

Secondhand Snoring as noise pollution: The hidden danger to the Health and Wellbeing of Families and Society.

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I. Abstract

Title: Secondhand Snoring as Noise Pollution: The Hidden Danger to the Health and Wellbeing of Families and Society

This master's thesis explores the harmful effects of snoring and noise pollution on an individual's health and well-being, their relationship with family members, and overall, how snoring as noise pollution also has long-term health implications for family members, posing the same risk as environmental noise pollution. It includes a systematic study of snoring prevalence, risk factors, and its impact on physical and mental health, sleep quality, and relationship satisfaction. The thesis also addresses the long-term consequences of noise pollution on health. By recognizing snoring as a form of noise pollution, this study highlights the need for awareness and public health interventions to address this issue. The findings of this study will be useful for doctors, policymakers, and researchers in developing effective therapies and interventions for snoring and noise pollution.

II. Introduction

The objective of this thesis is to fill the existing research void by performing a comprehensive review of literature on the effects of snoring on the health and overall welfare of family members. This review will centre on the impact of snoring on the quality of sleep and its plausible association with unfavourable health consequences such as cardiovascular ailments, metabolic dysfunctions, and psychological disorders.

The main objective of this literature review is to amalgamate current research and studies in order to assess the potential health implications of snoring on family members. Additionally, this review aims to offer perspectives on the creation of more efficacious interventions that can effectively tackle this matter. The hypothesis posited is as follows:

Hypothesis: Snoring has negative health consequences for family members (N1), in contrast to the notion that snoring is a benign condition that can be tolerated.

The study's hypothesis posits that snoring has a negative impact on the health and overall well-being of individuals within the family unit. The present study will commence with a comprehensive review of the existing literature, focusing on the incidence and consequences of snoring among affected individuals. This will encompass an exploration of the associated health ramifications, as well as the available therapeutic interventions. The subsequent discussion will centre on the impact of snoring on family members, including their physical and psychological health, level of satisfaction in their relationships, and overall quality of life. However, due to the perceived lack of literature on the effects of snoring on family members, the present review will mainly investigate extant literature on noise pollution and its impact on sleep and health to draw comparisons between the effects of noise pollution and snoring.

Considering the constraints of this investigation, an all-encompassing longitudinal inquiry that scrutinises the impact of snoring and its remediation on the health outcomes of individuals who snore, and their kin would be optimal. However, due to the limitations inherent in obtaining data beyond the snorer, it is hoped that this thesis can serve as a preliminary step towards future research endeavours in this domain by

consolidating pertinent research and studies that may suggest the necessity for additional inquiry. This is mainly due to this writer's belief that through the extrapolation of extant literature, it is possible to gain insight into the potential influence of snoring on familial health and wellness, and to pinpoint avenues for further investigation.

Moreover, comprehending the potential implications of snoring on family members is crucial for formulating comprehensive interventions that consider the well-being of both snorers and their relatives. Despite the availability of diverse treatment modalities, a considerable number of individuals suffering from snoring and sleep apnea do not receive the most effective treatment, frequently due to inadequate awareness, imprecise diagnosis, or nonadherence to recommended interventions (Kapur et al., 2017). This underscores the necessity for more efficacious and all-encompassing interventions that can tackle the broader ramifications of snoring for familial units.

The results of this literature review have potential implications for healthcare professionals and policymakers, emphasising the necessity for more comprehensive interventions that consider the broader social consequences of snoring on families.

A. Background of snoring as a global problem

There is a pressing demand for efficacious interventions targeting snoring and sleep apnea.

Given the significant prevalence of snoring and its consequential health ramifications, there is an urgent need for effective interventions aimed at addressing snoring and obstructive sleep apnea (OSA) (Benjafield, A.V. et al, 2019; Peppard, P.E. et al, 2013; Young, T. et al, 1993). Various interventions have been proposed and implemented to address the issue, including lifestyle modifications such as weight loss, changes in sleeping position, and refraining from alcohol consumption before bedtime, as well as medical treatments such as continuous positive airway pressure (CPAP) devices, oral appliances, surgical procedures, and orofacial myofunctional therapy (Epstein et al., 2009; Paolucci Teresa et al, 2023). Despite the availability of diverse treatment modalities, a considerable number of individuals suffering from snoring and sleep apnea fail to receive adequate treatment, often due to inadequate awareness, inaccurate diagnosis, or non-adherence to recommended interventions (Kapur et al., 2017).

Insufficient consideration has been given to the potential ramifications of snoring on individuals within the familial unit.

The negative effects of snoring on individuals who snore have been extensively documented in academic literature. However, the impact of snoring on family members, specifically spouses or partners who share the same sleeping space, has not been thoroughly examined in scholarly research, as noted by Beninati. (1999), meanwhile a relatively recent literature review by Luyster, F.S. (2017) tells us there is a limited understanding and lack of comprehensive research examining the impact of OSA and OSA treatments on partners. The acoustic emissions produced by snoring have the potential to disrupt the sleep patterns of individuals within the household. With poor sleep leading to a range of unfavourable health outcomes and interpersonal difficulties (Singh et al., 2022). The necessity to address this gap in academic literature is rooted in the need to create comprehensive interventions that consider the well-being of both snorers and their families.

The present study aims to investigate the collateral impact snoring has on individuals

Snoring is a commonly observed sleep disorder that affects a substantial proportion of the adult population. Occasional occurrences of snoring are reported in approximately 45% of the population, while regular instances are observed in approximately 25% of individuals (Young, T. et al, 1993). The phenomenon of snoring is typified by a partial obstruction of the upper respiratory tract during the state of sleep, which arises due to the relaxation of the pharyngeal muscles. The present ailment perturbs the air passage through the oral and nasal cavities (Epstein et al., 2009). The production of snoring sound is attributed to the vibration of soft tissues in the pharynx caused by turbulent airflow generated during respiration, as reported by King, E. D et al. (2000).

The presentation of snoring can have a significant impact on the individual, resulting in compromised sleep quality, excessive daytime sleepiness, and an increased risk of developing sleep apnea, hypertension, and other cardiovascular diseases (Peppard et al., 2000).

B. The lack of studies on the impact of snoring on family members

The present discourse provides an overview of the existing literature on the effects of snoring on family members.

The lack of studies on the impact of snoring on family members has been noted in previous literature (Beninati, 1999; Troxel et al., 2010), and the present discourse provides an overview of the existing literature on the effects of snoring on family members. Thus far, the preponderance of scholarly inquiry pertaining to snoring has centered on the afflicted party, scrutinizing the etiology, incidence, and therapeutic modalities for snoring and its associated maladies, such as sleep apnea (Epstein et al., 2009; King et al., 2000). A limited body of literature has examined the effects of snoring on family members, with a primary focus on investigating the correlation

between snoring and the quality of sleep experienced by spouses (Beninati, 1999; Troxel et al., 2010). Notwithstanding the extant studies, the scope of inquiry has been constrained, and numerous inquiries persist concerning the wider ramifications of snoring for familial cohorts.

There exists a dearth of literature regarding the potential effects of snoring on the well-being of family members.

The dearth of comprehensive research pertaining to the influence of snoring on family members represents a noteworthy lacuna in the literature, constraining our comprehension of the wider implications of snoring beyond the afflicted individual (Zarhin, 2016). Further investigation is required to establish the correlation between snoring and diverse outcomes for family members, encompassing physical and psychological well-being, relationship contentment, and general quality of life, in order to formulate efficacious interventions that cater to the requirements of snorers and their families.

The significance of addressing the research gap pertaining to the effects of snoring on family members.

The importance of filling the knowledge gap about the impacts of snoring on family members has been noted in several studies (Armstrong, Wallace, & Marais, 1999; Zarhin, 2016). Our understanding of the full effects of snoring and its impact on familial relationships is hampered by this study gap. For clinical practise, closing this gap has significant ramifications (Prasad et al., 2003). First off, technology might make it easier to spot relatives' risks and disadvantages that had previously gone unnoticed. This would let medical practitioners to address these issues and improve the general welfare of snorers and their families. Second, understanding how snoring affects family members can help develop creative interventions and strategies that are tailored to the needs of both snorers and their loved ones, resulting in more comprehensive and effective treatment plans (Zarhin, 2016). In the end, more research on how snoring affects family relationships can help highlight how important it is to address snoring as a familial issue. This may encourage healthcare professionals and policymakers to consider the broader social implications when

developing guidelines and recommendations for the prevention and treatment of snoring and sleep apnea.

C. The importance of examining the impact of snoring on family members

The potential ramifications of snoring on familial individuals.

The literature suggests that snoring can have a multifaceted impact on family members, affecting various domains such as physical and mental health, relationship satisfaction, and overall quality of life. This is supported by studies conducted by Roberts et al. (2022), Zarhin (2016), Armstrong et al. (1999), Prasad et al. (2003), Ditzen et al. (2007), Brody (2010), Sotomayor-Peterson & Lucero-Liu (2017), Scharte & Bolte (2013), and Stansfeld & Clark (2015). The auditory disruption induced by snoring may lead to sleep disruptions for the significant others or partners of individuals who snore. The consequences of this phenomenon may include unfavourable outcomes such as insomnia, heightened levels of stress, excessive daytime sleepiness, and an increased propensity for developing health conditions such as mental health disorders, hypertension, and cardiovascular disease. (Roberts et al., 2022; Armstrong et al., 1999; Prasad et al., 2003; Sotomayor-Peterson & Lucero-Liu, 2017; Scharte & Bolte, 2013; Stansfeld & Clark, 2015). The aforementioned conditions have the potential to adversely affect family dynamics and the parent-child relationship. Parents may experience a decline in energy levels and mood, which could manifest as negative affect and behaviour towards their children (Stansfeld & Clark, 2015). The deterioration of the parental relationship may have significant implications for the future health of offspring as adults, such as an elevated susceptibility to mood disorders and cardiovascular disease (Li et al., 2020; Kuschick et al., 2021).

There is a pressing need to develop a comprehensive understanding of the impact of snoring on family members.

A comprehensive comprehension of the impact of snoring on family members is crucial to address the issue of snoring and enhance the well-being of both snorers and their families (Zarhin, 2016). The present study aims to investigate the multifaceted impact of snoring-related noise on sleep quality and health, as well as its potential ramifications on family dynamics, relationship satisfaction, and overall quality of life. This research builds upon prior studies conducted by Armstrong et al. (1999), Brody (2010), and Prasad et al. (2003). Scholarly inquiries should also consider investigating the potential mediating and moderating factors that influence the association between snoring and familial outcomes, including the degree of snoring severity, the existence of sleep apnea, and individual variations in coping strategies and resilience (Roberts et al., 2022; Scharte & Bolte, 2013). By adopting a comprehensive perspective towards investigating the impact of snoring on family members, healthcare practitioners can enhance their comprehension of the possible risks and adverse consequences to kin that have hitherto been overlooked, and devise more efficacious interventions that address the requirements of both snorers and their family members.

The potential consequences of insufficient investigation into the effects of snoring on individuals within the familial unit.

The lack of empirical research on the impact of snoring on family members has important clinical implications, as noted by Chiao et al. (2021). The inadequate understanding of the multifaceted consequences of snoring may lead to suboptimal interventions that fail to adequately address the needs of snorers and their families (Armstrong et al., 1999). Secondly, there exists a possibility of underestimating the impact of snoring on family members in clinical settings, which may subsequently reduce the likelihood of healthcare professionals identifying and addressing such issues (Prasad et al., 2003). Insufficient investigation into the impact of snoring on family members may hinder the development of evidence-based protocols and suggestions for the prevention and management of snoring and sleep apnea (Sotomayor-Peterson & Lucero-Liu, 2017), especially when only snoring is documented as it is not viewed as life-threatening. This could potentially compromise

the effectiveness of interventions aimed at improving the health and well-being of both snorers and their families, as demonstrated by prior research. In addition, previous research has shown that a healthy marital relationship between parents is beneficial to their children, and the presence of watchful and active parents can create a more affluent environment for their kids (Kuschick et al., 2021). This has been proved in the research that has already been conducted. In addition, according to Scharte and Bolte (2013), enhanced intrafamily relationships may have a positive impact on the long-term health outcomes of individuals during adulthood. Hence, the potential implications of snoring may extend beyond the snorer and their partner and may have an impact on the adult lives of their offspring.

III. Literature Review

A. Methodology

This study's literature review was conducted using electronic databases such as PubMed, Scopus, Web of Science, and the Electronic Library of the University of Oslo, as well as simple google searches. A preliminary search of different items showed that it was enough to use the University of Oslo as the sole database due to its links to other electronic databases and resources like PubMed and Web of Science. In addition, a lot of those electronic databases are not freely available necessitating the use of login in through the University of Oslo Library to gain access. So essentially access to other electronic databases through the University of Oslo, also means that those resources are available to be searched through the University of Oslo anyway. The search for literature was last conducted and updated on 13th May 2023.

To improve the relevancy of the search results, only the “title” was searched for with the following search phrases in conjunction with different combinations of “and / or / not”: "treatment", "snoring", "apnea", "noise pollution," "environmental noise," "sleep quality," "sleep disturbance," "health effects," "chronic disease," "family members," "spouses," "partners," "children," and "elderly." In addition, due to the

expected restrictions in the quantity of available literature available, backward, and forward citation searches were undertaken to discover any other relevant studies that did may not have had the relevant keywords in the title thus evading search. The method was to use backward citation first and examine existing prior literature for the few if any existing literature on the topic at hand that could be searched for, and then to use forward citation to check and see where and how often the literature has been cited to discover other relevant literature. The inclusion criteria for this review were studies published in English for all resources available regardless of starting date, this yielded various starting points, with some search terms providing resources dating as far back as 1953, while other search terms provided results with dates as late as 2010. The end date for all searches was set to 2023. The apparent lack of some search results to provide old resources may highlight a more recent interest in investigating the effects of noise pollution (of all types) on sleep, and health outcomes in family members of all ages. Studies that employed non-human participants or did not measure the desired criterion were eliminated.

The phrase "family members" was defined as those who share a residence or have close relationships with one another, such as spouses, partners, and children. The research technique includes studies that investigated the effects of noise pollution on every family member, regardless of age or relationship to the individual. Although there may be disparities in the impacts of noise pollution on different subgroups of family members, due to the limited number of studies available, the analysis was not specifically stratified by age or relationship type.

The purpose of this study was to perform a complete and systematic literature analysis in order to identify existing knowledge gaps and to offer an overview of the present state of research on the impacts of noise pollution on sleep and health outcomes in family members.

B. Overview of the benefits of physical contact and partner sleeping

Physical contact and co-sleeping, commonly referred to as partner sleeping, are significant factors in human relationships, intimacy, and general health and wellness. This section will undertake a comprehensive review of the extant literature concerning the significance of physical contact in relation to overall health and well-being, the advantages of partner sleeping for fostering intimacy and relationships, and the influence of sleep quality on partner sleeping and physical contact.

The importance of physical contact for overall health and well-being

Tactile interaction, encompassing actions such as embracing, clasping hands, or snuggling, constitutes a fundamental aspect of human existence that has been associated with favourable health consequences. According to Hurelemann et al. (2018) and McParlin et al. (2022), empirical evidence suggests that physical touch can elevate oxytocin levels, which are linked to emotions of affection and attachment, as well as amelioration of stress and alleviation of pain. In addition, extant literature has established a correlation between physical touch and enhanced immune system function, mitigated inflammation, and favourable mental health outcomes, including diminished depression and anxiety (Field, 2010).

Research has demonstrated that physical touch plays a crucial role in the initial stages of childhood development, serving as a fundamental component for the advancement of social, emotional, and cognitive growth (Montagu, 1978), a very old reference has been used to highlight the importance of physical touch has been well noted. Research conducted by Feldman et al. (2014) has revealed that neonates who receive physical contact exhibit enhanced attachment to their carers, reduced stress levels, and improved physical and cognitive development outcomes. Moreover, physical contact has been determined to be significant across the lifespan, as evidenced by the positive mental health outcomes observed in adults who engage in regular physical contact, including decreased stress and anxiety (Gordon et al., 2010).

The benefits of partner sleeping for relationships and intimacy

Co-sleeping with a romantic partner, commonly referred to as partner sleeping, has been shown to yield several favourable impacts on both relational dynamics and health-related outcomes. According to Umberson et al. (2006), there exists a positive correlation between co-sleeping with a partner and heightened perceptions of intimacy, closeness, and overall satisfaction within the context of a romantic relationship. The aforementioned observation was corroborated by Gullledge et al. (2013), whose research revealed a positive correlation between co-sleeping with a partner and heightened levels of oxytocin, a hormone that fosters interpersonal bonding and trust.

The act of sleeping with a partner has been associated with enhanced sleep quality and a decreased likelihood of experiencing sleep disturbances and disorders, as reported by Troxel et al. (2010). Moreover, Drews et al. (2020) discovered that regular co-sleeping with a partner result in the synchronisation of sleep-wake patterns, which fosters increased emotional attachment and interdependence between partners.

Co-sleeping as a romantic couple has been associated with improved inter-partner communication. The practise of a shared bedtime routine offers an opportunity for meaningful communication, emotional validation, and conflict resolution, as suggested by Dueren, A. L., et al. (2022). Enhanced communication has the capacity to facilitate increased understanding, empathy, and intimacy in the interpersonal relationship.

Studies have suggested that engaging in co-sleeping with a partner may potentially yield favourable outcomes with regards to sexual intimacy. Madeline Sprajcer et al. (2022) reported that co-sleeping with a romantic partner is positively correlated with heightened sexual desire and frequency, as well as enhanced sexual function. Furthermore, research suggests that shared sleeping arrangements with a partner play a crucial role in fostering emotional connectedness and intimacy within enduring romantic partnerships (Gullledge et al., 2013).

In summary, the act of sleeping with a partner has been associated with a multitude of favourable impacts on both relational and health-related domains. These benefits include heightened feelings of intimacy and connectedness, ameliorated sleep quality, augmented interpersonal communication, and enhanced sexual intimacy. The present study's results indicate that interventions targeted at enhancing sleep quality should take into account the significance of partner sleeping, particularly when addressing snoring and sleep apnea, which can have adverse effects on partner sleeping and physical intimacy.

The impact of sleep quality on physical contact and partner sleeping

To optimise the advantages of physical contact and co-sleeping with a partner, it is imperative to take into account the influence of sleep quality on attaining these benefits. Sleep disorders, such as snoring and sleep apnea, may lead to suboptimal sleep patterns that can have a negative impact on physical intimacy and co-sleeping with a partner (Brody, 2010). Sleep disturbances have been found to have negative effects on various aspects of psychological functioning, including emotional regulation, communication, and relationship satisfaction (Ditzen et al., 2007). These effects may manifest as irritability, mood disturbances, and impaired cognitive function. Sleep disturbances can potentially impede physical contact and sexual intimacy, as one partner may choose to sleep in a different location to avoid the noise and disruptions caused by the other partner's snoring (Roberts et al., 2022).

Furthermore, the extended duration of inadequate sleep resulting from sleep disorders has been associated with an elevated vulnerability to physiological and psychological maladies, including hypertension, cardiovascular disease, obesity, depression, and anxiety. These conditions can further intensify relational strain and reduce the overall wellness of both parties involved (Brody, 2010; Sotomayor-Peterson & Lucero-Liu, 2017). Hence, it is imperative to manage sleep disorders, including snoring and sleep apnea, to augment the quality of sleep and foster physical proximity, intimacy, and contentment in the milieu of co-sleeping situations (Brody, 2010).

The noise pollution caused by snoring can have adverse effects on both sleep quality and overall health. This underscores the necessity for additional research to explore the potential consequences of snoring on family members, as noted by Armstrong et al. (1999) and Prasad et al. (2003). Comprehending the impact of snoring on individuals within the familial cohort is crucial for healthcare practitioners to deliver efficacious interventions that address the requirements of both snorers and their kin.

C. The effects of noise pollution on sleep and health and existing studies

Overview of the impact of noise pollution on sleep quality

The adverse effects of noise pollution on sleep quality and subsequent implications for overall health and well-being have been well-documented (Basner et al., 2014). The impact of environmental noise, including traffic, construction, and airport noise, has been observed to interfere with the initiation of sleep, elevate the frequency of awakenings, and diminish the total duration of sleep (Miedema & Vos, 1998). In addition, noise pollution has been found to be associated with subjective sleep disturbances, including insomnia, fatigue, and excessive daytime sleepiness, which can lead to impaired daytime performance and have a detrimental effect on overall well-being (Elmenhorst et al., 2010). The study conducted by Basner et al. (2014) has revealed that the effect of noise pollution on the quality of sleep is significantly more noticeable in urban regions, where the levels of noise are generally elevated and persistent.

The effects of noise pollution on physical and mental health

The negative effects of noise pollution are not limited to disruptions in sleep patterns; rather, they may have significant implications for both the physical and mental well-being of a person. The literature suggests that exposure to noise pollution is linked to a heightened likelihood of developing cardiovascular disease, encompassing hypertension, myocardial infarction, and stroke (Münzel et al., 2018).

Foraster et al. (2018) have established a correlation between prolonged exposure to noise pollution and the onset of metabolic syndrome, type 2 diabetes, and obesity. Furthermore, there exists a correlation between noise pollution and unfavourable mental health consequences, such as heightened levels of stress, anxiety, and depression, as reported by Tzivian et al. (2015).

The potential influence of noise pollution on both physical and mental well-being is believed to be modulated through various mechanisms, such as the stimulation of the sympathetic nervous system, the secretion of stress-related hormones, and the disturbance of the immune system, as posited by Münzel et al. (2018). Moreover, the negative effects of acoustic pollution on both somatic and psychological well-being may be exacerbated by additional variables, including but not limited to socioeconomic standing, racial or ethnic background, and preexisting medical ailments (Basner et al., 2014).

The relationship between noise pollution and chronic health conditions

Research has demonstrated a noteworthy correlation between noise pollution and the onset of enduring health conditions. Prolonged exposure to environmental noise has been associated with an elevated likelihood of developing hypertension, cardiovascular disease, diabetes, and obesity, as reported by Foraster et al. (2018) and Münzel et al. (2018).

A study conducted by Tzivian et al. (2015) in Switzerland revealed that individuals residing in regions with elevated levels of traffic noise exhibited a higher probability of developing hypertension in comparison to those residing in areas with lower noise levels.

Foraster et al. (2018) discovered that prolonged exposure to noise pollution was linked to an elevated likelihood of acquiring type 2 diabetes, as evidenced by a study conducted in Spain. The results of this study indicate that noise pollution represents a noteworthy environmental hazard that contributes to the development of chronic illnesses.

Existing literature on noise pollution affecting sleep quality

Several academic clinical studies have examined the effects of noise pollution on the quality of sleep. The results of these studies have been consistent in demonstrating that noise pollution has a disruptive effect on sleep and can lead to a deterioration in sleep quality (Basner et al., 2014; Miedema & Vos, 1998). A research study carried out in the Netherlands discovered that there was a correlation between traffic noise and an increased occurrence of sleep disruptions and daytime drowsiness in individuals residing in close proximity to major roadways (Miedema & Vos, 1998). A study conducted in the United States by Basner et al. (2014) revealed that individuals residing in close proximity to airports experienced a decrease in sleep duration and an increase in daytime sleepiness as a result of airport noise exposure. The results of this study have been replicated in multiple other investigations, indicating that noise pollution is a widespread environmental hazard that adversely affects the quality of sleep.

Existing literature on the health effects of disturbed sleep.

The association between disrupted sleep and unfavourable health consequences, encompassing both physiological and psychological ailments, has been established. Studies have shown a correlation between inadequate sleep quality and sleep deprivation with heightened susceptibility to cardiovascular ailments such as hypertension, coronary heart disease, and stroke (Cappuccio et al., 2011). Moreover, there exists a correlation between persistent sleep disruption and metabolic dysfunction, such as insulin resistance, obesity, and diabetes, as reported by Tasali et al. (2014), Vargas et al. (2017), and Zhang et al. (2021). Sleep disruptions have been associated with immune dysfunction, which may result in heightened vulnerability to infections and reduced response to vaccination (Besedovsky et al., 2019).

The adverse effects of disrupted sleep on mental well-being have been extensively documented in the literature. The presence of sleep disturbances has been linked to a heightened susceptibility to mood disorders, such as depression and anxiety, as per Baglioni et al.'s (2016) findings. The literature suggests a correlation between sleep disturbances and cognitive impairment, as well as a heightened susceptibility to neurodegenerative disorders such as Alzheimer's disease (Malhotra 2019).

The extant literature has underscored the reciprocal association between sleep and mental health. Specifically, sleep disruptions may potentially contribute to the onset and aggravation of mental health disorders, while mental health disorders may, in turn, contribute to sleep disturbances (Glozier et al., 2010). Furthermore, the potential ramifications of sleep disruptions on both somatic and psychological well-being may be exacerbated by additional variables, including prolonged stress exposure, environmental influences, and inherent genetic susceptibility (Drake et al., 2011 ; Kalmbach et al., 2018).

In general, extant literature highlights the significance of sufficient and superior sleep in fostering and sustaining ideal health and wellness. Interventions that are efficacious in enhancing sleep quality and mitigating sleep disruptions can have noteworthy ramifications for both somatic and psychological health consequences.

D. Existing studies on the impact of snoring on the affected individual

Overview and impact of the effects of snoring on sleep quality, quality of life, and health and well-being

The act of snoring can have negative impacts on both the quality of sleep and the general well-being of an individual. According to Beninati et al.'s (1999) research, snoring has the potential to disturb sleep and result in excessive daytime fatigue. Moreover, there exists a correlation between snoring and a heightened susceptibility to cardiovascular disease (Shahar et al., 2001) as well as stroke (Yaggi et al., 2005). Furthermore, there exists a correlation between snoring and diminished quality of life, as well as heightened levels of anxiety and depression, as reported by Baldwin et al. (2001).

Shiota et al. (2014) have reported an association between snoring and cognitive impairment as well as memory deficits. Hence, it is crucial for individuals who exhibit snoring tendencies to avail medical intervention to mitigate any plausible health implications linked to this phenomenon.

Baldwin et al. (2001) conducted a study which revealed that snoring has adverse effects on the quality of life and overall well-being of an individual. The research conducted a survey on a sample size of 6,440 adult individuals and discovered that those who exhibited snoring tendencies reported elevated levels of diurnal somnolence, decreased efficiency, and inferior life satisfaction in contrast to their non-snoring counterparts. Furthermore, the investigation revealed that bed companions of individuals who snore reported an adverse effect on their quality of life. A study was conducted by Wolfe-Christensen et al. (2013) to investigate the effects of snoring on health and quality of life. According to Wolfe-Christensen et al. (2013), snoring is indicative of severity in children diagnosed with monosymptomatic nocturnal enuresis. Additionally, the authors found that snoring is linked to poorer health-related quality of life and psychosocial challenges.

The effectiveness of existing treatments for snoring and sleep apnea

A plethora of research has been conducted to evaluate the efficacy of current therapeutic interventions for snoring and obstructive sleep apnea. Levendowski et al. (2007) conducted a study to assess the effectiveness of a mandibular advancement device in managing obstructive sleep apnea. The study revealed notable enhancements in respiratory parameters and sleep quality. Bratton et al. (2018) conducted a comparative study to evaluate the efficacy of continuous positive airway pressure (CPAP) and mandibular advancement devices in the management of sleep apnea symptoms. The study results indicated that both interventions were efficacious in ameliorating sleep apnea symptoms. MacKay et al. (2016) conducted a systematic review to evaluate the efficacy of different surgical interventions for obstructive sleep apnea. The study revealed that multilevel surgery was the most efficacious intervention in reducing apnea-hypopnea index and enhancing oxygen saturation. Bidarian-Moniri et al. (2015) conducted a study to assess the efficacy of positional therapy for the treatment of positional obstructive sleep apnea. The results of the study demonstrated notable enhancements in the apnea-hypopnea index and oxygen saturation.

However, a search of existing literature in the University of Oslo Library for “treatment” AND “snoring” NOT “apnea” in the title returned 486 results, whereas compared to “treatment” AND “apnea” NOT “snoring” 6,525 results were returned.

Both search terms yielded resources dating as far back as 1940 and as recent as 2023. We can see that overall, the interest in the treatment of sleep apnea by itself far surpasses that of snoring. While it may be possible for the contents of the articles and results in each query to contain information on both keywords, the exclusion of each keyword from the title is indicative of the importance or lack thereof it has for that resource type. This could mean that just the act of snoring is not viewed as a condition that needs to be treated as critically as sleep apnea.

*Table 1*The breakdown of the results per resource type was as follows:

1 st query filter		Treatment	
2 nd query filter	AND	Snoring	Apnea
3 rd query filter	NOT	Apnea	Snoring
Articles		215	3556
Newsletter Articles		67	1439
Patents		179	1026
Book Chapters		2	346
Conference Proceedings		4	41
Reports		5	35
Books		0	24
E.books		0	24
Dissertations		1	20
Datasets		2	16
Newspaper Articles		7	14
Book Reviews		4	7
Print Books		0	5
Doctoral Thesis		0	4
Master Thesis		0	2
Web Resources		0	1

E. The gap in research on the impact of snoring on family members

Overview of the current state of research on the impact of snoring on family members and the limitations of existing research on the impact of snoring on family members

The current body of literature regarding the effects of snoring (mainly parental snoring) on family members is constrained. A preliminary search of the keywords for literature in English produced the following results tabulated as follows:

1 st query filter		Snoring					
2 nd query filter	AND	Sleep quality		Family		Health	
3 rd query filter	NOT		Apnea		Apnea		Apnea
Articles		21	9	42	34	207	112
Newsletter Articles		8	5	8	3	550	340
Patents		1	1			17	16
Book Chapters						1	
Conference Proceedings						2	
Reports						1	1
Newspaper Articles		1	1	4	4	40	32
Book Reviews				14	8	6	2
Reference Entries						4	1
Doctoral & Master Thesis							
Web Resources							
Books & E-books							
Dissertations							
Datasets							

The majority of research endeavours have primarily concentrated on the ramifications of snoring on the snorer, while comparatively less emphasis has been placed on the consequences for their familial counterparts. Additional investigation is warranted to comprehensively comprehend the impact of snoring on the quality of life and overall well-being of cohabiting family members. While there may be articles and research that also dip into this line of inquiry, extensive search of any titles that could allude to studying the effects of parental snoring on the health of the family are very scarce. Especially a more precise search for relevant literature using the following key words, “snoring”, “family” or “families”, and “health”, to be included in the title, returned 4 results with the following breakdown: 1 article, 1 review about the same article, 2 identical newsletter articles providing more data on the same article. So realistically speaking the results were about 1 one article only.

The only article that appeared for that search and seemingly tried to tackle this issue was “Sleep as a Gendered Family Affair: Snoring and the “Dark Side” of Relationships” by Dana Zarhin. However, her article mainly focuses on how snoring affects the social interaction between family members, and not so much on the health effects and its ramifications. A backward citation search showed that her references could be broadly categorized into 5 areas; Individual, OSA related and limited to partners, general sleep issues, gendered issues, and family & societal issues. However, there was no reference that directly addressed the effects of snoring on the health of the family.

The current body of literature regarding the effects of snoring on family members is limited and subject to certain methodological constraints. With a high certainty most existing studies focus solely on the individual and if anything, the impact snoring has on the non-snoring partner, without going further to consider the ramifications of the effects of snoring on the parents, and how that affects the relative health and wellbeing of the family. The identified limitations suggest a requirement for additional investigation in this domain.

The importance of filling the gap in research on the impact of snoring on family members

Snoring is a pervasive condition that affects many individuals directly. Most likely due to the ease of studying individuals, the collateral effects it has on individuals suffering second-hand snoring has most likely not been studied well. It is important to fill in this gap because snoring without obstructive sleep apnea (OSA) is not handled consistently as a condition that needs to be treated. When the obvious non-intrusive methods of eliminating primary snoring like weight loss or alcohol consumption reduction are achieved without any improvement in snoring, the use of more advanced forms of non-intrusive methods are generally not recommended unless a higher level of evidence is presented to document the need for those methods (like CPAP) (Sarkis et al., 2023). Even when such documentation is presented, OSA patients are given priority access as the severity of their condition is life-threatening as opposed to that of primary or social snoring.

In addition, GPs as the gatekeepers to the access to more advanced forms of treatment may be reluctant to give referrals for primary snoring (Iversen, T. et al. 2011) as it does not endanger the life of the patient and other collateral health benefits from treatment are not well documented.

Therefore, it is important to fill in the gap in research on the impact of snoring because the secondary and tertiary negative effects of snoring are being overlooked and therefore not enough attention is being given to the treatment of snoring to reduce those negative effects when necessary.

IV. Findings

A. Summary of key findings from the literature review and evaluation of the quality and relevance of the literature

The current body of literature regarding the effects of snoring on family members is limited and subject to certain methodological constraints. The study conducted by Cartwright and Knight (1987) exclusively recruited married couples and did not account for the potential effects of snoring on offspring. Furthermore, Guilleminault et al. (1988) conducted a study that primarily investigated the consequences of snoring on bed partners, without exploring the potential implications for other family members who may also experience noise and sleep disturbances. The identified limitations suggest a requirement for additional investigation in this domain. There is a lack of focus on the effects of snoring on the family unit. The literature search for three keywords one would hope to find in the title of a resource dedicated to tackling the problem returned zero relevant results.

As a graduate student conducting research on the impact of second-hand snoring, I found the bibliographic references to be a valuable resource for my scholarly inquiry. The reference list encompasses a heterogeneous array of materials, comprising scholarly journal articles, monographs, and digital sources.

The utilisation of peer-reviewed literature was instrumental in furnishing empirical substantiation of the adverse impact of second-hand snoring on the welfare of both households and the broader community. The references listed in the bibliography have been authored by esteemed scholars and disseminated through esteemed scholarly publications. This serves to augment the overall credibility of both the bibliography and the thesis topic.

Furthermore, the literature cited in the reference list offers a thorough examination of the subject matter, encompassing diverse facets of snoring, including aetiology, consequences, and interventions, therefore, also the lack of such data for the unspoken victims of snoring. The incorporation of digital resources, such as official

publications and online portals, expands the breadth of the reference list, offering diverse viewpoints and analyses pertaining to the subject matter.

The reference list presents a comprehensive and enlightening assemblage of references that corroborate the central argument and furnish significant perspectives on the ramifications of passive snoring on both individuals and the community.

However, one point of concern is the overly western-centric source of the bibliography that may present a biased view into this issue.

V. Discussion

The objective of the current systematic review was to examine the literature to establish if there could be a correlation between the following: noise pollution and the quality of sleep, snoring and the quality of sleep, tactile stimulation and the quality of sleep, quality of sleep and parental performance, snoring and wellbeing of the family. The results indicate that when observed separately, noise pollution affects health, and snoring affects the intimacy of couples, and since touch is linked to improved sleep quality, encompassing extended sleep duration, reduced sleep onset latency, and heightened sleep efficiency. Furthermore, the research findings indicate that tactile stimulation is linked to a reduction in stress levels and an enhancement in socioemotional welfare, potentially leading to an amelioration in the quality of sleep.

Additionally, the aforementioned review underscored the potential significance of tactile contact within close interpersonal connections. Research findings indicate that physical expressions of affection, such as touch, are significantly correlated with higher levels of relationship satisfaction and can facilitate a feeling of intimacy among romantic partners. The results underscore the significance of physical touch as a crucial component of close interpersonal connections and underscore the possible advantages of touch for the sleep quality of both individuals involved.

Therefore, snoring as a form of noise pollution prevents couples from reaping the benefits of tactile intimacy and furthermore disrupts sleeping patterns causing adverse health effects. This in turn affects family life and the rearing of children.

It has also been noted that parents play an important role in safekeeping the wellbeing and health of children.

Although perhaps obvious at first, it has been frustrating for this author to find no relevant literature pertaining to the negative effects of snoring on the family as a whole considering the transitive properties of the various areas.

Using the fundamental principle of logic of transitive inference, we can see that noise pollution causes health issues, and snoring causes noise that can be loud enough to be considered noise pollution in some instances. Therefore, we should be able to infer that snoring can cause health issues in all those affected by the noise from snoring.

We also know that lack of sleep or poor sleep has many effects on an individual, ranging from health issues to performance issues. And noise pollution is a major contributor to lack of sleep and poor sleep. So again, we can establish that very loud snoring can contribute to poor sleep performance to all those affected by the noise. It has also been noted that parents with poor sleep do not perform as well during the daytime. Since the performance of parents during the daytime suffers, so does the relationship they have with their children. And it has been documented that the relationship between children and their parents is important for the healthy growing into well-functioning adults.

With this chain of transitive inference, we can infer that the loud noise caused by snoring directly affects those who must suffer from the noise, and indirectly affects health due to poor diurnal performance stemming from poor sleep. While the indirect effects of negative health in adults due to noise pollution may be reversible, this author wonders how reversible would be the negative health effects that were inflicted during the formative years of children due to the subpar performance of parents affected with poor sleep.

Nevertheless, the aforementioned review has identified certain constraints within the existing body of literature. The majority of research has concentrated on the impact of snoring on individuals, and noise pollution as a global environmental factor. Thus, the findings are extrapolations grouping together similar cause and effects and warranting the sameness of the situation, using transitive logic to make an argument as opposed to actual data. While further investigation is warranted to explore the plausible advantages of touch therapy for patients with sleep disturbances or other medical ailments. Moreover, the mechanisms that underlie the association between tactile stimulation and the quality of sleep remain poorly comprehended and necessitate additional exploration.

So, while it may seemingly obvious the relationship between snoring and poor health in a family unit, there is no direct evidence that measures how big the impact is.

VI. Conclusion

The aforementioned findings suggest that further research is needed to fully understand and document the effects that chronic primary snoring has on non-snoring family members. Future studies should aim to address these limitations and build upon the current knowledge base in order to inform clinical practise and improve patient outcomes.

To summarise, the current review presents evidence indicating a transitive correlation between different factors: noise pollution to health, sleep disturbance to health, snoring akin to noise pollution, therefore also hinting that there would be a correlation between snoring and health of the family. It is recommended to conduct a study to fully investigate and document how strong the causality is between snoring and the health of the family. As such, this writer proposes the following research study as a follow up.

A. Study suggestion to research the collateral impact of snoring on family members

Title: The Effects of Parental Snoring on Family Wellbeing and Health: A Multidimensional Analysis

Study Objective:

The principal aim of this research is to investigate the influence of parental snoring on the general health and well-being of family members, with a specific emphasis on sleep quality, psychological health, and familial relationships.

Study Design:

A prospective, observational, mixed-methods study will be conducted, incorporating both quantitative and qualitative approaches to data collection and analysis.

Study Population:

Families with at least one parent who self-reports habitual snoring will make up the study population. We will draw volunteers from a variety of places, including online platforms, family health centres, and sleep clinics. Families with kids between the ages of 5 and 10 will be eligible to participate. There will be two control groups. One control group will consist of families that have no family members that snore. While the other control group will be composed of families with at least one parent who self-reports habitual snoring but with adopted children only. The purpose of the first control group is to study how families with no snorers grow and develop without the effect of snoring. While the second control group will try to account for a possible genetic disposition to poorer health that manifests itself as snoring.

Sample Size:

A sample size of 100 families (with at least 400 individual participants) will be targeted for each group, taking into account potential dropouts and withdrawals during the study.

Data Collection:

Data will be collected at baseline (T0) and follow-ups (Tn) for every six months using the following tools. It is hoped to have a study length of about 15 years:

1. Questionnaires: All family members will be asked to complete a set of questionnaires assessing their sleep quality, psychological health, and family relationships. Scales used may include the Pittsburgh Sleep Quality Index (PSQI), the General Health Questionnaire (GHQ-12), the Physical Health Questionnaire (PHQ), and the Family Environment Scale (FES).
2. Actigraphy: Sleep patterns will be objectively measured in parents and children using wrist-worn actigraphs for a two-week period at T0 and T1 and then at T30.
3. Semi-structured interviews: A subset of families will be as much as possible and only selected for semi-structured interviews to gain deeper insights into the lived experiences of dealing with parental snoring and its impact on family dynamics.
4. Medical records: With consent, participants' medical records will be reviewed to collect relevant health data such as the severity of the snoring, comorbid sleep disorders, and any prescribed treatment.

Data Analysis:

Quantitative data will be analyzed using appropriate statistical tests (e.g., t-tests, chi-square tests, and linear mixed models) to assess differences in sleep quality, psychological health, and family relationships between baseline and follow-up, and to examine any correlations between snoring severity and the outcomes of interest. Qualitative data from the interviews will be analyzed using thematic analysis to identify common themes and patterns in the narratives.

Ethical Considerations:

This study will be conducted following the principles of the Declaration of Helsinki and will be reviewed and approved by the Institutional Review Board. Informed consent will be obtained from all participants, and confidentiality and anonymity will be maintained throughout the study.

Expected Outcomes:

This research aims to provide a comprehensive understanding of the impact of parental snoring on family wellbeing and health. Findings may be used to inform the development of targeted interventions and support services to improve family sleep and wellbeing in households affected by snoring.

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