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Digital and Pharmacological Interventions for Vaping Cessation in Young Adults: A Systematic Review

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Abstract **Background:** The surge in e-cigarette use among young adults has raised significant concerns about nicotine dependence and associated health risks. Traditional cessation methods often fall short in addressing the unique behavioral and psychological dimensions of vaping. Emerging strategies-amely digital interventions such as text message-based and mobile app support, alongside pharmacotherapy using varenicline and cytisinicline-resent new opportunities. This systematic review evaluates the effectiveness and clinical relevance of these interventions in supporting vaping cessation among young adults. **Materials and Methods:** A systematic search of PubMed, Scopus, Web of Science and Cochrane Library was conducted for randomized controlled trials (RCTs) assessing digital interventions and pharmacotherapy (varenicline, cytisinicline) for vaping cessation in young adults aged 18-30. Studies with follow-up durations exceeding 3 months were included. Outcomes evaluated included quit rates, reduction in vaping frequency, changes in nicotine dependence, adherence and long-term abstinence. Dual independent review and data extraction were performed using standardized forms. Study quality was assessed using the Cochrane Risk of Bias tool (RoB2). **Results:** Three eligible RCTs were included. Digital interventions, particularly personalized and interactive text messaging, achieved significantly higher quit rates (up to 24.1%) compared to controls (18.6%). Mobile-based behavioral tools integrating gamification, CBT and peer support showed improved user engagement and adherence. Varenicline increased abstinence rates up to 40% at 12 weeks but was associated with side effects including nausea and vivid dreams. Cytisinicline showed comparable efficacy (31.8% abstinence at 12 weeks) with a better safety profile and shorter treatment duration. Combined approaches (digital+pharmacological) demonstrated enhanced outcomes compared to single-modality interventions. **Conclusion:** Digital and pharmacological interventions are effective tools for vaping cessation among young adults. While text-based and mobile health solutions offer accessible behavioral support, pharmacotherapies provide critical aid for highly dependent users. A personalized, multimodal approach may maximize cessation success. Clinicians and public health providers should consider integrating these strategies into routine cessation programs. Further large-scale studies are needed to explore long-term effectiveness, adherence factors and cost-efficiency.

Key Words Vaping cessation, young adults, digital health, varenicline, cytisinicline, nicotine dependence, e-cigarettes

INTRODUCTION

Vaping has emerged as a pressing public health challenge, particularly among young adults, driven by the rising popularity of e-cigarettes and the persistent misconception that these products are a safer alternative to traditional smoking. Although often marketed as harm reduction tools, a growing body of evidence reveals that e-cigarettes are associated with serious health risks, including nicotine dependence, respiratory dysfunction and potential long-term cardiovascular effects. Given the increasing prevalence of e-cigarette use, there is an urgent need to establish and evaluate effective, age-appropriate vaping cessation strategies.

Digitalized interventions-such as mobile-based behavioral therapy and text message-based support systems-have shown potential as scalable, cost-effective tools for delivering personalized motivation, real-time guidance and behavioral reinforcement to quit vaping [1]. Simultaneously,

pharmacotherapies like varenicline and cytisinicline are emerging as pharmacological aids to address the physiological aspects of nicotine withdrawal and dependence. However, current cessation methods largely mirror those designed for smoking, which may not fully address the psychological, behavioral and social factors unique to vaping. This underscores a significant knowledge gap in the field of vaping cessation that this review seeks to address.

E-cigarettes are battery-powered devices that generate an aerosol by heating flavored liquids, often containing nicotine. While youth vaping rates vary internationally based on policy strictness-for instance, 30-day prevalence of 20.8% in the U.S. vs. 10.0% in Canada-there is a consistent global concern about the health effects of vaping in adolescents and young adults [2,3]. Epidemiological studies define "youth" as individuals under 24 and "young adults" as those aged 20 to 25. Alarmingly, these demographics represent the fastest-growing group of e-cigarette users [4].

In India, vaping has similarly trended upward: the proportion of individuals aged 14 and above reporting vaping increased from 2.5% in 2020 to 7.5% in 2022. Among those aged 18-24, 4.8% reported current e-cigarette use between 2020-2021 and one in five non-smokers had tried vaping. Six-month prevalence rose sharply in this group-from 5.6% to 21.4% between 2020 and 2022 [5]. Countries that once reported declining tobacco use are now witnessing rising vaping rates, which may be contributing to a reversal in smoking trends.

Modern vaping products-particularly sleek, pod-shaped devices-have become increasingly appealing due to their concealability, high nicotine delivery and attractive flavor options. These products often resemble USB drives and use disposable cartridges, contributing to their widespread adoption. Marketing messages emphasizing freedom, relaxation and social appeal further entice teens and young adults [6,7].

Beyond nicotine dependence, vaping has been linked to severe health issues, such as acute poisoning, inhalation toxicity and seizures. E-cigarette or Vaping Product Use-Associated Lung Injury (EVALI) gained national attention following hospitalizations and deaths in users of vitamin E acetate-containing devices [8]. Most EVALI patients had used THC products from unregulated sources. Pathological findings in suspected EVALI cases include diffuse alveolar damage, organizing pneumonia and foamy macrophages [9].

Exploding vaping devices, environmental waste and dual-use behaviors-where young adults continue to vape while attempting to quit smoking-add to the public health burden [6,10]. Though many young users express a desire to quit, the lack of specialized cessation programs tailored to vaping makes this difficult. The World Health Organization recommends that countries implement dedicated support systems for those attempting to quit e-cigarettes, suggesting the necessity of formal vaping cessation interventions.

Behavior change theories have played a central role in understanding tobacco cessation and can be similarly applied to vaping. The Social Cognitive Theory (SCT), used in this review, incorporates personal, environmental and behavioral factors to explain how individuals acquire and maintain behavior. Applied to vaping, SCT includes key constructs such as self-efficacy (belief in one's ability to quit), risk-benefit perceptions of vaping and social norms related to peer and community influence [11,12]. These psychosocial components are critical in crafting effective cessation tools.

While pharmacological treatments like nicotine replacement, bupropion and varenicline have demonstrated modest efficacy in smoking cessation, their use in vaping cessation remains underexplored. Side effects and long-term adherence challenges limit their impact. Importantly, no vaping-specific pharmacotherapy has received U.S. FDA approval since 2006.

Varenicline, a partial agonist of the $\alpha 4\beta 2$ nicotinic acetylcholine receptor, modulates dopamine to reduce craving and withdrawal. Its dual mechanism-simulating and blocking nicotine response-has been effective in tobacco users and may benefit those using smokeless tobacco and e-cigarettes [13,14]. Cytisinicline (cytisine), another partial agonist at the same receptor, offers similar effects with fewer adverse reactions and has been used over-the-counter in Eastern Europe for decades [15].

Despite increased demand for vaping cessation support, there remains a lack of evidence-based interventions specifically designed for this purpose. Many current programs are adaptations of tobacco cessation frameworks, with limited proven success in vaping populations [16,17]. While campaigns such as "My Life, My Quit" and "Not an Experiment" aim to support quitting, only the Truth Initiative's This is Quitting program explicitly targets youth vaping with text-based, tailored messaging [11,18].

This systematic review was conducted to assess the effectiveness of digital and pharmacological interventions-specifically text messaging programs, mobile behavioral support, varenicline and cytisinicline-in promoting vaping cessation among young adults aged 18-24. By evaluating quit rates, adherence and long-term abstinence, the review aims to identify strategies that can be translated into real-world, cost-effective cessation programs tailored for this vulnerable age group.

MATERIALS AND METHODS

Protocol and Registration

This systematic review was conducted in strict adherence to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The study protocol was registered prospectively in the PROSPERO database (International Prospective Register of Systematic Reviews) on August 24, 2024, under the registration number CRD42024565082.

PICO Framework

- **Population:** Young adults aged 18 to 24 years
- **Intervention:** Digitalized interventions for vaping cessation (e.g., text message programs, mobile behavioral support)
- **Comparison:** Pharmacotherapy involving varenicline and cytisinicline
- **Outcome:** Effectiveness in vaping cessation, including quit rates, abstinence maintenance, adherence and behavioral change

Study Design and Eligibility Criteria

This review included randomized controlled trials (RCTs) evaluating digitalized interventions and/or pharmacotherapy for vaping cessation among young adults. Inclusion criteria:

- Participants aged 18-24 years
- Minimum follow-up period >3 months
- Studies published in English
- Peer-reviewed articles with accessible full texts

Excluded were:

- Theoretical reviews
- Studies with follow-up duration <3 months
- Non-English language publications (due to translation feasibility constraints)

Search Strategy

A comprehensive literature search was conducted across six electronic databases: PubMed, Google Scholar, Web of Science, Scopus, ScienceDirect and the Cochrane Database of Systematic Reviews. Additional manual searches were performed through the WHO Clinical Trials Registry Platform and the Clinical Trial Registry of India.

Searches were tailored using a combination of MeSH terms, Boolean operators and filters to maximize sensitivity and specificity. The following structured search terms were applied:

(((((((Adults) OR (Young adults)) OR (Grown-up persons)) OR (Young adulthood)) OR (Later adulthood)) OR (senior citizen)) AND ((((((Text message) OR (Digitalized)) OR (Mobile phone)) OR (website)) OR (social media)) OR (Social awareness))) AND ((((((Varenicline drug) OR ((Cytisinicline drug)) OR (Nicotinic receptor agonist)) OR (Chantix)) OR (Cytisine)) OR (Tabex))) AND (((Vaping cessation) OR (Quitting tobacco)) OR (Vape quitting)) ((Clinical Trial, Randomized Controlled Trial)).

Search terms were refined iteratively by screening test sets of abstracts and adjusting terms to reduce irrelevant results. The final search was completed in August 2024.

Study Selection and Data Extraction

All retrieved articles were imported into reference management software and duplicate entries were removed. Two reviewers (J and L) independently screened all titles and abstracts against the inclusion criteria. Full-text screening was then conducted for eligible studies.

Data extraction was performed independently using a standardized extraction form. Extracted information included:

- Publication year, authorship and journal
- Study setting (country), population characteristics and sample size
- Randomization method and blinding
- Intervention and comparator details
- Outcome measures: abstinence rates, adherence, relapse and follow-up duration
- Statistical Methods and Effect Estimates

Disagreements between reviewers were resolved through discussion or by consulting a third reviewer when consensus could not be reached.

Quality Assessment and Level of Evidence

Study quality was appraised using the Cochrane Risk of Bias Tool (RoB2). Each included RCT was independently rated across domains such as randomization, blinding, attrition and outcome reporting. Inter-rater agreement was quantified using the Cohen's kappa statistic to ensure consistency.

The Oxford Centre for Evidence-Based Medicine 2016 Levels of Evidence was used to classify the strength of evidence for each included study.

Data Analysis

Due to the heterogeneity in outcome measures, intervention types and follow-up durations, a meta-analysis was not feasible. Instead, a qualitative synthesis of findings was conducted to compare outcomes across digital interventions and pharmacotherapies. Measures such as abstinence rates, participant adherence and dropout levels were interpreted in context with the respective study designs.

RESULTS

Study Selection

A total of 293 articles were initially retrieved from six electronic databases: PubMed (n = 6), Cochrane (n = 7), ScienceDirect (n = 77), Web of Science (n = 64), Scopus (n = 18), ClinicalTrials.gov (n = 3) and Google Scholar (n = 115). An additional 135 records were identified through manual and supplementary searches. After removing 135 duplicate records, 158 articles remained for screening. Following title and abstract review, seven articles were selected for full-text assessment, of which only three randomized controlled trials (RCTs) met the inclusion criteria and were included in the qualitative synthesis (Figure 1).

Study Characteristics

Details of the three included studies are summarized in (Table 1-2). All studies employed randomized controlled

Table 1: Characteristics of selected studies

Author and year	Study setting	Groups	Study design	Sample size	Age group	Abstinence rate evaluation	Statistical analysis
Graham *et al.* [20]	US residents who owned a mobile phone	Group I: Text message program (This is Quitting arm) Group II - Control arm	Parallel, 2-group individually randomized clinical trial	2588 M-1253 F-1303	18-24 years	Self-reported 30-day point prevalence abstinence (ppa) at 7 months under ITT were 24.1% among TIQ participants and 18.6% among controls	2-tailed test
Caponnetto *et al.* [21]	Centro per la Prevenzi- one e Cura del Tabagismo (CPCT), the University-run smoking cessation center	Group I-Varenicline (1 mg, administered twice daily for 12 weeks) plus counselling Group II-Placebo treatment (administered twice daily, for 12 weeks) plus counselling	Randomized, parallel-group, placebo-controlled trial	140	≥18 years	Continuous Abstinence Rate from 4-24 weeks were 34.3% for varenicline with counselling and 22.2% for placebo with counselling	One-way ANOVA and Mann-Whitney U-test
Rigotti *et al.* [22]	Karnataka	Group I-Cytisinicline (3 mg, administered thrice daily for 12 weeks) Group II-Placebo for 12 weeks. All received behavioural support	Split-mouth, randomized controlled clinical trial	90 M-44 F-46	>18 years	Continuous e-cigarettes abstinence at the end of 12 weeks were 23.4% among cytisinicline group and 13.2% among placebo group	Chi-square test

Table 2: Characteristics of selected studies

Author and year	Randomization	Blinding	Allocation concealment	Intervention	Follow up
Graham *et al.* [20]	Yes-randomization Participants and examiners were blinded	Yes - double blinding	Yes	This is Quitting (TIQ) is a fully automated, tailored, interactive text message program	1 and 7 months
Caponnetto *et al.* [21]	Yes-5 block randomization Participants and examiners were blinded	Yes - double blinding	Yes	Varenicline (1 mg, administered twice daily for 12 weeks) plus counselling	12 weeks and 24 weeks
Rigotti *et al.* [22]	Yes-randomization Participants and examiners were blinded	Yes - double blinding	Yes	Cytisinicline (3 mgs, administered thrice daily for 12 weeks) plus behavioural support	12 weeks and 16 weeks

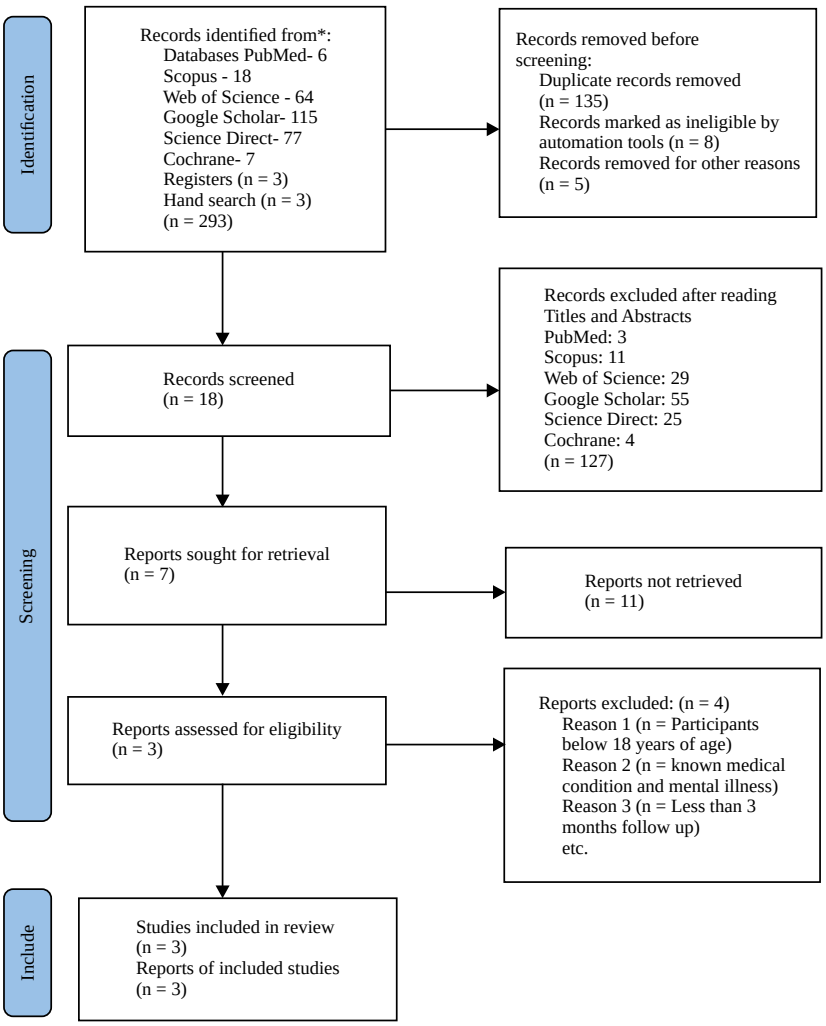

Figure 1 PRISMA Flowchart [19]

designs-either parallel-group or split-mouth-and reported using blinding, although with varying degrees of clarity. One study assessed a digitalized intervention (text-message program) [20], while the other two evaluated pharmacotherapies: varenicline [21] and cytisinicline [22]. The sample size ranged from 90 participants in the study by Rigotti *et al.* [22] to 2,588 in Graham *et al.* [20], the latter being the largest study. While two studies were conducted internationally [20,21], one was conducted in India [22].

Participants in Graham *et al.* [20] study were exclusively 18-24 years old, whereas Caponnetto *et al.* [21] and Rigotti *et al.* [22] included adults aged $\geq$18. Follow-up durations varied across studies, with Caponnetto *et al.* [21] having the shortest follow-up of five months and Rigotti *et al.* [22] reporting the longest follow-up at 12 months.

Quality Assessment and Level of Evidence

All studies underwent risk of bias assessment using the Cochrane Risk of Bias 2 (RoB2) tool. The inter-rater reliability was high (κ = 0.84), indicating consistent evaluations by the reviewers. All three studies were rated as having low risk of bias in the randomization domain. Two studies maintained low risk across most domains, while one showed a substantial risk of bias related to deviations from intended interventions. Outcome measurement was low-risk in two studies and moderate in one. All studies were rated low risk for missing outcome data. Selective reporting was noted in one study, leading to a moderate-risk score in that domain. According to the Oxford Centre for Evidence-Based Medicine 2016 classification, all included studies were graded as Level 1b evidence.

Effectiveness of Interventions

Digitalized Interventions

Graham *et al.* [20] evaluated the This is Quitting (TIQ) text-message intervention. At seven months, the abstinence rate was 24.1% (95% CI: 21.8%-26.5%) in the TIQ group compared to 18.6% (95% CI: 16.7%-20.8%) in the control group, with the difference being statistically significant

(p<0.01). Follow-up retention was high at 76% (n = 2,467) with no evidence of differential attrition. However, abstinence rates did not significantly change beyond the seven-month mark, indicating that the primary impact of the digital intervention occurred within the initial months of engagement.

Pharmacotherapy Interventions

Short- to Mid-Term Follow-Up (3 to 6 Months)

Caponnetto *et al.* [21] reported a 12-week continuous abstinence rate of 40% in the varenicline group versus 20% in the placebo group. At 24 weeks, the rates were 34.3% and 22.2%, respectively. Similarly, Rigotti *et al.* [22] found that cytisinicline yielded a 12-week abstinence rate of 31.8% compared to 15.1% with placebo. By 16 weeks, these rates declined slightly to 23.4% (cytisinicline) and 13.2% (placebo), though the differences remained statistically significant.

Long-Term Follow-Up (6 to 12 Months)

Both Caponnetto *et al.* [21] and Rigotti *et al.* [22] observed no significant gains in abstinence between 6 and 12 months, indicating a plateau in long-term efficacy. The initial advantages seen with pharmacotherapy did not appear to extend significantly into the longer term without sustained behavioral support.

Comparative Risk of Bias

Among the three studies, two were judged to have overall low risk of bias. The third study was rated as moderate risk due to ambiguities in allocation concealment and blinding procedures, which may contribute to selection, performance, or detection biases (Figure 2 and 3).

Digital interventions-particularly personalized, interactive text-message programs-demonstrated significant short-term improvements in quit rates among young adults. Pharmacotherapies such as varenicline and cytisinicline were

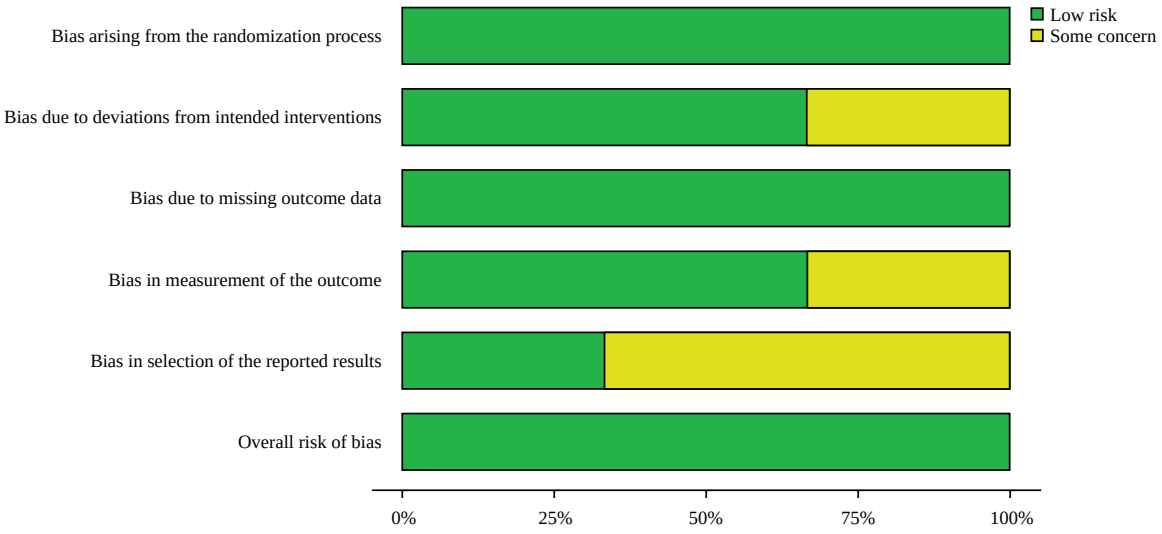

Figure 2: Cochrane risk of bias assessment for randomized [RoB2]

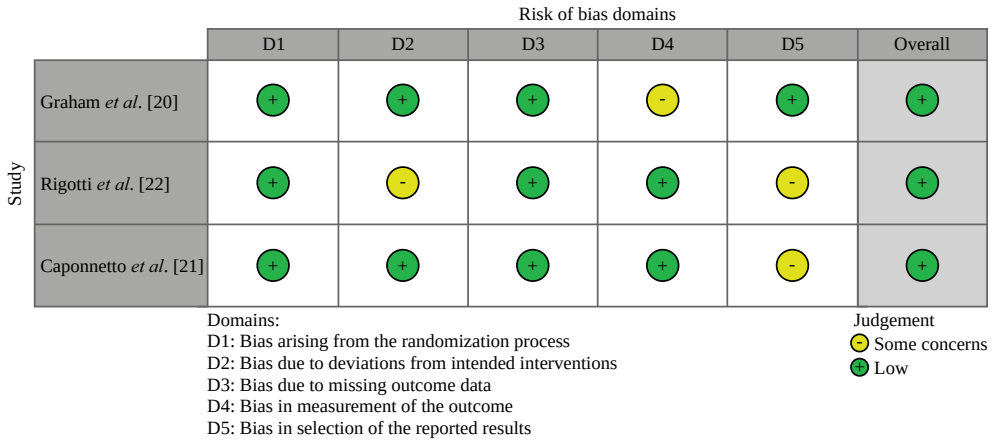

Figure 3: Cochrane risk of bias assessment for randomized [RoB2]

effective, particularly for participants with higher nicotine dependence, with abstinence rates ranging from 23.4% to 40% over 12 to 24 weeks. However, their long-term effectiveness plateaued without additional behavioral reinforcement. The combined findings suggest that a multimodal cessation approach-blending digital behavioral support with pharmacotherapy-may offer the most effective and sustained outcomes for vaping cessation in young adult populations.

DISCUSSION

The rising prevalence of vaping among young adults poses a significant public health challenge, especially given the growing evidence of long-term health risks associated with e-cigarette use. While traditional tobacco cessation methods are somewhat effective, they often fail to address the psychological, behavioral and social dimensions unique to vaping. In this context, digital interventions and pharmacotherapies such as varenicline and cytisinicline are emerging as promising approaches. This systematic review aimed to evaluate the effectiveness of these interventions in reducing e-cigarette use among young adults by analyzing their impact on quit rates, adherence and long-term abstinence outcomes [23-25].

Effectiveness of Digitalized Interventions

Text message-based and mobile app-driven behavioral programs are gaining popularity as accessible, scalable and low-cost tools for vaping cessation. These digital interventions provide structured support, motivation and real-time interaction, which are particularly effective in engaging young adults who are highly attuned to digital communication. Studies have shown that personalized, interactive text messaging systems-such as the This is Quitting (TIQ) program-can significantly increase abstinence rates compared to minimal or no intervention [20].

Programs such as Text2Quit and Smokefree TXT, originally developed for smoking cessation, have been adapted for vaping with promising outcomes. These interventions typically double quit rates, but their success is highly dependent on message frequency, personalization and participant engagement. Mobile apps and web-based platforms also offer Cognitive-Behavioral Therapy (CBT), mindfulness exercises and peer support networks. However, despite their strengths, these interventions often face high attrition rates due to user fatigue or lack of sustained engagement. Incorporating gamification, incentives and social components may help enhance adherence and long-term retention [2,6,8].

Pharmacotherapy for Vaping Cessation

Pharmacological interventions such as varenicline and cytisinicline are particularly effective for individuals with higher levels of nicotine dependence. Varenicline, a partial agonist at α4β2 nicotinic acetylcholine receptors, reduces cravings and withdrawal symptoms by modulating dopamine release. Several clinical trials have demonstrated its superiority over placebo and even Nicotine Replacement Therapy (NRT) in achieving sustained abstinence [13,14]. In vaping cessation, varenicline has shown early success, especially among dual users with a history of tobacco smoking. However, common side effects-including nausea, vivid dreams and mood disturbances-can limit adherence in younger populations.

Cytisinicline, a naturally occurring plant-based alkaloid with a similar mechanism of action to varenicline, has emerged as a lower-cost and safer alternative. It blocks nicotine's reinforcing effects while offering a shorter treatment duration (typically 25 days) and a more favorable side-effect profile. Although early evidence supports its role in smoking cessation, its use for vaping cessation is still underexplored. Larger-scale trials are needed to confirm its long-term safety and efficacy for this indication [15].

Comparative Effectiveness and Practical Implications

Both intervention types demonstrate efficacy, but their success varies based on the user's nicotine dependence, behavioral patterns and readiness to quit. Digital interventions are generally more effective for mild to moderate users who benefit from behavioral support and motivation, while pharmacotherapy is better suited for highly dependent users requiring physiological support for withdrawal management. Importantly, pharmacological therapies do not address the psychological and social aspects of addiction, underlining the importance of combining both approaches in a multimodal treatment strategy.

This review also highlights a persistent challenge: the lack of standardized, evidence-based guidelines for vaping cessation. Unlike traditional smoking cessation, where pharmacotherapy and behavioral therapy are well-established, vaping cessation is still in a formative stage. Social influences-such as peer pressure, flavored e-cigarettes and the glamorization of vaping on social media-further complicate quit attempts and increase relapse risk, particularly among younger users.

Future Directions and Recommendations

In light of the evidence, several strategies can improve cessation success:

- **Personalized Cessation Programs:** Integration of AI-driven text messaging and app-based systems with pharmacological therapy to tailor support based on vaping behaviors
- **Expanded Research on Cytisinicline:** Conducting large, multicenter trials to establish its efficacy and safety profile for vaping cessation
- **Gamification and Incentives:** Designing engaging mobile interfaces with reward systems to maintain user interest and adherence

- **Public Awareness Campaigns:** Leveraging social media and healthcare providers to educate youth about vaping risks and promote evidence-based cessation tools
- **Policy and Regulatory Measures:** Enforcing stricter controls on flavored e-cigarette marketing and online promotions to reduce initiation and encourage quitting [26,27]

In this review, three RCTs met the inclusion criteria, offering high-quality evidence with a minimum follow-up period of three months. While this threshold was sufficient to capture short- and mid-term outcomes, longer follow-up durations may be needed to understand relapse patterns and sustained abstinence. A recent review by Fagerström *et al.* [28] reported significantly higher abstinence rates in varenicline users versus placebo for smokeless tobacco cessation, suggesting the drug's potential for vaping cessation as well. Similarly, a large pragmatic trial by Fucito *et al.* [29] emphasized the need for more trials evaluating varenicline with minimal behavioral support among e-cigarette users.

Limitations and Challenges

Despite their potential, both intervention types face implementation challenges. Digital interventions are prone to high dropout rates due to message fatigue and lack of personalization. Moreover, most studies rely on self-reported abstinence, which may introduce social desirability and recall bias. Pharmacotherapies, although clinically effective, suffer from adherence issues related to side effects. Furthermore, cytisinicline research is still in its early phases, with limited long-term data. These limitations call for more rigorous study designs, improved reporting protocols and real-world evaluations to ensure scalability and generalizability [26].

To mitigate bias in future trials, researchers should consider standardized methodologies, such as random sequence generation, split-mouth designs and enhanced data collection on confounding variables. Incorporating objective measures (e.g., biochemical verification of abstinence) and collecting additional behavioral data can also strengthen the reliability of results.

Clinical significance

Digitalized interventions, including text message-based support and mobile health (mHealth) applications, present a scalable and cost-effective approach that can be integrated into routine clinical practice for vaping cessation counselling. Healthcare providers can leverage automated messaging platforms to deliver personalized behavioral support, monitor progress and encourage follow-up, thereby enhancing continuity of care. For individuals with low to moderate nicotine dependence, digital interventions alone may be sufficient to initiate and sustain quit attempts. In contrast, highly dependent users may benefit most from a combined approach-incorporating pharmacotherapy such as varenicline or cytisinicline alongside digital behavioral support. This personalized, multimodal framework can help address both the physiological and psychological dimensions of vaping addiction. Moreover, public health agencies and policymakers can utilize these digital tools to design community-wide cessation initiatives, especially targeting high-risk groups such as college students, young professionals and individuals influenced by social media exposure to e-cigarette content.

CONCLUSION

This systematic review highlights the growing body of evidence supporting the use of digital and pharmacological interventions for vaping cessation among young adults. Digital tools-including personalized text messaging and mobile-based behavioral programs-offer accessible and engaging platforms for behavioral support. Pharmacotherapies like varenicline and cytisinicline provide essential pharmacological assistance by reducing nicotine cravings and withdrawal symptoms. When integrated thoughtfully, these two approaches can form a personalized and synergistic treatment model that leads to improved quit rates, increased adherence and sustained abstinence.

While the findings are promising, several challenges persist. Digital interventions face engagement barriers, such as high dropout rates and limited personalization, which can reduce long-term efficacy. Pharmacotherapy, though effective, is often hindered by side effects that impact user adherence. Additionally, vaping behaviors continue to evolve rapidly, driven by social influences, marketing and device innovation, complicating cessation efforts. Therefore, further research is needed-particularly longitudinal studies that assess sustained abstinence and investigate how interventions can be tailored based on nicotine dependence, behavioral readiness and psychological triggers.

Ultimately, a comprehensive, adaptable cessation framework that combines digital engagement with clinical support may offer the most effective path forward in reducing nicotine dependence and improving public health outcomes among young adult vapers.

Conflict of interest

None declared.

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