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Parental awareness and perceptions toward pediatric obstructive sleep apnea: cross-sectional survey in Southwestern Saudi Arabia

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ABSTRACT

Background: Pediatric obstructive sleep apnea (OSA) is an under-recognized sleep-disordered breathing condition with important neurobehavioral and cardiometabolic consequences. This study assessed parental knowledge, attitudes, and practices (KAP) regarding pediatric OSA in southwestern Saudi Arabia and identified associated sociodemographic factors.

Methods: An observational cross-sectional online survey was conducted in the Aseer and Jazan regions (June-August 2025). Parents (≥18 years) were recruited via social media using convenience sampling (N = 716). The validated Arabic questionnaire measured knowledge (0-11; adequate ≥6), attitudes (5-25; positive ≥16), and practices (0-12; adequate ≥7). Multivariable logistic regression examined predictors of adequate knowledge, positive attitudes, and adequate practice.

Results: Inadequate knowledge was prevalent (66.3%), while most participants reported positive attitudes (82.3%). Among caregivers, reported practice was predominantly adequate (91.1%). In adjusted analyses, increasing age was associated with lower odds of adequate knowledge and positive attitudes (both aOR = 0.98 per year; $p < 0.05$). Female gender was associated with higher odds across KAP domains (aORs 1.47-1.58; $p < 0.05$). Higher education predicted better knowledge and more positive attitudes ($p < 0.05$), and a greater number of children predicted lower odds of adequate practice (aOR = 0.84; $p = 0.036$). Social media was the preferred awareness channel (49.5%), followed by school/community sessions (23.8%).

Conclusion: Public knowledge of pediatric OSA in southwestern Saudi Arabia is limited despite positive attitudes, supporting targeted, culturally appropriate awareness interventions, primarily via social media.

Keywords: Pediatric obstructive sleep apnea, knowledge, attitudes, practices, Saudi Arabia.

Introduction

Pediatric obstructive sleep apnea (OSA) is a chronic sleep-disordered breathing condition characterized by recurrent episodes of partial or complete upper airway obstruction during sleep [1,2]. These obstructions lead to intermittent hypoxia, hypercapnia, and fragmented sleep, which have significant physiological and neurobehavioral consequences [1,3].

The underlying mechanisms of pediatric OSA are multifactorial, involving a complex interplay of anatomical, neuromuscular, and inflammatory factors [3]. The primary anatomical predisposition in children

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is adenotonsillar hypertrophy, in which enlarged tonsils and adenoids obstruct the upper airway during sleep [2]. This is considered the leading cause of pediatric OSA in non-obese children [1]. Other craniofacial anomalies, such as retrognathia or midface hypoplasia, can also narrow the pharyngeal airway and contribute to OSA [3]. Neuromuscular factors maintain airway patency during wakefulness; however, during sleep, reduced pharyngeal dilator muscle tone can lead to airway collapse, particularly in susceptible individuals. Inflammatory processes within the upper airway, often associated with allergic rhinitis or chronic sinusitis, can also contribute to mucosal edema and further narrow the airway [4].

While adenotonsillar hypertrophy is a prominent risk factor, other conditions significantly increase a child's susceptibility to OSA. Obesity is a major risk factor, with studies showing a strong association between increasing body mass index and OSA severity in both adults and children [5]. Adipose tissue accumulation around the pharynx can directly narrow the airway, and obesity is also linked to systemic inflammation that can exacerbate airway issues [6]. Neuromuscular disorders, such as cerebral palsy or muscular dystrophy, can impair the function of upper airway muscles, increasing the likelihood of collapse [7]. Genetic syndromes, including Down syndrome, Prader-Willi syndrome, and achondroplasia, are often associated with craniofacial abnormalities and hypotonia, predisposing children to OSA [8]. Allergic rhinitis and asthma can lead to nasal congestion and mouth breathing, altering upper airway mechanics and increasing resistance [9].

Globally, pediatric OSA affects an estimated 1%-5% of children [10,11]. In the Middle East, screening-based studies indicate a substantial proportion of children at elevated risk: 13% of Saudi primary school children in Al-Kharj were classified as high risk for sleep-disordered breathing (SDB) using the Pediatric Sleep Questionnaire [12], and in Amman, Jordan, high-risk OSA was more common in adolescents than children (25.6% *vs.* 20.8%) using a pediatric SDB scale [13]. These data underscore the regional relevance of pediatric OSA/SDB and support evaluating parental knowledge and practices in Saudi Arabia, where awareness remains limited and delayed recognition contributes to cardiometabolic and neurocognitive morbidity and related costs [14].

OSA is associated with substantial morbidity, including neurobehavioral sequelae (e.g., attention-deficit/hyperactivity disorder-like symptoms, learning difficulties, reduced academic performance, and impaired executive function) [15], and cardiovascular complications such as systemic and pulmonary hypertension, particularly among children with obesity and more severe disease [16]. Despite these well-established consequences, pediatric OSA is frequently under-recognized, and parental awareness remains limited, contributing to delayed diagnosis and suboptimal management; caregivers commonly have gaps in recognizing symptoms, anticipating complications, and understanding available treatments [17,18]. In Saudi Arabia, these knowledge gaps underscore the need to evaluate community perceptions to guide targeted health education and promote timely care. Accordingly, this study aimed to assess parental knowledge, attitudes, and practices (KAP) toward pediatric OSA in Southwestern Saudi Arabia and to identify factors associated with knowledge and attitudes regarding the condition.

Materials and Methods

Study design, population, and sampling

This observational cross-sectional study was conducted in the Aseer and Jazan regions of southwestern Saudi Arabia, which share similar sociocultural and demographic characteristics and comprise both urban and rural, family-oriented communities. The study population included adults (≥18 years) residing in these regions who were parents or caregivers. Non-residents, individuals under 18 years, and those unable to complete the Arabic questionnaire were excluded. The sample size was calculated using the Raosoft calculator with a 5% margin of error, 95% confidence level, and 50% response distribution, based on an estimated combined adult population of 2.4 million. The minimum required sample was 385; however, to increase precision and account for non-response, 716 participants were recruited through convenience sampling via social media platforms.

Instrument and measures

Data were collected between June 1 and August 14, 2025, using a validated, structured, self-administered questionnaire distributed online via social media platforms [WhatsApp, X (formerly Twitter), and Facebook] targeting health, parenting, and community groups in the Aseer and Jazan regions. The instrument was adapted from a previously validated, reliable tool, administered without modification and with permission [19]. It comprised five sections: (1) Sociodemographic characteristics (region, age, gender, marital status, number of children, education level, occupation, and household income); (2) Knowledge (nine questions on childhood OSA definition, risk factors, symptoms, complications, and management; scored 1 for correct, -1 for incorrect, 0 for "I don't know"; total 0-11, categorized as inadequate < 6 or adequate ≥ 6); (3) Attitudes (five Likert-scale items assessing perceptions of seriousness, help-seeking, treatment confidence, quality-of-life impact, and support for treatment; total 5-25, classified as negative ≤ 10, neutral 11-15, or positive 16-25); (4) Practice (five items for participants with children, addressing observation, professional consultation, response to suspected OSA, use of remedies, and symptom dismissal; scored as in the knowledge section with a maximum of 12 points, classified as inadequate < 7 or adequate ≥ 7); and (5) Community education (perceived need for public education on childhood OSA and preferred delivery methods).

Statistical analysis

Data were analyzed using SPSS version 27.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were reported as frequencies and percentages for categorical variables. KAP scores were dichotomized using

predefined cutoffs: knowledge (adequate ≥6/11), attitude (positive ≥16/25), and practice (adequate ≥7/12; assessed only among participants with children). Associations between sociodemographic variables and KAP levels were assessed using chi-square tests, followed by binary logistic regression to calculate crude and adjusted odds ratios with 95% confidence intervals. Multivariable models included all demographic variables. Statistical significance was set at $p < 0.05$. Note: a review of raw table data revealed an inconsistency in practice reporting (included non-parents despite method specification); percentages were recalculated, excluding non-parents for consistency.

Results

Among 716 participants (Table 1), the largest age group was 41-50 years (32.3%), and about half were aged 18-40 years (25.4% and 24.9%). Most respondents were women (70.5%) and married (95.2%). Over half held a bachelor's degree (56.3%), and the most common employment category was the government sector (38.0%). Nearly all participants reported having children, most commonly 1-3 (43.6%) or 4-7 (42.3%). Monthly household income was most frequently <SAR 5,000 (28.8%), followed by SAR 5,000-10,000 (25.4%) and >SAR 20,000 (19.6%).

Table 1. *Sociodemographic characteristics of participants (N = 716).*

Variable	Category	*n* (%)
Age	18-30	182 (25.4)
	31-40	178 (24.9)
	41-50	231 (32.3)
	51-60	96 (13.4)
	>60	29 (4.0)
Gender	Male	211 (29.5)
	Female	505 (70.5)
Marital status	Married	682 (95.2)
	Divorced	30 (4.1)
	Widowed	4 (0.5)
Education level	None	6 (0.8)
	Primary school	21 (2.9)
	Middle school	36 (5.0)
	Secondary school	111 (15.5)
	Diploma	59 (8.2)
	Bachelor's degree	403 (56.3)
	Master's or higher	80 (11.2)
Occupation	Healthcare worker	81 (11.3)
	Government sector	272 (38.0)
	Private sector	101 (14.1)
	Student	111 (15.5)
	Unemployed	151 (21.1)
Number of children	None	72 (10.1)
	1-3	312 (43.6)
	4-7	303 (42.3)
	>7	29 (4.0)
Household income (SAR/month)	<5,000	206 (28.8)
	5,000-10,000	182 (25.4)
	10,001-15,000	140 (19.6)
	15,001-20,000	48 (6.7)
	>20,000	140 (19.6)

Table 2 summarizes participants' knowledge, attitude, and practice. Inadequate knowledge was more prevalent than adequate knowledge (66.3% *vs.* 33.7%). Most participants reported positive attitudes (82.3%). Among ($n = 665$), practice was predominantly adequate (91.1%), with only 8.9% reporting inadequate practice.

Table 3 shows no significant differences in knowledge, attitudes, or practices by age, gender, marital status, number of children, or income (all p-values > 0.05). Higher education was associated with better knowledge ($p < 0.001$), and attitude varied by occupation ($p < 0.05$); practice did not differ across sociodemographic groups.

In multivariable analyses (Table 4), older age was associated with lower odds of adequate knowledge and positive attitude (both aOR = 0.98 per year; $p < 0.05$), but not with practice. Female participants had higher odds of adequate knowledge, positive attitude, and adequate practice (aORs 1.47-1.58; all $p < 0.05$). Higher education level was independently associated with better knowledge and more positive attitudes ($p < 0.05$), whereas a greater number of children was associated with lower odds of adequate practice (aOR = 0.84; $p = 0.036$). Region, marital status, occupation, and household income were not significantly associated with outcomes ($p > 0.05$).

Figure 1 indicates that social media campaigns were the most preferred awareness method (49.5%, $n = 339$), followed by educational sessions at schools/community centers (23.8%, $n = 163$). Less frequently selected options included pamphlets/brochures at healthcare facilities (14.5%, $n = 99$), online articles/educational websites (7.7%, $n = 53$), and television/radio advertisements (4.5%, $n = 31$).

Discussion

In this cross-sectional, online survey study conducted in the Aseer and Jazan regions of southwestern Saudi Arabia using convenience sampling, we assessed parental KAP regarding childhood OSA. The findings indicate a marked KAP discordance: knowledge was predominantly inadequate (66.3%), whereas attitudes were largely positive (82.3%); although reported practice among

Table 2. *Levels of knowledge, attitude, and practice among participants (N = 716).*

Domain	Category	*n* (%)
Knowledge	Adequate	241 (33.7)
	Inadequate	475 (66.3)
Attitude	Positive	589 (82.3)
	Neutral	89 (12.4)
	Negative	38 (5.3)
Practice	Adequate	652 (91.1)
	Inadequate	64 (8.9)

Table 3. *Association between sociodemographic characteristics and levels of knowledge, attitude, and practice (N = 716).*

Variable	Category	Knowledge: adequate *n* (%)	*p*-value	Attitude: positive *n* (%)	*p*-value	Practice: adequate *n* (%)	*p*-value
Age (years)	18-30	42 (32.3)	NS	109 (83.8)	NS	127 (97.7)	NS
	31-40	79 (33.2)		196 (82.4)		234 (98.3)	
	41—50	89 (34.8)		210 (82.0)		251 (98.0)	
	51-60	26 (31.7)		65 (79.3)		80 (97.6)	
	>60	5 (50.0)		9 (90.0)		10 (100.0)	
Gender	Male	82 (34.2)	NS	194 (80.8)	NS	234 (97.5)	NS
	Female	159 (33.4)		395 (83.0)		468 (98.3)	
Marital status	Married	226 (33.7)	NS	551 (82.2)	NS	656 (97.9)	NS
	Divorced	11 (33.3)		28 (84.8)		30 (100.0)	
	Widowed	1 (25.0)		3 (75.0)		4 (100.0)	
Education level	None	1 (20.0)		3 (60.0)		5 (100.0)	
	Primary school	3 (25.0)	***	9 (75.0)	NS	12 (100.0)	NS
	Middle school	7 (25.0)		22 (78.6)		27 (96.4)	
	Secondary school	24 (26.7)		72 (80.0)		88 (97.8)	
	Diploma	37 (30.6)		98 (81.0)		119 (98.3)	
	Bachelor's degree	143 (35.9)		331 (83.2)		391 (98.2)	
	Master's or higher	26 (41.9)		54 (87.1)		60 (96.8)	
Occupation	Healthcare worker	29 (37.7)	NS	66 (85.7)	*	76 (98.7)	NS
	Government sector	112 (33.7)		273 (82.2)		325 (97.9)	
	Private sector	26 (32.9)		65 (82.3)		78 (98.7)	
	Student	5 (33.3)		13 (86.7)		15 (100.0)	
	Unemployed	69 (32.4)		172 (80.8)		208 (97.7)	
Number of children	None	19 (37.3)	NS	43 (84.3)	NS	N/A	NS
	1–3	115 (33.8)		282 (82.9)		335 (98.5)	
	4–7	99 (33.1)		244 (81.6)		293 (98.0)	
	>7	8 (30.8)		20 (76.9)		24 (92.3)	
Household income (SAR/month)	<5,000	65 (33.7)	NS	157 (81.3)	NS	189 (97.9)	NS
	5,000–10,000	58 (34.1)		140 (82.4)		167 (98.2)	
	10,001-15,000	62 (33.0)		155 (82.4)		184 (97.9)	
	15,001-20,000	37 (31.1)		98 (82.4)		117 (98.3)	
	>20,000	19 (41.3)		39 (84.8)		45 (97.8)	

*NS = not significant (p > 0.05); * p < 0.05; *** p < 0.001.*

Table 4. *Multivariable associations of sociodemographic factors with adequate knowledge, positive attitude, and adequate practice toward childhood OSA (N = 716).*

Predictor (reference)	Knowledge aOR (95% CI)	Adj. *p*-value	Attitude aOR (95% CI)	Adj. *p*-value	Practice aOR (95% CI)	Adj. *p*-value
Region (Jazan *vs.* Aseer)	0.89 (0.65-1.22)	0.468	0.92 (0.64-1.31)	0.637	0.93 (0.67-1.29)	0.664
Age (per year)	0.98 (0.97-0.99)	0.018*	0.98 (0.97-0.99)	0.012*	0.99 (0.98-1.00)	0.141
Gender (Female *vs.* Male)	1.52 (1.11-2.08)	0.009*	1.47 (1.04-2.07)	0.029*	1.58 (1.14-2.19)	0.006*
Marital status (Single *vs.* Married)	1.15 (0.78-1.70)	0.483	1.32 (0.84-2.07)	0.227	1.12 (0.69-1.82)	0.639
Number of children (per category increase)	0.90 (0.77-1.05)	0.177	0.95 (0.81-1.11)	0.513	0.84 (0.71-0.99)	0.036*
Education level (per level increase)	1.10 (1.02-1.19)	0.016*	1.13 (1.04-1.23)	0.005*	1.02 (0.94-1.11)	0.616
Occupation (per category)	0.97 (0.89-1.06)	0.501	0.95 (0.86-1.04)	0.265	0.98 (0.89-1.08)	0.691
Household income (per category increase)	1.03 (0.93-1.14)	0.571	1.05 (0.94-1.18)	0.377	1.01 (0.90-1.13)	0.886

*aOR, adjusted odds ratio; CI, confidence interval; *p < 0.05.*

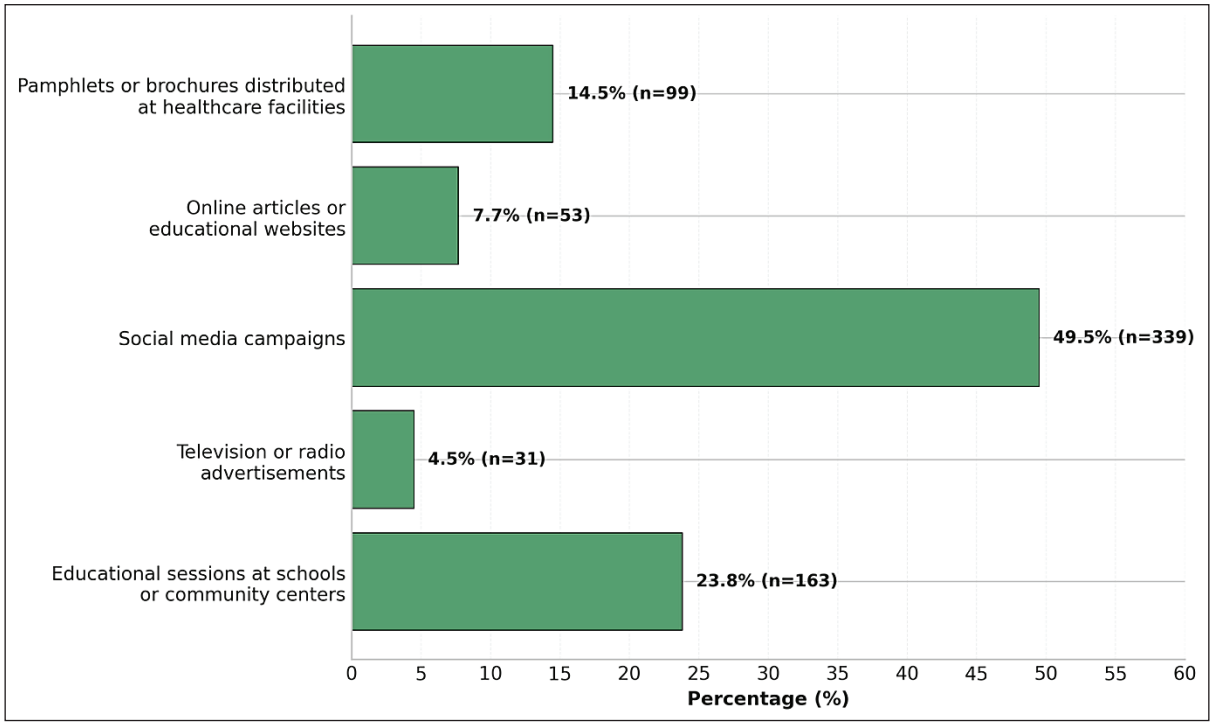

Figure 1. *Preferred methods for raising awareness about childhood OSA among participants.*

caregivers appeared high (91.1% adequate), it warrants cautious interpretation given measurement limitations. Consistent with these results, participants identified social media as the preferred channel for disseminating awareness, followed by school- and community-based educational sessions.

Pediatric OSA remains comparatively common yet under-recognized, despite well-established neurobehavioral and cardiometabolic consequences when diagnosis and treatment are delayed [20-22]. In our study, the coexistence of predominantly positive attitudes with inadequate knowledge is best interpreted as a gap between general endorsement of OSA seriousness and operational understanding needed for accurate recognition and appropriate escalation (e.g., distinguishing habitual snoring and related daytime sequelae from benign, transient symptoms) [21,22]. Similar knowledge-attitude discordance has been reported in Saudi populations, where respondents may perceive OSA as important while lacking accurate knowledge of diagnostic pathways and management, including in parental/caregiver studies of pediatric OSA [23-25]. Accordingly, the high attitudinal readiness observed here should be viewed as an implementation advantage, but effective awareness efforts must prioritize actionable knowledge (symptom thresholds, referral triggers, and expectations of clinical evaluation) to convert willingness into timely, correct care-seeking decisions [20,23,24].

In multivariable analyses, the modest inverse association of age with adequate knowledge and positive attitudes may reflect differential access to and appraisal of digital health information, consistent with evidence that digital health literacy varies across age strata and with Saudi data showing age-related gradients in OSA awareness [26-28]. Women showed higher odds across knowledge, attitude, and practice domains. This pattern may reflect caregiving role norms and greater maternal involvement in child health monitoring and healthcare navigation, as suggested by Saudi caregiver-burden findings and broader evidence on sex/gender differences in caregiving engagement [29,30]. Higher educational attainment was positively associated with knowledge and attitudes, aligning with Saudi parental and national studies linking education to better OSA awareness [24,26,27]. In contrast, having more children was inversely associated with adequate practice. This may indicate time constraints and competing caregiving demands that limit consistent symptom monitoring and timely, structured health-seeking behaviors [23,29].

This study has several strengths. The sample size was large and exceeded the minimum required. Participants were recruited from two regions, which improves geographic coverage. The knowledge and attitude scales demonstrated acceptable-to-good reliability. We also used multivariable regression to address potential confounding. In addition, the study adds practical value by identifying participants' preferred channels for disseminating pediatric OSA awareness. Several limitations should be noted. The cross-sectional design does not allow causal inference. Convenience sampling and online recruitment may reduce representativeness and introduce selection bias. All outcomes were self-reported, which increases the risk of recall and social desirability bias.

Public health efforts should focus on addressing the identified knowledge gaps. Messages should be culturally appropriate and evidence-based. Social media should be the primary delivery channel, supported by school- and

community-based educational sessions. Content should emphasize symptom recognition, key risk factors, potential complications, and clear guidance on when and where to seek care. Future studies should strengthen measurement and study design. The practice scale should be refined and psychometrically revalidated. Where feasible, practice outcomes should be more objective or behaviorally anchored. More representative recruitment strategies are needed, such as probability sampling or mixed-mode approaches. Educational interventions should be evaluated using pre–post or controlled designs. Research should also examine age-related barriers and caregiver burden, particularly in larger families, to improve targeting and effectiveness.

Conclusion

This cross-sectional survey of adults in the Aseer and Jazan regions identified a clear disparity in public awareness of pediatric OSA, with predominantly inadequate knowledge despite largely positive attitudes and reportedly adequate caregiver practices. Older age and lower educational attainment were associated with lower knowledge and less positive attitudes, while female gender was consistently associated with more favorable KAP profiles, and a greater number of children was linked to lower odds of adequate practice among caregivers. These findings underscore the need for culturally tailored, evidence-based awareness initiatives that translate key clinical messages into actionable guidance on symptom recognition, risk factors, complications, and appropriate help-seeking, delivered primarily through social media and reinforced through school and community education.

List of Abbrevaitions

KAP	Knowledge, attitudes, and practices
OSA	Obstructive sleep apnea
SDB	Sleep-disordered breathing

Conflicts of interest

The authors declare no conflict of interest.

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Institutional Review Board Statement

The Institutional Review Board Statement details should read: Local Committee for Research Ethics, Jazan University (HAPO-10-Z-001), Reference No. REC-46/09/1447, approved on 24 March 2025.

Informed consent statement

Informed consent was obtained from all participants before data collection. Participation was voluntary, and confidentiality was ensured.

Data availability statement

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Author contributions

Conceptualization, A.F.B., B.M.A., H.A.A., K.A.M. and A.A.N.; methodology, K.M.A., A.A.A., M.E.E. and H.N.M.; formal analysis, H.N.M. and B.M.A.; data collection, A.F.B., H.A.A., M.S.D., W.S.A., N.A.M., G.T.A., M.N.K. and M.A.J.; writing-original draft preparation, A.F.B., B.M.A., H.A.A., M.S.D., W.S.A., N.A.M., G.T.A., M.N.K., M.A.J. and K.M.A.; writing-review and editing, A.A.A., M.E.E., H.N.M., K.A.M. and A.A.N.; supervision, A.A.N. All authors have read and agreed to the published version of the manuscript.

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Supplementary content (If any) is available online.

References

1. Jadhav U, Bhanushali J, Sindhu A, Reddy BSK, Toshniwal A, Rashmika M. A comprehensive review of pediatric obstructive sleep apnea: from assessment to intervention. Cureus. 2025;17(1):e78051. https://doi.org/10.7759/cureus.78051
2. Vani B, Navneet A, Gaurav M, Ganga D, Deepak SJ, Srishti JN. Little snores, big concern: a review on pediatric obstructive sleep apnea. Int J Pedod Rehabil. 2024;8(2):60–6. https://doi.org/10.56501/intjpedorehab.v8i2.929
3. Saint-Fleur AL, Christophides A, Gummalla P, Kier C. Much ado about sleep: current concepts on mechanisms and predisposition to pediatric obstructive sleep apnea. Children (Basel). 2021;8(11):1032. https://doi.org/10.3390/children8111032
4. Vicente E, Marin JM, Carrizo SJ, Osuna CS, González R, Marin-Oto M, et al. Upper airway and systemic inflammation in obstructive sleep apnoea. Eur Respir J. 2016;48(4):1108–17. https://doi.org/10.1183/13993003.00234-2016
5. Lam JC, Mak JC, Ip MS. Obesity, obstructive sleep apnoea and metabolic syndrome. Respirology. 2012;17(2):223–36. https://doi.org/10.1111/j.1440-1843.2011.02081.x
6. Isono S. Obesity and obstructive sleep apnoea: mechanisms for increased collapsibility of the passive pharyngeal airway. Respirology. 2012;17(1):32–42. https://doi.org/10.1111/j.1440-1843.2011.02093.x
7. Boentert M. Sleep disorders in neuromuscular diseases: a narrative review. Clin Transl Neurosci. 2023;7(3):23. https://doi.org/10.3390/ctn7030023

8. Piotto M, Gambadauro A, Rocchi A, et al. Pediatric sleep respiratory disorders: a narrative review of epidemiology and risk factors. Children (Basel). 2023;10(6):955. https://doi.org/10.3390/children10060955
9. Ferreira NB, Ponte A, Grande AC, Pimenta AC, Pinto CS, Bousquet J, et al. Frequency of obstructive sleep apnea in patients with asthma or allergic rhinitis: a systematic review and meta-analysis. Sleep Med. 2025;134:106705. https://doi.org/10.1016/j.sleep.2025.106705
10. Alkhalifah K, Alsalhi S, Alrashed A, Almagushi S, Alharbi M, Almutairi A, et al. Worldwide prevalence of obstructive sleep apnea among pediatrics: a systematic review and meta-analysis. Int J Med Dev Ctries. 2024;8(1):455–9. https://doi.org/10.24911/IJMDC.51-1701581085
11. Iannella G, Pace A, Bellizzi MG, Magliulo G, Greco A, De Virgilio A, et al. The global burden of obstructive sleep apnea. Diag (Basel). 2025;15(9):1088. https://doi.org/10.3390/diagnostics15091088
12. Alwadei SH, Alsaeed S, Masoud AI, Alwadei F, Gufran K, Alwadei A. Sleep-disordered breathing among Saudi primary school children: incidence and risk factors. Healthcare (Basel). 2023;11(5):747. https://doi.org/10.3390/healthcare11050747
13. Boyajian SD, Salameh MA, Alzyoud K, Amaireh EA, Badah L, Al Qutami M, et al. Prevalence of symptoms suggestive of sleep apnea among children and its impact on academic performance. J Egypt Public Health Assoc. 2025;100(1):2. https://doi.org/10.1186/s42506-025-00182-2
14. Alakörkkö I, Törmälehto S, Leppänen T, Mcnicholas WT, Arnardottir ES, Sund R. The economic cost of obstructive sleep apnea: a systematic review. Sleep Med Rev. 2023;72:101854. https://doi.org/10.1016/j.smrv.2023.101854
15. Urbano GL, Tablizo BJ, Moufarrej Y, Tablizo MA, Chen ML, Witmans M. The link between pediatric obstructive sleep apnea and attention deficit hyperactivity disorder. Children (Basel). 2021;8(9):824. https://doi.org/10.3390/children8090824
16. Ingram DG, Singh AV, Ehsan Z, Birnbaum BF. Obstructive sleep apnea and pulmonary hypertension in children. Paediatr Respir Rev. 2017;23:33–9. https://doi.org/10.1016/j.prrv.2017.01.001
17. Starke M, Möller A. Parents' needs for knowledge concerning the medical diagnosis of their children. J Child Health Care. 2002;6(4):245–57. https://doi.org/10.1177/136749350200600402
18. Sanders LM, Shaw JS, Guez G, Baur C, Rudd R. Health literacy and child health promotion: implications for research, clinical care, and public policy. Pediatrics. 2009;124 Suppl 3(Suppl 3):S306–14. https://doi.org/10.1542/peds.2009-1162G
19. Alghamdi AS, Alghamdi RM, Alghamdi RA, Alzahrani HT, Alghamdi HM, Alghamdi MA. Knowledge, attitude, and practice of the general population toward pediatric obstructive sleep apnea in Al-Baha region, Saudi Arabia: a cross-sectional study. Saudi J Otorhinolaryngol Head Neck Surg. 2024;26(4):230–9. https://doi.org/10.4103/sjoh.sjoh_48_24
20. Solano-Pérez E, Coso C, Castillo-García M, Romero-Peralta S, Lopez-Monzoni S, Laviña E, et al. Diagnosis and treatment of sleep apnea in children: a future perspective is needed. Biomedicines. 2023;11(6):1708. https://doi.org/10.3390/biomedicines11061708
21. Thomas S, Patel S, Gummalla P, Tablizo MA, Kier C. You cannot hit snooze on OSA: sequelae of pediatric obstructive sleep apnea. Children (Basel). 2022;9(2):261. https://doi.org/10.3390/children9020261
22. Xiao L, Sunkonkit K, Shi J, Narang I. Neurocognition, behavior, socioeconomic, and health outcomes of pediatric obstructive sleep apnea. Am J Respir Crit Care Med. 2023;207(7):936–8. https://doi.org/10.1164/rccm.202201-0051RR
23. Alkhalifah KM, Allabun FS, Alsughayyir AA, et al. The knowledge and awareness of parents regarding pediatric obstructive sleep apnea in the central region of Saudi Arabia. Healthcare (Basel). 2025;13(9):968. https://doi.org/10.3390/healthcare13090968
24. Al-Makramani A, Shawish AM, Albarrati AM, et al. Awareness and knowledge of parents and caregivers regarding pediatric obstructive sleep apnea in Jazan, Saudi Arabia: a cross-sectional study. Cureus. 2024;16(7):e64297. https://doi.org/10.7759/cureus.64297.
25. Alshehri AM, Alshehri MS, Alamri OM, Alshehri FS, Alshahrani MM, Alflan MA, et al. Knowledge, awareness, and attitudes toward obstructive sleep apnea among the population of the Asir Region of Saudi Arabia in 2019. Cureus. 2020;12(3):7254. https://doi.org/10.7759/cureus.7254
26. Alshurtan KS, Aldhaifi SY, Alamrani SA. Community awareness of obstructive sleep apnea: saudi Arabia. Sleep Breath. 2025;29:271. https://doi.org/10.1007/s11325-025-03436-7
27. Aldhahir AM, Alyami MM, Aljumayh AM, Al Omayr AM, Alghamdi SA, Alasimi AH, et al. Public knowledge and awareness of obstructive sleep apnea in Saudi Arabia: a population-based study of over 16,000 adults. PLoS One. 2025;20(12):337822. https://doi.org/10.1371/journal.pone.0337822
28. Wiener RC, Abuhalimeh BJ. Evaluating adult digital health literacy, 2020-2025: a systematic review. PLoS Digit Health. 2025;4(11):1075. https://doi.org/10.1371/journal.pdig.0001075
29. Almulla H, Aljaloud O, Almulla H, Nasser S. Caregiver burden, perceived stress, and social support among parents of chronically ill children in Saudi Arabia. BMC Nursing. 2024;23(1):811. https://doi.org/10.1186/s12912-024-02494-8
30. Duangjina T, Jeamjitvibool T, Park C, Raszewski R, Gruss V, Fritschi C. Sex and gender differences in caregiver burden among family caregivers of persons with dementia: a systematic review and meta-analysis. Arch Gerontol Geriatr. 2025;138:105977. https://doi.org/10.1016/j.archger.2025.105977