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Association between vaping use and mental health among youth in the United States

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Abstract. The study aimed to find the association between e-cigarette use and mental health among youth in the United States. Google Scholar was used as the search engine in this study. PubMed was used as a database. We focused on observational studies, looking into the association between vaping and mental health conditions among adolescents in the United States. We found 1,692 studies and removed duplicates. After reviewing abstracts and titles, we manually removed 1,684 studies. Finally, eight studies were included. E-cigarette use was associated with mental health, such as depression, anxiety, psychological distress, internalizing, and externalizing. Only one study showed that there was no association between vaping and mental health conditions. It is essential to increase awareness regarding the correlation between electronic cigarettes and mental health among adolescents.

Keywords: e-cigarette, youth, mental health, the United States.

1. Introduction

Electronic cigarettes (E-cigarettes) or vapes are battery-powered products which people inhale through inhalable aerosols produced by nicotine-containing solutions [1]. Because of technology's rapid development, e-cigarette products' popularity has increased among younger generations in the United States [2]. The prevalence of E-cigarettes among high school students has increased dramatically in recent years, from 11.7% in 2017 [3] to 43.6% in 2021 [4]. E-cigarettes have become popular among youth since 2014 [5], because most e-cigarette advertisements consist of youth-appealing contents [6].

Vaping is harmful to both individuals' physical and mental health. Long-term vaping can cause changes in sensory and physical functioning, especially in the respiratory system [7]. With the long-term usage of vaping, it can cause various types of diseases such as E-cigarette or vaping products use associated lung injury (EVALI) [8]. In addition, vaping was associated with various types of mental health such as depression, anxiety, psychological distress, internalizing, or externalizing. Biological mechanisms can explain this association. Nicotine can possibly damage the cerebral cortex, which in turn affects the development of the brain [9].

Previous studies found that the association between vaping and mental health was bidirectional [10]. Several cross-sectional studies showed that vaping was related to depression and suicidality [11, 12]. Besides, several longitudinal studies displayed that vaping caused internalizing (depression, anxiety, eating disorder, etc) and externalizing (attention deficit, conduct disorder, etc) disorders [11]. On the

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other hand, other longitudinal studies found that post-traumatic stress disorder (PTSD), compulsive sexual behavior, or other mental health-related illness led to vaping initiation [13].

Multiple-product use was strongly associated with mental health conditions. Previous research in California among high school students showed that polyproduct uses were associated with Attention Deficit/Hyperactivity Disorder (ADHD) [14]. Co-use could cause nicotine dependence, which may eventually lead to substance use disorder [15].

Previous studies have shown sufficient evidence to prove the binary direction of the use of e-cigarette and individuals' mental health. However, our findings displayed that the summary of risk factors of mental health among youth still needs to be further explored. Also, the evidence lacked the proof of the association between youth's mental health and vape use, as well as co-use of e-cigarettes and other substances. The aim of this study is vaping and mental health relationship among adolescents in the United States.

2. Methods

2.1. Literature Search

Google Scholar and PubMed were used as academic search engines in this study. The keywords included: e-cigarette, vape, electronic vapor product, vaping, adolescent, youth, middle and high school students, anxiety, depression, mental health, internalizing, externalizing, psychological distress, the United States, and other synonyms of these words. Publications from 2013 to 2022 were included in this study. Also, the language was limited to only English.

2.2. Study Selection

1,692 studies were found in our initial search. Due to duplication, 667 studies were deleted. Because the range of some of the studies found did not match the main purpose of this study, 998 articles were removed. 19 full-text articles were excluded because of not accessing vaping use or not being written in English. Finally, our study included eight papers (Figure 1).

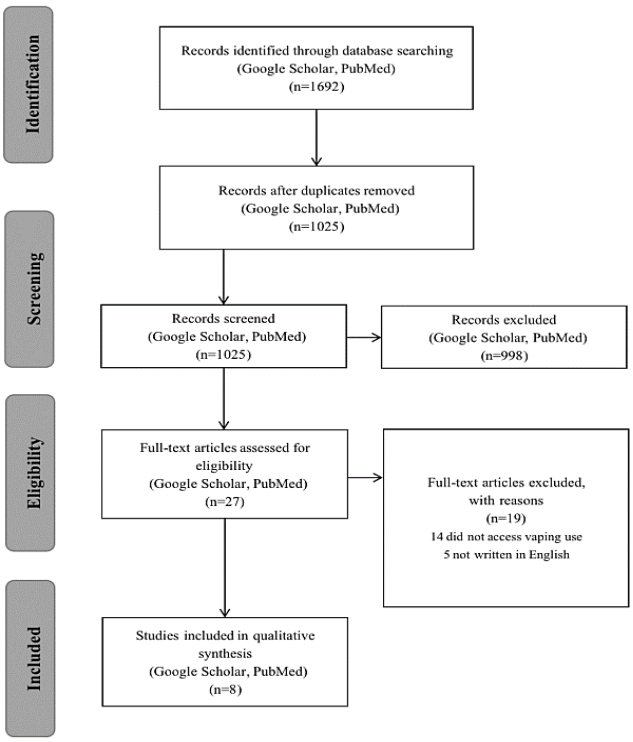

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) flow diagram.

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2.3. Data Items

Vapers include past-year e-cigarette use and past-month e-cigarette use [16]. Past-year e-cigarette users refer to people who use e-cigarettes at least once in the past year. Past-month e-cigarette users refer to people who use e-cigarettes at least once in the past month. There are different types of mental health, such as depression, anxiety, psychological distress, internalizing, or externalizing. The main symptom of depression is having a decaying mood, where people experience low mood on a normal daily basis [17]. Internalizing can be a social withdrawal or can be defined as anxiety, depression, and psychosomatic complaints [18]. Externalizing is more prone to anger, impulsivity, and low regulation compared to internalizing symptoms. Anxiety is a distressing subjective experience, where patients may need relief from their distress immediately. Psychological distress is defined as non-specific symptoms of stress, anxiety, and depression [19].

2.4. Risk of Bias Across Studies

Self-reports have a bias. They are prone to inherent biases that can affect the accuracy and reliability of collected data. Individuals may share information based on their personal perceptions, memory recalls, or own interpretations, leading to possible distortions in the reported data. This bias can be influenced by multiple factors such as cultural norms or the emotional state the person providing the information is in.

3. Results

3.1. Study characteristics

Among the eight selected studies, two papers were conducted at a national level, while the rest were conducted at a regional level. Within those studies, four regional papers were conducted in California, one at a northeastern U.S. university and one at a midwestern university. Among the eight studies, six were cohort studies, providing longitudinal data, and the remaining two were cross-sectional studies, capturing a snapshot of substance use patterns. These papers were conducted between 2008 and 2017, covering several years. In terms of target populations, four papers focused on middle and high school students (6th to 12th grade), two papers focused on college students, one paper focused on individuals aged 12 to 18, and one paper focused on young adults in the age range of 18 to 24 years (Table 1).

Table 1. Study Characteristics of eight selected studies

Title	Author/ Year	Location	Study Type	Study Year	Sample size	Exposure	Outcome
Mental Health Problems and Initiation of E-cigarette and Combustible Cigarette Use	Kira E. Riehm 2019	National	cohort 2	2013-2015	7702	co-use (marijuana and alcohol)	internalizing
Prevalence of Electronic Cigarette Dependence Among Youth and Its Association With Future Use	Erin A. Vogel 2020	Los Angeles, CA	cohort 1	2016-2017 (6 months) Data analyzed from 2019.3 to 2019.12	3168 (444 reported past-year e-cigarette use)	dual use of combustible and e-cigarettes	nicotine vaping status

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Table 1. (continued)

Frequency of E-cigarette Use, Health Status, and Risk and Protective Health Behaviors in Adolescents	Michael S. Dunbar 2018	CA	cohort (wave)	2008-2014	2488	co-use (marijuana and alcohol)	anxiety/ externalizing
Associations of Electronic Cigarette Nicotine Concentration With Subsequent Cigarette Smoking and Vaping Levels in Adolescents	Nicholas I. Goldenson 2017	CA	cohort 1	2015	181	no co-use	
Characterizing Polytobacco Use Trajectories and Their Associations With Substance Use and Mental Health Across Mid-Adolescence	Junhan Cho 2018	CA	cohort half a year	2015	3393	vape, hookah & combustible (polytobacco), alcohol marijuana and illicit drug use	Anxiety/ depression
E-cigarettes, Alcohol Use, and Mental Health: Use and perceptions of e-cigarettes among college students, by alcohol use and mental health status	Kathryn R. Hefner 2018	a northeastern U.S. university	Cross-sectional	2016	631	alcohol and other drugs	

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Table 1. (continued)

E-Cigarette Use (Vaping) is Associated with Illicit Drug Use, Mental Health Problems, and Impulsivity in University Students	John E. Grant 2019	a large midwestern university	cross sectional	2016	3572	co-use with alcohol and other drugs	
Internalizing and Externalizing Problems as Risk Factors for Initiation and Progression of E-cigarette and Combustible Cigarette Use in the US Youth Population	Anne Buu 2020	National	cohort	Wave 1: 2013-2014 Wave 2: 2014-2015	Wave 1: 13651 youth 32320 adults	e-cigarette and combustible cigarette	internalizing/ externalizing

In these eight papers, three studies had smaller sample sizes, ranging from 181 to 631. The remaining four studies had larger sample sizes, ranging from 2,488 to 13,651 people (Table 1).

All of the papers were self-reported. Five out of eight papers reported co-use of vaping and other substance uses, such as marijuana, hookah, and cigarettes.

Mental health conditions included internalizing, externalizing, anxiety, depression, psychological distress, and tobacco product dependence symptoms. Internalizing and externalizing problems were measured by the Global Appraisal of Individual Needs-Short Screener (GAIN-SS) [20]. The frequency of anxiety was assessed by individual items from the five-item Mental Health Index (MHI-5) [21]. Depression was measured by the Patient Health Questionnaire (PHQ-9) [13]. Tobacco product dependence symptoms were measured using the Hooked on Nicotine Checklist [16]. Generalized anxiety was assessed by the Revised Children's Anxiety and Depression Scale (RCADS) [14]. Psychological distress was measured by Kessler 6 (K6), including "felt nervous, hopeless, restless or fidgety, worthless, depressed, and felt that everything was an effort [22]."

There were two cross-sectional studies. One of papers showed that the prevalence of e-cigarette use was higher among college students with psychiatric and substance use disorders than those without these mental health conditions [15]. In another cross-sectional study, vape use was significantly associated with several mental health issues, such as PTSD, ADHD, and anxiety [13]. Additionally, it is mentioned that e-cigarette users had significantly poorer self-esteem. The results showed that depressive symptoms, compulsive sexual behavior, and binge-eating disorder were not significantly associated with vape usage [13] (Table 1).

There were seven longitudinal studies used in this research. In the first study, it showed that high internalizing and externalizing problems were significantly associated with e-cigarette use. With the different severity of internalizing and externalizing, the probability of e-cigarette usage was always

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higher than the probability of combustible cigarette use or dual use [16, 20]. There was no significant association between the frequency of e-cigarette use and depression or anxiety symptoms [21]. Chronic polyproduct users and polyproduct users had a higher chance of having depression, anxiety, and ADHD symptoms [14]. Smoking may be one of the risk factors associated with poor mental health [10]. In the last study, it was stated that neither internalizing nor externalizing were significantly associated with initiating the usage of e-cigarette [23] (Table 1).

4. Discussions

According to the results, there are associations between the usage of e-cigarettes and mental health conditions [13-16, 20, 21, 23]. The relationship between vaping and mental health can be bidirectional according to the previous findings. Vaping was associated with different forms of mental health, such as anxiety, depression, internalizing, and externalizing. Mental health also caused the usage of e-cigarettes. The purpose of this review is to increase awareness of mental health prevention and awareness of the negative impact of vaping among youth.

Consistent with the previous published review, it also found a bidirectional association between suicidal attempts and vaping [12]. However, one of the prior reviews showed e-cigarette use among youth is related to greater mental health conditions [11].

Three articles stated that individuals with mental illness have a higher chance of e-cigarette usage. Other three studies concluded that vaping leads to a variety of mental health problems. One article mentioned that the association between usage of e-cigarettes and mental health is unclear. One of the papers showed that high e-cigarette nicotine concentration was associated with more depressive symptoms [16]. The results are different due to the different hypotheses being proposed in each study. The sample size would also be a factor that creates the difference. High school students (age 15-17) were more likely to use e-cigarettes than middle school students (ages 12-14). African Americans were less likely to use vape and dual use (vape and combustible cigarette). Both internalizing and externalizing problems had a higher likelihood of initiating the use of e-cigarettes. Both high levels of internalizing and externalizing problems had a higher proportion of dual use initiation [20]. Nicotine vaping in the past year and any vaping in the past month were more likely to report vaping dependence symptoms. In the six-month followup, youths with at least one vaping dependence symptom had a higher likelihood to vape than those with zero vaping dependence symptoms [16]. However, one of the papers showed no association between e-cigarette only users and nonusers [21]. Another paper focused on nicotine vaping and its concentration. Peer vaping was more likely to use higher nicotine concentrations of vaping. Delinquent behavior had a high chance of using vape with a high concentration of nicotine [24]. Polyproduct users (combustible cigarettes, e-cigarettes, and hookah) had more likelihood of having depression, anxiety, or ADHD compared to tobacco nonusers [14]. College students with psychiatric and substance use disorders were more likely to use e-cigarettes [15]. University students with Primary Care PTSD Screen (PC-PTSD), Generalized Anxiety Disorder 7 (GAD-7), compulsive sexual behavior, gambling disorder, ADHD, and Rosenberg self-esteem had higher percentages of e-cigarette use [13]. Youths with internalizing and externalizing problems had a greater likelihood of using e-cigarettes. High school students (ages 15-17) are more likely to vape than middle school students (ages 12-14). There was no difference between genders. Non-Hispanic Black individuals had a lower likelihood of vaping. The more money students received, the more likely they used vaping [23].

Self-reporting is not the most accurate way of measuring the nicotine content in the body. However, using biomarkers in blood samples will be the most precise way to measure the amount of nicotine in the body rather than self-reporting the usage of e-cigarettes.

5. Conclusion

There is a correlation between e-cigarette usage and mental health. There can be a bidirectional relationship between vaping and mental health. E-cigarette usage is linked to different kinds of mental health conditions such as internalizing, externalizing, depression, and anxiety. Mental health can influence the initiation of e-cigarette use.

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References

[1] Cheng T 2014 Chemical evaluation of Electronic Cigarettes. Tobacco Control

[2] Dai H and Leventhal A 2019 Prevalence of e-cigarette use among adults in the United States, 2014-2018. JAMA

[3] 2022 Surgeon general's advisory on e-cigarette use among youth. Centers for Disease Control and Prevention

[4] 2021 Youth e-cigarette use remains serious public health concern amid covid-19 pandemic. Centers for Disease Control and Prevention

[5] 2022 Youth and tobacco use. Centers for Disease Control and Prevention

[6] Struik L, Dow-Fleisner S, Belliveau M, Thompson D and Janke R 2020 Tactics for drawing youth to vaping: Content analysis of electronic cigarette advertisements. Journal of medical Internet research

[7] Abafalvi L, Pénzes M, Urbán R and et al 2019 Perceived health effects of vaping among Hungarian adult e-cigarette-only and dual users: A cross-sectional internet survey - BMC public health. BioMed Central

[8] Kaliniskiy A, Bach C, Nacca N and et al 2019 E-cigarette, or vaping, product use associated lung ... - sciencedirect. Science Direct

[9] Lyzwinski L, Naslund J, Miller C and Eisenberg M 2022 Global youth vaping and Respiratory Health: Epidemiology, interventions, and policies. Nature News

[10] Patten S 2021 Vaping and mental health. Journal of the Canadian Academy of Child and Adolescent Psychiatry, Journal de l'Academie canadienne de psychiatrie de l'enfant et de l'adolescent

[11] Becker T, Arnold M, Ro V, Martin L and Rice T 2021 Systematic Review of Electronic Cigarette Use (Vaping) and Mental Health Comorbidity Among Adolescents and Young Adults. Academic.oup.com

[12] Javed S, Usmani S, Sarfraz Z and et al 2022 A scoping review of vaping, e-cigarettes and mental health impact: Depression and Suicidality. GBMC Healthcare Scholarly Commons

[13] Grant J, Lust K, Fridberg D, King A and Chamberlain S 2019 E-cigarette use (vaping) is associated with illicit drug use, mental health problems, and impulsivity in university students. Annals of clinical psychiatry : official journal of the American Academy of Clinical Psychiatrists

[14] Cho J, Goldenson N, Stone M and et al 2018 Characterizing Polytobacco Use Trajectories and Their Associations With Substance Use and Mental Health Across Mid-Adolescence. Academic.oup.com

[15] Hefner K, Sollazzo A, Mullaney S, Coker KL and Sofuoglu M 2018 E-cigarettes, alcohol use, and mental health: Use and perceptions of e-cigarettes among college students, by alcohol use and mental health status. Addictive behaviors

[16] Vogel E, Cho J and McConnell R 2020 Prevalence of Electronic Cigarette Dependence Among Youth and Its Association With Future Use. Jama Network

[17] Rondón J 2018 Depression: A review of its definition. Researchgate

[18] Eisenberg N, Cumberland A, Spinrad TL and et al 2003 The Relations of Regulation and Emotionality to Children's Externalizing and Internalizing Problem Behavior. Society for Research in Child Development

[19] Viertiö S, Kiviruusu O, Piirtola M and et al 2021 Factors contributing to psychological distress in the working population, with a special reference to gender difference. BioMed Central

[20] Riehm KE, Young AS, Feder KA, et al. Mental Health Problems and Initiation of E-cigarette and Combustible Cigarette Use. Publications.aap.org, 2019;23

[21] Dunbar M, Tucker J, Ewing B and et al 2017 Frequency of e-cigarette use, health status, and risk and protective health behaviors in adolescents. Journal of addiction medicine

DOI: 10.54254/2753-8818/33/20240918

[22] Prochaska J, Sung H-Y, Max W, Shi Y and Ong M 2012 Validity study of the K6 scale as a measure of moderate mental distress based on mental health treatment need and utilization. International journal of methods in psychiatric research
[23] Buu A, Hu Y-H, Wong S-W and Lin H-C 2020 Internalizing and externalizing problems as risk factors for initiation and progression of e-cigarette and combustible cigarette use in the US youth population - International Journal of Mental Health and Addiction. SpringerLink
[24] Goldenson N, Leventhal A and Stone M 2017 Associations of e-cigarette nicotine concentration and subsequent nicotine use. JAMA Pediatrics