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Low levels of awareness of obstructive sleep apnoea amongst the Australian general public

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Introduction: Despite the serious health implications associated with obstructive sleep apnoea, the condition remains under-diagnosed. This study aims to evaluate the awareness of the condition amongst the Australian community.

Methods: A total of 2016 respondents recruited from a web-based panel completed an online questionnaire which assessed awareness and experience of obstructive sleep apnoea and sleep-disordered breathing. The association between the level of awareness and various socio-demographic variables was analysed using uni- and multivariate analyses.

Results: The results of the questionnaire indicated that 50% and 70% of participants were unaware of adult and paediatric obstructive sleep apnoea. Socio-demographic variables including age, annual household income and education level significantly influenced a participant's level of awareness. Approximately 8.3% of the participants had previously been diagnosed with obstructive sleep apnoea. However, 65% of participants exhibiting symptoms of daytime sleepiness had not sought health care. Paediatric sleep apnoea had been previously diagnosed in 7.1% of children residing in participant's households but 49% of children with regular snoring had not been medically evaluated.

Conclusion: A deficiency exists in the awareness of sleep apnoea amongst the Australian general public. This is reflected in the discrepancy between the number of participants exhibiting potential symptoms and those who sought medical advice.

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Introduction

Affecting both adults and children, obstructive sleep apnoea (OSA) is a serious condition characterised by intermittent cessation or a reduction in airflow due to repetitive pharyngeal collapse during sleep.[1] In adults, it causes neurocognitive and cardiovascular sequelae related to recurrent central nervous system arousals, asphyxia and sleep deprivation.[2,3] Paediatric obstructive sleep apnoea can adversely influence somatic growth, induce adverse cardiovascular effects such as hypertension and reduced ventricular function, and lead to neurocognitive and behavioural deficits.[4–6]

The overall prevalence estimate of OSA is approximately 3% to 7% for men and 2% to 5% for women but sleep disordered breathing has been reported to affect up to 49.7% of men and 23.4% of women, with a greater prevalence in overweight and older individuals irrespective of their ethnicity.[7–12] Paediatric OSA affects 1% to10% of children.[4,5]

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Despite the relatively high prevalence of obstructive sleep apnoea, it is recognised that the condition is under-diagnosed.[13,14] Young et al.[15] conducted polysomnography screenings on 602 subjects aged 30 to 60 years of age and found that undiagnosed sleep-disordered breathing presented in 9% and 24% of women and men, respectively. A similar study involved a sample of 4925 subjects with a subset of 1090 undergoing polysomnography.[16] Comparing the proportion of subjects with a prior diagnosis of sleep apnoea to those who were diagnosed through polysomnography screening conducted in the study, it was reported that at least 80% of people with moderate to severe sleep apnoea syndrome were undiagnosed.

Surveys regarding sleep problems in Australian adults from 2010 and 2016 indicated that diagnosed sleep disorders had increased to 12.9% in men but remained unchanged in women at 3.7%. Previous authors have concluded that despite increasing awareness, the prevalence of sleep problems have not improved over time and may be under-represented and un-diagnosed.[17,18] Self-reported and parental-reported adolescent sleep problems were assessed in 308 adolescents (age range 13–17 years) from eight socioeconomically diverse South Australian high schools and it was found that almost 67% of the adolescents had a sleeping problem based on certain criteria; however, adolescent self-reporting was 21.1% and parent awareness that their adolescent had a sleeping problem was 14.3% which were well below the number of individuals who actually had a sleeping issue. This indicated a lack and need for adolescent and parent education regarding sleep disturbances.[19] Similarly, in another Australian sample, when the frequency of sleep problems was assessed by the use of a 'Sleep Disturbance Scale for Children' questionnaire in 361 children of a wider age range (4.5–16.5 years) during 'sick' visits to their general practitioner, it was found that 24.6% had a clinically significant sleep problem; however, only 4.1% of the parents reported the problem while 7.9% of the parents were informed by their GPs regarding the child's condition. The lack of parent awareness combined with the 13.9% of those with clinically significant symptoms who discussed the sleep issues with their general practitioner within the previous 12 months, indicates that the chronic sleep problems in Australian children are significantly under-reported by parents during general practice consultations and reflects the need for community awareness and practitioner's responsibility as the first line in the provision of care.[20]

The seriousness of the potential sequelae related to OSA in both adults and children highlights the importance of prompt diagnosis and management. The lack of detection may be associated with inadequate patient awareness of the associated symptoms that are often identified by a bed partner or family member. The parents of children with OSA may also not be aware of the health and developmental implications of the condition. Therefore, the aim of the present study was to evaluate the level of awareness of adult and paediatric OSA and their associated risk factors, presenting signs and symptoms, and potential consequences within the Australian general population. A secondary objective of the investigation was to evaluate and correlate patterns and potential barriers to seeking care and treatment.

Methods

The study was reviewed and approved by the University of Sydney Ethics Review Committee 2015/161. Participants were recruited through an online research panel administered by Survey Sampling International (SSI). The company maintains an extensive database of Australians who have indicated their willingness to be involved in online survey research. Data were collected from a sample of 2016 Australian participants aged 18 years and above.

A standardised online questionnaire (Supporting Information) was developed based on existing literature, similar population-based questionnaires concerning other health conditions[21–23] and input from an expert advisory panel. The survey was pre-tested and validated by 30 people to ensure adequate comprehension and appropriate interpretation.

Socio-demographic characteristics

The first section of the questionnaire related to a range of socio-demographic questions including gender (male, female), age group (18–24, 25–34, 35–44, 45–54, 55–64, 65+), the highest level of educational qualification obtained (no formal education, high school graduate, Technical and Further Education (TAFE), Bachelor's degree, Master's degree, advanced

graduate work or PhD), annual income (less than $24,999, $25,000–$49,999, $50,000–$99,999, $100,000 or more), and employment status (full time, part-time, carer, student, unemployed, retired).

Awareness of obstructive sleep apnoea

Based on the response to the opening question of "Do you know what the term obstructive sleep apnoea means?" participants were directed through one of two possible question pathways. Having answered "Yes", the participant was then provided with questions assessing the level of awareness of obstructive sleep apnoea. If the participant had answered "No" to the opening question, items related to the level of awareness were by-passed in order to discourage guessing.

The awareness of OSA was assessed based on responses to questions on the definition of obstructive sleep apnoea, associated signs and symptoms, risk factors, potential consequences, and possible pathways for diagnosis and treatment. The majority of the questions were in multiple-choice format. However, the first of two questions related to the definition of obstructive sleep apnoea was of an open-ended format designed to assess the extent to which participants were able to demonstrate their knowledge without prompting.[23] The question was phrased as "Please describe in one sentence what obstructive sleep apnoea means to you". Responses were coded so that answers including 'breathing disruption' or 'airway obstruction during sleep' were considered correct. The following question also enquired about the nature of OSA but was re-formatted as multiple-choice to test the participant's recognition of the condition.

Multiple-choice questions were generally phrased as "Which of the following do you think best describes obstructive sleep apnoea ? Choose one answer", and "As far as you know, which of the following may be signs of obstructive sleep apnoea ? Please select all that apply." This was followed by a list of established signs and symptoms, risk factors, sequelae and treatments according to the specific question. Some closed questions included 'distractor items' to discourage guessing.

The respondents were also questioned on how they had heard about obstructive sleep apnoea and were encouraged to select all that applied from a list that included health professionals, family and friends, television programs, the Internet and health promotion campaigns.

Awareness of paediatric obstructive sleep apnoea

The opening question of the series of items related to awareness of paediatric obstructive sleep apnoea was phrased "As far as you know, can obstructive sleep apnoea occur in children?" If the participant answered "no" or "I don't know", the remaining items pertaining to awareness of paediatric sleep apnoea were by-passed to prevent guessing and skewing of the results. Items related to paediatric sleep apnoea focused on associated signs and symptoms, risk factors, potential consequences, and possible pathways for diagnosis and treatment.

Experience of symptoms related to sleep-disordered breathing

A series of items addressed the participant's own experience with OSA, as well as snoring and daytime sleepiness. Questions were based on the Epworth Sleepiness Scale which consists of eight items scored from 0 to 3 depending on the participant's likelihood of dozing or falling asleep in everyday situations.[24,25] Participants who displayed significant scores of 10 or greater or notable self-recognised signs of potential sleep disordered breathing were asked about their history of seeking medical help. Barriers to seeking medical attention were assessed by 10 items that had been identified in the literature.[23] These included four emotional barriers (e.g. too scared/embarrassed), three practical (e.g. too busy), and three service barriers (e.g. unsure of who to talk to). Participants were advised to select all that applied.

Experience of symptoms related to paediatric sleep-disordered breathing

Individuals with children under the age of 16 residing in their household were asked questions related to the child's experience of sleep-disordered breathing. The questions were adapted from the Sleep Disturbance Scale for Children (SDSC).[26] Participants were asked to rate from a scale of 1 to 5 the frequency at which the child snores, gasps or displays difficulty in breathing. Participants who noted that the child

Table I. Demographic characteristics of sample (n = 2016).

	N (%)
Gender	
Male	982 (48.71%)
Female	1034 (51.29%)
Age	
18–24	253 (12.55%)
25–34	361 (17.91%)
35–44	385 (19.10%)
45–54	370 (18.35%)
55–64	292 (14.48%)
65+	355 (17.61%)
Highest qualification achieved	
Did not complete high school	198 (9.82%)
High school	490 (24.31%)
TAFE	591 (29.32%)
Bachelor	518 (25.69%)
Masters	164 (8.13%)
PhD	55 (2.73%)
Occupation status	
Full-time	753 (37.35%)
Part-time	359 (17.81%)
Carer	142 (7.04%
Student	154 (7.64%)
Temporarily unemployed	124 (6.15%)
Retired	414 (20.54%)
Permanently unemployed	70 (3.47%)
Annual household income (AUD)	
<25,000	305 (15.13%)
25–50,0000	476 (23.61%)
50–100,000	728 (36.11%
>100,000	507 (25.15%

snored or displayed symptoms of sleep-disordered breathing more than once a month were questioned on the child's history of seeking medical care. Participants were also asked about potential barriers to seeking treatment.

Statistical analysis

The data were analysed using SAS Enterprise Guide, Version 7.1 of the SAS System for Windows (Cary, NC, USA). Descriptive statistics were completed for gender, age, education level, occupational status and annual household income of the participants. Univariate and multivariate logistic regression analyses were performed to evaluate the association between the socio-demographic variables and the level of awareness of OSA.

Results

Respondent characteristics

Of the 2016 participants, 48.7% were male and 51.3% were female. The variation in age, education level, employment status and annual income are described in Table I.

Awareness of obstructive sleep apnoea

All 2016 recruited participants completed the online questionnaire. Of those, 56.9% (1148 participants) claimed to know about obstructive sleep apnoea. However, just over half (50.2%) correctly defined OSA in the open-ended question. This improved to 51.4% (1037 participants) in the multiple-choice format. There was no significant difference between males and females (p = 0.331).

Univariate analyses demonstrated that age, education level, employment status and household incomes significantly influenced a respondent's awareness of obstructive sleep apnoea (Table II). A significant relationship was found between the age and the level of awareness of OSA with older respondents aged over 65 being more likely to be aware of OSA compared to younger respondents in the 18- to 24-year-old age group (OR = 2.31, x^2 = 22.72, p<0.001). The level of education also significantly influenced a respondent's awareness of OSA. Highly educated participants were more likely to be aware of the condition (OR = 3.26, x^2 = 11.98, p<0.0001).

Interrupted breathing and regular snoring were noted as major signs of OSA by 48.4% and 40.2% of participants, respectively. Obesity was the most noted predisposing factor by 47.9% of the participants. Increased age and being male were lesser-known risk factors (25.1% and 20.0%, respectively). Approximately one-third of respondents recognised that OSA could lead to excessive daytime sleepiness. An increased risk of cardiovascular disease (30.4%), accidents (29.5%) and depression (19.8%) were lesser-recognised potential consequences.

Table II. Demographic characteristics (gender, age group, education, employment status, annual income) and their associations with awareness of obstructive sleep apnoea.

			Univariate			Multivariate					
Demographic characteristic	Yes %	No %	χ^2	P	DF	OR	95% CI		χ^2	*P*	DF
Gender			0.80	0.33	1				0.08	0.78	1
Male	57.8	42.3				Ref					
Female	55.8	44.2				1.03	0.86	1.23	0.07	0.79	
All	56.7	43.3									'
Age group			25.32	0.00	5				29.65	<0.0001	5
18–24	45.8	54.2				Ref					
25–34	54.9	45.1				1.23	0.88	1.73	1.47	0.23	
35–44	56.6	43.4				1.35	0.97	1.88	3.10	0.08	
45–54	54.7	45.3				1.36	0.98	1.90	3.31	0.07	
55–64	61.1	38.9				1.80	1.26	2.55	10.69	0.00	
65+	65.0	35.0				2.31	1.64	3.25	22.72	<0.0001	
Education			27.85	<0.0001	5				32.60	<0.0001	5
Did not complete high school	47.9	52.2				Ref					
High school graduate	52.5	47.5				1.34	0.95	1.88	2.81	0.09	
TAFE	55.8	44.3				1.53	1.09	2.13	6.16	0.01	
Bachelor's degree	64.1	35.9				2.29	1.62	3.24	21.76	<0.0001	
Master's Degree	57.9	42.1				1.75	1.13	2.69	6.36	0.01	
Advanced Graduate work or Ph.D	72.8	27.2				3.26	1.67	6.38	11.98	0.00	
Employment			18.60	0.00	6						
Working full time (more than 30 hr a week)	56.8	43.3									
Working part-time (8–30 hr a week)	58.4	41.6									
Carer (of home, family, etc.,)	55.8	44.2									
Student	45.6	54.4									
Temporarily unemployed	52.2	47.8									
Retired	62.8	37.2									
Permanently unemployed	45.8	54.2									
Household income			11.49	0.01	3						
Less than $24,999	48.3	51.7									
$25,000–$49,999	59.6	40.5									
$50,000–$99,999	56.7	43.3									
$100,000 or more	59.2	40.8									

Of those who were previously aware of OSA, the general medical practitioner was the main health professional who was consulted if OSA was suspected (85.6%), followed by a sleep physician (53.0%). Dentists (4.3%), physiotherapists (3.2%) and chiropractors (1.7%) were not commonly considered in the management of OSA.

Communication with family and friends (44.3%), however, was cited as the most common source of information regarding the condition, followed by television programs (35.7%), and health professionals to a lesser degree (34.5%).

Awareness of paediatric obstructive sleep apnoea

Of the total sample, 30.4% were aware that obstructive sleep apnoea could affect children. This improved slightly to 34.9% when considering respondents with children residing in their household. Females were significantly more likely to be aware of paediatric OSA compared to males (OR = 1.45, $x^2 = 16.72$, $p<0.0001$). Educated participants were more likely to be aware of paediatric OSA compared to those who had not finished high school (OR = 2.39, $x^2 = 19.8$, $p<0.0001$) (Table III). Sleep deprivation (21.7%), irritability (17.7%) and delayed learning (17.8%) were the most recognised consequences of the condition. Heart disease (5.6%) delayed somatic growth (5.9%), nocturnal enuresis (6.3%), and associations with Attention Deficit Hyperactivity Disorder (ADHD) (6.6%) were less recognised.

Experience of sleep-disordered breathing

Approximately 8.3% of participants (167 participants) were previously diagnosed with OSA. Females were significantly less likely to have been previously diagnosed compared to males (OR = 0.38, $x^2 = 24.59$, $p<0.0001$). Univariate analyses found that age ($x^2 = 27.73$, $p<0.0001$), employment status ($x^2 = 44.01$, $p<0.001$), and annual income ($x^2 = 9.85$, $p = 0.02$) were also significantly associated with a previous diagnosis (Table IV).

A total of 667 responders (33.1%) reported frequent snoring and 242 participants (12.0%) scored 10 or above in the Epworth Sleepiness Scale. Of these, 50 (20.7%) were previously diagnosed with OSA, and 192 (79.3%) were undiagnosed. Approximately 65% of participants with significant scores had not previously consulted a health professional regarding their daytime sleepiness and over half of these participants were not concerned enough to seek medical advice. Females were less likely to have significant scores than males (OR = 0.8, $x^2 = 24.59$, $p<0.0001$) (Table V).

Experience of paediatric sleep-disordered breathing

A total of 581 participants had a child aged 16 years or younger residing in their household, of which 41 (7.1%) had been previously diagnosed with OSA. A total of 94 children (16.1%) were reported to snore regularly and 81 children (13.9%) scored 7 or above in the questions related to sleep-disordered breathing according to the Sleep Disturbance Scale for Children. Of the 94 children who snored regularly, 48.9% (46 participants) had not consulted a health professional. Of the 81 children who exhibited significant scores, 46.9% (38 participants) had not been brought to the attention of a health professional regarding their signs of sleep-disordered breathing.

Discussion

The results of the present survey demonstrate a lack of understanding amongst the Australian general public regarding the nature of OSA. Notably, only half of the sample was able to describe the condition. Socio-demographic characteristics including age, education level, employment status and annual household income significantly influenced the participant's awareness of OSA. Younger participants with lower levels of education and lower incomes were least informed of the condition. An awareness of paediatric sleep apnoea was comparatively poor with less than a third of respondents recognising that the condition could affect children. A trend towards lesser-educated participants being more poorly informed was also observed. Interestingly, female participants were more aware of paediatric OSA compared to male participants.

In regard to participant experience of OSA, a total of 167 participants reported a previous diagnosis. Similar to others,[17,18] the present study was also limited due to the nature of the self-report surveys; however, a prevalence rate of 8.3% was comparable to that previously reported.[7] Notably, just over one-fifth of

Table III. Demographic characteristics (gender, age group, education, employment status, annual income) and their associations with awareness of paediatric obstructive sleep apnoea.

				Univariate			Multivariate					
Demographic characteristic	Yes	No	Don't know	χ^2	*P*	DF	OR	95% CI		χ^2	*P*	DF
Gender				20.64	<0.0001	1				16.72	<0.0001	1
Male	25.8	10.8	63.4				Ref					
Female	35.0	8.5	56.4				1.45	1.21	1.73	16.72	<0.0001	
All	30.5	9.6	59.8									
Age group				61.72	<0.0001	5						
18–24	34.8	9.0	56.2									
25–34	29.7	17.2	53.1									
35–44	29.3	14.3	56.4									
45–54	29.0	6.2	64.9									
55–64	31.9	6.7	61.4									
65+	30.4	3.4	66.3									
Education				42.44	<0.0001	5				19.80	0.00	5
Did not complete high school	26.2	3.0	70.8				Ref					
High school graduate	30.5	8.3	61.2				1.44	1.02	2.05	4.18	0.04	
TAFE	28.9	9.1	62.0				1.39	0.99	1.96	3.61	0.06	
Bachelor's degree	32.2	11.5	56.4				1.73	1.23	2.45	9.73	0.00	
Master's Degree	33.0	19.1	48.0				2.19	1.43	3.35	13.15	0.00	
Advanced Graduate work or Ph.D	41.7	5.6	52.7				2.39	1.32	4.34	8.25	0.00	

Table III. Demographic characteristics (gender, age group, education, employment status, annual income) and their associations with awareness of paediatric obstructive sleep apnoea (continued).

				Univariate					Multivariate		
Demographic characteristic	Yes	No	Don't know	χ^2	P	DF	OR	95% CI	χ^2	P	DF
Employment				38.71	0.00	6					
Working full time (more than 30 hr a week)	28.0	13.2	58.8								
Working part-time (8–30 hr a week)	31.2	9.5	59.3								
Carer (of home, family, etc.,)	37.3	11.1	51.6								
Student	36.2	10.5	53.3								
Temporarily unemployed	25.8	6.5	67.7								
Retired	32.0	4.0	64.0								
Permanently unemployed	28.6	5.7	65.7								
Household income				8.37	0.21	3					
Less than $24,999	29.1	9.0	61.9								
$25,000–$49,999	34.5	7.9	57.6								
$50,000–$99,999	27.9	10.4	61.7								
$100,000 or more	31.5	10.5	58.0								

Table IV. Demographic characteristics (gender, age group, education, employment status, annual income) and their associations with previous diagnosis of obstructive sleep apnoea.

Previous diagnosis of obstructive sleep apnoea			Univariate			Multivariate					
Demographic characteristic	Yes	No	χ^2	*P*	DF	OR	95% CI		χ^2	*P*	DF
Gender			26.66	<0.0001	1				24.59	<0.0001	1
Male	20.2	79.8				Ref					
Female	9.3	90.7				0.38	0.26	0.56	24.59	<0.0001	
All	8.4	48.6									
Age group			27.73	<0.0001	5						
18–24	5.9	94.1									
25–34	9.6	90.4									
35–44	11.9	88.1									
45–54	16.1	83.9									
55–64	16.7	83.3									
65+	23.5	76.5									
State			14.32	0.05	7				15.42	0.03	7
New South Wales	13.6	86.5				Ref					
Queensland	17.2	82.9				1.40	0.87	2.23	1.92	0.17	
Victoria	17.4	82.6				1.62	1.03	2.53	4.35	0.04	
Western Australia	9.7	90.3				0.81	0.40	1.64	0.33	0.56	
Tasmania	9.9	90.1				0.69	0.18	2.61	0.30	0.59	
South Australia	7.7	92.3				0.53	0.23	1.27	2.03	0.15	
ACT	25.2	74.8				2.39	0.84	6.83	2.66	0.10	
Northern Territory	33.2	66.8				3.44	0.89	13.27	3.21	0.07	
Education			3.81	0.58	5						
Did not complete high school	19.8	80.2									
High school graduate	13.6	86.5									
TAFE	15.8	84.2									
Bachelor's degree	14.2	85.8									
Master's Degree	10.6	89.4									
Advanced Graduate work or Ph.D	15.1	85.0									

the participants with significant Epworth sleepiness scores had a previous diagnosis of OSA. Therefore, the remaining respondents with significant scores exhibited unexplained daytime sleepiness. Despite 75% of the participants being concerned about the symptoms, less than half had consulted a health professional. The main barrier to seeking care appeared to be insufficient concern to warrant seeking professional advice. The generally poor awareness of OSA and its potential morbidity, as evident in the responses to the questionnaire, appears to underlie this failure to pursue care.

Table IV. Demographic characteristics (gender, age group, education, employment status, annual income) and their associations with previous diagnosis of obstructive sleep apnoea (continued).

Previous diagnosis of obstructive sleep apnoea			Univariate			Multivariate					
Demographic characteristic	Yes	No	χ^2	*P*	DF	OR	95% CI		χ^2	*P*	DF
Employment			44.01	<0.0001	6				37.42	<0.0001	
Working full time (more than 30 hr a week)	11.2	88.9				Ref					
Working part-time (8–30 hr a week)	11.4	88.6				1.38	0.80	2.38			
Carer (of home, family, etc.,)	12.5	87.5				1.76	0.81	3.81			
Student	7.0	93.0				0.73	0.28	1.95			
Temporarily unemployed	10.5	89.5				1.22	0.51	2.92			
Retired	27.4	72.6				3.30	2.17	5.03			
Permanently unemployed	12.0	88.1				1.01	0.33	3.10			
Household income			9.85	0.02	3						
Less than $24,999	19.7	80.3									
$25,000–$49,999	18.4	81.6									
$50,000–$99,999	11.8	88.2									
$100,000 or more	12.7	87.4									

A previous diagnosis of paediatric obstructive sleep apnoea was reported by 7.1% of participants with a child aged 16 years or younger residing in the household. Notably, 13.9% of children exhibited significant symptoms of sleep-disordered breathing scoring 7 or greater for questions derived from the Sleep Disturbance Scale for Children.[26] However, those with a previous diagnosis of OSA comprised less than half of the children with significant sleep-disordered breathing scores, suggesting that a significant number of paediatric OSA cases remain undiagnosed. A lack of parental knowledge regarding childhood sleep has been proposed as a potential factor explaining the under-presentation and diagnosis of childhood sleep problems.[27] A study evaluating which children were likely to be at risk of sleep-disordered breathing and brought to the attention of healthcare providers found that only 31% of children displaying frequent symptoms and had been in contact with a health professional regarding assessment.[28] Similarly, Blunden et al.[29] found that snoring was mentioned by parents at consultations with their general practitioner in only 8–15% of cases despite the child regularly snoring. An additional study found that over half of the parents incorrectly believed that snoring was a sign of a healthy sleep.[30] The inadequate level of awareness of OSA and its potential symptoms and consequences is a possible reason for the under-presentation and diagnosis of the condition. In the present study, the appreciation of potential complications associated with adult and paediatric sleep apnoea was inadequate, with less than one-third of participants acknowledging the association between sleep-disordered breathing and cardiovascular disease, increased risks of accidents and depression. The lack of awareness regarding OSA within the Australian general public is also reflected by the discrepancy between the number of participants with symptoms related to sleep-disordered breathing and those who had sought medical advice. Aside from inadequate awareness, the main barrier to seeking care appears to be insufficient concern about regular snoring and daytime sleepiness. A timely diagnosis and treatment of sleep-disordered breathing is linked with significant improvements in disease-associated morbidities.[29] With increasing evidence suggesting a

Table V. Demographic characteristics (gender, age group, education, employment status, annual income) and their associations with significant Epsworth Sleepiness Scores.

Epsworth Sleepiness Scale			Univariate			Multivariate					
Demographic characteristic	≥10	<10	χ^2	*P*	DF	OR	95% CI		χ^2	*P*	DF
Gender			0.79	0.61	1				24.59	<0.0001	1
Male	13.5	86.5				Ref					
Female	11.0	89.0				0.80	0.60	1.06	2.35	0.13	
All	12.2	87.8									
Age group			10.77	0.06	5				15.52	0.01	5
18–24	12.9	87.1				Ref					
25–34	15.5	84.5				0.92	0.55	1.55	0.09	0.76	
35–44	14.3	85.7				0.76	0.45	1.29	1.03	0.31	
45–54	10.2	89.8				0.54	0.31	0.94	4.81	0.03	
55–64	11.5	88.5				0.53	0.29	0.98	4.13	0.04	
65+	8.8	91.2				0.29	0.14	0.61	10.46	0.00	
Education			10.39	0.07	5						
Did not complete high school	10.6	89.4									
High school graduate	11.1	88.9									
TAFE	10.0	90.1									
Bachelor's degree	14.7	85.4									
Master's Degree	16.5	83.6									
Advanced Graduate work or Ph.D	16.5	83.5									
Employment			13.01	0.04	6				14.17	0.03	6
Working full time (more than 30 hr a week)	15.5	84.5				Ref					
Working part-time (8–30 hr a week)	10.5	89.5				0.73	0.48	1.09	2.36	0.12	
Carer (of home, family, etc.,)	9.0	91.0				0.61	0.33	1.15	2.35	0.13	
Student	9.1	90.9				0.44	0.22	0.85	5.86	0.02	
Temporarily unemployed	9.7	90.3				0.57	0.30	1.08	2.93	0.09	
Retired	11.3	88.7				1.40	0.80	2.46	1.41	0.23	
Permanently unemployed	8.5	91.5				0.55	0.23	1.32	1.77	0.18	
Household income			1.59	0.66	3						
Less than $24,999	13.5	86.5									
$25,000–$49,999	11.0	89.1									
$50,000–$99,999	11.9	88.1									
$100,000 or more	13.1	86.9									

contributory role of OSA in several diseases, a greater emphasis is required to identify those who remain undiagnosed. Another Australian survey, conducted using a smaller sample with 8.3% of participants having *a priori* OSA diagnosis, also suggested treatment of OSA was suboptimal.[18] 54.8% of people diagnosed with OSA were not receiving any treatment and only 31% used continuous positive airway pressure (CPAP) for 4 hr or more, while 3% used other means such as surgery or oral appliances.

Approximately one-fifth of the sample recognised sleep deprivation, delayed learning and irritability as possible consequences of paediatric obstructive sleep apnoea. Furthermore, less than 10% of respondents acknowledged cardiovascular disease, ADHD and enuresis as potential sequelae of paediatric OSA. The present findings are similar to those of Strocker and Shapiro[31] who found that the majority of parents were unaware of the symptoms, consequences, and treatment of paediatric OSA as only one-fifth of participants recognising cardiopulmonary problems, growth delay and ADHD as potential complications. This also suggests that greater emphasis is required in enhancing parental sleep education.

The most common source of OSA education appeared to come from communication between family and friends. Health professionals were surprisingly unlikely provide information on sleep health. Insufficient emphasis regarding the significance and prevalence of OSA in the education of health care professionals has been proposed to hinder the potential for early intervention.[7,32] Considering the significant lack of awareness on OSA within the general public, there is a great need for improved sleep health education. Health promotional campaigns related to obstructive sleep apnoea, with a particular focus towards households with lower incomes and education levels may be a viable pathway to address this health problem on a national scale.

An improvement in public awareness of the major symptoms of obstructive sleep apnoea, details of disease associated morbidity and who best to provide advice, would lead to more efficient and effective detection and management of the condition. In 2018, an inquiry was conducted by the Australian Parliament regarding sleep awareness in Australia and an important issue identified was the inadequate training in sleep medicine provided to General Practitioners.[33] A National Sleep Health Promotion Campaign was also put forward by the Sleep Health Foundation and Australasian Sleep Association to raise OSA awareness and improve the education of health professionals.[34] This issue is reported to be similar worldwide for both adult and paediatric OSA.[35,36] A primary study of a physician's education in sleep and sleep disorders was conducted in 126 accredited medical schools in the United States. From the overall response rate of 82.6%, it was found that the average total teaching time on the topic was 2 hr with one-third of the schools reporting no structured teaching time while 4 more hours of additional training through didactic teaching was within the 4th year of electives.[37] Two decades later, surveys distributed to 409 medical schools across 12 countries (Australia, India, Indonesia, Japan, Malaysia, New Zealand, Singapore, South Korea, Thailand, United States, Canada and Viet Nam) to assess the level of education reported that the average amount of time spent on sleep education was still under 2.5 hr, with 27% of the students responding that their medical school provided no sleep education. Only Australia and the United States/Canada provide more than 3 hr of education while a mean 17 min was allocated on paediatric topics and over 2 hr on adult-related topics.[35] In a survey of paediatricians, the vast majority (96%) believed that it was within their responsibilities to inform patients/guardians about sleep hygiene; however, only 18% had received formal training on sleep disorders and were considered likely more knowledgeable and capable of screening and counselling patients/guardians on sleep problems.[38]

A recent review in 2020 by Meaklim et al. emphasised that sleep education in healthcare settings was inadequate in Australia and New Zealand and that sleep education must be improved for all healthcare students and currently registered/practicing healthcare providers.[39] Dental practitioners also have a role in the screening and management of OSA for certain adult and paediatric OSA patients.[40,41] However, dental sleep medicine education was also reported to be below optimal hours. The OSA education provided in dental schools in the USA and Middle East was reported to be between 1.2 and 3.9 hr.[42,43] In Australia and New Zealand, this was slightly better at an average of 4.8 hr of sleep education.[44] Therefore, it is apparent that several barriers exist which are associated with, not only the patient's/parent's/guardian's awareness, but also with the health care provider's education, comfort, and confidence in

dealing with the diagnosis and management of obstructive sleep apnoea.

Conclusion

The present study revealed that the level of awareness regarding obstructive sleep apnoea in adults and children in Australia is low, which could have implications on timely diagnosis and management. The need to improve the population's understanding and ability to identify potential sleep abnormality and providing more educational support for healthcare professionals are significant steps in addressing this health care burden.

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Competing interests

The authors declare that there is no conflict of interest.

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