Update on the assessment and investigation of adult obstructive sleep apnoea

Garun S Hamilton, Ching Li Chai-Coetzer

Background
Obstructive sleep apnoea (OSA) is common. Medicare Benefits Schedule rules regarding which patients are eligible for a sleep study without first needing to see a sleep or respiratory specialist have recently changed and incorporate validated questionnaires of OSA risk and subjective sleepiness.

Objective
The aim of this article is to bring general practitioners (GPs) up to date with the key factors that should be assessed when considering whether a patient has OSA. It also highlights the strengths and weaknesses of the screening questionnaires, and the pros and cons of different types of sleep studies.

Discussion
OSA may significantly affect quality of life, mood, safety and cardiovascular risk. Assessment should focus on symptoms. Screening questionnaires have high sensitivity but, when used alone, poor specificity for moderate-to-severe OSA. The Epworth Sleepiness Scale (ESS) is a poor marker of OSA but does predict response to treatment when elevated. GPs can directly order sleep studies when OSA questionnaires are positive and the ESS is elevated; however, negative questionnaires do not exclude OSA or another sleep disorder.

OBSTRUCTIVE SLEEP APNOEA (OSA) is the repetitive collapse of the upper airway during sleep. The collapse is either complete, leading to cessation of airflow (apnoea), or partial, leading to a reduction in airflow (hypopnoea). Partial collapse is more common. The severity of OSA is usually determined by the frequency of obstructive respiratory events and defined by the Apnoea Hypopnoea Index (AHI), which is the average number of respiratory disturbances per hour of sleep. OSA has been arbitrarily defined as an AHI ≥5 events/hour, and moderate-to-severe OSA is defined as an AHI ≥15 events/hour. The prevalence of OSA is very high in the general adult population, with figures as high as 38%, depending on the population studied and definition used. Much of this OSA is mild in severity (AHI between 5–15 events/hour) and minimally symptomatic. Although not associated with adverse vascular sequelae, mild OSA may still be associated with troublesome daytime symptoms in some subjects. Moderate-to-severe OSA (AHI ≥15 events/hour) is more commonly symptomatic and is associated with other adverse outcomes such as cardiovascular and cerebrovascular disease, cognitive decline, motor vehicle accidents and depression. It is also very common, being found in 6–17% of the general adult population, with a recent Australian study showing a prevalence of 8.3%. In general, both mild OSA plus daytime symptoms and moderate-to-severe OSA are indications to consider OSA treatment.

Given the high prevalence of OSA in the general adult population, a large number of patients presenting to general practitioners (GPs) will have OSA. Known risk factors include obesity, adenotonsillar hypertrophy (mainly seen in children and young adults), increasing age, type 2 diabetes, alcohol and sedative use, and hypertension that is difficult to control. Because many patients with OSA may be minimally symptomatic, it is unclear whether there are overall benefits to widespread screening of either the general population or high-risk individuals (eg those with type 2 diabetes). A recent review of the literature by the US Preventive Services Task Force has concluded that there is insufficient evidence to support screening for OSA in otherwise asymptomatic individuals. Nevertheless, a large number of patients presenting to GPs will have symptoms of OSA, and it is important to consider ‘trigger symptoms’ that warrant further assessment of OSA risk and determination of the need for sleep testing.
OSA symptoms
Adult patients with OSA typically present to GPs for at least one of three major reasons, and these reasons commonly overlap within a patient. First, they may be concerned about their own daily symptoms. These include unrefreshing sleep, tiredness and fatigue, poor concentration and focus, a low mood or excessive daytime sleepiness. Second, they may be suspicious that they have OSA (eg because of apnoeas witnessed by their partner) and are concerned about the potential adverse health consequences. Third, patients may be affected by their partner’s symptoms, often reporting changes in mood, concentration and irritability. In addition, driving risk may be raised if the partner has witnessed apnoeic episodes.

It is important to consider a number of other features. The rest of this article refers to adult OSA, not paediatric OSA.

Clinical assessment
As well as asking about symptoms related to OSA in the clinical assessment, it is important to consider a number of other factors that may affect the diagnostic and treatment pathway. These include the following.

- Signs of adenotonsillar hypertrophy. Although less common with increasing age, this is important as it points to a potential surgical treatment for OSA.
- Driving and workplace safety. If OSA is suspected in commercial drivers or other safety-critical workers – or if there are symptoms of sleepiness while driving – assessment for OSA (or another sleep disorder) should be undertaken urgently and advice about driving risk provided.  

OSA screening questionnaires

Berlin Questionnaire
The first screening questionnaire for OSA that was designed specifically for use in general practice was the Berlin Questionnaire (BQ). The BQ was a consensus outcome following a conference on sleep in primary care held in Berlin, Germany, in 1996 that was attended by US and German respiratory and primary care physicians. The BQ consists of 11 items within three different categories that ask about:

- snoring and witnessed apneas (category 1)
- daytime sleepiness or fatigue (category 2)
- obesity (body mass index [BMI]; category 3)

Table 1. OSA50 questionnaire

<table>
<thead>
<tr>
<th>Item</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Obesity (by waist circumference)</td>
<td>1</td>
</tr>
<tr>
<td>2. Snoring</td>
<td>1</td>
</tr>
<tr>
<td>3. Witnessed apneas</td>
<td>1</td>
</tr>
<tr>
<td>4. Age ≥50 years</td>
<td>1</td>
</tr>
</tbody>
</table>

Total score: .. / 10 points

STOP-BANG questionnaire
The STOP-BANG questionnaire (www.stopbang.ca/osa/screening.php) was developed by an anaesthetist from Toronto, Canada, and was originally validated for use in a pre-operative, post-operative, and intensive care setting.
elective surgery population.\textsuperscript{15} It consists of eight yes/no questions related to:
1. snoring
2. tiredness
3. observed apneas
4. high blood pressure
5. BMI >35 kg/m\textsuperscript{2}
6. age >50 years
7. neck circumference >40 cm
8. male gender.
High risk for OSA is defined as a positive response to ≥3 items. A potential advantage of the STOP-BANG questionnaire is that different cut-off scores can be used to trade off sensitivity and specificity. For example, using a higher cut-off score reduces the sensitivity but increases the specificity of the STOP-BANG questionnaire.\textsuperscript{16} This means a higher cut-off will miss more cases of OSA when negative, but a positive result will be more likely to be a true positive. This is highly relevant when considering the MBS item number rules, which specify that a cut-off score of ≥4 be used.

**Performance of OSA screening questionnaires**

OSA screening questionnaires at recommended cut-off points tend to have high sensitivity but poor specificity (Table 2); in other words, while the majority of patients who have OSA will screen positive, there will be a large number of false-positive results.\textsuperscript{13,14,16} Therefore, screening questionnaires alone are inadequate for confirming a diagnosis, and patients who have a positive screening test should proceed to further evaluation with formal sleep study testing to confirm the presence or absence of OSA.

Surprisingly, very few studies have assessed the performance of the questionnaires in primary care populations. Ongoing Australian research suggests that the sensitivity in primary care is lower than in other selected populations. This means that a negative screening questionnaire does not rule out OSA (or any alternative sleep disorder), and referral to a sleep medicine specialist is recommended if there is ongoing doubt. These questionnaires have not been validated in children and should only be used in adults.

**Epworth Sleepiness Scale**

The Epworth Sleepiness Scale (ESS) provides a subjective measure of daytime sleepiness by asking the patient to rate their chance of dozing off (score of 0–3) in eight commonly encountered scenarios to provide a score out of 24, with higher scores indicating greater degrees of daytime sleepiness.\textsuperscript{17} An ESS score ≥8 suggests the presence of at least mild daytime sleepiness.\textsuperscript{18} Of critical importance, the ESS score does not correlate well with AHI, as not all patients with OSA will have symptoms of sleepiness detected by the ESS and there are multiple causes for excessive daytime sleepiness beyond OSA (eg other sleep disorders, depression). Therefore, the ESS should not be used alone as a screening tool to identify patients at high risk of OSA. When used in conjunction with an OSA screening questionnaire, the ESS is likely to be helpful in identifying patients at high risk of symptomatic disease who will benefit from treatment. However, this remains the subject of ongoing research and it is important to realise that the majority of patients with OSA will not have an ESS ≥8.\textsuperscript{19,20}

**Medicare Benefits Schedule rules regarding primary care referral pathways for sleep studies**

The new Medicare Benefits Schedule (MBS) rules have resulted in two potential pathways to a sleep study.

1. GPs may refer patients to a sleep or respiratory medicine specialist for a clinical assessment; the specialist can then order a sleep test as appropriate.

2. GPs may directly order a sleep test (either at home or in a sleep laboratory), without the patient first needing a clinical review by a sleep or respiratory specialist, if certain criteria are met. Patients must have a positive OSA screening questionnaire (either BQ cut-off of ≥5 or a STOP-BANG cut-off of ≥4), in addition to having an ESS ≥8. The aim is to allow GPs to expedite diagnosis and treatment in a highly symptomatic group of patients with OSA; however, it is important to realise that many patients with significant OSA will not meet this questionnaire combination. These patients will need assessment by sleep or respiratory medicine specialists. Refer to Figure 1 for potential investigation pathways.

### Table 2. Diagnostic utility of obstructive sleep apnoea screening questionnaires for detecting moderate-to-severe obstructive sleep apnoea

<table>
<thead>
<tr>
<th>Berlin Questionnaire\textsuperscript{13}</th>
<th>STOP-BANG cut-off ≥3\textsuperscript{16}</th>
<th>STOP-BANG cut-off ≥4\textsuperscript{16}</th>
<th>OSA50\textsuperscript{14}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity* %</td>
<td>82</td>
<td>94</td>
<td>81</td>
</tr>
<tr>
<td>Specificity† %</td>
<td>39</td>
<td>32</td>
<td>51</td>
</tr>
</tbody>
</table>

Data taken from validation studies\textsuperscript{14} and meta-analyses\textsuperscript{13,16}

* Sensitivity refers to the proportion of subjects with OSA who have a positive questionnaire. (Note: for a highly sensitive test, a negative result is good at ruling out disease.)

† Specificity refers to the proportion of subjects without OSA who have a negative questionnaire. (Note: for a highly specific test, a positive result is good at ruling in disease.)

In general, OSA screening questionnaires have good but not optimal sensitivity, and poor specificity for detecting AHI ≥15 events/hour. OSA, obstructive sleep apnoea; AHI, Apnoea Hypopnoea Index
Types of sleep studies
The gold standard test for diagnosing OSA is with in-laboratory full polysomnography (PSG) with a sleep technician in attendance throughout the night. However, in-laboratory PSG is limited in its availability, labour intensive and costly, so increasing attention has been focused on home sleep study testing. Traditionally, sleep studies have been divided into the following four categories:
• Type 1: Attended, in-laboratory, full PSG with ≥7 recording channels measuring sleep stage, breathing and cardiac parameters, and limb movements.
• Type 2: Unattended, home, full PSG with ≥7 recording channels.
• Type 3: Limited channel monitoring of breathing parameters without sleep assessment.

Patient presents with symptoms suspicious for OSA.

Assessment of further history, examination, comorbidities, driving risk.

Questionnaire negative, ESS ≥8
Consider other sleep disorders, mood disorders and sleep specialist referral.

Questionnaire positive, ESS <8
OSA still possible, consider referral to sleep specialist.

1. OSA50 ≥5 or STOP BANG ≥4 or positive BQ
AND
2. ESS ≥8
(i.e., high pretest probability of OSA)

Direct referral for diagnostic PSG:
• Level 2 home or Level 1 in-lab where home study not suitable.
• Level 3 or 4 study may be acceptable depending on local resources (e.g., rural setting).
• ASA/NATA-accredited laboratory recommended but not mandatory.

Moderate-to-severe OSA on PSG (AHI >15) or mild OSA with significant symptoms and with no major comorbidities, driving risk (refer sleep specialist if latter present)

GP-guided OSA treatment, provided skilled in this with access to specialist support: Implement treatment with lifestyle measures and CPAP. Consider dental or surgical referral where appropriate. Manage cardiovascular and metabolic comorbidities.

Monitor symptoms, CPAP adherence, treatment response.

Refer to sleep specialist

Rx failure

Figure 1. Potential flow chart for OSA investigation
ASA, Australasian Sleep Association; BQ, Berlin Questionnaire; CPAP, continuous positive airway pressure; ESS, Epworth Sleepiness Scale; GP, general practitioner; NATA, National Association of Testing Authorities, Australia; OSA, obstructive sleep apnoea; Rx, treatment
• Type 4: Limited channel monitoring of only 1–2 channels (eg oximetry). Results from home PSG (type 2) testing have been shown to have a high level of agreement when compared with in-laboratory PSG for the diagnosis of OSA, although there is greater potential for signal loss and study failure (~7%) due to the lack of an attending sleep technician.21,22 While home PSG testing is likely to be appropriate for many patients with a suspected diagnosis of OSA, some patients should undergo attended, in-laboratory (type 1) PSG testing.23 Factors that may make home sleep studies unsuitable for some patients include the following:

Patient-related factors
1. Neuropsychological (eg severe intellectual disability, neuromuscular disease, major communication difficulties)
2. Severe physical disability with inadequate carer attendance
3. Unsuitable home environment (eg noise levels, family interactions, distance from sleep laboratory, staff safety concerns)
4. Discretionary (eg symptoms or former test results do not equate with clinical impression; patients seeking a second opinion where original diagnosis is uncertain; serious medicolegal consequences are relevant; patient preference on the basis of factors such as distance to travel, cost, concern about the equipment etc)

Sleep disorder-related factors
1. Consideration of other sleep disorders such as central sleep apnoea, hypoventilation, heart failure, neurological disorders, sleep-related movement disorder, parasomnia or seizure disorder, unexplained hypersomnolence
2. Video confirmation of body positional/rotational aspects of sleep-disordered breathing required, or of other associated movements.

There has been growing interest in the use of unattended type 3 and 4 limited-channel sleep studies as a result of their ability to expedite OSA diagnosis and treatment and their potential to reduce healthcare costs. Type 3 and 4 studies have been shown to have good ability to confirm OSA in highly selected patients with a high pre-test probability of moderate-to-severe OSA without other significant medical or sleep comorbidities.24,25 MBS reimbursement is not currently available in Australia for type 3 and 4 testing, so their use in this country has remained limited.

Conclusion
OSA is a treatable, common disease presenting to GPs. Untreated, it may have major adverse impacts on health. An initial clinical assessment, which includes validated questionnaires, helps triage patients to sleep testing pathways that have now become embedded in the MBS. Despite their ability to recognise some patients with sleepiness and a high likelihood of OSA who can proceed to expedited sleep testing, it is important to note that negative questionnaires (particularly the ESS) do not rule out patients having clinically significant OSA. These patients will need specialist referral.

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Competing interests: GSH has received equipment to support research from Resmed, Philips Respironics and Air Liquide Healthcare. GSH was a member of the Thoracic Medicine Clinical Committee of the MBS Review. CLC created the OSA50 questionnaire that features in this article and is a chief investigator on the NHMRC Centres of Research Excellence Project titled, ‘National centre for sleep services research – Positioning primary care at the centre of sleep health management’.

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References


