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Article Review

Domestic Environmental Factors Associated with Pediatric Snoring: A Scoping Review Protocol

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ABSTRACT

Since one-third of children who snore consistently may have OSAS, understanding the causes is vital. Preventing snoring requires addressing obesity, allergies, and anatomical anomalies. Indoor allergens and enlarged tonsils and adenoids may also cause youngsters to snore. The review aims to identify and categorize key concepts, types of evidence, and research gaps in this area. The scoping review will follow the methodology and stages outlined by the Joana Briggs Institute ((JBI). The final output will follow the PRISMA-Protocols (PRISMA-P) 2015 checklist. This review serves as a necessary step before conducting a systematic review and clinical studies. Childhood snoring is a common problem that can have adverse effects on a child's health and well-being. It is importing ant for parents to understand the hazards of snoring and seek support if they suspect their child may have a sleep disorder. Treatment options vary depending on the cause and severity of snoring, and may include lifestyle changes, medication, or surgery. More research is need to better understand the relationship between environmental factors and snoring children, including the impact of pollutant such as NO_2 and passive smoking. Early detection and treatment of snoring in children is crucial, as if can have long-term effects on their health and well-being. The conclusion is that knowledge empowers parents to take the necessary steps to ensure the well-being and healthy sleep of their children.

Keywords : *Domestic Environmental, Children, Snoring, Scoping Review*

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INTRODUCTION

Snoring is a common condition in children, with varying prevalence rates reported across different studies. Habitual snoring, which refers to regular snoring is estimated to occur in 3.2% to 11% of children, while infrequent snoring is present in 17% to 27% of all children [1,2]. In a study of Indonesia children aged 5 to 13, the prevalence of snoring was found to be 31.6%, with 5.3% classified as habitual snorers and 26.4% as occasional snorers [3].

It is important to note that approximately one-third of children who snore regularly may have obstructive sleep apnea

syndrome (OSAS), a condition characterized by interrupted breathing during sleep [4]. While most studies have focused on the impact of OSAS on children's health, some research suggests that snoring itself can have adverse effects on

neurocognitive function, behavior, and blood pressure, even in the absence of apnea [6].

Given these concerns, both medical professionals and parents have become increasingly interested in understanding the causes of snoring in children and exploring prevention strategies. By addressing the underlying factors contributing to snoring, such as obesity, allergies, or anatomical abnormalities, it may be possible to alleviate the symptoms and improve children's overall well-being [1,7]

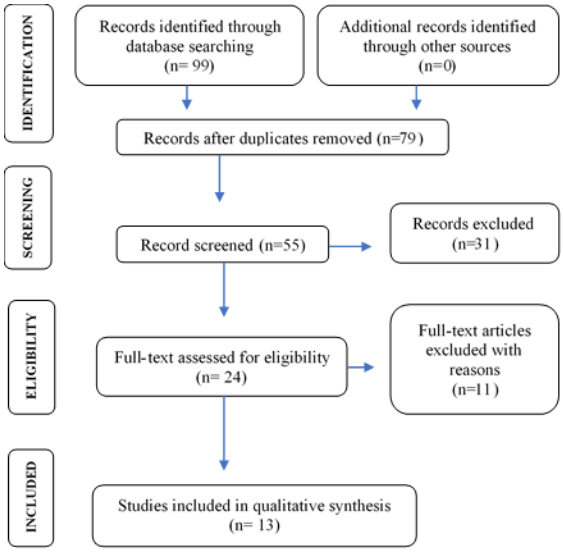
It is important to understand the environmental factors that contribute to snoring in children, as they can have a significant impact on their health and well-being. A scoping review was conducted to identify research on domestic environmental factors associated with snoring in children. The review found that exposure to indoor irritants such as volatile organic compounds, microbes, formaldehyde, and nitrogen dioxide may increase the risk of snoring. Other factors such as enlarged tonsils and adenoids, obesity, and allergies were also identified as contributing factors [8,9]. By addressing these factors, it may be possible to alleviate snoring symptoms and improve children's overall health [10,11]. Therefore, the purpose of this study is needed to understand the relationship between environmental factors and snoring in children.

METHODS

Study Design

A scoping review will be conducted to assess the range, scope, and types of studies related to the topic of interest. The scoping review will follow the methodology and stages outlined by the Joana Briggs Institute ((JBI) [12]. The final output will follow the PRISMA-Protocols (PRISMA-P) 2015 checklist (Figure 1) [13].

Figure 1. Prisma diagram for article selection process.



Search Strategies

A scoping review is a method of knowledge synthesis that investigates an exploratory research question with the goal of identifying and categorizing key concepts, types of evidence, and research gaps in a specific area or field. This is achieved through a systematic search, selection, and synthesis of existing knowledge. We will conduct a scoping review to explore broad questions and obtain an overview of a topic, rather than conducting a detailed synthesis of a specific question. This is particularly true for the specific topic of Domestic Environmental Factors Associated with Snoring in Children, as there is a lack of comprehensive and diverse literature on the subject. It aims to identify and analyze any gaps in knowledge that are significant for future research. This review serves as a necessary step before conducting a systematic review and clinical studies [14,15].

Eligibility criteria

Population/studies

Children aged between in kindergarten, pre-elementary school, junior high school and senior high school

Inclusion criteria include:

1. Prevalence rates of children with snoring condition measured objectively and subjective measures;

2. Intervention strategies and outcomes for reducing this condition.
3. Children in kindergarten, pre-elementary school, junior high school and senior high school, perspectives or outcomes of intervention strategies to reduce this condition (including mixed methods, qualitative and quantitative studies).

Exclusion criteria include:

All studies on snoring in children conducted in kinder garden, junior high school, senior high school without being limited to geographic region, ethnicity or gender, will be included.

Study types

The inclusion criteria for this scoping review will focus on published primary research studies that utilize mixed methods, quantitative, and qualitative methodologies. Specifically, studies that examine physical activity in children but also report data on snoring will be considered for inclusion, as long as they meet the remaining inclusion criteria.

On the other hand, certain exclusion criteria will be applied. These include studies that have limited availability of full-text articles, manuscripts written in languages other than English, and case reports criteria, the scoping review aims to ensure the inclusion of relevant and high-quality research studies [14].

Data Extraction from Included Studies

S and NTW will conduct a thorough screening of electronic databases, following the eligibility criteria. The Endnote library will import every relevant article and eliminate any duplicates. Subsequently, the Endnote library will be shared with the review team for the subsequent stage of the study selection process. A screening tool will be created based on the eligibility criteria for both the abstract and full text screening stages. Two reviewers, identified as SYW and HN will independently perform abstract and full text screening. The screened articles will be categorized as either included or excluded. There are discrepancies between the self-assessment (SYW) and (HN). The review team will engage in a discussion to reach a consensus on the abstract screening phase. During the full text phase, SA and S will address any discrepancies that may arise between SYW and HN, if an article is not available online, the library services of the institution will be consulted for assistance [16].

The search strategy looks for to identify English-language studies published between January 2004 and July 2023. The user conducted a search on PubMed, Scopus, Cochran, and Embase. A comprehensive search,strategy will be developed using indexed descriptors and keywords. The selected keywords are “domestic environment”, “snoring children”, “bacterial contaminant”, “air pollute”, “environmental tobacco smoke”. The initial search will be performed in PubMed and subsequently translated into additional databases. The reference lists of the included studies and previously published reviews will be examined to identify additional relevant articles.

RESULTS

The data charting form in table 1 has been specifically designed for this study. Two team members will independently chart the data, but charges may be made if valuable information is found to be missing. Table 1 includes study metrics, population characteristics, and study aims and outcomes. The restricted data from this chart will undergo thematic analysis, either quantitatively or qualitatively, to effectively address the research question. Two team members will be responsible for coding the data to minimize bias and errors.

Table 1. Results of the article review

Source	Country	Population	Aim	Study design	n	Key findings	Conclusion
Isaiah et al. (2021)[4]	United State of America	9–10-year-olds without major psychological or neurological issues	The study explores the influence of confounding factors on the cognitive outcomes of preadolescent children and their habitual snoring.	Cross-sectional	11873	The link between habitual snoring and cognitive performance was significantly reduced following demographic, anthropometric, and socioeconomic adjustments.	After controlling for baseline demographic, anthropometric, and socioeconomic factors, parent-reported frequent snoring had little effect on cognitive performance in 9–10-year-olds in this cross-sectional investigation.
Potasz et al. (2010)[5]	Sao Paulo	A study of 330 children in a clinical laboratory was conducted to assess sleep disorders.	The prevalence of sleep disturbances in children from a public hospital in São Paulo, Brazil.	Cross sectional	330 children	Excessive environmental pollution in urban areas like São Paulo may contribute to children's increased allergies and respiratory disorders, favoring SDB.	Sleep problems, especially sleep disordered breathing and sleep hyperhidrosis, were common in boys in our study compared to international literature.
Tenero et al. (2017)[6]	Verona, Italy	We searched Medline, Scopus, and ISI Web of Science	Environmental air pollution can cause childhood sleep-disordered breathing.	Systematic review	8 articles	The findings indicate that ambient (not voluptuary) pollution worsens sleep-disordered breathing in children (grade C).	Studies Research indicates significant differences between polluted and unpolluted areas, and indoor pollution therapies can improve children's sleep-disordered breathing.
Sahin et al. (2009)[10]	Isparta, Turkey	1,605 7-13-year-olds (819 boys and 786 girls) from 9 randomly selected elementary schools in Isparta, Turkey.	-	Cross sectional	1605 children	In multivariate analysis, poor school performance was independently associated with hyperactivity, nocturnal enuresis, teeth grinding, and low parental/maternal education.	Children with Habitual Snoring had increased daytime and night-time sleep issues. No correlation was found between HS and poor school performance.
Neroni et al. (2021)[14]	Rome, Italy	The study explored through PubMed/MEDLINE and ScienceDirect.	To analyse literature data to better understand the relationship between sleep disorders and gut microbiota composition.	Systematic review	13 articles	Children with sleep-related breathing difficulties, intestinal permeability is associated with greater plasmatic LPS levels and inflammatory mediators.	There is evidence that gut microbiota can affect mental states, sleep quality, and circadian rhythm, and psycho-physiological stress can affect microbiota composition.
Meng et al. (2021)[15]	Wuhan, China	Elementary school children in period 1 (N=2,517) and in period 2 (N=3,152) were recruited in Wuhan, China..	The study on the health effects of air pollution on Chinese children's respiratory health in four Chinese cities.	Cross sectional	5669	Urban Wuhan children's respiratory health has improved since the 1990s, with urban children benefiting most. However, asthma and bronchitis prevalence remain unaffected.	Over 25 years, Wuhan children's respiratory health and indoor air quality have improved, with kitchen smoke influencing wheeze prevalence, and reducing tobacco smoke exposure may help prevent bronchitis.
Wang et al. (2023)[17]	Tianjin, China	Snoring index (SIS) data came from Google Trends and Baidu Index. 2011–2020	Research on seasonal changes and snoring worldwide has been searching using Google Trends and Baidu Index	Seasonal time series	Brazil, Japan, and Germany.	The 2020 time series decomposition revealed decreasing SIS values in the US, China, Japan, Russia, and Australia, possibly due to COVID-19 infections, consequences, and fear.	Snoring data Search Index exhibited cyclical fluctuations during the investigation. In the cold and heating seasons, the search index for snoring increased, suggesting seasonality.
Huang et al. (2022)[18]	China	A pediatric OSA was confirmed overnight by PSG, with adenoid and tonsillar hypertrophy diagnosed by an otolaryngologist	To examine the salivary microbiome of children with OSA and its longitudinal changes before and after adenotonsillectomy.	Cross sectional study	36	The study's inability to link salivary microbiome to OSA suggests further research, with a small sample size and subjective symptoms making follow-up assessments challenging.	The study linked salivary microbiome to obstructive sleep apnea, but further research is needed due to follow-up challenges, small sample size, and subjective symptoms improvement in OSA children post-therapy.

Collado et al. (2019)[19]	Finland	The children's birth dates range from April 2011 to February 2013.	To characterize the connection between gut microbiota and child snoring.	Cohort study	43	Snorers have higher Proteobacteria, Enterobacteriaceae, and Erysipelotrichaceae levels, leading to a worse Firmicutes-Bacteroidetes ratio, potentially causing health disorders and contributing to snoring.	The gut microbiota, influenced by bacterial species and imbalances, can contribute to snoring's long-term effects, and treating the early microbiome can mitigate its effects.
Gozal et al. (2014)[20]	Teheran, Iran	6- to 12-year-old children attending public schools in five distinct neighbourhoods.	The study investigates the correlation between habitual snoring and air pollution levels in Tehran, Iran.	Cross-sectional studies	4322	Research indicates that poor air quality, particularly high nitrogen dioxide levels, can cause regular snoring in children, even after weight and allergies are considered. Improved air quality could potentially reduce snoring in children.	Poor air quality, especially high nitrogen dioxide levels, can cause regular snoring in children, even after considering weight and allergies, and improved air quality could potentially reduce snoring.
Sanchez et al. (2019)[21]	Chile	First grade children of elementary schools throughout Chile	To investigate links between air pollution and SDB symptoms in children.	Cross sectional	564 children	Environmental pollution may disrupt children's sleep. Significant relationships were found between sleep respiratory symptoms and humidity, low temperatures, O_3, and SO_2.	Wheezing and snoring are strongly linked to O_3 and SO_2 air pollution. Weather variables like humidity and cold temperatures may also cause SDB symptoms.
Sun et al. (2018)[22]	Qingdao, China	A meta-analysis of 24 studies involving 87,829 individuals was conducted using PubMed, Embase, and Web of Science	A meta-analysis examined how family member environmental tobacco smoke and prenatal smoke exposure affect children's habitual snoring.	Systematic review Meta-analysis	24 articles	The meta-analysis, with a high sample size, adjusted odds ratios, dose-response analysis, steady association between household smoking and habitual snoring, and no publication bias.	This meta-analysis of observational research shows that ETS, particularly prenatal tobacco smoke and maternal smoking, increases HS risk.
Zhang et al. (2004)[23]	Perth, Australia	The Snoring stats Search Index cycled, with an increase in search indexes during cold and heating seasons,	To examine domestic environmental factors affecting kid snoring.	Cross-sectional	996 children	NO2 increases lipid membrane fluidity, potentially affecting receptor-ligand interactions and increasing snoring prevalence and obstructive sleep apnea risk.	Primary schoolers often snore. Domestic surroundings may increase snoring. Child snoring is linked to home nitrogen dioxide.

The primary objective of this study is to identify evidence on the assessment approaches used in Domestic Environmental Factors Associated with Snoring in Children from the charted data so as to map the assessment practices across various kinder garden, junior high school, and senior high school. Data will be quantitatively represented using figures and tables and qualitatively described in relation to the research question, including themes such as assessment used, similarities as well as disparate approaches, and contextual nuances.

The critical appraisal of evidence sources, although not mandatory, will be an included step in this review to assess the methodological quality using methods appraisal tool (MMAT). This instrument has a prescribed set of questions that examine the appropriateness of the different sections reported in each of the evidence sources [23].

DISCUSSION

Understanding the causes of snoring in children is crucial for parents to ensure the well-being and healthy sleep of their children. Snoring in children can have various causes, ranging from temporary factors to long-lasting issues. While occasional snoring may not be a cause for concern, frequent or severe snoring can indicate a problem with breathing during sleep [11,24].

There are different types of snoring in children, with varying frequency, severity, and impact. Primary snoring refers to habitual snoring without any noticeable symptoms or associated health issues. On the other hand, obstructive sleep apnea (OSA) is a more serious condition characterized by repeated pauses in breathing during the night due to airway blockage. OSA can lead to fragmented sleep and have negative impacts on physical health, mental health, learning, and behavior [25,26].

To endure the well-being of children with snoring issues, it is important for parents to be aware of the potential consequences and seek appropriate treatment. Treatment options for snoring in children depend on the underlying cause and severity of the condition. It may involve lifestyle changes, such as weight management and sleep position adjustments, or medical interventions, such as the use of continuous positive airway pressure (CPAP) machines or surgical procedures [17].

Further research is needed to explore the association between domestic environmental factors and snoring in children. This scoping review aims to fill this research gap by utilizing mixed methods, quantitative, and qualitative methodologies to review published primary research studies. By identifying key domains and research gaps, this review will contribute to a better understanding of the relationship between domestic environmental factors and snoring in children [18,27].

The prevalence of habitual snoring varies across different studies and countries, ranging from 4.9% to 34.5% in primary school children. In Australia, a study reported a prevalence of habitual snoring among primary school children was found to be 15.2%, with 24.9% experiencing infrequent snoring. Interestingly, the prevalence of snoring was lower in older children compared to younger ones, and there was no significant difference between boys and girls [28].

The adenoids, which are located in the upper airway, may play a role in various upper airway disorders in children. Adenoidectomy, the surgical removal of the adenoids is commonly performed to relive recurrent ear infection in children. However, even after treatment with antibiotics and surgery, some children may still harbor pathologic bacteria in the nasopharynx [29].

Minor, occasional snoring is believed to occur in up to 27% of children and is usually not a cause for concern. Primary snoring, without other symptoms is estimated to affect around 10-12% of children. Among children diagnosed with sleep-disordered breathing, approximately 70% receive a diagnosis of primary snoring. However, it can be challenging to determine the exact statistic for snoring and sleep apnea in children. Parents may not always observe their child's snoring or be aware of its frequency and severity. Additionally, detailed testing for sleep apnea, such as polysomnography may not be readily available, affordable, or practical in all cases [30,31].

The findings of the scoping review indicate a strong association between snoring and respiratory symptoms, asthma, and other allergic conditions in children, consistent with previous studies. Passive smoking was identified as a major risk factor for habitual snoring [32], while an interesting observation was the inverse relationship between snoring and pet

ownership, which may have a protective effect against allergic disease. Additionally, domestic exposure to NO_2 was significantly associated with snoring, with high levels of exposure increasing the risk by 4.5 times. This suggests that gas heating during winter, which contributes to NO_2 exposure, may be a contributing factor to snoring in children. Further research is needed to investigate the mechanisms behind these associations [33,34].

The association between NO_2 exposure and snoring in children requires further investigation to determine the underlying mechanisms. While there is evidence linking NO_2 exposure to the development of allergic disease, the association between NO_2 and snoring appears to be independent of atopy [35,36]. Snoring is caused by upper airway obstruction during sleep, commonly at the nasal turbinate or nasopharynx. Exposure to NO_2 may increase lipid membrane fluidity, leading to altered receptor-ligand interactions and changes in cell-cell and cell-pathogen interactions in the upper airway. Further research is needed to understand the specific mechanisms linking NO_2 exposure and snoring in children [37,38].

It is therefore crucial to identify and address snoring in children early on. Treatment options vary depending on the underlying cause and severity of the snoring [39,40]. Lifestyle modifications such as weight loss, proper sleep positioning, and avoiding allergens can be helpful. Medical interventions include continuous positive airway pressure (CPAP) machines, oral appliances, and in some cases, surgery [19,20]. However, more research is needed to understand the mechanisms behind the association between snoring and exposure to environmental pollutants such as NO_2 [21]. Parents and caregivers should be aware of the potential risks associated with snoring in children and seek medical attention if they suspect their child may have sleep-disordered breathing [22,41].

CONCLUSION

The findings showed that domestic environmental factors have a relationship with snoring and this review will ensure that healthcare professionals, researches, and parents have access to the latest information on the causes, consequences, and treatment option for snoring in children. Ultimately, this knowledge will help parents in taking appropriate measures to ensure the well-being healthy sleep of their children.

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