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實 EVIDENCE 証

Hospital Authority Head Office
Professional Services & Medical Development Division

Clinical Effectiveness Unit
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Sleep Apnoea

This report presents evidence on the diagnosis of sleep apnoea (SA) and reported experiences of sleep disorders centres.

Diagnosis of sleep apnoea

The following search engines were used to identify recent (on or after 1995) systematic reviews, healthcare technology assessment (HTA) reports and clinical practice guidelines (CPG) on diagnosis of SA. Only publications in English were included.

- TRIP Database (Centre for Research Support, University of Wales, College of Medicine, U.K.)
- DARE, EED, HTA Databases (NHS Centre for Reviews and Dissemination, University of York, U.K.)
- EMBASE (1980 to week 07, 2002)
- MEDLINE (1966 to Aug week 3, 2002)
- Cochrane Database of Systematic Review (Issue 1, 2002)

Evidence retrieved

Ref	Publication
1.	Ross SD, Allen IE, Harrison KJ, Kvasz M, Connelly J, Sheinhait IA. Systematic review of the literature regarding the diagnosis of sleep apnea [online]. Rockville, MD: Agency for Health Care Policy and Research. 1999 Feb. Evidence Report/Technology Assessment: No. 1. AHCPR Publication No. 99-E002. Available from: URL: http://hstat.nlm.nih.gov/hq/Hquest/db/local.epc.er.apnea/screen/TocDisplay/s/63216/action/Toc.
2.	Ross SD, Sheinhait IA, Harrison KJ, Kvasz M, Connelly JE, Shea SA et al. Systematic review and meta-analysis of the literature regarding the diagnosis of sleep apnea. Sleep 2000 Jun 15;23(4):519-32.
3.	Chesson AL Jr., Ferber RA, Fry JM, Grigg-Damberger M, Hartse KM, Hurwitz TD et al. The indications for polysomnography and related procedures. Available from: URL:www.aasmnet.org/PDF/IndicationsPSGReview.pdf
4.	Heitman SJ, Flemons WW. Evidence-based medicine and sleep apnea. Respir Care 2001 Dec;46(12):1418-32.
5.	Chesson AL Jr., Ferber RA, Fry JM, Grigg-Damberger M, Hartse KM, Hurwitz TD et al. Practice parameters for the indications for polysomnography and related procedures. Available from: URL: http://www.asda.org/PDF/IndiactionsPSGParameter.pdf.
6.	Thorphy M, Chesson A, Derderian S, Kader G, Millman R, Potolicchio S Jr. et al. Practice parameters for the use of actigraphy in the clinical assessment of sleep disorders. Available from: URL: http://www.asda.org/PDF/ActigraphyParameter.pdf.

Evidence Summary

Citations 1 to 3 provide up-to-date evidence on the diagnosis of sleep apnoea, address limitations of the literature and provide direction for further research.

<table>
<tr><th colspan="2">Evidence</th><th rowspan="2">Type of publication</th><th rowspan="2">Purpose of study</th><th rowspan="2">Conclusions / Recommendations</th></tr>
<tr><th>Level</th><th>Ref.</th></tr>
<tr><td>I</td><td>1</td><td>Systemically developed HTA report</td><td>The report addressed the following questions regarding diagnosing SA in adults:
1) What diagnostic and screening tests are presently available and the strength of the evidence?
2) What is the predictive value of these tests in different populations?
3) What are the implications of the polysomnography (PSG) results in terms of serious clinical events occurring as co-morbidities in association with a diagnosis of SA?

Sleep monitoring devices, radiologic imaging, laboratory assays, and clinical signs and symptoms were compared against standard sleep laboratory PSG.</td><td>Evidence-base:
• 71 studies (7,572 patients) primarily derived from case series and observational studies;
• Variability in PSG definitions of apnea and hypopnea, and the thresholds for Apnea Index (AI) and Apnea-Hypopnea Index (AHI), with or without presence of clinical signs and/ or symptoms;
• Variability in components of “standard” PSG, and requirement for all “standard” PSG channels not established in SA diagnosis. Night to night PSG reproducibility is not well documented and may differ by SA diagnostic thresholds.

Test performance:
<table>
<tr><th></th><th>Studies No.</th><th>Patients No.</th><th>Sensitivity</th><th>Specificity</th></tr>
<tr><td>Partial channel PGS</td><td>3</td><td>213</td><td>82 – 94 %</td><td>82 –100 %</td></tr>
<tr><td colspan="5">Conclusion: Sensitivity & Specificity appear promising as possible pre-screening tests or replacements for full PSG.</td></tr>
<tr><td>Portable devices (mostly supervised from sleep labs, not home)</td><td>25</td><td>1,631</td><td>32 – 100 %</td><td>33 – 100 %</td></tr>
<tr><td colspan="5">Conclusion: Studies were variable due to study and device heterogeneity.</td></tr>
<tr><td>Oximetry</td><td>12</td><td>1,784</td><td>87.4 %(mean)</td><td>64.9 %(mean)</td></tr>
<tr><td colspan="5">Conclusion: Oximetry studies provided moderate sensitivity & specificity</td></tr>
<tr><td>Partial Time PSGs</td><td>7</td><td>505</td><td>69.7*% (mean)</td><td>87.4* %(mean)</td></tr>
<tr><td></td><td></td><td></td><td>79.5# %(mean)</td><td>86.7# % (mean)</td></tr>
<tr><td colspan="5">Conclusion: Sensitivity & specificity of partial time PSGs appear promising as possible prescreening tests or replacement full PSG.</td></tr>
<tr><td>Radiologic</td><td>5</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td colspan="5">Conclusion: Radiology studies could not be analysed due to insufficient data.</td></tr>
<tr><td>Miscellaneous:
Anthropomorphics signs & ENT exams;
Chemical essay
Questionnaire</td><td>
17

1
3</td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Conclusions: Several of these studies could not be analysed due to insufficient data.</td></tr>
<tr><td>Flow volume loops</td><td>4</td><td>595</td><td>39.1% (mean)</td><td>60.5% (mean)</td></tr>
<tr><td>Global Impressions of clinicians</td><td>4</td><td>1,139</td><td>58.9% (mean)</td><td>65.5% (mean)</td></tr>
<tr><td colspan="5">Conclusions: Global Impressions provided sensitivity & specificity; least accurate were flow volume loops.</td></tr>
</table>
* AI/AHI threshold of 5; # AI/AHI threshold of 10</td></tr>
</table>

<table>
<tr><th colspan="2">Evidence</th><th rowspan="2">Type of publication</th><th rowspan="2">Purpose of study</th><th rowspan="2">Conclusions / Recommendations (cont'd)</th></tr>
<tr><th>Level</th><th>Ref</th></tr>
<tr><td>I</td><td></td><td></td><td></td><td>Co-morbidity:
<table>
<tr><th></th><th>No. of study</th><th>SA patient</th><th>Mean % of patient with co-morbidity</th></tr>
<tr><td>Hypertension</td><td>24</td><td>3,497</td><td>42%</td></tr>
<tr><td>Coronary artery disease</td><td>9</td><td>1,086</td><td>20.3%</td></tr>
<tr><td>Ventricular arrhythmias</td><td>5</td><td>205</td><td>13.1%</td></tr>
<tr><td>Mortality</td><td>5</td><td>2,281</td><td>7% (Prolonged follow-up 95-13 years)</td></tr>
</table>
The authors concluded, "……..the diagnosis of SA is still best accomplished with full PSG. Progress has been made in establishing reasonable sensitivity and specificity of tests other than full PSG, and future researchers should focus on building this evidence base. Standardisation of terms and diagnostic criteria is an absolute requirement to expedite development and enhance the utility of this literature in the future."</td></tr>
<tr><td>I</td><td>2</td><td>Systematic review</td><td>Same study as (1)</td><td>Same study as (1)</td></tr>
<tr><td>IV</td><td>3</td><td>Narrative review</td><td>Review evidence on using PSG to diagnose sleep-related breathing disorders, other respiratory disorders, nacrolapsy, parasomnias and sleep-related epilepsy, restless legs syndrome and periodic limb movement disorders, insomnia and circadian rhythm sleep disorders.</td><td>The review was appraised and approved by the Board of Directors of the American Sleep Disorders Association (ASDA) and provides the background for the accompanying ASDA Standards of Practice Committee's Parameters for the Practice of Sleep Medicine in North America (see Ref 5).</td></tr>
<tr><td>IV</td><td>4</td><td>Narrative review</td><td>To provide a framework for evaluating levels of evidence on health impact, diagnosis and treatment of obstructive SA.</td><td>Highlighted the supports and use of clinical prediction rules and unattended ambulatory monitoring as reasonable alternatives to PSG for diagnosing obstructive SA in selected patients, which would help alleviating the long waiting lists at many sleep centers.
i) Clinical prediction rules have sensitivities as high as 95%, but specificities tend to be low (41-63%). They are useful in ruling out important disease but cannot be relied upon to confirm obstructive SA.
ii) Most studies on unattended ambulatory monitoring devices had weak study designs that precluded meaningful meta-analysis of their results.</td></tr>
</table>

Evidence		Type of publication	Purpose of study	Conclusions / Recommendations
Level	Ref			
II	5	CPG (related to Ref 3)	Provide evidence-based recommendations on the indications of PSG (and, in some cases, related sleep medicine procedures such as cardiorespiratory sleep studies and multiple sleep latency and maintenance of wakefulness tests) for the diagnosis of common sleep disorders.	<u>Conditions for which PSG are indicated:</u> - Diagnosis of sleep-related breathing disorders. - Continuous positive airway pressure (CPAP) titration in patients with sleep-related breathing disorders. - Evaluation for presence of obstructive SA in patients before undergoing laser-assisted uvulopalatopharyngoplasty. - Evaluation of suspected narcolepsy performed on the day after the PSG evaluation. - Evaluation of patients with sleep behaviours suggestive of parasomnias that are unusual or atypical because of the patient's age at onset; the time, duration, or frequency of occurrence of the behaviour; or the specifics of the particular motor patterns in question. - For patients with neuromuscular disorders and sleep-related symptoms to evaluate symptoms of sleep disorders not adequately diagnosed by obtaining a sleep history, assessing sleep hygiene, and reviewing sleep diaries. - When a diagnosis of periodic limb movement disorder is considered because of complaints by the patient or an observer of repetitive limb movements during sleep and frequent awakenings, fragmented sleep, difficulty maintaining sleep, or excessive daytime sleepiness. <u>Conditions for which PSG are not routinely indicated:</u> - Patients treated with CPAP whose symptoms continue to be resolved with CPAP treatment. - Patients with epilepsy who have no specific complaints consistent with a sleep disorder. - Diagnosis or treatment of restless legs syndrome. - Diagnosis of depression. - Diagnosis of circadian rhythm sleep disorders (except persistent cases when diagnosis is unclear – see summary on reference 6 below). - Diagnosis of chronic lung disease (nocturnal hypoxemia in patients with chronic obstructive, restrictive, or reactive lung disease is usually adequately evaluated by oximetry). <u>Recommendations on other types of diagnostic tests:</u> - Multiple sleep latency test is not routinely indicated for most patients with sleep-related breathing disorders or diagnosis of depression. - Oximetry lacks the specificity and sensitivity to be used as an alternative to PSG or a cardiorespiratory sleep study for diagnosing sleep-related disorder.

Evidence		Type of publication	Purpose of study	Conclusions / Recommendations
Level	Ref			
IV	6	CPG	Provide recommendations on using actigraphy in assessing sleep disorders.	Conditions for which actigraphy are indicated: - Adjunct to a detailed history, examination, and subjective sleep diary for the diagnosis and treatment of insomnia, circadian-rhythm disorders, and excessive sleepiness. - Adjunct to modified portable SA testing when determining the rest-activity pattern during the testing period. - Demonstration of multiday human rest-activity patterns and estimation of sleep-wake patterns in the occasional clinical situations where a sleep log or diary cannot provide similar information. Conditions for which actigraphy are not recommended: - Routine diagnosis, assessment of severity, or management of any of the sleep disorders, including insomnias, obstructive SA syndrome and periodic limb movement disorder.

Sleep Disorders Centres Experiences

Using the search terms - sleep, disorder$, centre$ or center$, laborator$ - the following search engines were used in identifying publications published between 1995 to 2001 on experiences of sleep disorders centres.

- EMBASE (1988 to week 34, 2001)
- MEDLINE (1966 to Aug week 4, 2001)

395 titles fulfilled the criteria that were then screened for relevance. Where relevant, the abstract was retrieved for further examination. The table below represents a summary of the included publications.

Evidence retrieved

Ref	Publication
1.	Hashimoto T, Ogino H, Koga T, Uchimura N. The Koga Hospital Center for studies on sleep: status report. Psychiatry Clin Neurosci 2000 Jun;54(3):301-2.
2.	Punjabi NM, Welch D, Strohl K. Sleep disorders in regional sleep centers: a national cooperative study. Sleep 2000 Jun 15;23(4):471-80.
3.	Mendelson WB. Experiences of a sleep disorders center: 1700 patients later. Cleve Clin J Med 1997 Jan;64(1):46-51.
4.	Mendelson WB. Children in the sleep center: a case series. Child Adolesc Psychiatr Clin N Am 1996;5(3):753-61.

Evidence Summary

Ref	Study design	Duration	Patients	Main findings
1	Retrospective case series	3.25 years	473 adults	PSG diagnosed 256 (54%) sleep-related breathing disorders: obstructive SA (124), central SA (56), mixed SA (8), sleep hypoxemia (18), insomnia (4). The most common complication was heart disease (133 patients). Other complications included hypertension, and respiratory and cerebrovascular diseases. CPAP therapy was most commonly applied and was effective in each type of SA syndrome.
2	Prospective point-prevalence survey	2 months	4122 adult patient encounter	Obstructive SA (67.8%), narcolepsy (4.9%), restless legs syndrome (3.2%) were the top three reported primary diagnoses. Nearly 1/3 of patients had a primary or secondary diagnosis of a non-respiratory sleep disorder.
3	Retrospective case series	6 years	1700 adults	Patients with sleep disorders may present with a wide range of symptoms: the series included psychiatric disorders (6%), periodic led movement disorder (6.7%), snoring (9.4%), obstructive SA (43.9%) and others such as medical illness, drug or alcohol abuse, seizure disorders, narcolepsy, circadian rhythm disorders and disorders of arousal (34%).
4	Retrospective case series	6 years	152 children	117 had sleep studies. 67% found to have SA of which 52% were obstructive. The rest included narcolepsy, periodic leg movement disorder, parasomnias, and limit-setting sleep disorders. The variety of pathologies seen emphasizes the importance of a multidisciplinary approach in dealing with paediatric sleep disorders.

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實 EVIDENCE 証 in CONTEXT

Hospital Authority Head Office *Clinical Effectiveness Unit*

Professional Services & Medical Development Division *Addendum to '實 EVIDENCE 証' Issue 17, 2002*

Developing Sleep Study Services for Sleep Apnoea

In view of the growing interest in using sleep studies to investigate sleep related breathing disorders, an expert panel was convened to explore service development strategy in the public sector. Preliminary discussion generated the following observations:

1. The discovery of sleep related breathing disorders and the potential of offering treatment to alleviate the abnormal physiology create enthusiasms in sleep studies.

2. Considering the prevalence[i,ii] and associated serious morbidity, sleep apnoea (SA) is of major public health concern. However, lack of awareness in both patients and clinicians contributed to underreporting of the condition[iii].

3. Clinical evaluation of SA has significant limitations and cannot serve as a reliable screening test. Among the diagnostic methods proposed, overnight full-channel polysomnography (PSG) performed in a sleep laboratory remains the preferred standard. However, PSG is costly and requires professional expertise in its interpretation. The vast number of individuals with common complaints such as snoring and fatigue would exert huge burden on the healthcare system. It is difficult to make simplistic recommendations about indications for sleep studies, and it is hard to decide how much of the health care budget should be allotted to sleep study in an equitable manner. There is a need for further cost-effectiveness study.

4. There are gaps in the evidence on treatment effectiveness, from alleviating the abnormal physiology associated with SA to long-term clinical outcomes. Such evidence is beginning to appear but few in number[iv].

5. For enhancing the development of sleep disorder medicine in Hong Kong, it is desirable to establish standards for sleep laboratory operation and structured training for clinical and supporting staff. With the current multi-disciplinary approach, it is important to emphasis consensus building through close collaboration of specialists from different backgrounds.

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[i] Ip et al. estimated the male prevalence of symptomatic OSA in middle-aged men is about 4% and that in women about 2%. [Ip MSM, Lam B, Lauder IJ, Tsang KWT, Chung KF, Mok YW et al. A community study of sleep-disordered breathing in middle-aged Chinese men in Hong Kong. Chest 2001 Jan;119(1): 62-9].

Young et al. estimated 2% of women and 4% of men in the middle-aged work force would meet minimal diagnostic criteria of sleep apnoea, i.e. ≥5 apnoea-hypopnea episodes per hour per sleep. [Young T, Palta M, Dempsey J, Skatrud J, Weber S, Badr S. The occurrence of sleep-disordered breathing among middle-aged adults. N Engl J Med 1993 Apr 29;328(17):1230-5].

[ii] In a systematic review of literature published from 1980 to November 1, 1997 regarding the diagnosis of sleep apnoea, the prevalence was found to be 9.2% (range 0-33%) in the general population (11 studies with 2410 participants) and 34.6% (range 2-43%) in healthy elderly (7 studies with 469 participants) [Ross SD, Allen IE, Harrison KJ, Kvasz M, Connelly JE, Sheinhait IA. Systematic review of the literature regarding the diagnosis of sleep apnea [online]. Rockville, MD: Agency for Health Care Policy and Research. 1999 Feb. Evidence Report/Technology Assessment: No. 1. AHCPR Publication No. 99-E002. Available from: URL: http://hstat.nlm.nih.gov/hq/Hquest/db/local.epc.er.apnea/screen/TocDisplay/s/63216/action/Toc].

[iii] National Commission on Sleep Disorders Research. Wake up America: a national sleep alert: report of the National Commission on Sleep Disorders Research. Washington, DC: Government Printing Office, 1993.

[iv]Wright J, White J, Ducharme F. Continuous positive airways pressure for obstructive sleep apnoea. In: Cochrane Database of Systematic Reviews [online], Issue 1, 2002. Available from: Ovid Technologies, Inc.

Engleman HM, Kingshott RN, Wraith PK, Mackey TW, Deary IJ, Douglas NJ. Randomized placebo-controlled crossover trial of continuous positive airway pressure for mild sleep apnea/hypopnea syndrome. Am J Respir Crit Care Med 1999 Feb;159(2):461-7.

Jenkinson C, Davies RJO, Mullins R, Stradling JR. Comparison of therapeutic and subtherapeutic nasal continuous positive airway pressure for obstructive sleep apnoea: a randomised prospective parallel trial. Lancet 1999 Jun 19;353:2100-5.

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