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Positive Screening for Sleep-Related Breathing Disorders Among Children in Jordan: A Cross-Sectional Survey of Parents

Abdallah Y. Naser [1,*] and Rheem Almhizai [2]

[1] Department of Applied Pharmaceutical Sciences and Clinical Pharmacy, Faculty of Pharmacy, Isra University, Amman 11622, Jordan
[2] Department of Pediatrics, College of Medicine, Imam Mohammad Ibn Saud Islamic University (IMSIU), Riyadh 13317, Saudi Arabia
* Correspondence: abdallah.naser@iu.edu.jo

Abstract

Background: Sleep-related breathing disorders (SRBDs) in children range from primary snoring to obstructive sleep apnea and can affect health, behavior and learning. This study aimed to estimate the proportion of children in Jordan who screen positive for SRBD and to identify associated factors. **Methods:** This was a cross-sectional survey study that was conducted in Jordan between 27 November and 15 December 2025. Parents completed the Arabic 22-item Pediatric Sleep Questionnaire (PSQ) scale online (using Google Forms). The primary analysis was restricted to parents who reported a single child age group (one year or older) and a single mode of delivery, so that answers most likely referred to one child. A positive screen was defined as eight or more "yes" responses. Multivariable logistic regression was used to identify associated factors. **Results:** Of 1112 respondents, 476 met the criteria and were included in the primary analysis. Among them, parent reports for 108 children (22.7%; 95% confidence interval (CI): 19.2–26.7%) screened positive for SRBD. Habitual snoring was reported for 13.7% of children and witnessed breathing pauses for 10.9%. In the multivariable regression model, a positive screen was associated with a family history of snoring or sleep apnea (adjusted odds ratio (aOR) = 3.72, 95% CI: 2.07–6.71), sleeping in a noisy or shared room (aOR = 2.45, 95% CI: 1.38–4.33), and having a divorced (aOR = 2.97, 95% CI: 1.17–7.56) or widowed parent (aOR = 3.83, 95% CI: 1.04–14.16). **Conclusions:** About one in five parent reports in this online convenience sample met the PSQ screening threshold for SRBD symptoms. A positive screen indicates a need for further evaluation and does not confirm a sleep disorder. Asking about family history of snoring and the sleep environment may help primary care and school health staff identify children who need referral for sleep assessment.

Keywords: children; Jordan; Pediatric Sleep Questionnaire; screening; sleep-related breathing disorders; snoring

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1. Introduction

Sleep is characterized as a cyclical, dynamic, complex, reversible state of unconsciousness that is crucial for many aspects of a child's development, including neurocognitive, since it helps with learning and memory strengthening, as well as emotional and behavioral regulation [1,2]. Complex interactions between different parts of the central nervous system are involved in the complicated organization and control of wakefulness and sleep [3]. Children's sleep patterns and length fluctuate greatly between nations with diverse cultural backgrounds. In general, children in preschool (3–5 years old) need between 10 and 13 h of

sleep, students (6–13 years old) need between 9 and 11 h, and teenagers (14–17 years old) need between 8 and 10 h [4]. According to earlier research, sleep accounts for approximately 44% of an average day for children and adolescents [5]. Therefore, in order to encourage healthy sleeping practices and the best possible health for children, it is imperative to recognize and address these issues.

Childhood sleep disorders are frequent and can include insomnia, nightly urination, anxiety, sleepwalking, disoriented awakenings, and respiratory and circadian abnormalities [6]. These disorders can have a significant impact on the child's overall health, resulting in medical comorbidities, and even mental disorders [7,8]. Furthermore, between 15% and 70% of parents encounter sleep difficulties in their children, with trouble in initiating or maintaining sleep, unusual actions or movements, snoring or abnormal breathing, and excessive daytime sleepiness being the most common sleep complaints [9]. Sleep-related breathing disorders (SRBDs) form a spectrum that ranges from primary snoring to upper airway resistance and obstructive sleep apnea (OSA). Parent-reported snoring affects about 7.5% of children, and OSA confirmed by sleep studies affects 1–4% [10]. Aside from these findings that underscore the significance of sleep disorders and its detrimental effects on children, to the best of our knowledge, data on SRBD symptoms among children in Jordan are limited. Therefore, this study aimed to estimate the proportion of children in Jordan who screen positive for SRBD and to identify factors associated with a positive screen. Findings of this study should target the development of future pediatric care programs aiming at optimizing health outcomes and quality of life among children and adolescents.

2. Methods

2.1. Study Design and Setting

This was a cross-sectional survey study that was conducted in Jordan between 27 November and 15 December 2025.

2.2. Study Population and Sampling Technique

Data were collected through a self-administered online survey completed by parents about their children. The target population was parents or primary caregivers aged 18 years or older, living in Jordan, with at least one child. Respondents were excluded if they lived outside Jordan, did not give consent, or did not have children. Participants were recruited by snowball sampling and were asked to participate in the study and send the survey link to their relatives or friends who met the inclusion criteria of the study. A link to the online questionnaire was shared on social media platforms (Facebook, WhatsApp, Snapchat, and Instagram). Participation was voluntary and anonymous. Parents reported the age groups of all their children and completed the questionnaire with reference to their children; no instruction was given to select a specific child when more than one child was present in the household. To increase the likelihood that Pediatric Sleep Questionnaire (PSQ) answers referred to one child, the primary analysis was restricted to respondents who reported a single child age group and a single mode of delivery. Respondents who reported only a child younger than one year ($n = 69$) were also excluded, because most PSQ items cannot be answered meaningfully in infancy, leaving 476 respondents in the primary analysis. This restriction does not confirm that a parent had only one child (for example, a parent of two teenagers born vaginally would report one age group and one delivery mode); therefore, results are presented as parent-reported screening results. Included and excluded respondents were compared (Table S1). The age groups recorded did not allow children aged one year to be separated from those aged two to three years. Results for all 1112 respondents are presented only at the respondent (household) level.

2.3. Data Collection Tool

Data were collected with an online survey tool (Google Forms, v1, Google LLC, Mountain View, CA, USA). The first page explained the study's aim. Participants had to give electronic informed consent before they could open the questionnaire.

The questionnaire had three sections: parents' and children's sociodemographic characteristics (gender, age, education level, marital status and occupation, and the child's age group, comorbidities and mode of delivery), sleep environment and habits (four items) (family history of snoring or sleep apnea, sleeping in a noisy or shared room, using a mobile phone or watching television within 30 min of bedtime, and daily physical activity of at least 60 min), and the Arabic version of the PSQ, used to screen for SRBD [11].

The PSQ was developed by Chervin et al. as a parent-reported screening tool for SRBD in children aged 2–18 years [12]. This study used its 22-item SRBD scale, which has three subscales: snoring and breathing (nine items), daytime sleepiness (seven items), and inattention and hyperactivity (six items). Each item is answered "yes", "no" or "don't know". Each "yes" response was scored 1 and each "no" or "don't know" response 0 [11], and item scores were summed to give a total score from 0 to 22, with higher scores indicating more symptoms. A child with eight or more "yes" responses was classified as screening positive (and in need of further sleep evaluation). This threshold corresponds to the one-third (0.33) proportion proposed by Chervin et al. when all items are answered [12], and it has been used in the previous literature [13]. Because Chervin et al. calculated the score as the proportion of "yes" answers among items answered "yes" or "no", treating "don't know" as missing [12], this original scoring (proportion > 0.33) was applied in a sensitivity analysis, together with the cut-off of more than eight positive responses reported in the Arabic validation study [11]. The snoring and breathing subscale was also scored separately as the proportion of "yes" answers among its answered items, with a proportion > 0.33 considered screening positive.

2.4. Questionnaire Validity

In the original validation, the 22-item scale was valid and reliable, and it predicted polysomnographically confirmed SRBD with a sensitivity of 81% and a specificity of 87% [12,14]. We used the validated Arabic version of the PSQ [11]. It was translated by independent forward translation by three bilingual native Arabic speakers, followed by a panel discussion to reach a culturally and linguistically adapted final version. The APSQ showed high internal consistency (Cronbach's $\alpha = 0.907$ for the total scale), good test–retest reliability at 15 days (ICC = 0.771), and high accuracy in distinguishing children with polysomnography-confirmed OSA from controls (AUC = 0.97; sensitivity 96.9%; specificity 100%) [11]. The Arabic validation was conducted among 132 children aged 2–18 years (66 with OSA and 66 controls) attending clinics at Minia University Hospital, Egypt [11]; its sensitivity and specificity are therefore unlikely to be applicable to a community sample. In the present study sample, the internal consistency of the 22-item scale was Cronbach's $\alpha = 0.892$ (Cronbach's $\alpha = 0.903$ in the primary analysis sample).

2.5. Sample Size Calculation

The minimum sample size was calculated with Cochran's formula for a single proportion, assuming a prevalence of 50% to maximize the sample size:

$N = Z^2 \times p(1-p)/d^2 = (1.96)^2 \times 0.5 \times 0.5/(0.05)^2 \approx 385$ participants, where $Z = 1.96$ is the standard normal value for 95% confidence, $p = 0.50$ is the expected prevalence, and $d = 0.05$ is the margin of error.

2.6. Ethical Considerations

The study was approved by the Scientific Research Ethics Committee of Isra University (approval number: SREC/25/11/175), dated 27 November 2025. No data were collected before obtaining the ethical approval for this study. All participants gave electronic informed consent before taking part. The study followed the principles of the Declaration of Helsinki. The PSQ is copyrighted by the Regents of the University of Michigan. It was used under license from Mapi Research Trust (User Agreement Special Terms No. 111820). PSQ contact information and permission to use: Mapi Research Trust, Lyon, France.

2.7. Data Analysis

Statistical analyses were performed with Statistical Package for Social Science (SPSS) version 31 (IBM Corp., Armonk, NY, USA). Categorical variables were summarized as frequencies (percentages). The PSQ score was not normally distributed (Kolmogorov–Smirnov test, p-value < 0.001) and was summarized as mean ± standard deviation (SD) and median (interquartile range (IQR)). The proportion screening positive was compared across groups with the chi-square test, and 95% confidence intervals (CIs) for proportions were calculated with the Wilson method. Multivariable logistic regression was used to identify factors associated with a positive screen. Regression model variables were chosen a priori from the questionnaire and the literature and were entered simultaneously. Crude odds ratios (ORs) and adjusted odds ratios (aORs) are reported with 95% CIs. Collinearity was assessed with variance inflation factors (VIFs), and model fit with the Hosmer–Lemeshow test and Nagelkerke R^2. A two-sided p value < 0.05 was considered statistically significant. Sensitivity analyses were performed to estimate the prevalence rate using the original proportional scoring, the Arabic validation cut-off, children aged four years or older only, and excluding bedwetting. Age-specific proportions with 95% CIs were also calculated. As a sensitivity analysis of the regression, a reduced model was fitted that kept child age as the only age variable and combined divorced and widowed parents into one category.

3. Results

A total of 1112 participants were included in the study. Most respondents were female (959, 86.2%) and married (952, 85.6%). The largest age group was 26–34 years (456, 41.0%). Nearly half of the participants held a bachelor's degree (508, 45.7%). More than half of the participants were employed ($n = 599$, 53.9%).

Regarding child-related characteristics, children aged 4–6 years (379, 34.1%) and those older than 12 years (390, 35.1%) represented the largest groups. Most children had no reported comorbidities (918, 82.6%). Regarding mode of delivery, normal vaginal delivery was reported in 530 (47.7%) of cases, cesarean section in 181 (16.3%), and a history of both delivery types in 401 (36.1%) (Table 1). Because parents could report more than one child, the child age groups add up to more than 100%. In total, 545 parents reported a single child age group and a single mode of delivery; after excluding 69 whose child was younger than one year, 476 parents formed the sample for the primary analysis.

In the primary analysis ($n = 476$), 128 respondents (26.9%) reported a family history of snoring or sleep apnea, 151 children (31.7%) slept in a noisy or shared room, 237 (49.8%) used a mobile phone or watched television in the 30 min before bedtime, and 169 (35.5%) were physically active for at least 60 min daily. Habitual snoring was reported for 65 children (13.7%), difficult breathing during sleep for 48 (10.1%), and witnessed breathing pauses for 52 (10.9%). Daytime mouth breathing was reported for 85 children (17.9%), dry mouth on waking for 98 (20.6%), and occasional bedwetting for 82 (17.2%) (Table 2).

In the primary analysis, the mean PSQ score was 3.77 ± 4.72 (median 2, IQR 0–7), and 108 children (22.7%; 95% CI: 19.2–26.7%) screened positive for SRBD. By child age

group, the proportion screening positive was 40.9% (95% CI: 31.2–51.4%) at 1–3 years, 44.6% (32.4–57.6%) at 4–6 years, 31.7% (21.3–44.2%) at 7–12 years, and 10.3% (7.2–14.5%) above 12 years; children older than 12 years made up more than half of this sample (272/476, 57.1%). The snoring and breathing subscale alone was positive in 108 of 472 children with at least one answered subscale item (22.9%; 95% CI: 19.3–26.9%). Across all 1112 respondents, the mean score was 6.29 ± 5.47, and 514 (46.2%; 95% CI: 43.3–49.2%) gave answers meeting the screening threshold for one or more of their children. In the primary analysis, the proportion screening positive differed by parent sex, age, marital status and occupation, child age group, comorbidities, family history of snoring, noisy or shared bedroom, screen use before bedtime, and physical activity (p-value < 0.001) (Table 3).

Table 1. Sociodemographic characteristics of all respondents and their children (n = 1112).

Sociodemographic Characteristics		***n***	**%**
Gender	Females	959	86.2%
	Males	153	13.8%
Age (years)	18–25	156	14.0%
	26–34	456	41.0%
	35–44	251	22.6%
	>44	249	22.4%
Education level	High school or less	130	11.7%
	Diploma	415	37.3%
	Bachelor	508	45.7%
	Postgrad	59	5.3%
Marital status	Married	952	85.6%
	Divorced	117	10.5%
	Widowed	43	3.9%
Occupation	Not working	392	35.3%
	Students	69	6.2%
	Working	599	53.9%
	Retired	52	4.7%
Age of Child			
Less than 1 year	Yes	216	19.4%
1–3 years	Yes	468	42.1%
4–6 years	Yes	379	34.1%
7–12 years	Yes	198	17.8%
Older than 12 years	Yes	390	35.1%
Comorbidities	Yes	194	17.4%
Delivery mode	Normal delivery	530	47.7%
	Cesarean section delivery	181	16.3%
	Both	401	36.1%

Table 2. Sleep environment and PSQ item responses in the primary analysis ($n = 476$).

Items	No	Yes	I Don't Know
Sleep environment and habits			
Does any family member suffer from snoring or sleep apnea?	348 (73.1%)	128 (26.9%)	–
Do your children sleep in a room that is noisy or shared with others?	325 (68.3%)	151 (31.7%)	–
Do your children use a mobile phone or watch television during the last 30 min before bedtime?	239 (50.2%)	237 (49.8%)	–
Do your children engage in physical activity or exercise for at least 60 min daily?	307 (64.5%)	169 (35.5%)	–
PSQ items			
During sleep, does your child snore more than half of the time?	390 (81.9%)	65 (13.7%)	21 (4.4%)
During sleep, does your child always snore?	401 (84.2%)	64 (13.4%)	11 (2.3%)
During sleep, does your child snore loudly?	407 (85.5%)	55 (11.6%)	14 (2.9%)
During sleep, does your child breathe with difficulty or loudly?	389 (81.7%)	69 (14.5%)	18 (3.8%)
During sleep, does your child struggle to breathe or have very difficult breathing?	419 (88.0%)	48 (10.1%)	9 (1.9%)
Have you ever observed your child stop breathing, even once?	410 (86.1%)	52 (10.9%)	14 (2.9%)
Does your child tend to breathe through the mouth during the daytime?	360 (75.6%)	85 (17.9%)	31 (6.5%)
Does your child have a dry mouth upon waking in the morning?	340 (71.4%)	98 (20.6%)	38 (8.0%)
Does your child experience bedwetting occasionally during sleep?	384 (80.7%)	82 (17.2%)	10 (2.1%)
Does your child wake up in the morning feeling unrefreshed?	334 (70.2%)	118 (24.8%)	24 (5.0%)
Does your child experience difficulty staying awake during the day?	350 (73.5%)	110 (23.1%)	16 (3.4%)
Has your child's teacher or supervisor noticed a tendency for your child to be sleepy during the day?	408 (85.7%)	50 (10.5%)	18 (3.8%)
Does your child have difficulty waking up in the morning?	356 (74.8%)	110 (23.1%)	10 (2.1%)
Does your child experience headaches upon waking in the morning?	386 (81.1%)	61 (12.8%)	29 (6.1%)
Has your child stopped growing at a normal rate at any time since birth?	391 (82.1%)	62 (13.0%)	23 (4.8%)
Is your child overweight?	380 (79.8%)	82 (17.2%)	14 (2.9%)
My child often does not seem to listen when spoken to directly.	370 (77.7%)	90 (18.9%)	16 (3.4%)
My child often has difficulty organizing tasks.	335 (70.4%)	118 (24.8%)	23 (4.8%)
My child is often easily distracted by external stimuli.	371 (77.9%)	87 (18.3%)	18 (3.8%)
My child often moves his/her hands or feet or squirms in his/her seat	361 (75.8%)	94 (19.7%)	21 (4.4%)
My child often appears to be "constantly active," as if driven by a motor.	376 (79.0%)	84 (17.6%)	16 (3.4%)
My child often interrupts others or intrudes on their activities (e.g., interrupts conversations or games).	353 (74.2%)	112 (23.5%)	11 (2.3%)

In the multivariable model, a positive screen was independently associated with a family history of snoring or sleep apnea (aOR = 3.72, 95% CI: 2.07–6.71; p-value < 0.001), sleeping in a noisy or shared room (aOR = 2.45, 95% CI: 1.38–4.33; p-value = 0.002), and having a divorced (aOR = 2.97, 95% CI: 1.17–7.56; p-value = 0.022) or widowed parent (aOR = 3.83, 95% CI: 1.04–14.16; p-value = 0.044) compared with a married parent.

The model fitted the data adequately (Hosmer–Lemeshow $\chi^2 = 6.02$, p-value = 0.645; Nagelkerke $R^2 = 0.414$), and the highest VIF was 6.72 (parent aged > 44 years), which reflects the overlap between parent and child age (Table 3). In a reduced model (17 rather than 21 parameters) that kept child age as the only age variable and combined divorced and widowed parents, the main associations were unchanged: family history of snoring or sleep apnea (aOR = 3.85, 95% CI: 2.16–6.87), noisy or shared bedroom (aOR = 2.45, 95% CI:

1.39–4.30) and divorced or widowed parent (aOR = 3.39, 95% CI: 1.55–7.39). In this model, children older than 12 years had lower odds of a positive screen than those aged 1–3 years (aOR = 0.30, 95% CI: 0.14–0.63) (highest VIF = 2.59; Hosmer–Lemeshow *p*-value = 0.316; Nagelkerke R^2 = 0.397).

Table 3. Factors associated with a positive SRBD screen in the primary analysis (*n* = 476).

Characteristic	Category	*n*	Positive, *n* (%)	Crude OR (95% CI)	aOR (95% CI)	*p*-Value
Parent sex	Female	394	73 (18.5)	Reference	Reference	
	Male	82	35 (42.7)	3.27 (1.97–5.43)	1.75 (0.89–3.45)	0.103
Parent age (years)	18–25	48	16 (33.3)	Reference	Reference	
	26–34	101	50 (49.5)	1.96 (0.96–4.01)	1.24 (0.48–3.18)	0.659
	35–44	116	23 (19.8)	0.49 (0.23–1.05)	0.54 (0.18–1.62)	0.272
	>44	211	19 (9.0)	0.20 (0.09–0.42)	0.39 (0.11–1.35)	0.138
Education level	High school or less	76	13 (17.1)	Reference	Reference	
	Diploma	209	41 (19.6)	1.18 (0.59–2.35)	2.11 (0.89–5.01)	0.091
	Bachelor	157	46 (29.3)	2.01 (1.01–4.00)	1.90 (0.80–4.54)	0.146
	Postgraduate	34	8 (23.5)	1.49 (0.55–4.02)	2.65 (0.79–8.91)	0.115
Marital status	Married	427	78 (18.3)	Reference	Reference	
	Divorced	35	24 (68.6)	9.76 (4.59–20.76)	2.97 (1.17–7.56)	0.022
	Widowed	14	6 (42.9)	3.36 (1.13–9.95)	3.83 (1.04–14.16)	0.044
Occupation	Not working	231	36 (15.6)	Reference	Reference	
	Students	20	9 (45.0)	4.43 (1.71–11.46)	1.24 (0.34–4.46)	0.745
	Working	197	58 (29.4)	2.26 (1.41–3.61)	0.85 (0.44–1.65)	0.640
	Retired	28	5 (17.9)	1.18 (0.42–3.30)	0.92 (0.24–3.52)	0.905
Child age (years)	1–3	88	36 (40.9)	Reference	Reference	
	4–6	56	25 (44.6)	1.16 (0.59–2.29)	1.28 (0.53–3.07)	0.580
	7–12	60	19 (31.7)	0.67 (0.34–1.33)	1.08 (0.41–2.83)	0.876
	>12	272	28 (10.3)	0.17 (0.09–0.30)	0.63 (0.23–1.73)	0.368
Child comorbidities	No	408	71 (17.4)	Reference	Reference	
	Yes	68	37 (54.4)	5.67 (3.30–9.74)	1.83 (0.91–3.68)	0.091
Mode of delivery	Normal delivery	365	79 (21.6)	Reference	Reference	
	Cesarean section	111	29 (26.1)	1.28 (0.78–2.09)	1.04 (0.56–1.93)	0.889
Family history of snoring or sleep apnea	No	348	46 (13.2)	Reference	Reference	
	Yes	128	62 (48.4)	6.17 (3.87–9.82)	3.72 (2.07–6.71)	<0.001
Noisy or shared bedroom	No	325	44 (13.5)	Reference	Reference	
	Yes	151	64 (42.4)	4.70 (2.99–7.39)	2.45 (1.38–4.33)	0.002
Screen use before bedtime	No	239	37 (15.5)	Reference	Reference	
	Yes	237	71 (30.0)	2.34 (1.49–3.65)	1.23 (0.68–2.24)	0.492
Physical activity ≥ 60 min daily	No	307	48 (15.6)	Reference	Reference	
	Yes	169	60 (35.5)	2.97 (1.91–4.61)	1.03 (0.57–1.86)	0.914

OR, odds ratio; aOR, adjusted odds ratio; CI, confidence interval.

Sensitivity analyses gave estimates between 18.6% and 25.6% (Table 4). The estimate was lower with the Arabic validation cut-off (18.7%) and among children aged four years or older (18.6%). Compared with excluded respondents, included respondents were older,

less often held a bachelor's degree, were more often not working, and less often reported a family history of snoring (26.9% vs. 38.5%) or a noisy or shared bedroom (31.7% vs. 46.2%) (Table S1).

Table 4. Sensitivity analyses of the proportion screening positive for SRBD.

Analysis	*n*	Screen Positive, *n* (%; 95% CI)
Primary analysis: ≥8 "yes" responses	476	108 (22.7; 19.2–26.7)
Original proportional scoring (>0.33; "don't know" as missing)	472	121 (25.6; 21.9–29.8)
Arabic validation cut-off (>8 "yes" responses)	476	89 (18.7; 15.5–22.4)
Children aged ≥ 4 years only	388	72 (18.6; 15.0–22.7)
Bedwetting item excluded (≥8 of 21 items)	476	99 (20.8; 17.4–24.7)
All respondents, household level (≥8 "yes" responses)	1112	514 (46.2; 43.3–49.2)

4. Discussion

This study estimated the proportion of children in Jordan who screened positive for SRBD. Among parents who reported a single child age group and delivery mode, 22.7% of reports met the screening threshold. This overall figure depends on the age mix of the sample, since more than half of the children were older than 12 years and only 10.3% of them screened positive. Because both Saudi studies included primary school children, the fairer comparison is with our 7–12 year group (31.7%, 95% CI: 21.3–44.2%), which is higher than the 21% reported among 1350 Saudi primary school children and the 13% reported among 1866 Saudi children aged 6–12 years, both using the same threshold of eight or more positive answers [13,15]. Because snowball recruitment through social media may attract parents who are already concerned about their child's sleep, our estimate is likely to overestimate the community prevalence. The prevalence rate of 46.2% across all respondents in this study reflects households with several children, in which any child could prompt a "yes" answer, and should not be read as a prevalence among children. Similarly, the strong association with reporting both delivery modes in the household-level data is likely to have reflected family size; among respondents in the primary analysis, cesarean delivery was not associated with a positive screen (aOR = 1.04, 95% CI: 0.56–1.93). A positive screen identifies children who need clinical evaluation and does not confirm SRBD.

In the primary analysis sample, 13.4% of children were reported to always snore and 13.7% to snore more than half of the time, and 21 respondents (4.4%) answered "yes" to always snoring but "no" to snoring more than half of the time, which suggests that some items were misread. In the full study sample, this inconsistency was more frequent (136 respondents), consistent with answers referring to different children. Witnessed breathing pauses were reported for 10.9% of children, above the 0.2–4% usually reported in community samples [10]; parents may have interpreted brief pauses or irregular breathing as apneas.

In the current study, a family history of snoring or sleep apnea was the factor most strongly associated with a positive screen (aOR = 3.72). A large previous analysis of over 1500 Chinese children discovered that family history of snoring is a potential risk factor for OSA in children, suggesting that a family history of snoring is common among children suffering from sleep disorders [16]. Furthermore, family history of OSA may affect the risk of sleep-disordered breathing in children, according to a narrative review of the

epidemiology and risk factors of pediatric sleep respiratory disorders in children [17]. This relationship was also observed in a systematic review and meta-analysis, which reported a significant association between family history of OSA and pediatric OSA [18]. These results highlight the need to pay greater attention to children who have a family history of snoring or sleep apnea because they could be a risk factor for sleep disorders in the future.

Sleeping in a noisy or shared room was also independently associated with a positive screen (aOR = 2.45) in our study. However, both family history of snoring and a shared bedroom were reported by the same parent who completed the PSQ. A parent who shares a room with the child has more chance to hear snoring or notice a pause in breathing, and a parent aware of snoring in the family may be more alert to it, so part of these associations may reflect differences in observation and reporting rather than in risk. Screen use before bedtime (49.8% of children) and parental occupation were associated with a positive screen only in the crude analysis and not after adjustment, although previous studies have linked bedtime screen use and parents' nonstandard work hours with poorer sleep in children [19–21]. Physically active children screened positive more often in the crude analysis (OR = 2.97, 95% CI: 1.91–4.61). This is most likely explained by age: 52–60% of children aged 1–12 years were reported to be active, compared with 19.9% of those older than 12 years, who had the lowest proportion screening positive. Adjustment for child age alone reduced the OR to 1.80 (95% CI: 1.11–2.93), and the association did not remain significant in the full model (aOR = 1.03).

In the present study, difficult breathing during sleep and witnessed breathing pauses were each reported for about 10% of children (10.1% and 10.9%). Among 1440 children aged 5–12 years in Saudi Arabia, nearly 23% were observed to stop breathing during sleep, and 80% of them exhibited mouth breathing during sleep for at least one night per week, which is an indicator of breathing difficulty, because children often breathe via their mouths to make up for the restriction in their upper airways [22], among 30.6% of the participating children.

In our study, daytime mouth breathing (17.9%), dry mouth on waking (20.6%) and occasional bedwetting (17.2%) were each reported for about one in five children. Similar prevalence was reported in a Saudi study, where 21%, 21.4% and 20.3% of primary school children were observed to breathe through their mouths during the day, have dry mouth upon waking, and wet their beds, respectively [13]. A cross-sectional study conducted in Indonesia reported that mouth breathing was observed in 27.7% of elementary school children, with 41.1% of mouth-breathing children having sleep-disordered breathing [23]. The study concluded that children who breathe through their mouths are more likely to acquire sleep-disordered breathing, emphasizing the significance of early screening and interventions in order to avoid the negative health consequences associated with these disorders [23]. Furthermore, significant associations between both mouth breathing and nocturnal enuresis, sleep-disordered breathing, and dental or facial characteristics were also reported in other studies [24,25].

In the current study, children of divorced or widowed parents had higher odds of a positive screen. Due to the cross-sectional study design, these findings imply associations rather than effects. Parents' circumstances may also influence how they perceive and report their child's symptoms, so the higher odds may partly reflect differences in reporting rather than in the children. Similarly, a prior study conducted in Sweden found that children of separated parents, including those in sole maternal custody or shared physical custody, were more likely to have sleep difficulties, such as late bedtimes and sleep initiation problems compared to children in families with 2 parents [26]. A study from the USA confirmed that single-parent family structure is an independent influencing factor of sleep difficulties in adolescents [27].

In the primary analysis in this study, the proportion screening positive was higher among children aged 1–6 years than among those older than 12 years (40.9–44.6% vs. 10.3%), but child age was not independently associated with a positive screen after adjustment. Bedwetting and some behavioral items are developmentally common in young children and may raise their scores; however, restricting the analysis to children aged four years or older, or removing the bedwetting item, changed the estimate only slightly (18.6% and 20.8%). A previous study found high prevalence of sleep disorders among preschool children aged 3–6 years in rural China, with younger age being a significant factor [28]. In another study involving a sample of 4- to 9-year-old children in Germany, younger children were more likely to experience night terrors, parasomnia, sleep onset delay, and reluctance to bedtime than older children [29]. These studies suggest that preschool children are at a higher risk of sleeping problems than older children and adolescents, highlighting the importance of investigating the factors leading to sleep disturbances among this age group of children, and developing effective strategies to address these factors and optimize the sleeping schedules of these children.

A positive PSQ screen should prompt clinical assessment rather than be taken as a confirmed diagnosis. Primary care physicians, pharmacists and school nurses could ask parents briefly about snoring, witnessed breathing pauses, family history of snoring and the child's sleep environment, and refer children with a positive screen or habitual snoring to a specialist for sleep assessment. Moreover, they could advise on a quiet sleeping environment and on limiting screen use before bedtime.

This study has limitations. First, the cross-sectional study design does not allow causal inference across the study variables. Second, the utilization of the snowball sampling technique through social media provides no denominator; therefore, the response rate for this study could not be estimated. Parents who are concerned about their child's sleep may have been more likely to take part, and mothers made up 86.2% of respondents, both of which may lead to overestimation and limit the generalizability of our study findings. Third, parents were not asked to report on one specific child. Reporting a single child age group and delivery mode does not confirm that a parent had only one child (for example, two teenagers born vaginally), so some answers may still refer to more than one child; our findings are therefore parent-reported screening results rather than child-level prevalence estimates. Fourth, the PSQ was validated against polysomnography in clinical samples, and no objective sleep assessment was performed. Fifth, Google Forms does not record IP addresses and usually limits duplicate responses through account sign in, which would also have excluded parents without a Google account. Therefore, the study findings should be interpreted carefully.

5. Conclusions

A positive screen indicates the need for further evaluation and does not confirm a sleep disorder. A family history of snoring or sleep apnea and a noisy or shared bedroom were independently associated with a positive screen. Primary care and school health staff could utilize the findings of this study to identify children who may need referral for sleep assessment. Further studies that sample individual children and include objective sleep assessment are needed to estimate the prevalence of SRBD in Jordan and its associated factors.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/healthcare14223993/s1, Table S1: Sociodemographic characteristics of respondents included in and excluded from the primary analysis.

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References

1. Licis, A. Sleep-Wake Disorders in Childhood. *Continuum* **2020**, *26*, 1034–1069. [CrossRef] [PubMed]
2. Mindell, J.A.; Williamson, A.A. Benefits of a bedtime routine in young children: Sleep, development, and beyond. *Sleep Med. Rev.* **2018**, *40*, 93–108. [CrossRef] [PubMed]
3. Huang, L.; Zhu, W.; Li, N.; Zhang, B.; Dai, W.; Li, S.; Xu, H. Functions and mechanisms of adenosine and its receptors in sleep regulation. *Sleep Med.* **2024**, *115*, 210–217. [CrossRef] [PubMed]
4. Navarro Vergara, A.; González Rabelino, G. Sleep disorders and their impact on neurodevelopment. *Medicina* **2022**, *82*, 30–34. [PubMed]
5. Nguyen, H.T.; Zubrick, S.R.; Mitrou, F. Daylight duration and time allocation of children and adolescents. *Econ. Hum. Biol.* **2024**, *55*, 101435. [CrossRef] [PubMed]
6. Reiter, J.; Ramagopal, M.; Gileles-Hillel, A.; Forno, E. Sleep disorders in children with asthma. *Pediatr. Pulmonol.* **2022**, *57*, 1851–1859. [CrossRef] [PubMed]
7. Lazaratou, H.; Soldatou, A.; Dikeos, D. Medical comorbidity of sleep disorders in children and adolescents. *Curr. Opin. Psychiatry* **2012**, *25*, 391–397. [CrossRef] [PubMed]
8. Schnatschmidt, M.; Schlarb, A. Review: Sleep and mental disorders in childhood and adolescence. *Z. Kinder Jugendpsychiatrie Psychother.* **2018**, *46*, 368–381.
9. Leung, T.N.H.; Wong, K.L.; Chan, A.K.C.; Li, A.M. Common Childhood Sleep Problems and Disorders. *Curr. Pediatr. Rev.* **2024**, *20*, 27–42. [CrossRef] [PubMed]
10. Lumeng, J.C.; Chervin, R.D. Epidemiology of Pediatric Obstructive Sleep Apnea. *Proc. Am. Thorac. Soc.* **2008**, *5*, 242–252. [CrossRef] [PubMed]
11. Abd El-hakeem, W.H.; Sayed, S.I.; Shahin, F.W. Arabic version of Pediatric Sleep Questionnaire (PSQ). *Egypt. J. Otolaryngol.* **2025**, *41*, 12. [CrossRef]
12. Chervin, R.D.; Hedger, K.; Dillon, J.E.; Pituch, K.J. Pediatric sleep questionnaire (PSQ): Validity and reliability of scales for sleep-disordered breathing, snoring, sleepiness, and behavioral problems. *Sleep Med.* **2000**, *1*, 21–32. [CrossRef] [PubMed]
13. Baidas, L.; Al-Jobair, A.; Al-Kawari, H.; AlShehri, A.; Al-Madani, S.; Al-Balbeesi, H. Prevalence of sleep-disordered breathing and associations with orofacial symptoms among Saudi primary school children. *BMC Oral Health* **2019**, *19*, 43. [CrossRef] [PubMed]
14. Chervin, R.D.; Weatherly, R.A.; Garetz, S.L.; Ruzicka, D.L.; Giordani, B.J.; Hodges, E.K.; Dillon, J.E.; Guire, K.E. Pediatric sleep questionnaire: Prediction of sleep apnea and outcomes. *Arch. Otolaryngol. Head Neck Surg.* **2007**, *133*, 216–222. [PubMed]
15. Alwadei, S.H.; Alsaeed, S.; Masoud, A.I.; Alwadei, F.; Gufran, K.; Alwadei, A. Sleep-Disordered Breathing among Saudi Primary School Children: Incidence and Risk Factors. *Healthcare* **2023**, *11*, 747. [CrossRef] [PubMed]
16. Xiao, L.; Su, S.; Liang, J.; Jiang, Y.; Shu, Y.; Ding, L. Analysis of the Risk Factors Associated With Obstructive Sleep Apnea Syndrome in Chinese Children. *Front. Pediatr.* **2022**, *10*, 900216. [CrossRef] [PubMed]
17. Piotto, M.; Gambadauro, A.; Rocchi, A.; Lelii, M.; Madini, B.; Cerrato, L.; Chironi, F.; Belhaj, Y.; Patria, M.F. Pediatric Sleep Respiratory Disorders: A Narrative Review of Epidemiology and Risk Factors. *Children* **2023**, *10*, 955. [CrossRef] [PubMed]

18. Hasuneh, M.M.; Toubasi, A.A.; Khraisat, B.; Aldabbas, H.; Al-Iede, M. Risk Factors of Obstructive Sleep Apnea (OSA) in Pediatric Patients: A Systematic Review and Meta-analysis. *J. Pediatr. Health Care* **2024**, *38*, 717–726. [PubMed]
19. Carter, B.; Rees, P.; Hale, L.; Bhattacharjee, D.; Paradkar, M.S. Association Between Portable Screen-Based Media Device Access or Use and Sleep Outcomes: A Systematic Review and Meta-analysis. *JAMA Pediatr.* **2016**, *170*, 1202–1208. [PubMed]
20. Craft, A.L.; Perry-Jenkins, M.; Herman, R.; Spencer, R.M.C. Parents' Nonstandard Work and Children's Sleep: The Mediating Role of Bedtime Routines. *J. Pediatr. Psychol.* **2021**, *46*, 719–728. [CrossRef] [PubMed]
21. Staples, A.D.; Hoyniak, C.; McQuillan, M.E.; Molfese, V.; Bates, J.E. Screen use before bedtime: Consequences for nighttime sleep in young children. *Infant Behav. Dev.* **2021**, *62*, 101522. [CrossRef] [PubMed]
22. Aleid, A.; Alshahrani, N.; Alshammari, R.; Alruwaili, G.; Abdu, D.; Munhish, F.; Alsulami, F.A.A.; Alkhars, O.A.; Alsaid, A.T.; Aljedher, A.S.; et al. Assessing Sleep-Disordered Breathing in Saudi Arabian Children With Adenoid Hypertrophy: A Cross-Sectional Analysis. *J. Adv. Trends Med. Res.* **2001**, *1*, 1111–1118.
23. Primarti, R.S.; Fatma, A.; Jayanti, C.N.R.; Musnamirwan, I.A.; Setiawan, A.S. Mouth Breathing and Its Impact on Sleep Breathing Disorders in Children: A Cross-Sectional Study in Bandung, Indonesia. *Clin. Cosmet. Investig. Dent.* **2025**, *17*, 435–444. [CrossRef] [PubMed]
24. Alshehri, A.A.; Zaki, M.S.H.; Nour, S.O.; Gadi, W.H.; Zogel, B.A.; Alfaifi, S.M.; Masmali, E.M.; Aburasain, A.B.; Nour, M.O. Sleep-Disordered Breathing and Its Association with Nocturnal Enuresis at the Primary Schools in Saudi Arabia: A Cross-Sectional Study. *Children* **2023**, *10*, 1074. [CrossRef] [PubMed]
25. Huynh, N.T.; Morton, P.D.; Rompré, P.H.; Papadakis, A.; Remise, C. Associations between sleep-disordered breathing symptoms and facial and dental morphometry, assessed with screening examinations. *Am. J. Orthod. Dentofac. Orthop.* **2011**, *140*, 762–770. [CrossRef] [PubMed]
26. Turunen, J.; Norell-Clarke, A.; Hagquist, C. How do children and adolescents of separated parents sleep? An investigation of custody arrangements, sleep habits, sleep problems, and sleep duration in Sweden. *Sleep Health* **2021**, *7*, 716–722. [CrossRef] [PubMed]
27. Troxel, W.M.; Lee, L.; Hall, M.; Matthews, K.A. Single-parent family structure and sleep problems in black and white adolescents. *Sleep Med.* **2014**, *15*, 255–261. [CrossRef] [PubMed]
28. Zhao, T.; Xuan, K.; Liu, H.; Chen, X.; Qu, G.; Wu, Y.; Zhang, J.; Sun, Y. Sleep disturbances and correlates among a sample of preschool children in rural China. *Sleep Biol. Rhythm.* **2022**, *20*, 123–136. [CrossRef] [PubMed]
29. Lewien, C.; Genuneit, J.; Meigen, C.; Kiess, W.; Poulain, T. Sleep-related difficulties in healthy children and adolescents. *BMC Pediatr.* **2021**, *21*, 82. [CrossRef] [PubMed]

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