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Review

Puffing away your sleep: A scoping review of E-Smoking and sleep disruption

Yousef D. Alqurashi

Department of Respiratory Care, College of Applied Medical Sciences, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia

Abstract. *Background and aim:* E-cigarettes are becoming increasingly popular, raising concerns about their effects on health, particularly sleep. However, the impact of e-cigarette use on sleep health is not well explored. Therefore, the aim of this scoping review was to systematically map existing evidence on the impact of e-cigarette use on sleep health, identify research gaps, and provide recommendations for future studies. *Methods:* A scoping review of literature in PubMed and Web of Science was conducted using PRISMA guidelines. The focus was on studies that examined the impacts of e-cigarette use on sleep quality, duration, and disturbances. The review focused on identifying mechanisms and pathways linking e-cigarette use to sleep disruptions. After screening 1073 references, 48 studies met the inclusion criteria. *Results:* The evidence strongly suggests that e-cigarette use disrupts sleep quality and duration, primarily through the physiological effects of nicotine on the central nervous system. Users consistently report poorer sleep quality, shorter sleep duration, and increased disturbances, particularly in REM sleep, compared to non-users. Chronic nicotine exposure desensitizes receptors such as dopamine and norepinephrine, potentially exacerbating cognitive decline in users experiencing both nicotine exposure and sleep deprivation. *Conclusion:* E-cigarette use has significant adverse effects on sleep, warranting urgent attention. Recommendations include longitudinal research to establish causal relationships and to investigate population-specific effects, such as those observed in adolescents and individuals with preexisting sleep disorders. This review underscores the need for Comprehensive research and stricter regulations to mitigate this emerging public health issue. (www.actabiomedica.it)

Key words: e-cigarette, nicotine, e-smoking, sleep disruption, ENDS

Introduction

Sleep is indispensable for human health and well-being, playing a critical role in neurocognitive function, emotional regulation, and cardiovascular and metabolic health (1). During sleep, the body engages in numerous essential processes, including detoxification, cellular repair, tissue regeneration, and protein synthesis. Sleep is a fundamental component of human health, crucial for maintaining both physical and emotional well-being (2). Sleep disturbance can have a detrimental consequence on the human body. Chronic sleep deprivation can disrupt the intricate mechanisms of the human body, increasing the risk of mortality. These disruptions can contribute to a range of chronic diseases, including cardiovascular disease, mental health disorders, diabetes, and cancer (3). Given the significant impact of poor sleep on health, it is essential to identify and address the factors that influence sleep quality to promote human well-being and prevent disease. Environmental factors, such as stress, lifestyle choices, sleep habits, alcohol consumption, and smoking, can have detrimental effects on sleep (4). E-cigarettes, also known as electronic nicotine delivery

systems (ENDS), have gained popularity since their introduction to the market in 2004. They were introduced as an alternative to traditional tobacco smoking. E-cigarettes (ECIGs) or ENDS are electronic devices that are battery operated to vaporize a solution known as e-juice or e-liquid, which contains nicotine, flavors, and chemicals (5). Although introduced in 2004, ECIGs started gaining more and more popularity in the last decade. The first ever E-cigarette idea came in 1963 when a patent for a "smokeless non-tobacco cigarette" was registered by Herbert A. Gillbert. Cigarette smoking is the leading cause of various chronic diseases, so the objective of this invention was to give an alternative to smoking tobacco. After 40 years, Hon Lik, a Chinese pharmacist, invented the E-cigarette in its modern form in 2003, and E-cigarettes were then introduced in the market (6). Since then, they have evolved rapidly in the last decade, and this evolution is followed by the increase in ECIG consumption in different countries. The first generation of E-cigarettes were shaped like tobacco products such as cigars and pipes. Later, they were transformed into pens and USB sticks. It has three main components: cartridge, battery, and atomizer. E-cigarette operates by heating a liquid (e-liquid or q-juice) that contains nicotine, vegetable glycerin, propylene glycol, and flavors (7). Although the components labeled on the packaging may differ from the components that are converted after a chemical analysis, the variance can come from the contents of nicotine (8). Nowadays, almost 8,000 new flavors of E-cigarettes have been introduced into the market (9). Different companies offer newer and diverse flavors like fruity, chocolate, and bubblegum to convince buyers to reach for E-cigarettes. The e-liquid is contained in a refillable cartridge, and the power source of the E-cigarette is a lithium battery. When a user inhales, the atomizer heats the e-liquid which is vaporized and converted to aerosol. The aerosol is then inhaled into the lungs of the user, and the nicotine and other components of the e-liquid enter the bloodstream (10). This process is known as vaping. In 2004, the first generation of E-cigarettes was first introduced in the Chinese market. As E-cigarettes were highly promoted throughout the internet, they were introduced in the USA in 2007 (9). A massive part of the ECIG market is conducted online, and most of the e-cigarette companies have their own websites. Approximately 30-50% of total E-cigarette sales are carried out on the Internet. E-cigarettes are advertised as cheaper, less risky, and alternative to traditional cigarettes and are marketed as a smoking cessation aid (11). In 2009, sales of E-cigarettes were around 20 million dollars, and this value has doubled each year since then (9). The rising use of E-cigarettes is concerning for public health. There is growing evidence that E-cigarettes have potential negative impacts on the human body, including respiratory disorders and heart problems. As sleep issues are aggravated by cigarette smoking, the use of E-cigarettes may negatively influence sleep quality. Sleep deprivation is a concerning public health issue, which led the Centers for Disease Control in the United States to declare it a "public health problem"(12). The percentage of people who don't get enough sleep increased by 1% since 2013, from 35.8% in 2013 to 36.8% in 2022 (13). The cause of sleep deprivation in smokers has been associated mainly with lifestyle factors such as workload stress, 24/7 lifestyle, electronic usage, substance consumption, and smoking. The latter has been associated with multiple sleep disorders in numerous studies. It has also been associated with decreased total sleep time, increased sleep latency, and, in turn, less sleep efficiency. The mechanism behind the association between sleep disturbances and smoking has been attributed mainly to nicotine, the primary pharmacoactive ingredient in cigarettes(14). If nicotine is indeed the primary culprit behind sleep disruption caused by traditional cigarettes, we might expect to see a similar association with E-cigarettes (ENDS) given their delivery of nicotine. As the usage of e-smoking is rising, particularly in adolescents and young adults, it is critical to understand the effect of E-cigarette usage on sleep. The field of e-smoking is relatively new, and its potential effects on sleep remain underexplored and diverse. The purpose of this review is to comprehensively map the available literature and understand the breadth and scope of research in this area, rather than addressing a narrowly focused research question. Therefore, the aim of this scoping review was to systematically map existing evidence on the impact of e-cigarette use on sleep health, identify research gaps, and provide recommendations for future studies.

Methods

This scoping review was registered in Open Science Framework (OSF) (https://doi.org/10.17605/OSF.IO/HYC9D). A comprehensive analysis of the literature review was conducted by using databases such as PubMed, Google Scholar, and Scopus. This review of the literature was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). This search strategy was designed to get a wide range of data on E-cigarettes and their effects on overall sleep. The keywords used for this study included "E-cigarettes", "e-smoking", "ENDS", "ECIGs" "vaping", "nicotine", "poor sleep", "sleep disruption", "sleep disorders", and "health issues". The review also focuses on the following framework:

Population: E-cigarette users of all ages, with an emphasis on adolescents and individuals at higher risk of sleep disturbances.

Concept: The impact of e-cigarette uses on sleep health, examining both physiological and behavioral mechanisms and their broader implications.

Context: Public health and clinical settings where e-cigarette use is prevalent, with a focus on understanding implications for healthcare and policy.

Inclusion criteria

- Studies published in the last 10 years (2014 onwards) were considered.
- The research mainly focused on e-smoking and sleep health
- Studies having human participants of any age group
- Only articles written in English were chosen

Exclusion criteria

- Duplicate publications of the same study were not selected
- Articles from non-peer-reviewed sources like editorials, commentaries, and opinion pieces were excluded
- Research conducted solely on animals was not considered

Out of the 1073 studies retrieved from our search, 48 studies met the inclusion criteria (Figure 1).

Results

Unlike conventional cigarettes, E-cigarettes do not operate by combustion, so they are considered safer alternatives. However, E-cigarettes are not regulated and are mass-produced by many manufacturers. The components of the E-cigarette are not fully disclosed, and some recent studies have found harmful substances such as formaldehyde, propanol, acetaldehyde, acetone, and carcinogenic nitrosamines were present in the E-cigarette components (15,16). The amount of nicotine in the ECIG cartridges is up to 36 mg/mL, and the concentrations can be changed according to the user. Previously, acute nicotine poisoning was mentioned as a potential risk factor for E-cigarette health (17). Contact with excessive levels of nicotine, such as in E-cigarette cartridges, can occur due to inhalation, accidental ingestion, or direct contact with skin while handling the cartridges. Exposure to high levels of nicotine can be lethal for the human body, especially for some specific groups such as pregnant women, children, and nursing mothers (18). E-cigarettes deliver lower amounts of carcinogens than traditional cigarettes. The quantity of carcinogens is reduced, but they can still cause adverse effects even at low concentrations with repeated use. E-cigarettes release tobacco-specific nitrosamine and NNK (4-(N-methyl-N-nitrosoamino)-1-(3-pyridyl)-1-butanone, also known as nicotine-derived nitrosamine ketone) (19). NNK exposure increases in a non-linear manner, and it indicates that smaller amounts of NNK can raise the risk of cancer (19,20). An experimental study was conducted to evaluate the impact of short-term usage of E-cigarettes on normal epithelial cells and head and neck squamous cell carcinoma cell lines. It revealed a reduction in the viability of cell lines and

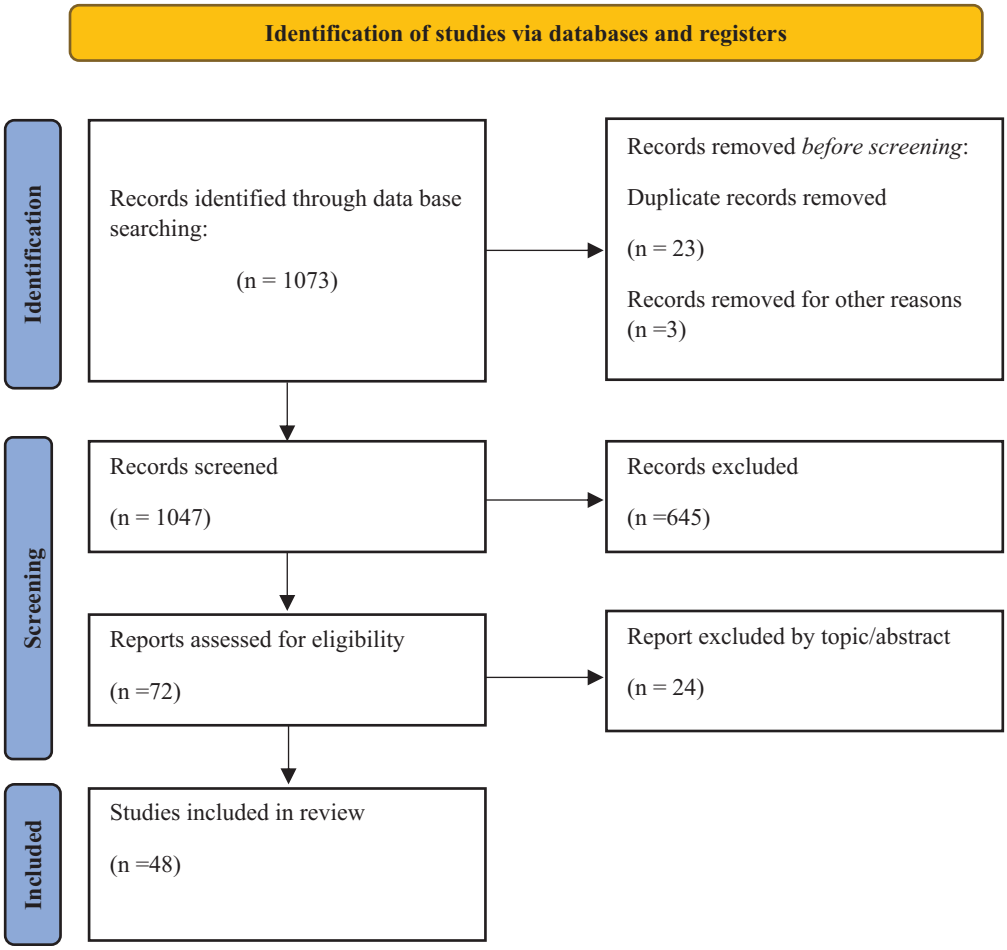

Figure 1. CONSORT diagram showing how the studies were identified, screened, and included in the final analysis.

clonogenic survival as compared to untreated controls. After a week passed, the researchers indicated breakage of DNA and cell death, and these findings suggest the carcinogenic effects of E-cigarette usage (21). E-cigarettes also have detrimental effects on the cardiovascular system. Although the effect of nicotine on the heart is debatable, the impact of other aerosol particles, such as aldehydes and propanols, are directly linked to cardiovascular disorders (22). The effect of these constituents is non-linear, and low amounts of these particles can increase cardiovascular risks. E-cigarette smokers also experience oxidative stress and increased inflammatory mediators like traditional smokers. Platelet activation, adhesion, and aggression are induced by e-smoking, and these triggers are linked with a high risk of cardiovascular diseases (23). The use of E-cigarettes is also related to a shift in the autonomic nervous system towards sympathetic dominance, which is associated with an increased risk of cardiac events (24). An increased risk of myocardial infarction is an indication of the biological stresses that using E-cigarettes induces on the cardiovascular system (25). E-cigarette usage is also associated with respiratory tract issues. Aerosols from E-cigarettes can contribute to mitochondrial stress, DNA damage, and inflammation of lung cells (26), can worsen asthma symptoms, and potentially can harm the lungs and neurocognitive function (26). The use of E-cigarette aerosol also exposes users to highly reactive free radicals. Its usage also doubled the risk of chronic bronchitis among US high school students (27). Similarly, the high usage of E-cigarettes among Korean students

showed an increased diagnosis of asthma (28). Recently, lipoid pneumonia is a rare condition that occurs when lipids, or fat-based substances, enter the lungs, causing inflammation and tissue damage. Traditionally, this condition has been associated with the inhalation of oil-based laxatives or accidental aspiration of oily substances. However, recent case reports have highlighted that vaping can also cause lipoid pneumonia. Vaping cartridges contain oil-based substances that are heated by a heating element to produce vapor. This vapor may contain microscopic, aerosolized lipid droplets, which, when inhaled, can accumulate in the lungs and trigger the inflammatory process characteristic of lipoid pneumonia. Several case studies have demonstrated an association between the use of e-cigarettes and the development of this condition, underscoring the potential respiratory risks associated with vaping (29–31).Nicotine concentrations in e-cigarettes and traditional cigarettes vary significantly. While e-cigarettes offer users the flexibility to adjust nicotine levels from 0 to 45 mg/mL, traditional cigarettes typically contain 11.9-14.5 mg of nicotine per cigarette (32) (33). In e-cigarettes nicotine levels can be adjusted according to the user preference. Both types of cigarettes can negatively impact sleep quality, but traditional cigarettes may pose a more consistent risk due to the presence of additional harmful substances like tar and tobacco (34). E-cigarette users exhibit a wide range of usage patterns, which can lead to diverse nicotine consumption profiles. In contrast, traditional cigarette smokers generally follow a more consistent usage pattern. The fixed nicotine content in traditional cigarettes contributes to their greater health risks, including sleep disruption. Despite the ability to adjust nicotine levels, e-cigarette users can still develop nicotine dependence and experience sleep disturbances. Chronic exposure to nicotine, whether from traditional cigarettes or e-cigarettes, can have detrimental consequences for sleep and overall health. (34) (35). Traditional cigarette components include tar, tobacco, nicotine, and carbon monoxide, and it is combusted to produce smoke, while E-cigarettes do not operate via combustion. Traditional cigarettes are well-documented to cause severe health problems, including cancer, heart disease, lung diseases, and chronic sleep disruption. While e-cigarettes are generally considered less harmful than traditional cigarettes, they are not risk-free and can pose significant health risks, such as those mentioned above (34). A recent study examined the association between e-cigarette and traditional cigarette use and the incidence of stroke. The findings revealed that traditional cigarette smokers had a significantly higher prevalence of stroke (78%) compared to e-cigarette users (1.5%)(36). However, E-cigarette smokers experienced an early onset of stroke (median age: 48 years) compared to traditional smokers (median age: 59 years). While traditional cigarette smokers have a higher overall prevalence of stroke, some studies suggest that e-cigarette use may also be associated with an increased risk (36). Nicotine (Scientific name: 3-(1-Methylpyrrolidin-2-yl)) is a naturally occurring alkaloid found in tobacco leaves. It stimulates the Central nervous system and cardiovascular system as it is a neurologically active substance (33). Nicotine is a major component of an E-cigarette, and it can be highly addictive (37). While the effects of nicotine can vary among individuals, it typically leads to heightened alertness, wakefulness, and sometimes vivid imagination. These effects can contribute to sleep disturbances. When taken at nighttime, it might induce insomnia and can cause high alertness, which can result in delayed sleep. Nicotine is also linked to obstructive sleep apnea and irregular circadian rhythms (38). Emerging evidence suggests a potential association between e-cigarette use and OSA. For instance, a cross-sectional study found that dual users of e-cigarettes and traditional cigarettes have a higher likelihood of developing OSA compared to non-smokers. This risk is particularly pronounced among females, individuals with obesity, and those with low physical activity levels. Additionally, nicotine, a primary component in e-cigarettes, is known to contribute to inflammation in the nose, throat, and lungs, which can exacerbate OSA symptoms(39). Nicotine makes its way to the CNS (Central Nervous System) and PNS (Peripheral nervous system) by adhering to nAChRs (Nichotinic AcetylCholine Receptors). These receptors are made up of five α and β subunits. In the brain, various subtypes of these receptors α4β2, α3β4 and α7 are present (40). When nicotine binds with nAChRs, it stimulates these receptors, which leads to the release of different neurotransmitters such as dopamine, glutamate, serotonin,

nor-epinephrine, and γ-aminobutyric acid (GABA) (33). When these neurotransmitters are released, the brain functioning is affected. Dopamine and nor-epinephrine release causes arousal and heightened alertness, leading to disrupted sleep. Serotonin and GABA typically promote relaxation and calm sleep. The stimulation caused by nicotine can disrupt this function and create sleeping issues. When nicotine is consumed in excessive amounts, it can desensitize the nAChRs; this action affects cognitive functioning and hamper the neurotransmitter balance, which affects sleep patterns (40). Nicotine affects the memory of an individual primarily through its interaction with nACHRs in the brain. Neurotransmitters like dopamine, glutamate, serotonin, nor-epinephrine, and γ-aminobutyric acid (GABA) are key players in cognitive functioning such as learning, memory, and attention (40). The cognitive effects of nicotine exhibit an "inverted J dose-response" in which a low amount of nicotine can enhance memory while a higher dosage can impair cognitive performance (41). The α7 and β2 nACHRs subtypes play a key role in cognitive functions; α7 receptors are involved in synaptic plasticity in the hippocampus and prefrontal regions (38), while β2 receptors influence working memory and attention (42). Dopamine is also influenced by nicotine, and in return, it enhances memory and attention. While nicotine can improve cognitive performance in smokers, excessive usage of nicotine can result in cognitive impairment. Desensitization and frequent upregulation of previous nACHRs disrupt normal cognitive functioning, which leads to the impairment of memory, attention, and learning (40). Although the impacts of stimulants on sleep other than nicotine are not completely known, researchers have found that Vitamin E acetate, added in a self-made e-liquid, can cause respiratory issues. Coughing, chest pain, and throat irritation were linked to the use of E-cigarettes, and such factors can cause sleep disturbances (5). Exposure to aerosol from E-cigarettes has adverse effects on the respiratory system. The development of chronic obstructive pulmonary disease is associated with prolonged exposure to acrolein, which is formed by heating propylene glycol and glycerin in e-liquids. This results in chronic pulmonary inflammation, excessive mucus production, damaged lung tissue, and neutrophil inflammation and can interfere with sleep quality and duration (43). Numerous studies have been conducted to investigate the potential link between e-cigarette use and sleep disturbances. While the exact relationship between sleep and e-smoking remains unclear, researchers have made significant efforts to determine whether e-cigarette use can disrupt sleep patterns. A cross-sectional study using the Health and Nutrition Examination Survey (NHANES) 2015-2016 found a significant association between e-cigarette use and sleep disturbances. Participants who used e-cigarettes were more likely to experience sleep disruptions compared to non-users. This association persisted even after accounting for sociodemographic factors and variables from the Unifying Energy Allocation Model of Sleep. The study concluded that nicotine intake, rather than other components of e-cigarettes, was the primary factor contributing to sleep disruptions (5). So et al. (2021) (33) suggested that frequent use of E-cigarettes can affect daytime functioning, sleepiness and tiredness. E-smokers can face difficulties in managing daytime alertness and performance, and to overcome this lethargy, they tend to use E-cigarette devices excessively. This study also suggested that an insufficient amount of sleep may lead to higher usage of combustible cigarettes as a redemptory measure. A study by Brett et al. (2020) examined the relationship between e-cigarette use and sleep quality among college students. Using the Pittsburgh Sleep Quality Index (PSQI), the researchers found that regular e-cigarette users were more likely to experience chronic sleep problems than non-users. E-cigarette users reported poor sleep quality, disrupted sleep, and higher rates of sleep medication use. The study's findings suggest that e-cigarette use, even occasional use, can contribute to sleep disturbances (44). A study by Kianersi et al. (2021) investigated the impact of e-cigarette use on sleep. The researchers found that both current and former e-cigarette users were more likely to experience sleep deprivation compared to individuals who had never used e-cigarettes. Daily e-cigarette users exhibited the highest prevalence of insufficient sleep. The study suggested that nicotine, a component of e-cigarettes, may contribute to sleep disturbances by affecting neurotransmitters involved in sleep regulation (45). Kianersi et al. highlighted the

dose-response relationship, where excessive use of e-cigarettes correlates with an increased risk of sleep issues. E-cigarette use has become increasingly prevalent among adolescents, with many reporting regular or frequent use. Riehm et al. (2019) (46) examined the association between e-cigarette use and sleep disturbances among adolescents. Adolescents who reported using e-cigarettes within the past year were more likely to experience sleep-related problems. The findings suggested that nicotine may be a contributing factor to these sleep disturbances. Another study by Merianos et al. (2021) (47) examined the relationship between sleep disturbances and excessive e-cigarette use among adolescents. The researchers found a consistent association between insufficient sleep and e-cigarette usage. Frequent e-cigarette use was correlated with a high prevalence of sleep disturbances among study participants. Recent studies have increasingly focused on the potential health risks associated with dual use, which involves the simultaneous use of traditional cigarettes and e-cigarettes. To further explore this issue, Kang et al. (2021) investigated the impact of dual use on depression and sleep quality. Their findings revealed that individuals who use both cigarettes and e-cigarettes (dual users) reported significantly higher depression scores, and lower sleep quality compared to those who only use cigarettes or neither. This suggests that dual use can have a particularly detrimental impact on mental health and sleep. The study highlights the importance of addressing the combined harms of traditional and electronic cigarettes (48). A recent study examined the relationship between vaping, sleep quantity, and adolescent suicidality. The findings revealed that both vaping and insufficient sleep were associated with higher odds of suicide attempts. However, the negative impact of vaping on suicidal thoughts was less pronounced among students who slept more than seven hours on school nights, suggesting that adequate sleep may mitigate some of the detrimental effects of vaping on mental health. This highlights the importance of addressing both vaping and sleep issues as strategies for preventing adolescent suicidality (49). Based on the evidence presented in the studies reviewed, there is a strong association between e-cigarette use and sleep disturbances. E-cigarette users are more likely to experience poor sleep quality, disrupted sleep, and sleep deprivation compared to non-users. Nicotine, a primary component of e-cigarettes, is believed to play a significant role in these negative effects, as it can disrupt neurotransmitters involved in sleep regulation. Additionally, the combined use of traditional cigarettes and e-cigarettes (dual use) has been shown to have a particularly detrimental impact on both mental health and sleep. These findings underscore the importance of addressing the harms of e-cigarettes to promote better sleep and overall well-being, especially among adolescents who are at a higher risk for substance use and its associated consequences. It is necessary to develop and implement strategies to improve sleep quality among e-smokers as it is evident from various studies that e-smoking can directly affect sleep conditions. Nicotine intake quantity and frequency should be gradually reduced to minimize the effects of nicotine on sleep quality. Nicotine replacement therapies (NRTs) like gums or patches at low doses assist in nicotine dependence and promote better sleep. NRTs provide a controlled dosage of nicotine without the harmful effects of e-smoking and traditional smoking (50). Moreover, families should encourage their children who are excessively using e-cigarettes with high nicotine levels to quit. Offering moral support from family members is crucial for individuals who are addicted to e-smoking. Providing emotional support regarding the challenges of quitting nicotine, creating a positive environment to reduce stress conditions and desires associated with nicotine usage, and promoting healthy alternatives can divert attention from smoking (47). Behavioral therapies for chronic sleep conditions, such as Cognitive Behavior Therapy (CBT-I), are highly effective for treating insomnia and other sleeping disorders as they address the psychological and behavioral characteristics that promote poor sleep (51). CBT-I focuses on changing the negative sleep practices to promote healthy sleep. This kind of therapy can be helpful for e-smokers as it helps to identify and change pessimistic thoughts related to sleep, make healthy sleep cycles, and introduce relaxation techniques. CBT-I helps to overcome the causes of sleep issues, which generally show improvements in sleep within two to three weeks of starting the therapy. CBT-I involves control of stimulus, sleep deprivation, and training for relaxation (52)(53). once

e-smokers started the CBT-I, they might notice explicit behavioral changes, such as having the ability to function better when depressed. This therapy should be considered for e-smokers as it can significantly improve the quality of sleep, reduce sleep disruption caused by nicotine usage, and contribute to overall physical and mental health, and this will lead to a healthy lifestyle (51). Good and comfortable sleep environments such as dark and quiet rooms, pre-sleep routine practices like reading, avoiding stimulant intake before sleep, or taking a warm bath can promote a safe and sound sleep can all have positive impact on sleep health (53). Different relaxation techniques help to reduce anxiety and distress and improve sleep quality. Meditation and exercises can help to relax the e-smoker, ultimately leading to a good and sound sleep (52). Mindfulness meditation involves acceptance of present experiences; it helps in the improvement of stress, anxiety, and negative thoughts that can disturb sleep. Breathing exercises can calm the central nervous system (CNS), alleviate physical stress, and contribute to relaxation (53). Regular physical activity like walking and swimming, managing stress through yoga practices, and journaling down thoughts can improve sleep. These techniques can be very helpful for E-cigarette users to release stress, and relaxation is promoted, which eventually can contribute to restorative sleep. From the current review, it is evident that E-cigarette usage is involved in sleep disruption. However, this review has several limitations. It mostly focuses on adolescents and young adults, so studies regarding older ages who use E-cigarettes must be considered. Most studies investigated the relationship between e-cigarette use and sleep disturbances were cross-sectional and retrospective research by designs. Therefore, experimental studies should be conducted. Longitudinal studies are of special importance to comprehend the association of E-smoking with sleep and long-term impacts (47). Inconsistent E-cigarette usage patterns such as frequency, duration, and intake of nicotine are documented inconsistently in every study. The analysis of such studies can make it difficult to comprehend the effects of e-smoking on sleep. While research has primarily focused on the effects of nicotine on sleep, the potential impact of other e-liquid components remains largely unexplored. Further investigation is needed to assess the effects of these additional substances on sleep patterns. Future studies should focus on the need for more standardized research to precisely evaluate the effects of E-cigarette usage on sleep disruption.

Conclusion

The findings from these studies consistently demonstrate a strong association between e-cigarette use and sleep disturbances. E-cigarette usage has a significant negative impact on sleep health, despite being perceived as a safer alternative to traditional cigarettes. Nicotine, a primary component of e-cigarettes, is believed to be a key factor in these sleep disruptions, affecting the central nervous system and interfering with sleep patterns. Excessive nicotine intake can also contribute to other health problems, including cardiovascular and respiratory issues. To address sleep-related issues associated with e-cigarette use, strategies such as cognitive-behavioral therapy for insomnia (CBT-I), good sleep practices, and meditation can be effective. Further research and stricter regulations on electronic cigarettes are essential to fully understand and mitigate their impact on sleep health

Ethical Approval: This article does not contain any studies with human participants or animals performed by the author.

Conflict of Interest: The author of this study certify that he has no affiliations with or involvement in any organization or entity with any financial interest in the subject matter or materials discussed in this manuscript.

Authors Contribution: YA have conducted all the work related to this manuscript.

Declaration on the Use of AI: Chat GPT4o was used only to rephrase or improve clarity of some sentences. Examples of Prompt used were “Rephrase this sentence” or “make this sentence clearer”. AI was not used to generate original sentences or produce ideas.

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Correspondence:
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Yousef Alqurashi, PhD
Respiratory Care Department, College of Applied Medical Sciences, Imam Abdulrahman Bin Faisal University, Dammam 34221, Saudi Arabia
E-mail: ydalqurashi@iau.edu.sa (YA)
ORCID ID: 0000-0003-3263-0237