



**THE IMPACT OF LONELINESS ON ELECTRONIC CIGARETTE USE AMONG ADOLESCENTS: A SCOPING REVIEW**

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**ABSTRACT**

Loneliness is increasingly recognised as a significant factor affecting adolescent health behaviours. Recent studies have indicated a potential link between feelings of loneliness and the rise in electronic cigarette (e-cigarette) usage among teenagers. This scoping review aims to systematically explore and synthesize the literature regarding the influence of loneliness on e-cigarette use among adolescents, identifying gaps and areas for further research. A comprehensive literature search was conducted following the PRISMA-ScR guidelines. Databases such as PubMed, Scopus, and Web of Science were utilised to locate peer-reviewed articles published in the last 10 years. Inclusion criteria focused on studies discussing loneliness and e-cigarette use among adolescents. Data extraction involved thematic analysis to identify recurring themes and outcomes. Preliminary findings indicate a positive correlation between feelings of loneliness and increased e-cigarette consumption in adolescents. The review highlights various psychosocial factors, including peer influence and mental health, contributing to this trend. The findings underscore the importance of addressing loneliness as a critical determinant in the promotion of e-cigarette use among youth. Future interventions should consider targeting social connectedness to mitigate the impact of loneliness on health behaviours.

Keywords: adolescents; electronic cigarettes; health behaviour; loneliness; psychosocial factors; scoping review

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**INTRODUCTION**

Loneliness, often described as the distressing feeling of being isolated or disconnected from others, has increasingly become a significant public health concern across various age groups, especially adolescents. Adolescence is a critical stage of development marked by extensive physical, emotional, and psychological changes. During this phase, social relationships gain heightened importance, and adolescents start to form their identities, navigate peer dynamics, and seek acceptance and belonging within social circles (Sala et al., 2024). However, feelings of loneliness can disrupt these experiences, leading to adverse effects on mental and physical health that can extend into adulthood if unaddressed. While loneliness has traditionally been associated with older adults, emerging research shows that it is alarmingly prevalent among young people, and its effects can be particularly detrimental during the teenage years when individuals are most vulnerable to emotional fluctuations and social pressures (Berg-Weger & Morley, 2020).

Adolescence is a sensitive period where social connections play a significant role in developing one's self-esteem and overall sense of self. For young people, social rejection, exclusion, or even the perception of social inadequacy can trigger intense feelings of loneliness. In the digital age, this issue is compounded by social media, where adolescents are exposed to carefully curated portrayals of others' lives, which can foster feelings of inadequacy and further social isolation. While social media offers a platform for connection, it can also be a source of comparison and perceived rejection, especially when adolescents

experience "fear of missing out" (FOMO) or receive fewer interactions on their posts than their peers (Khalaf et al., 2023; Orben et al., 2020). Loneliness in adolescence is associated with numerous negative health outcomes, including anxiety, depression, and a general decline in life satisfaction. Prolonged loneliness may even influence physiological responses, such as elevated cortisol levels, weakened immune function, and higher susceptibility to stress. Adolescents who experience loneliness may seek ways to cope with or numb these painful feelings, sometimes turning to maladaptive behaviors like substance use (Mushtaq et al., 2014).

The rise of e-cigarettes as a popular substance among adolescents can be attributed to various factors. These include aggressive marketing by manufacturers, social acceptance among peer groups, and the appeal of flavors and devices that seem modern and technologically advanced. E-cigarettes are often marketed on social media platforms frequented by young people, creating a culture that normalizes vaping and frames it as a desirable, even stylish, activity. This form of social acceptance can be particularly influential during adolescence when peer approval is highly valued (Cao et al., 2020). Studies show that adolescents may start using e-cigarettes due to curiosity or peer influence, but over time, the behavior can become habitual or even addictive, particularly with products containing high levels of nicotine. The effects of e-cigarettes on adolescent health are concerning, as nicotine addiction at a young age can lead to cognitive impairments, impact emotional regulation, and increase susceptibility to other forms of substance use in later life (Grebenu, 2020; Struik et al., 2023).

The connection between loneliness and substance use, including e-cigarettes, has become a growing area of interest in public health research. Adolescents who experience loneliness may turn to e-cigarettes as a coping mechanism to alleviate their emotional distress. The act of vaping may provide temporary relief, distracting them from their feelings of isolation or helping them fit into peer groups where e-cigarette use is prevalent. However, this form of relief is often short-lived and may contribute to a cycle of dependency, where adolescents feel compelled to vape more frequently to sustain the temporary alleviation of their loneliness. On the other hand, the habitual use of e-cigarettes may exacerbate loneliness in the long term. As adolescents become more reliant on vaping, they may isolate themselves from non-vaping peers or engage in more solitary behaviors to conceal their habit, thereby intensifying feelings of social isolation. This creates a paradox where e-cigarette use both mitigates and reinforces loneliness, leading to a potentially harmful cycle that can be difficult to break (Jones & Salzman, 2020).

Loneliness and e-cigarette use in adolescents are often influenced by broader mental health issues, including anxiety, depression, and low self-esteem. Adolescents struggling with mental health challenges may be more likely to experience loneliness, as their conditions can hinder their ability to engage in fulfilling social interactions. These individuals may turn to e-cigarettes as a form of self-medication or as a means of integrating into social groups, which can further entrench their isolation. Resilience, or an adolescent's capacity to cope with stress, plays a critical role in this dynamic; those with lower resilience levels may be more susceptible to both loneliness and substance use (Riehm et al., 2019). Furthermore, family dynamics and the presence (or lack) of supportive relationships can significantly affect these behaviors. Adolescents from households with low levels of parental support or open communication may be more prone to loneliness and, in turn, substance use, as they lack the social resources needed to navigate their emotional struggles (Trucco, 2020). Adolescents who experience high levels of family support and positive peer interactions may be better equipped to resist the lure of e-cigarettes, even if they experience loneliness.

Concurrently, we are witnessing a surge in electronic cigarette (e-cigarette) use among adolescents, a trend that has sparked intense concern among parents, educators, and healthcare professionals. Marketed initially as a safer alternative to traditional tobacco, e-cigarettes have quickly gained popularity among young people due to factors like appealing flavors, accessibility, and social media promotion. Despite claims of being "safer" than traditional smoking, e-cigarettes pose significant health risks, such as respiratory issues, cardiovascular impacts, and potential long-term addiction. The allure of e-cigarettes for teenagers is often embedded in social context such as peer influence, curiosity, and sometimes even as a coping mechanism for underlying emotional issues, including loneliness. The question arises: could there be a potential link between the rise of loneliness in adolescents and the increased prevalence of e-cigarette usage? How does loneliness influence an adolescent's propensity to engage in e-cigarette use? Does the act of using e-cigarettes impact feelings of loneliness, potentially creating a reinforcing cycle? Are there common risk factors, such as mental health challenges, low self-esteem, or lack of parental support, that contribute to both loneliness and substance use behaviors among adolescents? Therefore, the objective of this study is to analyze the relationship between loneliness and e-cigarette use in adolescents.

## **METHOD**

This scoping review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) guidelines (Tricco et al., 2018) to ensure transparency, replicability, and comprehensiveness in investigating the relationship between loneliness and e-cigarette use among adolescents, as shown in Figure 1. Following these guidelines, the review incorporated a structured approach from study selection to data synthesis, focusing on key themes such as mental health impacts, psychosocial factors, and social influences on adolescent substance use behaviors. The review involved a systematic search across three major academic databases: PubMed, Scopus, and Web of Science. These databases were selected for their extensive coverage of biomedical, psychological, and social sciences research, which is pertinent to the intersection of adolescent health, social behavior, and substance use. The search spanned a 10-year period (2014-2024), chosen to capture the rapid rise in e-cigarette popularity and evolving literature on adolescent loneliness and related behaviors. The search terms included combinations such as: "loneliness" AND "electronic cigarettes" AND "adolescents" OR "youth" Additional terms like "vaping," "social isolation," "e-cigarette usage," and "mental health" were included to broaden the search and ensure comprehensive coverage of the topic. Filters were applied to: 1) Age Range: 12 to 19 years (to focus on adolescents). 2) Language: English-only articles. 3) Publication Type: Peer-reviewed articles only.

Studies in grey literature, such as conference proceedings and dissertations, were excluded, given their limited peer review standards. Studies were included if they met the following criteria: 1) Population: Adolescents aged 12 to 19 years. This age group is particularly relevant for understanding the developmental and social challenges that contribute to loneliness and substance use behaviors. 2) Focus: The study had to examine the relationship between loneliness and e-cigarette use. Studies focusing solely on either loneliness or e-cigarette use without examining the interplay between these factors were excluded. 3) Study Design: A range of study designs, including cross-sectional studies, longitudinal cohort studies, and qualitative research, were included to capture diverse perspectives. Although experimental designs were less common, they were included when relevant. 4) Publication Type: Only peer-reviewed journal articles were included to maintain a high standard of reliability and validity. Studies that focused exclusively on traditional cigarette use or on age groups outside the specified range were excluded unless they provided age-specific results relevant to adolescents. For each included study, the following key data were extracted and organized

into a scoping review results table: 1) Study Design and Methodology: Details of each study’s design (e.g., cross-sectional, longitudinal) and data collection methods (surveys, interviews), aligned with the type of research conducted (e.g., systematic review, viewpoint, or qualitative study). 2) Sample Characteristics: Information such as sample size, demographics (age, gender), and geographical location. For example, Riehm et al. (2019) utilized a sample of 7,702 adolescents in a longitudinal design to examine mental health factors linked to e-cigarette initiation. 3) Measures of Loneliness and E-Cigarette Use: Details on how loneliness and e-cigarette use were measured in each study, such as self-reported loneliness scales (e.g., UCLA Loneliness Scale) and metrics of e-cigarette use (frequency, initiation age, and dependency). Specific focus was given to studies measuring e-cigarette use as a coping mechanism for loneliness. 4) Key Findings and Statistical Results: Extraction of major findings relevant to the link between loneliness and e-cigarette use. Studies often reported effect sizes, correlation coefficients, odds ratios, and statistical significance levels. For example, studies such as Trucco (2020) summarized psychosocial factors impacting adolescent substance use, while Jones & Salzman (2020) focused on the societal trends contributing to the vaping epidemic among adolescents. 5) Identified Themes: Common themes such as mental health correlations (e.g., depression and anxiety), social influence and peer pressure, and coping mechanisms were cataloged. For example, Cao et al. (2020) discussed health risks associated with e-cigarette use, specifically lung injury, in the context of adolescent health and social environments.

Although formal quality assessment is not mandatory for scoping reviews, a basic quality screening was applied to ensure reliability and relevance: 1) Clarity of Objectives: Whether the study clearly stated its research questions and aims. 2) Methodological Rigor: Evaluation of the appropriateness of study design, sample size, and data collection methods. 3) Relevance of Findings: Assessment of whether the study addressed the interplay between loneliness and e-cigarette use among adolescents specifically. 4) Studies with significant methodological limitations or that lacked clear relevance to the review’s research question were noted but included to provide a comprehensive understanding of the topic.

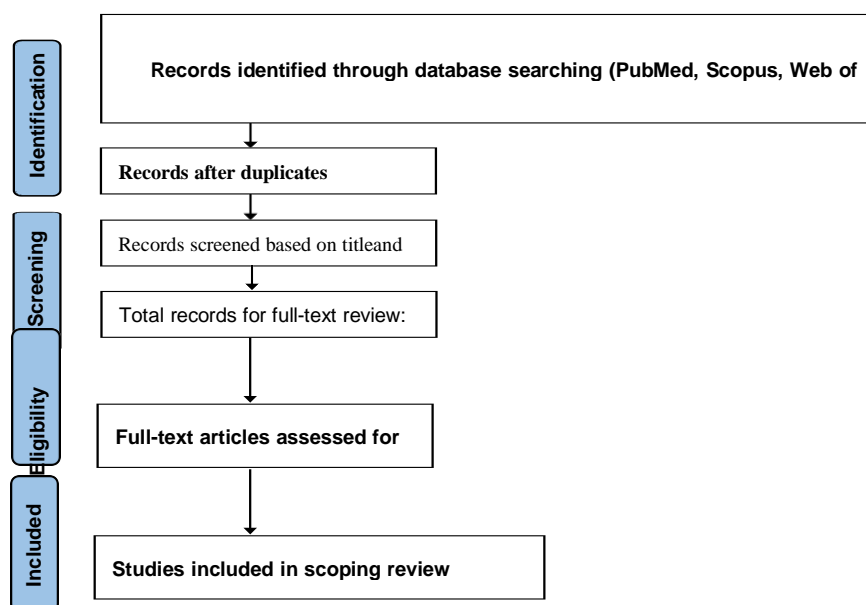


Figure 1. PRISM Flowchart

After data extraction, a thematic synthesis was conducted to identify commonalities, contradictions, and gaps in the literature. The synthesis focused on: 1) Identifying Common Risk Factors: Shared risk factors such as mental health issues (e.g., anxiety, depression), peer influence, and social media usage were analyzed across studies. 2) Understanding the Nature

of the Relationship: Exploration of whether loneliness contributes to e-cigarette use initiation or if e-cigarette use worsens feelings of loneliness. This analysis aimed to capture potential bidirectional or cyclical relationships. 3) Categorizing Loneliness as a Coping Mechanism: Findings that framed e-cigarette use as a coping mechanism for loneliness were compared with those suggesting that e-cigarette use might isolate users further. 4) Mapping Research Gaps: Identification of gaps, such as differences in e-cigarette use and loneliness experiences across demographics (e.g., socioeconomic status, gender) and the need for more research on the long-term social and psychological effects of e-cigarette use.

## **RESULT**

The review identified a total of 9 studies that met the inclusion criteria, providing a comprehensive view of current research on the link between loneliness and e-cigarette use among adolescents (Table 9). A thematic analysis of these studies uncovered several recurring themes, which offer insights into the ways loneliness, psychosocial factors, mental health, and intervention opportunities interact with adolescent e-cigarette use. The results are presented in the following key themes:

### **Increased E-Cigarette Usage Among Lonely Adolescents**

A consistent finding across the reviewed studies was a positive association between higher levels of loneliness and increased likelihood of e-cigarette use. Adolescents experiencing loneliness often reported using e-cigarettes as a means to cope with their negative emotions and feelings of isolation. This behavior was interpreted as an escape mechanism, where e-cigarettes served to alleviate, even temporarily, the distress associated with feeling socially disconnected. In several studies, lonely adolescents also indicated that e-cigarette use offered a sense of control or agency over their circumstances, particularly when they felt that other aspects of their social life were beyond their control. This temporary relief, however, tended to reinforce the behavior, leading to repeated use and potential nicotine dependency. Some studies highlighted that adolescents who perceived themselves as outcasts or who struggled with social acceptance were particularly susceptible to using e-cigarettes as a coping tool. This group expressed that vaping provided a temporary solution to their feelings of exclusion or unworthiness, underscoring a need for understanding e-cigarette use as a maladaptive response to loneliness.

### **Psychosocial Factors: Peer Pressure and Social Acceptance**

Peer influence and the desire for social acceptance emerged as critical mediating factors in the relationship between loneliness and e-cigarette use. Many studies reported that adolescents, especially those feeling socially isolated, were more likely to engage in e-cigarette use to integrate into peer groups where vaping was a popular or socially accepted activity. Loneliness heightened adolescents' sensitivity to peer pressure, making them more likely to engage in behaviors that they perceived as a means to gain social acceptance or prevent further exclusion. The studies noted that for many lonely adolescents, e-cigarettes provided a tangible way to bond with peers. For example, some participants mentioned that sharing e-cigarettes or vaping together offered a sense of connection and a shared experience, which they found lacking in other areas of their lives.

This social bonding aspect of vaping was particularly evident in studies conducted in settings where vaping was normalized or glamorized through social media. The findings also revealed in which lonely adolescents viewed e-cigarette use as a social equalizer, helping them blend in with peers who also used e-cigarettes. Interestingly, this dynamic was not limited to friendships but also extended to romantic relationships, where some adolescents reported using e-cigarettes as a means to increase their attractiveness or compatibility with potential

partners. However, the reliance on e-cigarette use for social acceptance often deepened the sense of loneliness, especially if these relationships proved superficial or short-lived.

### **Mental Health Correlates: Anxiety, Depression, and Substance Use**

Another significant theme was the association between loneliness and mental health issues, particularly anxiety and depression. Many studies highlighted that loneliness was a strong predictor of poor mental health outcomes, and these issues, in turn, contributed to the likelihood of substance use, including e-cigarette use. Adolescents experiencing high levels of anxiety or depression were found to have a higher risk of initiating or increasing e-cigarette use, often as a form of self-medication to manage their emotional pain. Several studies emphasized a bidirectional relationship between loneliness, mental health, and e-cigarette use.

For instance, adolescents who used e-cigarettes reported a temporary improvement in mood or reduction in anxiety, which reinforced the behavior. However, as the effects wore off, they often experienced heightened feelings of loneliness and worsening symptoms of anxiety or depression, leading to a vicious cycle of reliance on e-cigarettes for relief. The reviewed studies also highlighted co-morbidity between loneliness and mental health issues, indicating that adolescents who experienced one were more likely to experience the other. This co-morbidity heightened the risk of e-cigarette use as an attempt to manage multiple negative emotions. Adolescents who struggled with both loneliness and depression reported feeling caught in a pattern where e-cigarette use offered short-term relief but deepened their overall sense of isolation and dependence.

### **Intervention Opportunities: Enhancing Social Support and Positive Peer Relationships**

Given the findings on the role of loneliness, peer pressure, and mental health in e-cigarette use, several studies suggested intervention strategies focused on enhancing adolescents' social support systems and promoting positive peer relationships. These studies argued that addressing the root causes of loneliness, such as poor social skills or limited access to supportive networks, could serve as a protective factor against e-cigarette use. One promising intervention approach discussed in multiple studies was the promotion of positive peer connections through school and community-based programs. These programs aimed to foster a sense of belonging and inclusivity, encouraging adolescents to form healthy relationships and engage in group activities that do not involve substance use.

Some intervention programs mentioned included social skills training, resilience-building exercises, and peer mentoring initiatives that paired lonely adolescents with supportive peers, helping them build confidence and coping mechanisms for social challenges. Another notable suggestion was the implementation of mental health support services within school environments, particularly targeted at adolescents at risk of loneliness. By providing resources such as counseling, peer support groups, and workshops on mental health awareness, schools could offer lonely adolescents healthier coping strategies for managing their emotions and finding positive outlets for social interaction. Studies also highlighted the importance of family involvement in reducing loneliness and e-cigarette use among adolescents. Parents and guardians were encouraged to foster open communication, actively engage in their adolescent's social life, and encourage healthy friendships. Several studies suggested that family-based interventions could be particularly effective for younger adolescents, helping them establish a strong support network at home before they enter more challenging social environments.

Table 1.  
Included Scoping Review Results Analysis

Author(s)	Year	Title	Journal	Key Findings	Sample Size	Study Design	Themes/Factors Explored
Sala, A., Porcaro, L., & Gómez, E.	2024	Social Media Use and Adolescents' Mental Health and Well-Being: An Umbrella Review	<i>Computers in Human Behavior Reports</i>	Identified risks and mitigation proposals related to social media's impact on adolescents' mental health. Key risks include social comparison and addiction.	Not specified	Systematic review and meta-analysis	Social Media Use, Mental Health, Adolescent Well-Being
Berg-Weger, M., & Morley, J. E.	2020	Loneliness in Old Age: An Unaddressed Health Problem	<i>Journal of Nutrition, Health &amp; Aging</i>	Highlights loneliness as a significant issue for older adults, impacting both physical and mental health, with high prevalence.	Not specified	Editorial	Loneliness, Mental Health, Aging
Orben, A., Tomova, L., & Blakemore, S. J.	2020	The Effects of Social Deprivation on Adolescent Development and Mental Health	<i>The Lancet Child &amp; Adolescent Health</i>	Examines how social deprivation impacts adolescent development, emphasizing consequences for mental health and social skills.	Not specified	Viewpoint	Social Deprivation, Adolescent Development, Mental Health
Khalaf, A. M., et al.	2023	The Impact of Social Media on the Mental Health of Adolescents and Young Adults: A Systematic Review	<i>Cureus</i>	Identifies both risks (e.g., cyberbullying) and potential benefits (e.g., self-esteem) of social media on mental health.	Various	Systematic Review	Social Media, Mental Health, Adolescents
Cao, D. J., et al.	2020	Review of Health Consequences of Electronic Cigarettes and the Outbreak of Electronic Cigarette, or Vaping, Product Use-Associated Lung Injury	<i>Journal of Medical Toxicology</i>	Discusses the health risks associated with e-cigarettes, including respiratory and cardiovascular concerns, especially among adolescents.	Not specified	Review	E-Cigarettes, Lung Injury, Adolescent Health
Grebenau, M.	2020	A Review of Teen and Adolescent Attitudes Regarding E-cigarettes and Their Relevance to Education	<i>Journal of Adolescent and Family Health</i>	Explores adolescents' attitudes toward e-cigarettes, identifying education gaps and the need for awareness campaigns.	Not specified	Review	E-Cigarettes, Education, Adolescents
Riehm, K. E., et al.	2019	Mental Health Problems and Initiation of E-cigarette and Combustible Cigarette Use	<i>Pediatrics</i>	Shows link between mental health issues (anxiety, depression) and higher likelihood of e-cigarette initiation among adolescents.	7,702	Longitudinal study	Mental Health, E-Cigarette Use, Adolescents

Author(s)	Year	Title	Journal	Key Findings	Sample Size	Study Design	Themes/Factors Explored
Trucco, E. M.	2020	A Review of Psychosocial Factors Linked to Adolescent Substance Use	<i>Pharmacology and Biochemistry and Behavior</i>	Summarizes factors such as family, peer influence, and socio-economic conditions impacting adolescent substance use.	Not specified	Literature Review	Psychosocial Factors, Substance Use, Adolescents
Struik, L., et al.	2023	Factors that Influence Decision-Making Among Youth Who Vape and Youth Who Don't Vape	<i>Addictive Behaviors Reports</i>	Identifies individual and social determinants influencing adolescents' decision to vape or abstain.	105	Qualitative Study	Vaping, Decision-Making, Adolescents

## DISCUSSION

The findings from this scoping review underscore the intricate relationship between loneliness and e-cigarette use among adolescents, highlighting how loneliness can act as both a cause and consequence of e-cigarette use (Orben et al., 2020). This reveals loneliness as more than a background factor; it emerges as a significant driver that can shape adolescents' choices, behaviors, and mental health outcomes. Addressing loneliness, therefore, may be crucial not only for reducing e-cigarette use but also for enhancing adolescents' overall well-being and resilience (Step toe, 2023; U.S. Department of Health and Human Service, 2016).

### The Role of Loneliness as a Driver of E-Cigarette Use

Loneliness appears to be a profound emotional experience that motivates adolescents to seek out e-cigarette use as a coping mechanism. The review highlights how feelings of social isolation and lack of belonging can drive adolescents toward vaping, as it provides a temporary distraction from negative emotions (Dyal & Valente, 2015; Oliver et al., 2023). This finding aligns with broader theories of substance use that posit individuals may turn to substances in an attempt to self-medicate or manage psychological distress. E-cigarettes function as a form of emotional regulation and providing a quick fix to reduce feelings of loneliness.

E-cigarette use often takes place within social settings where it serves as a bridge for socialization and bonding. This is especially relevant for adolescents who place a high value on peer acceptance and often struggle with social pressures. Lonely adolescents may feel that they are participating in a shared activity that temporarily eases their sense of isolation (Khambayat et al., 2023; Valente et al., 2023). However, this behavior can lead to a harmful cycle as adolescents rely on e-cigarettes to mitigate their loneliness, they may become increasingly dependent on the behavior and then worsening their sense of isolation and leading to a potential pattern of addiction. The social nature of e-cigarette use therefore suggests that loneliness not only motivates adolescents to start vaping but may also play a role in sustaining their usage (Chao et al., 2019).

### Psychosocial Factors: Peer Influence and the Quest for Belonging

The review also illuminates the role of psychosocial factors particularly peer pressure and the desire for social acceptance in linking loneliness to e-cigarette use. Adolescence is marked by a heightened sensitivity to peer influence with adolescents often relying on peer relationships to form their sense of identity and self-worth. The appeal of fitting into social groups can be particularly compelling and making them more susceptible to adopting behaviors that align with group norms. This is especially pertinent in environments where e-cigarette use is normalized or glamorized (Laursen & Veenstra, 2021; Leigh & Clark, 2018).

The findings suggest that e-cigarette use can serve as a form of social currency for adolescents, offering them an entry point into peer groups and a means of achieving social visibility. Lonely adolescents may thus perceive e-cigarettes as a tool for social integration and viewing vaping as a way to bridge social gaps and connect with others (Perikleous et al., 2018; Valente et al., 2023). However, the reliance on e-cigarette uses as a means to attain belonging poses risks as it may lead adolescents to form superficial or transactional relationships that lack the depth needed to alleviate true loneliness. These relationships may reinforce feelings of inadequacy as adolescents may feel they need to continually engage in certain behaviors to be accepted. This highlights the paradox of e-cigarette use as both a means of achieving social connection and a factor that can ultimately deepen loneliness (Sawdey et al., 2019).

### **Mental Health Implications and the Cycle of Dependency**

A significant aspect of the relationship between loneliness and e-cigarette use is the impact of mental health on this connection. The review shows that loneliness in adolescents is often accompanied by increased levels of anxiety, depression, and other mental health challenges. These psychological issues exacerbate the appeal of e-cigarettes as a self-medicating tool with adolescents turning to vaping to alleviate symptoms of stress or depressive moods. However, the temporary relief offered by e-cigarettes can lead to a dependency and creating a cycle where adolescents continually turn to vaping as a coping mechanism for unresolved mental health issues (Javed et al., 2022; Lee et al., 2020).

This cycle of dependency is particularly concerning, as it suggests that e-cigarette use may mask underlying emotional problems without addressing their root causes. In many cases, adolescents who use e-cigarettes as a coping strategy may forgo healthier forms of emotional regulation such as seeking support from trusted individuals, engaging in physical activity, or practicing mindfulness techniques. As a result, they may become increasingly reliant on e-cigarettes and leading to potential nicotine addiction and further detriment to their mental health. Over time, this dependency can worsen feelings of loneliness and isolation as adolescents may withdraw from non-vaping peers or avoid social situations where vaping is not accepted.

### **The Need for Targeted Interventions to Foster Social Connection**

The findings of this review highlight a pressing need for interventions that not only target e-cigarette use among adolescents but also address the underlying loneliness and social disconnection that often drive this behavior. Traditional anti-smoking campaigns may not be sufficient for this population as they often fail to consider the emotional and social dimensions that make e-cigarettes appealing to lonely adolescents (Barnes et al., 2022). Instead, a more holistic approach that considers the psychological and social contexts of e-cigarette use is necessary. One promising avenue for intervention is the promotion of social support and community-building activities in school and community settings. Programs that foster positive peer relationships provide opportunities for genuine social interaction, and encourage teamwork can help adolescents feel more connected and valued, reducing their need to turn to e-cigarettes for social acceptance. For example, peer-led support groups or mentorship programs could offer lonely adolescents a safe space to discuss their challenges and receive support while also helping them build meaningful relationships. Similarly, extracurricular activities that emphasize teamwork and collaboration, such as sports, arts, or volunteer work, can provide structured environments for social bonding without the presence of substance use.

Mental health support should be integrated into intervention strategies with a focus on helping adolescents develop healthy coping mechanisms for managing emotions and stress. Schools

can play a key role by offering mental health services such as counseling and workshops on emotional regulation, resilience, and self-esteem. These programs can reduce the appeal of e-cigarettes as a coping mechanism (Santre, 2022; Wiedermann et al., 2023). Parents and caregivers also have an essential role to play in addressing loneliness and e-cigarette use. Family-based interventions, such as open communication and encouragement of healthy social habits can foster a supportive home environment that reduces adolescents' feelings of loneliness. Family support can serve as a buffer against social pressures and giving adolescents the confidence to resist peer influence and avoid behaviors they would not otherwise choose.

### **Implications for Health Professionals**

Health professionals working with adolescents should be mindful of the complex psychosocial aspects that underlie e-cigarette use. Rather than focusing solely on the physical risks of e-cigarettes, healthcare providers should consider assessing adolescents' emotional well-being, social experiences, and mental health status. Understanding these factors can offer a more comprehensive view of the reasons adolescents may be drawn to e-cigarettes and enabling health professionals to address both the behavior and its root causes. Health professionals can play a role in prevention by educating adolescents and their families about the connection between loneliness, mental health, and e-cigarette use. Healthcare providers can empower adolescents to seek healthier forms of social connection and emotional support while also helping parents recognize signs of loneliness or vulnerability in their children (Santre, 2022; Srinath et al., 2019; U.S. Department of Health and Human Service, 2016).

### **CONCLUSION**

This scoping review underscores the pressing need for a deeper and more nuanced understanding of the relationship between loneliness and e-cigarette use among adolescents. As e-cigarette consumption has steadily increased in recent years, particularly within younger populations, the social and emotional factors driving this behavior demand urgent attention from researchers, healthcare providers, policymakers, and educators. Loneliness, as highlighted in this review, is not just a passive backdrop to substance use but appears to play an active and significant role in shaping adolescents' choices around e-cigarette consumption. The temporary relief offered by e-cigarettes may mask deeper emotional distress, potentially leading to a cycle of dependency that worsens both their mental health and social outcomes. As adolescents rely on e-cigarettes for social acceptance or emotional escape, the behavior can ultimately exacerbate their feelings of loneliness, creating a feedback loop that is difficult to break.

The insights from this review underscore the need for prevention strategies that do more than simply warn of the physical risks of e-cigarette use. To be truly effective, interventions must address the underlying emotional and social drivers of this behavior. Programs that foster genuine social connections, promote healthy coping strategies, and provide robust mental health support have the potential to mitigate the allure of e-cigarettes as a means of managing loneliness. Schools and community organizations can play a central role in creating spaces where adolescents feel accepted and supported, reducing the risk of loneliness-driven e-cigarette use. Additionally, healthcare professionals can integrate screenings for loneliness and social isolation into routine care for adolescents, particularly for those at higher risk of substance use. Family engagement is also essential, as supportive home environments can serve as a buffer against social pressures and help adolescents develop the resilience needed to resist maladaptive coping mechanisms. The insights from this review advocate for a holistic approach to adolescent health, one that prioritizes social support, mental health resources, and educational efforts to discourage e-cigarette use.

Despite the insights provided by existing studies, several research gaps were identified. There is a lack of longitudinal studies that could more clearly establish causality between loneliness and e- cigarette use, as well as observe long-term health outcomes associated with this behavior. Most studies focused on general adolescent populations, with limited exploration of how factors like gender, socioeconomic background, or ethnicity may influence the relationship between loneliness and e-cigarette use. Given the rise of social media influence, there is limited research examining the role of digital media in shaping adolescents' perceptions of e-cigarettes and how online interactions might contribute to or alleviate loneliness.

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