	41,363 questionnaires mailed; 9872 returned; 689 agreed to have PSG; 542 had PSGs	542	56%	93% African American and 83.5% Caucasion	Not specified	Not specified	Not specified	Wide	Government	None	ICSD	Yes	R&K	Yes	ATS and Marcus 1992	Comprehensive PSG	Lights out between 21:00 and 21:30 h and were awakened at 07:00 h
Bokkala 2008	Retrospective review	Not applicable	982	77 had PLMS	61%	905	Not specified	9.4±4.2 (range: 1-19)	Not specified	Wide	Not specified	Other, specify: Serum ferritin levels	ICSD	Yes	R&K	Yes	Other	Comprehensive PSG	Not specified
Martin 2008	Retrospective review	Not applicable	235	101	PLMS≥5 : 80%	PLMS<5 :91	PLMS<5 :57%	PLMS≥5: 9.0±5.7	PLMS<5: 6.2±3.9	Wide	Pharma or equip. manufacturer and private	Parental observations	ICSD	Yes	R&K	Yes	Other	Comprehensive PSG	Not stated
Kirk 2004	Retrospective	Not applicable	591	7 with no other disorder; 33 total	Not specified	558	Not specified	PLM index > 5/hr: 8.6 (range: 1.8-17.9)	Not specified	Wide	Non-US	None	Other: ICSD and Marcus 1992	Yes	R&K	Yes	Other: listed by authors	Comprehensive PSG	Overnight
Normative values for PLM arousal index in children (4.3.2.2)																			
O'Brien 2007	Prospective cohort	Not specified	41,363 questionnaires mailed; 9872 returned; 689 agreed to have PSG; 542 had PSGs; mean age 6.7 ± 0.5	542	56%	93% African American and 83.5% Caucasion	Not specified	Not specified	Not specified	Wide	Government	None	ICSD	Yes	R&K	Yes	ATS and Marcus 1992	Comprehensive PSG	Lights out between 21:00 and 21:30 h and were awakened at 07:00 h
Martinez 2004	Prospective cohort	Blinded	252; 62% male	58	60%	194	40%	8y, 1mo±3y, 5mo	Not specified but not significantly different from PLM group	Wide	Government and Non-US	Other, specify: Questionnaire	PSG	Yes	R&K	Yes	Other: AASM 1999 and those listed by authors	Comprehensive PSG	At least 8.5 hrs
Kirk 2004	Retrospective	Not applicable	591	7 with no other disorder; 33 total	Not specified	558	Not specified	PLM index > 5/hr: 8.6 (range: 1.8-17.9)	Not specified	Wide	Non-US	None	Other: ICSD and Marcus 1992	Yes	R&K	Yes	Other: listed by authors	Comprehensive PSG	Overnight
Bokkala 2008	Retrospective review	Not applicable	982	77 had PLMS	61%	905	Not specified	9.4±4.2 (range: 1-19)	Not specified	Wide	Not specified	Other, specify: Serum ferritin levels	ICSD	Yes	R&K	Yes	Other	Comprehensive PSG	Not specified
The degree of night to night variability in PLMS in children with PLMD (4.3.2.3)																			
Picchietti 2009	Prospective	Not applicable	Not specified	36	75%	None	n/a	9	n/a	Broad	Not specified	None	Other: DSM-IV for ADHD, NIH for RLS, ICSD for PLMD	No	-	Yes	Other: Katz 2005 and Witmans 2003	Comprehensive PSG	Not stated

Evidence Table

Pediatric Non-Respiratory Indications for PSG and MSLT

Article	Study Design	Blinding	No. Eligible	No. Completing	% Males completing	No. Controls	% Males in controls	Age range or Mean age ± SD of cases (years)	Age Range or Mean age ± SD of controls, if applicable (years)	Patient spectrum	Funding	PSG compared to other diagnostic measure	Diagnostic criteria	Were sleep stage scoring methods clearly defined?	If yes what were the methods?	Were respiratory scoring methods defined?	If yes, what were the methods?	PSG Type	PSG Duration
Clinical utility of PSG in children with bruxism? (4.3.3)																			
Herrera 2006	Prospective cohort	Blinded	Not specified	10	50%	10	50%	9.2±3.2 (range: 5-15)	Age-matched to controls	Broad	Not specified but not industry supported	Behavioral scales Johannson scale (clinical scoring system for bruxism)	Other: Bruxism by Lavigne 2002; OSA by Carroll 1995	Yes	R&K	Yes	Other: For scoring, apnea was defined as a complete cessation of airflow and hypopnea as a 50% reduction of airflow, both lasting at least 2 respiratory cycles.	Comprehensive PSG	Not stated
Clinical utility of PSG in diagnosing sleep-related movement disorders in special populations of children (4.3.4)																			
Tarasiuk 2003	Case control	Of cases' sleep records	20	20	70%	13	54%	10.4±7.3 for β-thalassemia 13.5±5.1 for CDA-1	10±4	Wide	Not specified	Other, specify: hematological evaluation	Hematological evaluation: major or intermedia for β-thalassemia, CDA-1; PLMS by ICSD criteria	Yes	R&K	Yes	Other	Comprehensive PSG; NO CO2 measurements, otherwise resp methods good	Overnight, but 14 had MSLT next day; 9 had 2nd PSG
Rogers 2010	Retrospective chart review	Not specified	55	55	43.63%	n/a	n/a	9.5 ± 4.6	n/a	Wide	Other: not an industry supported study		Other	Yes	R&K/ for PLM Atlas Task Force	Yes	ATS	Comprehensive PSG	Overnight, ≥6 hours of recording time; Mean duration 430.6 minutes
Simakajornboon 2003	Prospective cohort	Not specified	39	39	51%	None	n/a	7.5±3.1 (range: 1-13)	n/a	Narrow	Private and government	Other, specify: serum iron and ferritin levels	Other: IRLS for RLS	Yes	R&K	Yes	Other	Comprehensive PSG	up to 12 hours
Miano 2005	Case control	Not specified	Not specified	10	50%	Mental retardation no epilepsy: 15 Mental retardation and epilepsy: 13	Mental retardation no epilepsy: 60% Mental retardation and epilepsy: 38	5.8 (range: 2–16)	Mental retardation no epilepsy: 7.6 years, range 3–10 Mental retardation and epilepsy: 6.8 years, range 3–9	Wide	Not specified	None	Other: genetic testing for AS PLMS/D; Crabtree 2003	Yes	R&K with some modifications for AS patients (described)	Yes	ATS	Comprehensive PSG	Not stated
SLEEP IN SPECIAL POPULATIONS (4.4)																			
Clinical Utility of PSG in the evaluation of sleep in special populations of children with chronic pain syndromes, fibromyalgia, or other rheumatological problems (4.4)																			
Tayag-Kier 2000	Case control	Blinded	Not specified	16	6%	14	9%	15.0±2.6	14.0±2.2	Wide	Not specified	None	Other: JF criteria of Yunus and Masi	Yes	R&K	Yes	ATS and Marcus 1992	Comprehensive PSG	Not stated
Zamir 1998	Case control	No blinding	16	16	31%	9	33%	12±4	11±3	Wide	Non-US	Other, specify: rheumatological evaluation	Other: criteria for JRA from Am. College of Rheumatology	Yes	R&K	Yes	Other	Comprehensive PSG	Overnight
Passarelli 2006	Case control	Blinded	41	21	43%	20	50%	13±2	13±2	Narrow	Not specified	Other, specify: sleep disturbance scale and clinical indicators for JRA	Other: several pain and rheumatology criteria	Yes	R&K	No	-	Comprehensive PSG	At least 7.5 hrs

Evidence Table

Pediatric Non-Respiratory Indications for PSG and MSLT

Article	Study Design	Blinding	No. Eligible	No. Completing	% Males completing	No. Controls	% Males in controls	Age range or Mean age ± SD of cases (years)	Age Range or Mean age ± SD of controls, if applicable (years)	Patient spectrum	Funding	PSG compared to other diagnostic measure	Diagnostic criteria	Were sleep stage scoring methods clearly defined?	If yes what were the methods?	Were respiratory scoring methods defined?	If yes, what were the methods?	PSG Type	PSG Duration
Ward 2008	Case control	Not specified	135	37	18.40%	32	12.50%	8.9±2.0	8.1±1.8	Narrow	Private funding	Other, specify: sleep self-report; self-report lab sleep; daily symptom diary; Oucher Faces Rating Pain Scale (pain intensity and location); Child Fatigue Scale (fatigue); Revised Children's Manifest Anxiety Scale (anxiety); Childhood Health Assessment Questionnaire	PSG	Yes	R&K	Yes	Other: Montgomery-Downs 2006	Comprehensive PSG	Not stated
Ward 2010	Case control	Not specified	135	37	16.20%	32	12.50%	8.9±2.0	8.1±1.8	Narrow	US govt agencies, public university	Multiple: specify: clinical evaluation, self-reported daytime sleepiness, Wechsler Abbreviated Scale of Intelligence, and Cambridge Neuropsychological Test Automated Battery	Other: Schanberg 2003, Labyak 2001	Yes	R&K	Yes	Other: Montgomery-Downs 2006	Multiple, specify: Comprehensive PSG and MSLT	Overnight
Lopes 2008	Case control	No blinding	24	12	42%	12	42%	12.5±2.4 (range: 9-17)	13.1±2.0	Wide	Not specified	None	Other: criteria for JIA from Am. College of Rheumatology	Yes	R&K	No	-	Comprehensive PSG	Minimum duration of 7.5 hrs of total sleep time
Vendrame 2008	Retrospectice review	Not specified	532 seen for headaches, 152 also had sleep complaints, 90 agreed to have PSG	90	60%	None	n/a	median: 11 (range: 5-19)	n/a	Wide	Not specified	None	Other: IHS for children 2nd ed (Olsen) 2004	No	-	Yes	Other	Other, specify: video PSG	Not specified

Evidence Table

Pediatric Non-Respiratory Indications for PSG and MSLT

Article	Study Description (short)	Study Outcomes/Findings (short)	Study Conclusions Relative to PSG (short)	% Subjects having diagnostic test and appropriate independent measure	Was a valid reference standard used to assess presence of disease? If yes, was it independent of the diagnostic test?	Reliability issues	Recording strategy issue	Validity issues: History	Validity issues: Questionnaire	Validity issues: Clinical	Diagnostic Accuracy (PPV, NPV, sensitivity, specificity etc.) if given
HYPERSOMNIAS (4.1)											
Normative MSLT values in children and adolescents (4.1.1)											
Carskadon 1992	To understand if the "post-lunch dip" is from eating or if it is because of a biphasic pattern of 24-hour sleep tendency	These results indicate a midday increase in sleep tendency that is unrelated to food intake but that may be related to developmental or maturational processes.	MSLT useful in characterizing sleep	0%	Not applicable	None	Not applicable	Not applicable	Not applicable	Not applicable	Not specified
Carskadon 1998	This study examined effects on adolescent sleep patterns, sleepiness, and circadian phase of a school transition requiring an earlier start.	Early start time was associated with significant sleep deprivation and daytime sleepiness. The occurrence of REM sleep on MSLT indicates that clinicians should exercise caution in interpreting MSLT REM sleep in adolescents evaluated on their "usual" schedules.	MSLT useful in characterizing sleep patterns of adolescents	100%	N/A	None	No	Not applicable	Not applicable	Not applicable	Not specified
Laberge 2000	Our aim was to compare the circadian phase characteristics of healthy adolescent and young adult males in a naturalistic summertime condition.	These results together indicate that adolescents and young adults investigated during summertime showed similar circadian phase characteristics, and that, in these age groups, an evening phase preference is associated with a delayed melatonin secretion pattern and delayed habitual sleep patterns without a decrease in sleep consolidation or vigilance.	MSLT useful in characterizing sleep patterns of adolescents in the summertime	100%	N/A	None	No	Not applicable	Not applicable	Not applicable	Not specified
Gozal 2001	The incidence of EDS in children with OSA is unknown. The purpose of the study is to determine overall daytime sleepiness in pediatric OSA	The mean apnea index was 15.1 6 9.5 standard deviation in OSA, 1.1 6 0.5 in PS, and 0.1 6 0.3 in C. Mean sleep latencies were 23.7 6 3.0 minutes in C, 23.7 6 3.1 minute in PS, and 20.0 6 7.1 minute in OSA patients. However, only 7 children with OSA had mean sleep latencies <10 minutes. In addition, shorter sleep latencies were more likely to occur in more obese OSA patients and those with more severe apnea index, and oxyhemoglobin desaturation. Shortened sleep latencies occur in children with OSA, but EDS is infrequent and tends to develop among more severe and/or obese patients.	Pathologic daytime sleepiness defined in this study as a mean sleep latency <10 minutes is seldom present in young children with OSA, although the latter will be associated with significant albeit modest increases in sleepiness. However, obesity and more severe respiratory disturbance seem to be important risk factors for development of EDS in pediatric OSA patients.	100%	Yes / no	None	Not applicable	EDS	Not applicable	Not applicable	Not specified
Palm 1989	This study was performed to contribute to the data on sleep and wakefulness in healthy youngsters and to set standards for studies of pathological conditions.	The MSLT results confirm that children who have stopped napping but have not yet entered puberty have a very low tendency to fall asleep during daytime.	PSG/MSLT helpful in distinguishing normal from non-normal sleep characteristics with respect to sleep latency in the MSLT	0%	Not applicable	None	Not applicable	Not applicable	Not applicable	Not applicable	Not specified
Carskadon 1980	Describes relationship between MSLT and Tanner staging	Daytime sleepiness was significantly greater in subjects at Tanner stages 3 and 4 than at Tanner stages 1 and 2. Subjects at Tanner stage 5 tended to be as sleepy as Tanner stage 3 and 4 subjects but did not differ significantly from the less mature subjects. No gender differences were found in daytime sleepiness for children at similar Tanner stages. More mature children were significantly sleepier at 1330 and 1530 than in the late afternoon and evening.	MSLT useful in characterizing sleep. Children have different norms than adults.	Not applicable	Not applicable	None	Not applicable	Not applicable	Not applicable	Not applicable	Not specified
Clinical utility of PSG and MSLT for the assessment of primary hypersomnias in children (4.1.2)											
Shin 2008	In the present study, we investigated the prevalence of narcolepsy-cataplexy in adolescents.	Three subjects were finally diagnosed as narcolepsy with cataplexy and seven subjects might be diagnosed as narcolepsy without cataplexy. Among three narcoleptics with cataplexy, two subjects were HLA-DQB1*0602 and DRB1*1501 positive, but one subject had no test of HLA typing. The prevalence of narcolepsy with cataplexy in Korean adolescence was thus determined to be 0.015% (95% confidence interval = 0.0–0.0313%).	PSG/MSLT useful in establishing a diagnosis of narcolepsy	Not applicable	Not applicable	None	Not applicable	Not applicable	Other, specify: UNS, PSQI, ESS, BDI	Not applicable	Not specified

Evidence Table

Pediatric Non-Respiratory Indications for PSG and MSLT

Article	Study Description (short)	Study Outcomes/Findings (short)	Study Conclusions Relative to PSG (short)	% Subjects having diagnostic test and appropriate independent measure	Was a valid reference standard used to assess presence of disease? If yes, was it independent of the diagnostic test?	Reliability issues	Recording strategy issue	Validity issues: History	Validity issues: Questionnaire	Validity issues: Clinical	Diagnostic Accuracy (PPV, NPV, sensitivity, specificity etc.) if given
Dauvilliers 2004	To measure the effect of age on Multiple Sleep Latency Test (MSLT) characteristics, sleep latency, and number of sleep-onset REM periods (SOREMP) in two large populations of narcoleptic patients with similar genetic backgrounds.	The results show a progressive decrease in the number of SOREMP with age and a progressive increase in the mean sleep latency on the MSLT as a function of age. This finding is also related to the severity of cataplexy as assessed from the clinical history with a progressive decrease in the frequency of cataplexy attacks with age. These results may reflect the progressive increase in sleep latency seen in normal aging and suggest that clinical improvement might be due to changes in the neural mechanisms responsible for SOREMP, which may weaken with age.	PSG useful in characterizing young patients with narcolepsy and establishing criteria for diagnosis	Not applicable	Yes / yes	None	Not applicable	Not applicable	Not applicable	Not applicable	Not specified
Guilleminault 1998	This report describes the onset of symptoms, diagnostic data, clinical course, and response to treatment when narcolepsy presents before puberty.	Narcolepsy was diagnosed in 51 children (29 boys) [representing about 5% of the narcoleptic population]. A mean of three referrals was made before narcolepsy was considered. In 10 children, cataplexy was the presenting symptom. Thirty-eight children acknowledged sleep paralysis and 30 acknowledged hypnagogic hallucinations. All children had sleep studies; 31 exhibited rapid eye movement at sleep onset. The mean sleep latency was 1.5 minutes ± 39 seconds on the Multiple Sleep Latency Test. All children had at least two sleep-onset rapid eye movement sleep episodes in this test. Forty-six children were HLA class 11-positive for DQd, and 45 were also positive for DRwl5. Thirty (65%) families refused referrals to support and counseling groups. Teachers often refused to acknowledge a medical problem. During followup, all children presented at least once with depressive symptoms in reaction to their syndrome. Narcolepsy should be considered when evaluating children with behavioral and depressive symptoms.	PSG/MSLT useful in diagnosing narcolepsy	Not applicable	No	None	No	Not applicable	Not applicable	Not applicable	Not specified
Huang 2009	This study was performed to evaluate the actions of baclofenand sodium oxybate, two medications with γ-aminobutyric acid type B (GABAB) receptor agonist properties, on symptoms of narcolepsy in drug-nai¨ve teenagers.	Both drugs increased total sleep time and delta waves during sleep, but only sodium oxybate had an effect on daytime sleepiness and cataplexy at 3 months. Improvement of total nocturnal sleep time had no beneficial effect on daytime sleepiness. The mechanism by which sodium oxybate improves cataplexy and sleepiness is inferred to be due to properties beyond direct GABAB agonist action.	MSLT useful in treating narcoleptics	100%	Not applicable	None	Not applicable	Not applicable	Not applicable	Clinical changes after intervention	Not specified
Han 2001	The purpose is to report the results of an effort to diagnose children with narcolepsy in a pediatric referral clinic. Comparisons were made between CT, MRI, and MSLT.	The findings of general interest are the issues of prevalence, clinical presentation of children, HLA testing, and diagnostic approach where sleep testing resources are sparse.	PSG/MSLT useful in diagnosing narcolepsy	100%	Yes / yes	None	Not applicable	Not applicable	Not applicable	Not applicable	Not specified
Reimao 1991	The objective of this report is to describe clinical, polysomnographic, and MSLT features of a group of pediatric narcoleptics.	Clinical, polysomnographic, and MSLT features of pediatric narcoleptics are remarkably similar to those of adult narcoleptics.	PSG/MSLT useful in characterizing narcoleptics	0%	no	None	Not applicable	Not applicable	Not applicable	Not applicable	Not specified
Ivanenko 2003	Modafinil is an alerting agent approved for the treatment of narcolepsy in adults. There are no studies examining the longterm effects and safety profile of modafinil in children with excessive daytime somnolence (EDS).	Modafinil has a modest, yet significant effect on EDS in children and appears to be safe and well tolerated.	PSG/MSLT useful in treating narcolepsy	Not applicable	Yes / yes	None	Not applicable	Not applicable	Not applicable	Clinical changes after intervention	Not specified
Vendrame 2008	This study aimed to (1) describe the clinical and polysomnographic features, and treatment outcomes, of a group of children with narcolepsy, and (2) describe other sleep disorders to be considered in the differential diagnosis of hypersomnia and which may coexist with narcolepsy.	16% of patients had narcolepsy; of these 85% had sleep-disordered breathing; 25% had PLMS; 5% had parasomnias. MSLT sleep latency was 6.14 minutes (mean) with SOREMP median 2/5 naps. Treatment with modafinil and sodium oxybate provided optimal control of daytime sleepiness. 72% had SDB; 16% had PLMS; 16.8% had DSPS; 2.4% had parasomnias. Physicians should routinely screen for hypersomnia in children by obtaining a detailed history and, in appropriate situations, ordering polysomnographic testing to rule out narcolepsy and other causes of hypersomnia.	PSG/MSLT useful in diagnosing narcoleptics	Not applicable	No	None	Not applicable	Not applicable	Not applicable	Not applicable	Not specified

Evidence Table

Pediatric Non-Respiratory Indications for PSG and MSLT

Article	Study Description (short)	Study Outcomes/Findings (short)	Study Conclusions Relative to PSG (short)	% Subjects having diagnostic test and appropriate independent measure	Was a valid reference standard used to assess presence of disease? If yes, was it independent of the diagnostic test?	Reliability issues	Recording strategy issue	Validity issues: History	Validity issues: Questionnaire	Validity issues: Clinical	Diagnostic Accuracy (PPV, NPV, sensitivity, specificity etc.) if given
Mason 2008	REM sleep distribution changes during development, but little is known about REM latency variation in childhood by age, sex, or pathologic sleep states. We hypothesized that: (1) REM latency would differ in normal children by age, with a younger cohort (1-10 years) demonstrating shorter REM latency than an older group (>10-18 years); (2) REM latency in children would differ from typical adult REM latency; and (3) intrinsic sleep disorders (narcolepsy, pediatric obstructive sleep apnea syndrome) would disrupt normal developmental patterns of REM latency.	There were no statistically significant main effects of age category or sex on REM latency. REM latency, however, exhibited a significant inverse correlation with age within the older control children. Healthy children exhibited REM latencies significantly longer than adults. Normal control patients demonstrated significantly longer REM latency than obstructive sleep apnea syndrome and narcolepsy patients.	PSG useful in characterizing narcoleptic patients	100% (MSLT)	Yes / yes (history)	Inter-reader	Not applicable	EDS	Not applicable	Not applicable	Not specified
Huang 2008	Cause and pathogenesis of the Kleine-Levin syndrome (KLS), a recurrent hypersomnia affecting mainly male adolescents, remain unknown, with only scant information on the sleep characteristics during episodes. We describe findings obtained with polysomnography (PSG) and Multiple Sleep Latency Test (MSLT) and correlation obtained between clinical and PSG findings from different episodes.	When PSG was performed early (before the end of the first half of the symptomatic period), an important reduction in slow wave sleep (SWS) was always present with progressive return to normal during the second half (with percentages very similar to those monitored during the asymptomatic period) despite persistence of clinical symptoms. REM sleep remained normal in the first half of the episode but decreased in the second half: the differences between first and second half of episodes were significant for SWS (p 0.014) and REM sleep (p 0.027). The overall mean sleep latency at MSLT was 9.51 4.82 minutes and 7 of 17 patients had two or more sleep onset REM periods during the symptomatic period	Important changes in sleep occur over time during the symptomatic period, with clear impairment of slow wave sleep at symptom onset. But Multiple Sleep Latency Test (MSLT) is of little help in defining sleep problems and findings from the MSLT do not correlate with symptom onset. [TH: PSG evidence of altered sleep architecture evolves during the symptomatic period, but differences between the symptomatic and asymptomatic periods were not statistically significant. Mean sleep latency was mildly low duirng symptomatic and asymptomatic periods.	100%	yes/ yes	None	None	None	Other, specify: self-report questionnaires	Other, specify: clinical presentation, symptomatic evolution	Not specified
Shin 2008	In the present study, we investigated the prevalence of narcolepsy-cataplexy in adolescents.	Three subjects were finally diagnosed as narcolepsy with cataplexy and seven subjects might be diagnosed as narcolepsy without cataplexy. Among three narcoleptics with cataplexy, two subjects were HLA-DQB1*0602 and DRB1*1501 positive, but one subject had no test of HLA typing. The prevalence of narcolepsy with cataplexy in Korean adolescence was thus determined to be 0.015% (95% confidence interval = 0.0–0.0313%).	PSG/MSLT useful in establishing a diagnosis of narcolepsy	Not applicable	Not applicable	None	Not applicable	Not applicable	Other, specify: UNS, PSQI, ESS, BDI	Not applicable	Not specified
Dauvilliers 2004	To measure the effect of age on Multiple Sleep Latency Test (MSLT) characteristics, sleep latency, and number of sleep-onset REM periods (SOREMP) in two large populations of narcoleptic patients with similar genetic backgrounds.	The results show a progressive decrease in the number of SOREMP with age and a progressive increase in the mean sleep latency on the MSLT as a function of age. This finding is also related to the severity of cataplexy as assessed from the clinical history with a progressive decrease in the frequency of cataplexy attacks with age. These results may reflect the progressive increase in sleep latency seen in normal aging and suggest that clinical improvement might be due to changes in the neural mechanisms responsible for SOREMP, which may weaken with age.	PSG useful in characterizing young patients with narcolepsy and establishing criteria for diagnosis	Not applicable	Yes / yes	None	Not applicable	Not applicable	Not applicable	Not applicable	Not specified

Evidence Table

Pediatric Non-Respiratory Indications for PSG and MSLT

Article	Study Description (short)	Study Outcomes/Findings (short)	Study Conclusions Relative to PSG (short)	% Subjects having diagnostic test and appropriate independent measure	Was a valid reference standard used to assess presence of disease? If yes, was it independent of the diagnostic test?	Reliability issues	Recording strategy issue	Validity issues: History	Validity issues: Questionnaire	Validity issues: Clinical	Diagnostic Accuracy (PPV, NPV, sensitivity, specificity etc.) if given
Guilleminault 1998	This report describes the onset of symptoms, diagnostic data, clinical course, and response to treatment when narcolepsy presents before puberty.	Narcolepsy was diagnosed in 51 children (29 boys) [representing about 5% of the narcoleptic population]. A mean of three referrals was made before narcolepsy was considered. In 10 children, cataplexy was the presenting symptom. Thirty-eight children acknowledged sleep paralysis and 30 acknowledged hypnagogic hallucinations. All children had sleep studies; 31 exhibited rapid eye movement at sleep onset. The mean sleep latency was 1.5 minutes ± 39 seconds on the Multiple Sleep Latency Test. All children had at least two sleep-onset rapid eye movement sleep episodes in this test. Forty-six children were HLA class 11-positive for DQd, and 45 were also positive for DRwl5. Thirty (65%) families refused referrals to support and counseling groups. Teachers often refused to acknowledge a medical problem. During followup, all children presented at least once with depressive symptoms in reaction to their syndrome. Narcolepsy should be considered when evaluating children with behavioral and depressive symptoms.	PSG/MSLT useful in diagnosing narcolepsy	Not applicable	No	None	No	Not applicable	Not applicable	Not applicable	Not specified
Han 2001	The purpose is to report the results of an effort to diagnose children with narcolepsy in a pediatric referral clinic. Comparisons were made between CT, MRI, and MSLT.	The findings of general interest are the issues of prevalence, clinical presentation of children, HLA testing, and diagnostic approach where sleep testing resources are sparse.	PSG/MSLT useful in diagnosing narcolepsy	100%	Yes / yes	None	Not applicable	Not applicable	Not applicable	Not applicable	Not specified
Reimao 1991	The objective of this report is to describe clinical, polysomnographic, and MSLT features of a group of pediatric narcoleptics.	Clinical, polysomnographic, and MSLT features of pediatric narcoleptics are remarkably similar to those of adult narcoleptics.	PSG/MSLT useful in characterizing narcoleptics	0%	no	None	Not applicable	Not applicable	Not applicable	Not applicable	Not specified
Aran 2010	To report on symptoms and therapies used in childhood narcolepsy-cataplexy.	Symptoms, HLA DQB1*0602 positive, CSF hypocretin conc., sleep efficiency, REM latency, sleep stage, TST, PLMS index, MSLT	PSG/MSLT useful in characterizing narcoleptics	73% PSG, 76% MSLT, 26% CSF hypocretin-1	Yes/yes	None	None	Not applicable	Questionnaire was not validated	Not applicable	Not specified
Clinical utility of PSG and MSLT for the assessment of hypersomnias in children with other sleep disorder and medical conditions (4.1.3)											
Chervin 2006	To compare a validated subjective measure of childhood sleepiness to an objective determination, assess the frequency of problematic sleepiness among children with suspected sleep-disordered breathing (SDB), and examine what standard or investigational polysomnographic measures of SDB predict subjective sleepiness.	Thirty-three (43%) of the children scheduled for adenotonsillectomy had high PSQ-SS scores, in comparison with only 3 (12%) of the controls (p = .004). The PSQ-SS scores correlated inversely with mean sleep latencies on the MSLTs (rho = -0.23, p = .006). The obstructive apnea index, apnea-hypopnea index, and respiratory disturbance index (which included respiratory event-related arousals identified by esophageal pressure monitoring) each correlated similarly with PSQ-SS scores, as did investigational quantification of esophageal pressures and respiratory cycle-related electroencephalographic changes (each rho ≈ 0.30, p < .02). A stepwise regression identified sigma-frequency respiratory cyclerelated electroencephalographic changes as the strongest independent predictor of subjective sleepiness among all subjects and particularly among those without obstructive sleep apnea.	Sleepiness is a frequent problem among children with suspected SDB. Subjective sleepiness (PSQ-SS) reflects MSLT results to a limited extent, as in adults. Standard polysomnographic measures of SDB predict subjective sleepiness, but respiratory cycle-related electroencephalographic changes may offer additional clinical utility. Standard polysomnographic measures can be informative about risk for daytime sleepiness but only to a moderate extent.	100% if consider PSG independent compared to PSQ-SS	Yes / no	None	Not applicable	EDS	Other, specify: PSQ-SS	Not applicable	Not specified
Gozal 2001	The incidence of EDS in children with OSA is unknown. The purpose of the study is to determine overall daytime sleepiness in pediatric OSA	The mean apnea index was 15.1 6 9.5 standard deviation in OSA, 1.1 6 0.5 in PS, and 0.1 6 0.3 in C. Mean sleep latencies were 23.7 6 3.0 minutes in C, 23.7 6 3.1 minute in PS, and 20.0 6 7.1 minute in OSA patients. However, only 7 children with OSA had mean sleep latencies <10 minutes. In addition, shorter sleep latencies were more likely to occur in more obese OSA patients and those with more severe apnea index, and oxyhemoglobin desaturation. Shortened sleep latencies occur in children with OSA, but EDS is infrequent and tends to develop among more severe and/or obese patients.	Pathologic daytime sleepiness defined in this study as a mean sleep latency <10 minutes is seldom present in young children with OSA, although the latter will be associated with significant albeit modest increases in sleepiness. However, obesity and more severe respiratory disturbance seem to be important risk factors for development of EDS in pediatric OSA patients.	100%	Yes / no	None	Not applicable	EDS	Not applicable	Not applicable	Not specified

Evidence Table

Pediatric Non-Respiratory Indications for PSG and MSLT

Article	Study Description (short)	Study Outcomes/Findings (short)	Study Conclusions Relative to PSG (short)	% Subjects having diagnostic test and appropriate independent measure	Was a valid reference standard used to assess presence of disease? If yes, was it independent of the diagnostic test?	Reliability issues	Recording strategy issue	Validity issues: History	Validity issues: Questionnaire	Validity issues: Clinical	Diagnostic Accuracy (PPV, NPV, sensitivity, specificity etc.) if given
Marcus 1996	Although childhood obesity is a common problem, few studies have evaluated the pulmonary complications of obesity in the pediatric population. We, therefore, performed pulmonary function tests (PFTs), polysomnography, and multiple sleep latency tests (MSLTs) in 22 obese children and adolescents [mean age, 10 2 5 (SD) years; 73% female; 184 5 36% ideal body weight], none of whom presented because of sleep or respiratory complaints.	PFTs were normal in all but two subjects. Ten (46%) subjects had abnormal polysomnograms. There was a positive correlation between the degree of obesity and the apnea index (r = 0.47, P < 0.05), and an inverse correlation between the degree of obesity and the S,02 nadir (r = -0.60, P < 0.01). The degree of sleepiness on MSLT correlated with the degree of obesity (r = -0.50, P < 0.05). We conclude that obese children and adolescents have a high prevalence of sleep-disordered breathing, although in many cases it is mild. Obstructive sleep apnea syndrome (OSAS) improved following tonsillectomy and adenoidectomy. We recommend that pediatricians have a high index of suspicion for OSAS when evaluating obese patients, and that polysomnography be considered for these patients.	PSG is helpful in diagnosing OSAS in obese children; Excessive daytime sleepiness is less common in children with OSAS than in adults with OSAS. The degree of sleepiness in our subjects correlated with the degree of obesity.	100 % had PSG and MSLT; 77% completed the questionnaire	Yes / no	None	Not applicable	Other, specify: obesity	Other, specify: symptoms of OSAS	Not applicable	Not specified
Ward 2010	To compare daytime sleepiness and neurobehavioral performance in children with active and inactive juvenile idiopathic arthritis (JIA), and explore relations among measures of sleep disturbance, daytime sleepiness, and neurobehavioral performance	Indices of sleep disturbance were associated with validated tests of neurobehavioral performance in JIA, regardless of disease activity.	PSG is useful for finding associations between sleep disturbance and validated tests of neurobehavioral performance.	100%	Yes / Yes	None	Not applicable	Not applicable	Other, specify: pain location daily diary, sleepiness scale	Physical examination	Not specified
Tarasiuk 2003	To investigate if children and adolescents who have β-thalassemia (major or intermedia) or CDA-1 experience sleep fragmentation and objective daytime sleepiness and also to investigate if children and adolescents with β-thalassemia have obstructive sleep apnea	Children and adolescents with β-thalassemia or CDA-1 have evidence of impaired sleep function that is partially due to periodic limb movements during sleep and arousals that result in objective diurnal sleepiness.	PSG characteristics are different between children with β-thalassemia and congenital dyserythropoietic anemia and control children	100% had PSG, but only 42% had MSLT	Yes	None	None	Not applicable	Not applicable	Not applicable	Not specified
Zamir 1998	To characterize sleep patterns of patients with juvenile rheumatoid arthritis (JRA)	Patients had 90% more arousals and awakenings and the median length of occurrences of uninterrupted sleep in stages 2 and 3 and REM sleep was 60% shorter than controls. Abnormal sleep has been confirmed in patients with JRA. Sleep disturbance is associated with daytime sleepiness as evidenced by abnormal MSLT results and longer afternoon naptime.	PSG characteristics are different between children with JRA and children without	100%	Yes / yes	None	Not applicable	Not applicable	Other, specify: sleep questionnaire	Other, specify: rheumatological exam	Not specified
PARASOMNIAS (4.2)											
Clinical utility of PSG in children and adolescents at high risk for parasomnias (4.2.1)											
Guilleminault 2005	This study aimed to compare PSG and CAP in prepubertal sleep walkers and matched controls. Two nights of PSG (1st night with Pes; 2nd night used for scoring CAP). All sleepwalkers chronically symptomatic and limited responsiveness to medications; all children medication free for >3 months prior to study	See sheet, too long	Findings supportive of instability of NREM sleep in sleepwalking pre-pubertal children Findings supportive of underlying sleep disordered breathing in these children which is not recognized using typical PSG montage (i.e. use of Pes identified 10 children with UARS that would otherwise be found to be "normal").	100%	N/A	None	No	Habitual snoring	Behavioral measures	Physical examination	Not specified

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Guilleminault 2003	This study looked at factors that may precipitate sleep terrors and sleepwalking in pre-pubertal children. Children meeting criteria for parasomnia were included as well as controls. Those found to have other sleep disorders (SDB, PLMD) were referred for treatment and had follow up PSG 3-4 months after treatment. SDB children who did not get treated also had follow up PSG	See sheet, too long	Findings supportive of other sleep disorder (SDB, PLMS) associated with parasomnia that may be a trigger for parasomnia Cessation of parasomnias in those treated for other sleep disorders further supports the role of SDB/PLMS in triggering parasomnia Note that no child had severe SDB and Pes was used to determine SDB status. This supports the role of using sensitive measures of respiration to define abnormal breathing	100%	Yes / NA	Inter-reader Test-retest	No	Other, specify: Sleep history including family history of sleep disorders	Other, specify: Pediatric questionnaire included information on behavior and learning	Physical examination	Not specified
Cao 2010	We asked three specific questions to further investigate this interaction: (i) Do SDB and sleepwalking occur simultaneously in several members of the same family? (ii) Are there similar craniofacial risk factors that could be identified in subjects who presented with both SDB and sleepwalking in the same family? (iii) Does treatment of the anatomic risk factors for SDB eliminate sleepwalking in the considered familial case?	All of our subjects with parasomnias presented with familial traits considered as risk factors for SDB. These anatomical risk factors are present at birth and even subtle SDB can lead to sleep disruption and instability of NREM sleep	PSG with video helpful in characterizing children with sleepwalking	100% had questionnaires	No, PSG used to diagnose	None	No	Not applicable	Sleep questionnaire	Not applicable	Not specified
Video-PSG features of NREM arousal disorders and REM sleep behavior disorder in children (4.2.2)											
Guilleminault 2003	This study looked at factors that may precipitate sleep terrors and sleepwalking in pre-pubertal children. Children meeting criteria for parasomnia were included as well as controls. Those found to have other sleep disorders (SDB, PLMD) were referred for treatment and had follow up PSG 3-4 months after treatment. SDB children who did not get treated also had follow up PSG	See sheet, too long	Findings supportive of other sleep disorder (SDB, PLMS) associated with parasomnia that may be a trigger for parasomnia Cessation of parasomnias in those treated for other sleep disorders further supports the role of SDB/PLMS in triggering parasomnia Note that no child had severe SDB and Pes was used to determine SDB status. This supports the role of using sensitive measures of respiration to define abnormal breathing	100%	Yes / NA	Inter-reader Test-retest	No	Other, specify: Sleep history including family history of sleep disorders	Other, specify: Pediatric questionnaire included information on behavior and learning	Physical examination	Not specified
Thirumalai 2002	We performed nocturnal polysomnography on 11 children with autism who had symptoms of disrupted sleep and nocturnal awakenings. We identified rapid eye movement (REM) sleep behavior disorder in 5 of these 11 patients.	Since REM sleep behavior disorder typically affects elderly males with neurodegenerative diseases, the identification of this phenomenon in autistic children could have profound implications for our understanding of the neurochemical and neurophysiologic bases of autism. Further, accurate diagnosis of REM sleep behavior disorder would enable specific treatment with clonazepam and help the family and the child consolidate sleep and improve daytime performance.	PSG helpful in identifying treatment options for children with autism	Not applicable	Yes / yes	None	No	Not applicable	Not applicable	Clinical changes after intervention	Not specified

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Clinical utility of PSG in children with suspected or known sleep-related seizures or epilepsy (4.2.3)											
Kaleyias 2008	The purpose of this retrospective analysis was to evaluate polysomnographic abnormalities in a cohort of children with epilepsy, referred with diverse sleep problems.	A significant proportion of children with epilepsy referred for polysomnography with diverse sleep problems manifest sleep-disordered breathing, including obstructive sleep apnea syndrome.	PSG useful in characterizing other sleep-related issues in children with epilepsy	Not applicable	N/A	None	No	Not applicable	Not applicable	Not applicable	Not specified
Maganti 2005	11 patients with primary generalized epilepsy (5 childhood absence, 4 juvenile absence, 2 JME) who were on medication and seizure free (duration not specified) underwent two nights of nocturnal PSG. Data from the second night were reported, as were results of Child Behavior Checklist (CBCL) and Connor's Continuous Performance Task (CPT), assessment of behavior and attention, respectively	1) Children with epilepsy had worse scores on CBCL Total Behavioral Problem scale p= .02) and Total internalizing p=.05) but not Total Externalizing (p= .14) Behavioral problem scales compared to controls 2) Children with epilepsy performed significantly worse than controls on overall CPT index (p=.004), as well as fewer correct hits (p=.0074), and errors of omission (p=.0068) 3) Stage 1 sleep % (p=.05) and REM latency p=.018) are increased compared with controls. No other differences were found **While not statistically significantly different from controls, RDI in pts was ⁿ.24 +/- ⁿ.7 vs. 1.45 +/- 1.39 which may be significant for individual patients Small numbers No correlation, but a trend was seen between CBCL Total behavioral problem scale and REM percentage and measure of attention and stage 1 percemtage Unable to exclude medication effects	1)PSG may be helpful in identifying abnormal sleep parameters in patients with well controlled primary generalized epilepsy. IT is not clear how these correlate with daytime behavior or attentional complaints, larger study needs to be done	Not stated	Yes / yes	None	No	Not applicable	Not applicable	Not applicable	Not specified
Miano 2010	The aim of this study was to assess the presence of sleep breathing disorder and periodic leg movements during sleep (PLMS), and to evaluate NREM sleep instability in a group of children with mental retardation (MR) and epilepsy	Children with MR showed many sleep architecture differences compared to controls. They also showed higher cyclic alternating pattern (CAP) rate, increased A1 index, long and less numerous CAP sequences than controls.	A detailed investigation and treatment of sleep disorders in children affected by MR and epilepsy may have a positive impact on seizure control.	Not applicable	N/A	None	No	Not applicable	Not applicable	Not applicable	Not specified
Nunes 2003	To investigate sleep alterations in children with partial refractory epilepsy compared to control children. Children with epilepsy were subdivided into 2 groups depending on the presence of seizure activity during the PSG	1) Total time in bed and total sleep time were reduced in both subgroups of children with epilepsy (p<.001) compared to controls 2) Epileptic patients had FEWER stage shifts per hour than controls (p<.005) 3) Percentage of stage 2 shifts (not sure if this means percentage of stage 2 – this is what the table reads, but text says stage "shifts") is reduced in patients with epilepsy and seizures (p=.008) 4) Percentage of stage 3-4 (?Shifts) is increased in pts with seizures (p=.001) 5) No other parameters reached statistical significance 6) No sleep disordered breathing parameters were measured. 7) 9/17 patients had seizures during the night more frequently in stage 2 sleep Small numbers, different AED regimens, large range in sleep time and time in bed, but this may in part reflect wide age range of patients. Hard to make comparisons	PSG findings support some differences in sleep architecture in children with partial refractory epilepsy when compared to controls. However, these findings need to be interpreted with respect to the limitations noted (antiepileptic meds etc). Unclear what the findings would be if the medication status of the subjects had been accounted for.	100%	NA	Yes	Yes: Other Studies conducted in multiple centers. Unknown if equipment used was the same.	Not applicable	Not applicable	Not applicable	Not specified
Bruni 1995	PSG was performed in children with TS to better investigate the relationships between sleep organization, sleep disorders and epilepsy.	Compared with ten healthy age-matched controls, the TS group showed a shorter total sleep time, a reduced sleep efficiency, a higher number, of awakenings and stage transitions, an increased wake after sleep onset and stage 1 and a decreased ItEM sleep. Children with seizures showed a more disrupted sleep architecture compared with seizure-free children. Sleep disorders in TS were mainly due to sleep-related epileptic events and were more evident in children who showed large bifrontal or temporal tubers on MRI.	PSG useful in characterizing children with TS	100%	Yes / yes	None	No	Not applicable	Not applicable	Not applicable	Not specified

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Becker 2004	To determine whether children with epilepsy would 1) have more SDB symptoms in association with greater seizure frequency; 2) have more behavioral problems in association with greater seizure frequency; and 3) display more behavior problems in association with sleep disruption.	See sheet, too long	- children with epilepsy appear to be at risk for obstructive events during sleep and other sleep disruptions such as REM latency and apnea length - findings supportive of a sleep disruption being associated with behavioral deficits rather than seizure severity	100%	Yes / Yes	None	No	Not applicable	Behavioral measures Sleep questionnaire	Other: standardized behavioral evaluations	Not specified
Hofstra 2009	We have analyzed clinical seizures of 176 consecutive patients (76 children, 100 adults) who had continuous electroencephalography (EEG) and video monitoring lasting more than 22 h. Several aspects of seizures were noted, including classification, time of day, origin, and sleep stage.	Significantly more seizures were observed from 11:00 to 17:00 h, and from 23:00 to 05:00 h significantly fewer seizures were seen. The daytime peak incidences were observed in seizures overall, complex partial seizures (in children and adults), seizures of extratemporal origin (in children), and seizures of temporal origin (in adults). Incidences significantly lower than expected were seen in the period 23:00 to 05:00 h in seizures overall, complex partial seizures (in children and adults), and in tonic seizures (in children). In addition, significantly fewer seizures of temporal (in children and adults) and extratemporal origin (in children) were observed in this period.	PSG is useful in determining when children have seizures.	Not stated	Unknown	None	Yes: Duration of study issues	Not applicable	Not applicable	Not applicable	Not specified
Pruvost 2006	A study of the effect of VNS on heart rate variability	VNS shifts the frequency of maximal power spectrum density (PSD) in the HF-band, decreases the related PSD and induces a partial cardiorespiratory decoupling.	PSG can be used to study the effect of therapy on children with refractory epilepsy	Not applicable	N/A	None	No	Not applicable	Not applicable	Not applicable	Not specified
Silvestri 2007	In this paper we explore the prevalence of ictal and interictal epileptiform discharges (IEDs) and sleep disorders in ADHD children referred to a sleep clinic for all night video-PSG.	In conclusion, ADHD is a condition often associated with EEG epileptiform abnormalities. Seizures/IEDs presence seems to play a role on cognitive abilities, conversely sleep disorders have a stronger impact on behavioural rather than cognitive indicators. Sleep disorders were found in 86% of ADHD children; among these, 26% had RLS. 53.1% of ADHD children had IEDs (28.2% centro-temporal spikes, 12.5% frontal spikes, 9.3% temporal—occipital spikes and 2.3% generalized S—W).	PSG useful in characterizing sleep of children with ADHD	100%	Yes / yes	None	No	Not applicable	Behavioral measures	Not applicable	Not specified
Zaaimi 2007	This study analyzed changes in the heart rates of children receiving vagus nerve stimulation (VNS) therapy for pharmacoresistant epilepsy.	In this case series of children with pharmacoresistant epilepsy, cardiorespiratory variations occurred while the VNS therapy pulse generator was delivering stimulation. Understanding these variations may allowfurther optimization of VNS parameters.	PSG useful in understanding VNS treatment in children with pharmacoresistant epilepsy	100%	Yes / yes	None	No	Not applicable	Not applicable	Not applicable	Not specified
Zaaimi 2009	This study analyzed the direct shortterm effect of vagus nerve stimulation (VNS) on respiratory sinus arrhythmia (RSA) in children with pharmacoresistant epilepsy.	During VNS, respiratory frequency increased and respiratory amplitude decreased with a variable effect on cardiac activity. The coupling between heart rate and respiratory rate was disturbed and RSA magnitude decreased significantly in 6 of 10 children during VNS. These changes in RSA magnitude varied from one child to another. The observed changes for respiratory and cardiac activity were concomitant with changes in RSA but were not correlated.	PSG useful in understanding VNS treatment in children with pharmacoresistant epilepsy	100%	yes/yes	None	No	Not applicable	Not applicable	Not applicable	Not specified
Zaaimi 2005	To analyze respiratory alterations and effects on SaO2 caused by vagus nerve stimulation (VNS) in children with epilepsy.	VNS caused a pronounced change in respiration in children with epilepsy, and this induced a decrease in SaO2.	PSG useful in characterizing treatment of epilepsy	Not applicable	N/A	None	No	Not applicable	Not applicable	Not applicable	Not specified

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Clinical utility of PSG to evaluate sleep architecture in children with enuresis (4.2.4.2)											
Neveus 1999	This study was undertaken to examine the sleep of children with enuresis with the aim of clarifying the relationship, if any, between the enuretic event and the polysomnogram. Furthermore, comparisons were made between responders and nonresponders to antidiuretic treatment and sleep during nights with and without enuretic events.	The enuretic event is a predominantly non-rapid eye movement sleep phenomenon. Responders and non-responders to desmopressin treatment void during different parts of the night.	PSG useful in understanding the mechanisms of enuresis and who might respond to therapy.	100%	No	None	Not applicable	Not applicable	Not applicable	Not applicable	Not specified
Sans Capdevila 2008	Habitual snoring and obstructive sleep apnea have been associated with bed-wetting in children, and effective obstructive sleep apnea treatment may improve enuresis. The purpose of this work was to assess whether habitual snoring is associated with increased incidence of enuresis and whether severity of obstructive sleep apnea correlates with enuretic frequency and to evaluate brain natriuretic peptide levels.	In summary, we have found in a large population-based cohort that the presence of HS is associated with marked increases in the prevalence of enuresis and that the latter does not seem to be affected by the severity of SDB. Furthermore, only minor increases in stage 4 non-REM sleep and in sleep efficiency emerge among enuretic children and are unlikely to account for the presence of enuresis. However, BNP morning levels are markedly elevated in children with enuresis, and the presence of SDB leads to further, albeit small, increases in BNP plasma levels. Taken together, these findings suggest that sleep fragmentation and, to a lesser extent, increased release of BNP in the context of increased upper airway resistance during sleep may contribute to the higher prevalence of enuresis in habitually snoring children.	PSG identifies relationship between HS, other sleep characteristics, and enuresis	Not applicable	Not applicable	None	Not applicable	Not applicable	Other, specify: questionnaire	Other, specify:BNP levels	Not specified
Dhondt 2009	Children with enuresis are generally believed to have sleep that is too deep with decreased arousability. We investigated sleep characteristics in children with refractory nocturnal enuresis.	Preliminary data indicate a high incidence of periodic limb movements in sleep at night in children with refractory nocturnal enuresis and increased cortical arousability, leading to awakening.	PSG useful in characterizing sleep of children with refractory nocturnal enuresis.	100%	Yes/yes	None	No	Other, specify: clinical history	Other, specify: bladder diary	Other, specify: examination, nocturnal diuresis volume	Not specified
Inoue 1987	Relationships between sleep and the mechanism by which nocturnal enuresis is caused, with special emphasis on the occurrence of rhythmic slow waves (RSW), was studied	1. No significant differences between 2 groups in EEG sleep stages; 2. Enuresis occurred with almost the same frequency in all sleep stages except 1 (higher) and higher in 2nd and 3rd cycles; 3. Immediately before enuretic event, 6-7 Hz RSW continued for 15-40 s in NREM sleep or 3-5 Hz in R sleep; 4. RSW observed in both groups and decreased with increasing age; however RSW occurred more often and the age-related decrease was delayed in enuretic children; and 5. RSW was induced by stimuli such as changes in sleep stages or body movement. The long-lasting RSW on sleep EEG was considered to be a sign of the onset of nocturnal enuresis.	PSG useful in characterizing sleep of children with enuresis	100%	No	None	No	Not applicable	Not applicable	Not applicable	Not specified
Wolfish 1999	Study to define sleep arousal thresholds	The results of this study suggest that enuretic males were more difficult to arouse than age-matched controls.	PSG useful in understanding the causes of enuresis and possible treatment programs	Not applicable	No	None	Not applicable	Not applicable	Not applicable	Not applicable	Not specified
Reimao 1993	The objective of this study was to evaluate enuretic events and its relations to sleep stages, sleep cycles and time durations in a selected group of children with primary essential sleep enuresis.	The enuretic events were phase-related, occurring predominantly in non-REM (NREM) sleep (p<.05)	PSG useful in characterizing sleep stages in children who have enuresis.	100%	yes/yes	None	No	Not applicable	Not applicable	Other, specify: details of "pediatric, urologic, and neurologic workup" not given	Not specified

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Clinical utility of PSG in correlating enuresis to habitual snoring and/or OSA (4.2.4.3)											
Sans Capdevila 2008	Habitual snoring and obstructive sleep apnea have been associated with bed-wetting in children, and effective obstructive sleep apnea treatment may improve enuresis. The purpose of this work was to assess whether habitual snoring is associated with increased incidence of enuresis and whether severity of obstructive sleep apnea correlates with enuretic frequency and to evaluate brain natriuretic peptide levels.	In summary, we have found in a large population-based cohort that the presence of HS is associated with marked increases in the prevalence of enuresis and that the latter does not seem to be affected by the severity of SDB. Furthermore, only minor increases in stage 4 non-REM sleep and in sleep efficiency emerge among enuretic children and are unlikely to account for the presence of enuresis. However, BNP morning levels are markedly elevated in children with enuresis, and the presence of SDB leads to further, albeit small, increases in BNP plasma levels. Taken together, these findings suggest that sleep fragmentation and, to a lesser extent, increased release of BNP in the context of increased upper airway resistance during sleep may contribute to the higher prevalence of enuresis in habitually snoring children.	PSG identifies relationship between HS, other sleep characteristics, and enuresis	Not applicable	Not applicable	None	Not applicable	Not applicable	Other, specify: questionnaire	Other, specify:BNP levels	Not specified
Brooks 2003	To test the hypothesis that the presence of nocturnal enuresis is related to the severity of sleep apnea, we examined the relation between the Respiratory Disturbance Index (RDI, apneas plus hypopneas per hour of sleep) and the presence and severity of enuresis.	There is a high prevalence of enuresis in children with suspected sleep-disordered breathing. Children with an RDI >1 were at higher risk for enuresis than children with an RDI ≤1. This may be due to the effects of obstructive sleep apnea on arousal response, bladder pressure, or urinary hormone secretion.	PSG can detect the presence and severity of OSA in children.	100%	yes/yes	None	No	Other, specify: Enuresis	Other, specify: standard questionnaire	Physical examination	Not specified
Barone 2009	The objective of this study was to examine the relationship of OSA, BMI, and monosymptomatic nocturnal enuresis in children.	Overweight and MNE are associated with OSA but not with each other.	OSA should be considered in overweight children with MNE, especially when they display other symptoms of OSA or fail to respond to standard MNE treatment programs	Not applicable	Not applicable	None	Not applicable	Not applicable	Not applicable	Not applicable	Not specified
Wang 1998	This study examined the predictive accuracy of clinical evaluation for OSA and outcome after T&A in a series of children undergoing PSG.	Predictive accuracies and prevalences for a variety of signs, symptoms, and clinical measurements are reported	Signs and symptoms lack predictive value for OSA; PSG is required	100%	No	None	Not applicable	snoring, witnessed apneas, enuresis, tonsillar size, weight	Not applicable	Not applicable	Predictive accuracies (as a percentage of those with symptoms/signs who have OSA) and prevalences (as a percentage of those with OSA who have the symptom/sign), respectively, were for moderate snoring 29% (12 of 41), 48%; loud snoring 31% (11 of 35), 44%; witnessed apneas 32% (22 of 69), 88%; enuresis 46% (11 of 24), 44%; 2+ tonsillar size 37% (21 of 57), 84%; 3+ tonsillar size 33% (3 of 9), 12%; 90th percentile weight or greater 26% (7 of 27), 28%; 10th percentile weight or less 33% (5 of 15), 20%.
Silvestri 2009	To outline specific sleep disturbances in different clinical subsets of Attention Deficit/Hyperactivity Disorder (ADHD) and to confirm, by means of nocturnal video-polysomnography (video-PSG), a variety of sleep disorders in ADHD besides the classically described periodic leg movement disorder (PLMD), restless legs syndrome (RLS) and sleep related breathing disorder (SRBD).	Most children/parents reported disturbed, fragmentary sleep at night; complaints were motor restlessness (50%), sleep walking (47.6%), night terrors (38%), confusional arousals (28.5%), snoring (21.4%), and leg discomfort at night associated with RLS (11.9%).	This study underlines the opportunity to propose and promote the inclusion of sleep studies, possibly by video-PSG, as part of the diagnostic screening for ADHD.	100%	yes/yes	None	No	Not applicable	Not applicable	Not applicable	Not specified

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SLEEP RELATED MOVEMENT DISORDERS (4.3)											
Clinical utility of PSG in Children with RLS (4.3.1)											
Chervin 2001	To assess the utility of several symptoms and a questionnaire-based scale in the identification of children with periodic leg movements during sleep (PLMS).	26% had five or more PLMS per hour of sleep (PLMI ≥ 5).Severity of SDB was not different among those with and without PLMI ≥ 5. Restless legs, growing pains, sleep-maintenance insomnia, unrefreshing sleep, and morning headaches show moderate associations with polysomnographically-defined PLMS, but several other symptoms do not. These results require confirmation but suggest that clinical assessment and the PLMS score may be helpful but far from definitive.	PSG required for confirmation of diagnosis of PLMS	100%	Yes/ yes	None	Not applicable	Observed apnea or labored breathing	Other, specify: Pediatric Sleep Questionnaire	Not applicable	Sensitivity of a PLMS score> 0.33 for PLMI ≥ 5 was 0.79, specificity was 0.56, positive predictive value was 0.38, and negative predictive value was 0.89. Internal consistency was reasonable (Cronbach's a = 0.71), as was test–retest reliability (r = 0.62, P = 0.0026, n = 21 separate subjects).
Chervin 2001	To determine what polysomnographic features of SDB might be associated with hyperactive behavior, we studied behavior, SDB, and PLMS in a series of patients.	Hyperactivity showed no significant associations with the rate of apneas and hypopneas, minimum oxygen saturation, or most negative esophageal pressure (p>0.10), but was associated with the presence of 5 or more PLMS per hour (p=0.02). The rate of PLMS showed a linear association with hyperactivity among those subjects with SDB (p = 0.002), but no association among those subjects without SDB (p = 0.64). These findings suggest that hyperactive behavior is common among children referred for suspected SDB, regardless of the presence or severity of SDB. Current observations cannot prove causality, but they are consistent with the hypothesis that PLMS may contribute to hyperactivity and SDB may act as an effect modifier.	Findings of PLMS on PSG should not be taken as incidental to the findings of SDB as treatment of either problem could improve a child's daytime behavior.	100%	No	None	Not applicable	Not applicable	Behavioral measures	Not applicable	Not specified
Martin 2008	To examine the prevalence of raised periodic limb movements of sleep (PLMS) index in children referred for polysomnography (PSG) and whether parental report of symptoms correlates with objective measurement during PSG.	Asking parents about their child's symptoms is not an accurate predictor of raised PLMS index. We recommend that leg electromyography be used in all pediatric sleep studies to record PLMS.	Asking parents about their child's symptoms is not an accurate predictor of raised PLMS index. We recommend that leg electromyography be used in all pediatric sleep studies to record PLMS.	100%	Yes / yes	None	Not applicable	Not applicable	Not applicable	Other, specify: parental questionnaire	Asking parents about whether their child kicks their legs excessively in sleep had sensitivity 50%, specificity 51%, positive predictive value (PPV) 10%, negative predictive value (NPV) 90% and positive likelihood ratio (LR+) 1.02 when compared to objective analysis. Asking parents about whether their child is restless in sleep had sensitivity 70%, specificity 26%, PPV 9%, NPV 89% and LR+ 0.95.
Picchietti 1998	The purpose of this study was to determine if a subset of children diagnosed with ADHD have periodic limb movement disorder and RLS	High incidence of PLMD in children diagnosed with ADHD: 26% of the ADHD children had PLMD.This study further documents the occurrence of PLMD and RLS in children and establishes a possible comorbidity between ADHD and PLMD. It is proposed that the sleep disruption associated with PLMD and RLS and motor restlessnes or RLS while awake could contribute to the inattention and hyperactivity seen in a subgroup of ADHD-diagnosed children.	PSG confirms high incidence of PLMD in children with ADHD; provides potential cause for ADHD symptoms	Not applicable	Yes / Yes	Inter-reader: Correspondence was 90% for individual limb movement scoring	Not applicable	Other, specify: sleep onset problems, sleep maintenance, restless sleep, mild daytime sleepiness, parasomnias/enuresis, family history	Not applicable	Not applicable	Not specified

Evidence Table

Pediatric Non-Respiratory Indications for PSG and MSLT

Article	Study Description (short)	Study Outcomes/Findings (short)	Study Conclusions Relative to PSG (short)	% Subjects having diagnostic test and appropriate independent measure	Was a valid reference standard used to assess presence of disease? If yes, was it independent of the diagnostic test?	Reliability issues	Recording strategy issue	Validity issues: History	Validity issues: Questionnaire	Validity issues: Clinical	Diagnostic Accuracy (PPV, NPV, sensitivity, specificity etc.) if given
Picchietti 1999	The first purpose of the current study is to test the hypothesis that PLMS and attendant sleep disruption occur in a greater number of children with ADHD than in normal control children without ADHD. The second purpose of this study is to test the hypothesis that RLS symptoms occur in a higher percentage of the parents of children with ADHD than in the parents of control subjects.	The prevalence of PLMS on polysomnography was higher in the children with ADHD than in the control subjects. Nine of 14 (64%) children with ADHD had PLMS at a rate of >5 per hour of sleep compared with none of the control children (p <0.0015). Three of 14 children with ADHD (21%) had PLMS at a rate of >20 per hour of sleep. Many of the PLMS in the children with ADHD were associated with arousals. Historical sleep times were less for children with ADHD. All nine children with ADHD who had a PLMS index of >5 per hour of sleep had a long-standing clinical history of sleep onset problems (>30 minutes) and/or maintenance problems (more than two full awakenings nightly) thus meeting the criteria for Periodic Limb Movement Disorder (PLMD). None of the control children had a clinical history of sleep onset or maintenance problems. The parents of the children with ADHD were more likely to have restless legs syndrome (RLS) than the parents of the control children. PLMS may directly lead to symptoms of ADHD through the mechanism of sleep disruption.	PSG provides data that supports PLMD as a potential cause for ADHD symptoms	Not applicable	Yes / Yes	Inter-reader	Not applicable	Not applicable	Not applicable	Not applicable	Not specified
Picchietti 1999	The purpose of this study is to review clinical features of children with moderate to severe Periodic Limb Movement Disorder (PLMD).	In conclusion, this study is the first detailed clinical series that documents the occurrence of moderate to severe PLMD in children and adolescents. As we have previously documented, the PLMS are often not noted by the parents. As the current study also shows, this appears to be true even in moderate to severe cases.	PSG documents PLMD in children that is often not noted by parents and can be associated with ADHD and RLS	0%	No	Inter-reader	Not applicable	Restless sleep	Not applicable	Not applicable	Not specified
Picchietti 2008	To describe the symptomatology reported by a series of children and adolescents who at initial consultation did not meet full diagnostic criteria for pediatric restless legs syndrome (RLS) but subsequently did so over the course of clinical follow-up.	in some children and adolescents clinical sleep disturbance can precede the full diagnostic manifestations of RLS by months or years. Eleven of 17 cases who had undergone PSG met diagnostic criteria for PLMD prior to meeting criteria for definite RLS.	Some aspects of RLS can occur long before full diagnostic criteria are present.	100%	Yes / Yes	None	Not applicable	Other, specify: clinical assessment, questionnaires	Not applicable	Other, specify: sleep onset or maintenance problems, daytime sleepiness	Not specified
Picchietti 2009	The goals of this retrospective study were to (1) apply the recent International Classification of Sleep Disorders 2nd edition (ICSD-2) diagnostic criteria for RLS and PLMD in pediatric cases where periodic limb movements in sleep (PLMS) P5 per hour were found; (2) review parental history of RLS; and (3) further define the clinical characteristics of RLS and PLMD in a pediatric subgroup where each child had a parent with clinically assessed RLS.	The major findings of this study are (1) the similar prevalence of parental RLS in pediatric RLS and pediatric PLMD and (2) the addition to the literature of ICSD-2 defined cases of pediatric RLS and pediatric PLMD. This supports the emerging view that PLMS may be a marker or endophenotype for a specific, common RLS genotype.	PSG useful in identifying criteria for diagnosing RLS and PLMD	0%	No	None	Not applicable	Other, specify: semistructured interview; sleep complaint, headache complaint, behavior complaint	Not applicable	Other, specify: clinical sleep disturbance (sleep onset problems, sleep maintenance problems, restless sleep, daytime sleepiness)	Not specified
Rajaram 2004	The purpose of this study is to determine if some children with growing pains meet diagnostic criteria for RLS and to compare the polysomnographic characteristics of these children to controls.	Some children diagnosed with growing pains meet diagnostic criteria for RLS, and a family history of RLS is common in these children. In some cases symptoms are severe enough to warrant treatment.	There were no statistically significant differences in sleep latency, sleep efficiency, the percentages of NREM and REM, RDI, AI Index, or in the PLMS index between the patients with growing pains and the controls (Tables 1 and 2). No significant differences were found between the PLMS indexes in the subgroups of children with growing pains with or without ADHD.	0%	No	None	Not applicable	Other, specify: growing pains	Not applicable	Clinical changes after intervention	Not specified

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Normative values for PLMS in children, by age (4.3.2.1)											
Martinez 2004	This study's aims were to determine: (1) prevalence of periodic leg movements (PLMs) in walking prepubertal children consulting a sleep clinic for any sleep disorder; (2) associations between PLMs and other sleep and medical disorders; and (3) the response of other sleep disorders to treatment with the dopamine agonist pramipexol.	Presence of chronic fatigue, sleepiness, disrupted nocturnal sleep, and difficulties in falling asleep should lead to a systematic search for PLMs that is independent of associated syndromes. Isolated treatment of SDB might help eliminate some, but not all, PLMs.	PSG correlated with clinical symptoms of leg muscle tiredness and leg pain for children with PLMs.	100%	Not other than PSG	None	Not applicable	Other, specify: leg pain and tiredness	Other, specify: sleep questionnaire and RLS symptoms	Clinical changes after intervention	Leg muscle tiredness in the morning had a sensitivity of 100% but a specificity of 79% for presence of PLMs during nocturnal sleep. Reporting of leg pain in general had a sensitivity of 80% and a specificity of 82% in this group of participants
Crabtree 2003	To characterize periodic limb movement disorder (PLMD) in a cohort of prepubertal children we examined sleep-related identifiable differences between children with PLMD and attention-deficit⁄hyperactivity disorder (ADHD),PLMD alone,and age-matched controls.	A total of 8.4% of children in the clinic-referred sample,a nd 11.9% of the children recruited from the community had PLMI >5. Of those,44.4% were identified as having ADHD. Children with PLMD had significantly lower percentage of rapid eye movement (REM) than control children (P < 0.001). Children in the PLMD⁄ADHD group had a significantly greater number of arousals associated with PLM (PLMa) than children with PLMD only (P < 0.05). While a relationship between ADHD and PLMD was observed,it was weaker than previous reports. Children in the PLMD⁄ADHD group were more likely to have PLMas than were children with PLMD only. We postulate that rather than a direct relationship between ADHD and PLMD, this link may be mediated by the presence of reduced REM sleep and more importantly by the sleep fragmentation associated with PLM-induced arousals.	PSG useful in differentiating children's sleep-related characteristics in PLMD and ADHD	100%	No	None	Not applicable	Not applicable	Not applicable	Not applicable	Not specified
O'Brien 2007	Ethnic differences in sleep architecture and other routinely assessed sleep parameters have not been critically assessed, thus the aim of this study was to compare sleep characteristics in African-American and Caucasian children.	African-American and Caucasian children have similar sleep architecture. African-American children are more likely to display respiratory disturbances during sleep, while PLMS are significantly more prevalent among Caucasian children.	PSG useful in identifying ethnic differences in PLMS	0%	No	None	Not applicable	Not applicable	Not applicable	Not applicable	Not specified
Bokkala 2008	We evaluated the prevalence and correlates of pediatric periodic limb movements detected by polysomnography. Also examined the association between ferritin levels and PLMS.	Periodic limb movements of sleep were identified in 77 of 982 polysomnograms, with a prevalence of 7.8% and male predominance (47 boys; 30 girls). Mean age was 9.4 ± 4.2 years (1-19 years). We found that 10% of patients with attention deficit hyperactivity disorder in our study exhibited periodic limb movements of sleep; our study also indicated that 46% of patients manifested obstructive sleep apnea. There was a very strong association between periodic limb movements of sleep and low ferritin levels in our series, with 96% of children manifesting low ferritin levels.	PSG useful in diagnosing root cause of symptoms such as: Habitual snoring, pauses in breath, gasping or snorting in sleep, daytime sleepiness	100%	No	None	Not applicable	Habitual snoring, pauses in breath, gasping or snorting in sleep, daytime sleepiness	Not applicable	Not applicable	Not specified
Martin 2008	To examine the prevalence of raised periodic limb movements of sleep (PLMS) index in children referred for polysomnography (PSG) and whether parental report of symptoms correlates with objective measurement during PSG.	Asking parents about their child's symptoms is not an accurate predictor of raised PLMS index. We recommend that leg electromyography be used in all pediatric sleep studies to record PLMS.	Asking parents about their child's symptoms is not an accurate predictor of raised PLMS index. We recommend that leg electromyography be used in all pediatric sleep studies to record PLMS.	100%	Yes / yes	None	Not applicable	Not applicable	Not applicable	Other, specify: parental questionnaire	Asking parents about whether their child kicks their legs excessively in sleep had sensitivity 50%, specificity 51%, positive predictive value (PPV) 10%, negative predictive value (NPV) 90% and positive likelihood ratio (LR+) 1.02 when compared to objective analysis. Asking parents about whether their child is restless in sleep had sensitivity 70%, specificity 26%, PPV 9%, NPV 89% and LR+ 0.95.

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Kirk 2004	To determine the prevalence of periodic limb movements of sleep (PLMS) in children referred for evaluation of sleep disorders.	Thirty-three of the 591 children (5.6%) had evidence of PLMs > 5 per hour. Twenty of the 33 (60.0%) had coexistent obstructive sleep apnea (AHI > 1/hour). Only 7 of the 591 children studied (1.2%) had evidence of PLM > 5 per hour with no other comorbidity. Two of 13 children with PLM > 5 per hour and no evidence of obstructive sleep apnea had attention-deficit/hyperactivity disorder. The prevalence of PLMS in the 28 of the 591 subjects with a preexisting diagnosis of ADHD was increased at 7.1%. PLMS is an uncommon disorder of childhood. In a select population at increased risk for having a sleep disorder, the prevalence of isolated PLMS is only 1.2%.	PSG used to characterize children with SRMD both primary and comorbid	0%	No	None	Not applicable	Not applicable	Not applicable	Not applicable	Not specified
Normative values for PLM arousal index in children (4.3.2.2)											
O'Brien 2007	Ethnic differences in sleep architecture and other routinely assessed sleep parameters have not been critically assessed, thus the aim of this study was to compare sleep characteristics in African-American and Caucasian children.	African-American and Caucasian children have similar sleep architecture. African-American children are more likely to display respiratory disturbances during sleep, while PLMS are significantly more prevalent among Caucasian children.	PSG useful in identifying ethnic differences in PLMS	0%	No	None	Not applicable	Not applicable	Not applicable	Not applicable	Not specified
Martinez 2004	This study's aims were to determine: (1) prevalence of periodic leg movements (PLMs) in walking prepubertal children consulting a sleep clinic for any sleep disorder; (2) associations between PLMs and other sleep and medical disorders; and (3) the response of other sleep disorders to treatment with the dopamine agonist pramipexol.	Presence of chronic fatigue, sleepiness, disrupted nocturnal sleep, and difficulties in falling asleep should lead to a systematic search for PLMs that is independent of associated syndromes. Isolated treatment of SDB might help eliminate some, but not all, PLMs.	PSG correlated with clinical symptoms of leg muscle tiredness and leg pain for children with PLMs.	100%	Not other than PSG	None	Not applicable	Other, specify: leg pain and tiredness	Other, specify: sleep questionnaire and RLS symptoms	Clinical changes after intervention	Leg muscle tiredness in the morning had a sensitivity of 100% but a specificity of 79% for presence of PLMs during nocturnal sleep. Reporting of leg pain in general had a sensitivity of 80% and a specificity of 82% in this group of participants
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Bokkala 2008	We evaluated the prevalence and correlates of pediatric periodic limb movements detected by polysomnography. Also examined the association between ferritin levels and PLMS.	Periodic limb movements of sleep were identified in 77 of 982 polysomnograms, with a prevalence of 7.8% and male predominance (47 boys; 30 girls). Mean age was 9.4 ± 4.2 years (1-19 years). We found that 10% of patients with attention deficit hyperactivity disorder in our study exhibited periodic limb movements of sleep; our study also indicated that 46% of patients manifested obstructive sleep apnea. There was a very strong association between periodic limb movements of sleep and low ferritin levels in our series, with 96% of children manifesting low ferritin levels.	PSG useful in diagnosing root cause of symptoms such as: Habitual snoring, pauses in breath, gasping or snorting in sleep, daytime sleepiness	100%	No	None	Not applicable	Habitual snoring, pauses in breath, gasping or snorting in sleep, daytime sleepiness	Not applicable	Not applicable	Not specified

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The degree of night to night variability in PLMS in children with PLMD (4.3.2.3)											
Picchietti 2009	The aim of this study was to investigate the night-to-night variability of PLMS in children.	In this sample of children, considerable individual night-to-night variability of PLMS indexes was observed. This finding has important clinical relevance for the diagnosis of restless legs syndrome and PLMD and may have an impact on future studies that correlate individual PLMS severity with frequently associated symptoms, such as negative affect, fatigue, and inattention. Our data, however, also suggest that individual PLMS variability is random and not likely to skew the group-level analysis of treatment outcome studies.	PLMS on PSG has significant night-to-night variability	0%	No	Test-retest	Not applicable	Not applicable	Not applicable	Not applicable	Not specified
Clinical utility of PSG in children with bruxism? (4.3.3)											
Herrera 2006	We investigated the sleep architecture, the incidence of gastroesophageal reflux, and the daytime cognitive behavioral functioning in a group of children with sleep bruxism.	There was no difference on sleep architecture between patients and controls, except for a higher arousal index for the bruxism group (36.7 vs 20.7, p < .007). Sleep bruxism occurred more frequently in stage 2 and REM sleep, with arousals in 66% of the cases. There was no relationship of bruxism to gastroesophageal reflux or intelligence. However, 40% of the patients had elevated scores on the Achenbach Child Behavior Checklist, indicating significant attention and behavior problems, and there were moderate correlations between the arousal index and several of the behavior-problem scales from the Achenbach Child Behavior Checklist (0.5 to 0.6). Conclusions: The data suggest that children with bruxism have a higher arousal index, which may be associated with an increased incidence of attention-behavior problems. Future studies investigating pediatric sleep bruxism will need to focus on behavior issues that may be prevalent in this population. Subjects also had longer sleep onset latencies. Also more physical somatic complaints.	PSG identifies bruxism, which affects arousals and could affect quality of sleep leading to possible daytime behavior and congnitive performance difficulties.	100%	Yes / yes	None	Not applicable	Not applicable	Behavioral measures	Not applicable	Not specified
Clinical utility of PSG in diagnosing sleep-related movement disorders in special populations of children (4.3.4)											
Tarasiuk 2003	To investigate if children and adolescents who have β-thalassemia (major or intermedia) or CDA-1 experience sleep fragmentation and objective daytime sleepiness and also to investigate if children and adolescents with β-thalassemia have obstructive sleep apnea	Children and adolescents with β-thalassemia or CDA-1 have evidence of impaired sleep function that is partially due to periodic limb movements during sleep and arousals that result in objective diurnal sleepiness. High level of sleep disruption with high arousal indices in both clinical groups. High prevalence of PLMS in both groups. No difference in these findings in small group that had 2nd study. both groups were sleepy on MSLT (mean SOL 7.8 for thal, andn10.7 for CDA-1 subjects)	PSG characteristics are different between children with β-thalassemia and congenital dyserythropoietic anemia and control children	100% had PSG, but only 42% had MSLT	Yes	Little concern re reliability as scoring and interps done by only two persons	Not applicable	Not applicable	Not applicable	Not applicable	Not specified
Rogers 2010	To describe polysomnographic parameters and their clinical correlates in a referred sample of children with sickle cell disease (SCD). 80 children referred for PSG who had sickle cell disease were screened...55 met inclusion criteria .....their PSG findings were reviewed. two subgroups were described, those with HbSS and those with HbSC disease. comparisons were made between these two groups	Both OSA and PLMs were common in children with SCD. 69.1% overall had OSA (OAHI > 1 26.4% of total sample had PLMS, 29.4% of those with no OSA had PLMS (< 5/hr) BMI negatively correlated with peak end-tidal CO2, and negatively correlated with indices of OSA Hemoglobin dependent indices (ie saturation data) more affected in HbSS, otherwise similar sleep parameters	This study contributes to the limited literature describing objective sleep using pediatric scoring criteria in this population. It further highlights implications for clinical care and suggests directions for future research in children with sickle cell disease in whom sleep and the impact of sleep disorders has been largely unexplored.	100%	No reference standard used	Reliability issues related to scoring techniques and changes in scoring criteria over the 4 year period of chart reviews	Not applicable	Other, specify: referred for evaluation of sleep disordered breathing	Not applicable	Not applicable	Not specified

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Simakajornboon 2003	To assess potential relationships between serum iron and ferritin levels and the severity of periodic limb movement in sleep (PLMS) in a pediatric population, and to evaluate the response to supplemental iron therapy.	In children, the presence of PLMS is frequently associated with low serum iron and a tendency toward low serum ferritin levels. In addition, iron therapy is associated with clinical improvement in most of these patients.	There was no significant correlation between serum ferritin concentration and PLMS severity as indicated by the PLMI (r=-0.19). In contrast, serum iron was significantly correlated with PLMI (r=-0.43, P<0.01). Indeed, patients with serum iron concentrations less than 50 µg/dL had a higher PLMI compared to patients with serum iron concentrations greater than 50 µg/dL	100%	No	None	Not applicable	Other, specify: sleep onset insomnia, sleep maintenance insomnia, restless sleep, observed leg jerks, EDS, hyperactivity, family history of RLS/PLMS	Not applicable	Clinical changes after intervention	Not specified
Miano 2005	The aim of this study was to evaluate the sleep breathing patterns and to detect the eventual presence of periodic leg movements (PLMs) in patients affected by Angelman syndrome (AS).	Sleep macrostructure showed only few significant differences between children with AS and the other two groups of subjects: AS patients showed higher percentage of wakefulness after sleep onset and sleep onset latency; moreover, the percentage of REM sleep was reduced in AS and in MRECsubjects. A tendency for AS subjects to present a higher PLMI than the other two groups was also found. These results confirm our previous questionnaire-based findings of a high prevalence of sleep breathing disorder and important PLMs in AS and allow us to hypothesize that epilepsy, rather than mental retardation, might exacerbate these sleep disorders.	Sleep breathing disorder and PLMs might contribute to the cognitive impairment and to the worsening of life quality of subjects with AS and with MR (mostly those with epilepsy). Therefore, our findings suggest the need to explore these sleep disorders in children affected by MR and to set up a correct treatment.	100%	Yes / yes	None	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not specified
SLEEP IN SPECIAL POPULATIONS (4.4)											
Clinical Utility of PSG in the evaluation of sleep in special populations of children with chronic pain syndromes, fibromyalgia, or other rheumatological problems (4.4)											
Tayag-Kier 2000	Our objectives were to evaluate in a controlled study the polysomnographic findings of children and adolescents with JF for alterations in sleep architecture as well as possible PLMS not previously noted in this age group.	JF subjects differed significantly from controls in sleep architecture. JF subjects presented with prolonged sleep latency, shortened total sleep time, decreased sleep efficiency, and increased wakefulness during sleep. In addition, JF subjects exhibited excessive movement activity during sleep. Six of the JF subjects (38%) were noted to have an abnormally elevated PLMS index (>5/hour), indicating PLMS in these subjects.	PSG identified abnormalities in sleep architecture and movements (PLMS) in children with JF	Not applicable	Yes / yes	None	Not applicable	Not applicable	Not applicable	Not applicable	Not specified
Zamir 1998	To characterize sleep patterns of patients with juvenile rheumatoid arthritis (JRA)	Patients had 90% more arousals and awakenings and the median length of occurrences of uninterrupted sleep in stages 2 and 3 and REM sleep was 60% shorter than controls. Abnormal sleep has been confirmed in patients with JRA. Sleep disturbance is associated with daytime sleepiness as evidenced by abnormal MSLT results and longer afternoon naptime.	PSG characteristics are different between children with JRA and children without	100%	Yes / yes	None	Not applicable	Not applicable	Other, specify: sleep questionnaire	Other, specify: rheumatological exam	Not specified
Passarelli 2006	To investigate the relationship between clinical manifestations and sleep abnormalities in patients with juvenile rheumatoid arthritis (JRA).	Patients with JRA exhibited higher indexes of periodic leg movements (PLM; p = 0.02), isolated leg movements (LM), and arousals, as well as increases in alpha activity in non-REM sleep (all p < 0.01), in spite of similar frequency of sleep complaints in comparison to controls. Among JRA patients, greater alpha activity in non-REM sleep was observed in the participants with greater joint involvement assessed by the Escola Paulista de Medicina-Pediatric Range of Motion Scale (p = 0.03) or joint count (p = 0.02). Correlation was observed between morning stiffness and PLM and/or LM (rS = 0.75, Sr = 0.74, p < 0.001 for both), and between self-rating scores of pain and alpha activity in non-REM sleep (r_S = 0.74, p < 0.001). Pain symptoms and disability are related to sleep fragmentation in patients with active polyarticular JRA.	PSG identifies sleep differences that correlate with pain and functional impairment in children with JRA	100%	Yes / Yes	None	Not applicable	Not applicable	Other, specify: sleep questionnaire and CHAQ functional disability, pain scores, stiffness	Not applicable	Not specified

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Ward 2008	To compare polysomnography (PSG) and self-reported sleep, symptoms (pain and fatigue), and anxiety between children with active and inactive juvenile rheumatoid arthritis (JRA) and examine relations among sleep, symptoms, and anxiety.	On the second (study) night, PSG and self-reported sleep variables were not different, but pain and fatigue were significantly higher (both p <.02) in children with active compared to inactive disease. In a stepwise regression, age, medications, disease status, anxiety, evening pain, total sleep time, and arousals explained 36% of the variance in fatigue and age, disease status, and evening pain were significant (all p <.04) predictors of fatigue. All children showed longer sleep latency and reduced sleep efficiency on the first night in the laboratory. Sleep was not altered in children with active JRA, however, the ''first night effect'' suggests that valid laboratory sleep assessments require an adaptation night.	PSG is useful in characterizing the effect of active vs. inactive JRA on sleep	100%	No	None	Not applicable	Not applicable	Other, specify: sleep self-report; self-report lab sleep; daily symptom diary; Oucher Faces Rating Pain Scale (pain intensity and location); Child Fatigue Scale (fatigue); Revised Children's Manifest Anxiety Scale (anxiety); Childhood Health Assessment Questionnaire	Not applicable	Not specified
Ward 2010	To compare daytime sleepiness and neurobehavioral performance in children with active and inactive juvenile idiopathic arthritis (JIA), and explore relations among measures of sleep disturbance, daytime sleepiness, and neurobehavioral performance	Indices of sleep disturbance were associated with validated tests of neurobehavioral performance in JIA, regardless of disease activity.	PSG is useful for finding associations between sleep disturbance and validated tests of neurobehavioral performance.	100%	Yes / Yes	None	Not applicable	Not applicable	Other, specify: pain location daily diary, sleepiness scale	Physical examination	Not specified
Lopes 2008	The objective of the present study was to evaluate the expression of a cyclic alternating pattern (CAP) in slow wave sleep (SWS) in children with the well-defined chronic syndrome juvenile idiopathic arthritis (JIA)	Sleep efficiency and sleep stage in minutes were similar for both groups. JIA patients presented nocturnal disrupted sleep, with an increase in short awakenings, but CAP analyses showed that sleep disruption was present even during SWS, showing an increase in the overall CAP rate (P < 0.01). Overall CAP rate during non-rapid eye movement sleep was significantly higher in pediatric patients who were in chronic pain.	PSG characteristics including CAP are different between children with JIA and children without	100%	Yes / Yes	None	Not applicable	Not applicable	Not applicable	Not applicable	Not specified
Vendrame 2008	We investigated polysomnographic findings in children with headaches, and correlated them with headache type and severity, body mass index, and medical treatment.	Our results support an association between migraine and sleepdisordered breathing, and between tension headache and bruxism, in children. Moreover, disrupted sleep architecture with reduced rapid eye movement and slow-wave sleep in severe and chronic migraine headaches may support an intrinsic relationship between sleep and headache disorders.	Sleep-disordered breathing was more frequent among children with migraine (56.6%) and nonspecific headache (54%) vs chronic migraine (27%). Tension headache was not associated with sleep-disordered breathing. In the nonspecific headache group, children with sleep-disordered breathing had higher body mass indexes (P = 0.008). Severe migraine and chronic migraine were associated with shorter sleep time, longer sleep latency, and shorter rapid eye movement and slow-wave sleep. Fifty percent of children with tension headache manifested bruxism vs 2.4% of children with nontension headache (odds ratio, 1.95; 95% confidence interval, 1.2-4.34). Our results support an association between migraine and sleepdisordered breathing, and between tension headache and bruxism, in children. Moreover, disrupted sleep architecture with reduced rapid eye movement and slow-wave sleep in severe and chronic migraine headaches may support an intrinsic relationship between sleep and headache disorders.	100%	Yes / yes	None	Not applicable	Other, specify: headache pain	Not applicable	Not applicable	Not specified

PICO TABLE

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Patient (Age)	Patient (Disorder)	Intervention	Comparison	Outcome
2-18 years	Hypersomnia-narcolepsy	PSG/MSLT	None	Definition for diagnosing narcolepsy without cataplexy or with atypical cataplexy
2-18 years	Hypersomnia-idiopathic	PSG/MSLT	None	Needed with sleep logs to diagnose idiopathic hypersomnia
2-18 years	Hypersomnia	Patient history	PSG/MSLT	PPV, NPV, Sensitivity, Specificity
2-18 years	Hypersomnia	Modified ESS	PSG	PPV, NPV, Sensitivity, Specificity
2-18 years	Restless Legs Syndrome	PSG	None	Indicated for the dx of RLS if patient meets the 4 adult criteria and cannot verbalize sensation (refer to ICSD-2; i.e., expert consensus developed at the NIH symposium)
2-18 years	RLS	Growing pains (no other symptoms)	PSG	PPV, NPV, Sensitivity, Specificity for RLS
2-18 years	RLS	Family History of RLS	PSG	PPV, NPV, Sensitivity, Specificity for RLS
2-18 years	RLS	Iron deficiency	PSG	PPV, NPV, Sensitivity, Specificity for RLS
2-18 years	RLS	ADHD	PSG	PPV, NPV, Sensitivity, Specificity for RLS
2-18 years	RLS	Williams Syndrome	PSG	PPV, NPV, Sensitivity, Specificity for RLS
2-18 years	Non-REM Parasomnias	History	PSG	1997 paper recommends PSG when diagnosis uncertain or injurious behavior or suspicion of other sleep disorder—they state that PSG is not necessary for diagnosis based on the “consistent descriptive literature”—not changed in more recent paper
2-18 years	Non-REM parasomnias	home audiovisual recording	PSG or ?versus history?	PPV, NPV, Sensitivity, Specificity
5-18 years	Nocturnal enuresis	History suggests sleep-related epilepsy	PSG	PSG indicated as per ICSD-2
2-18 years	REM Sleep Behavior Disorder	PSG		Necessary for diagnosis?

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2-18 years	Sleep-related seizure disorder	Inpatient video-EEG monitoring (x 3-5 day)—the gold standard for epilepsy diagnosis	PSG—standard (includes video?)	PPV, NPV, Sensitivity, Specificity
2-18 years	Sleep-related seizure disorder	Inpatient video-EEG x 3-5 days	PSG—16 channel EEG and video	PPV, NPV, Sensitivity, Specificity
2-18 years	Sleep-related seizure disorder	Home audiovisual recording	PSG—specify montage	PPV, NPV, Sensitivity, Specificity
2-18 years	Sleep-related seizure disorder	Wake EEG	PSG	PPV, NPV, Sensitivity, Specificity
2-18 years	Sleep-related seizure disorder	Sleep or sleep-deprived EEG	PSG	PPV, NPV, Sensitivity, Specificity
2-18 years	Sleep-related seizure disorder	24-hour EEG	PSG	PPV, NPV, Sensitivity, Specificity
2-18 years	DSPS/CRSD	History	PSG	Not indicated
2-18 years	Insomnia	History	PSG	Not indicated
2-18 years	Insomnia		PSG	Sensitivity/Specificity for diagnosing depression
2-18 years	Insomnia with depression		PSG	Usefulness in predicting response to therapy
2-18 years	ADHD	Symptoms of OSA	PSG	Sensitivity, Specificity for OSA
2-18 years	ADHD	Symptoms of RLS/PLMD	PSG	Sensitivity, Specificity for RLS/PLMD
2-18 years	ADHD	NO symptoms of OSA/RLS	PSG	Sensitivity, Specificity for OSA/RLS/PLMD
2-18 years	ADHD	Restless Sleep	PSG	Sensitivity, Specificity for OSA/RLS/PLMD
2-18 years	ADHD	Insufficient Sleep	PSG	Sensitivity, Specificity for OSA/RLS/PLMD
2-18 years	ADHD	Daytime Somnolence	PSG	Sensitivity, Specificity for OSA/RLS/PLMD
Infant	Seizures	EEG	PSG	Sensitivity, Specificity
Infant	Reflux		PSG	Sensitivity, Specificity