

Perspectives on Electronic Nicotine Delivery System Use Cessation Among Adults in Rural Areas: Implications for Future Studies

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ABSTRACT

Introduction: More young adults (age 18-24 years) in rural areas versus urban areas use electronic nicotine delivery systems (ENDS)—also known as e-cigarettes. Little is known about young adults' perceptions toward ENDS use and cessation. The objective of this study was to examine barriers and facilitators to ENDS use cessation among young adults living in rural areas, as well as their perceptions about ENDS use and cessation and to determine implications for future cessation studies.

Methods: We administered cross-sectional online surveys to young adults living in rural Midwestern counties. A total of 100 individuals responded to the surveys. Descriptive statistics were used to report their perceptions of ENDS use as well as barriers and facilitators to ENDS use cessation. The content analysis method was used to analyze the answers to an open-ended question regarding perceptions about the ENDS use cessation in the context of rural areas.

Results: Barriers to ENDS use cessation included perceived advantages to ENDS use, high nicotine dependence, and the perception that ENDS use was less harmful cigarettes. Facilitators to ENDS use cessation included cost of ENDS use, perceived harm, and high confidence in ability to quit. Participants' perceptions about ENDS use cessation in the context of rural areas were conceptualized under the themes of (1) exposure to and initiation of ENDS use, (2) continuation of ENDS use, and (3) prevention and cessation of ENDS use.

Conclusions: Health care providers, tobacco control researchers, and public health advocates should be aware of barriers and facilitators to ENDS use cessation among young adults for future cessation intervention studies relevant specifically to rural areas.

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INTRODUCTION

Electronic nicotine delivery systems (ENDS)—also known as e-cigarettes—are the most popular tobacco products among young adults (age 18-24 years) in the United States.¹⁻³ Nicotine, a primary concern of ENDS use, facilitates physiological changes in neuronal nicotine acetylcholine receptors in the brain, thereby maintaining addiction.^{4,5} ENDS use by young adults is associated with other health risk behaviors, including alcohol intake and the use of marijuana and other drugs.⁶⁻⁸ The literature supports relationships between ENDS use and cardiovascular disease,^{9,10} cancer,¹¹ chronic respiratory disease,¹² diabetes,¹³ and psychiatric conditions.^{13,14} Liquids and aerosols in ENDS also contain harmful ingredients that are known to cause severe disease or cancer, including formaldehyde, toluene, acetaldehyde, acrolein, heavy metals, nitrosamines, and other tiny particles of matter.^{15,16} Another major concern is that ENDS use in young adults serves as a gateway to later use of combustible tobacco.¹⁷⁻¹⁹

A recent study reported that the prevalence of current ENDS use among young adults in rural areas increased from 13.3% in 2018 to 15.9% in 2020, despite the urban prevalence remaining constant at 11% from 2018 to 2020.²⁰ In urban areas, the prevalence of exclusive ENDS use (not combining with other tobacco) and exclusive ENDS use without having ever smoked among young adults increased slightly from 7.5% to 7.8% and 5.7% to 5.9%, respectively, from 2018 to 2020.²⁰ However, its prevalence among the young adult population in rural areas exhibited greater

increases over the same period, from 8.6% to 12.6% and 6.7% to 9.9%, respectively.²⁰

Research on ENDS has been widely reported over the past decade, including a significant number of studies focused on health effects, relationships with other tobacco products or health-risk behaviors, and the socioeconomic characteristics of ENDS users.²¹ Historically, rural communities in the United States have higher smoking rates, less access to cessation support, a more smoking-friendly culture, and lower tobacco taxes compared to urban communities.²²⁻²⁴ However, there has been a serious gap in knowledge of the perceptions about young adults' ENDS use and cessation as well as barriers and facilitators associated with cessation in rural areas. Thus, the objectives of this paper were to understand perceived barriers and facilitators to ENDS use cessation among young adults in rural areas and to examine their perceptions about ENDS use and cessation.

METHODS

We conducted a cross-sectional survey with young adults residing in Wisconsin, Minnesota, and South Dakota. We recruited participants using multiple channels, including distributing study advertisements online to college students, advertising the study using regional public health and tobacco-free networks, and displaying study recruitment flyers at local events in rural areas of these states. Inclusion criteria were (1) English speaking, (2) age 18 to 24 years, (c) daily ENDS use in the past month, and (4) address in a rural county as defined by a Rural-Urban Continuum Code (RUCC) of 4 to 9. Individuals who reported use of other tobacco products (eg, cigarettes and smokeless tobacco) in the past month were excluded.

The RUCC is a classification number that distinguishes metropolitan counties by the population size of their metro area and nonmetropolitan counties by degree of urbanization and adjacency to a metro area.²⁵ RUCCs range from 1 to 10. Counties with RUCCs from 1 to 3 are classified as metro areas, and counties with RUCCs from 4 through 10 are classified as nonmetro areas. No counties in the United States are classified as 10.²⁶ In our study, counties with RUCCs from 4 through 9 were defined as rural areas. This rural classification method has been used in other rural tobacco studies.²⁷⁻²⁹

Individuals interested in participating in the study accessed the online screening survey via Qualtrics. They were asked to answer questions regarding inclusion and exclusion criteria and to enter their email address. Then, a personalized link for the main survey was delivered to the respondent's email address. The main survey took approximately 20 minutes to complete. Participants who completed the survey were provided an opportunity to win a \$100 electronic gift card.

Measures

Demographics and ENDS Use Cessation

The survey asked participants' age, gender, race, ethnicity, and

Table 1. Characteristics of Survey Participants (N=91)

Variable	N (%) or mean (±SD)
Age	20.4 (± 1.6)
Sex	
Man	16 (17.6)
Woman	72 (79.1)
Other	3 (3.3)
Race	
White	87 (95.6)
Other ^a	4 (4.4)
Ethnicity (Hispanic, Latino/a, or Spanish origin)	
Yes	5 (5.5)
No	86 (94.5)
State (n=81)	
Wisconsin	64 (79.0)
Minnesota	16 (19.8)
South Dakota	1 (1.2)
Nicotine dependence score	11.9 (± 4.0)
Perceived proportion of ENDS users	6.6 (± 2.4)
Perception of ENDS (n=90)	
Very good vs very bad	6.3 (± 2.6)
Very safe vs very dangerous	6.0 (± 2.8)
Very nice vs very awful	5.3 (± 2.7)
Readiness to quit ENDS (n=90)	
Within next month	12 (13.3)
Within next 6 months	33 (36.7)
At some point	42 (46.7)
Not thinking about it	3 (3.3)
Confidence in ENDS cessation	2.9 (± 1.3)
Talked about ENDS use with health care providers (n=89)	
Yes	28 (31.5)
No	61 (68.5)
Delivery preferences for cessation treatment ^b	
Text message	34 (37.4)
Social media	19 (20.9)
Smartphone application	16 (17.6)
Voice phone call	5 (5.5)
Office visit	7 (7.7)
Web (Internet)	12 (13.2)
Virtual meeting	5 (5.5)
Other	1 (1.1)
Not sure	41 (45.1)

Abbreviation: ENDS, electronic nicotine delivery system.

^aOther includes Asian (n=2) and multicultural (n=2).

^bMultiple responses allowed.

state, as well as ENDS use cessation-related questions including nicotine dependence, perceived proportion of ENDS users in their age group (18-24 years), perceptions of ENDS use, readiness to quit using ENDS, confidence in their ability to stop using ENDS, and delivery preferences for cessation treatment. Nicotine dependence level was measured by the Penn State Electronic Cigarette Dependence Index (PS-ECDI), a reliable and validated instrument to measure nicotine dependence among adult ENDS users. It comprises 10 items to measure nicotine dependence covering frequency of use, time until first use of the day, awakening at night to use, difficulty quitting, cravings, urges, and withdrawal

symptoms.^{30,31} Total scoring of PS-ECDI ranges from 0 to 20 (0-3 = no dependence, 4-8 = low dependence, 9-12 = medium dependence, ≥ 13 = high dependence).

The perceived proportion of similarly aged ENDS users was assessed with the question, “Out of every 10 people in your age group, how many do you think use e-cigarettes?” with answers ranging from 0 to 10. Perceptions about ENDS were measured with three 10-point semantic differential scale items assessing how good or bad, how safe or dangerous, and how nice or awful it is. Readiness to quit using ENDS was measured with the question, “Are you planning to quit e-cigarettes?” Options were “thinking of it within the next month,” “within the next 6 months,” at some point, but not within the next 6 months,” or “absolutely not thinking of quitting.” Participants also were asked, “How confident are you that you can quit e-cigarettes completely?” with options ranging from 1 to 5 (“not at all” to “very confident,” respectively).

The survey asked if participants had been asked about ENDS use by a health care provider in the past year (yes/no) and about their preferred delivery method for cessation treatment (ie, “What are your delivery preferences of an e-cigarette cessation [quitting] treatment program?”). Options were “text message,” “social media,” “smartphone application,” “voice phone call,” “office visit,” “Web,” “virtual meeting,” and “other.” Participants were allowed to select multiple answers to this question.

Barriers and Facilitators to ENDS Use Cessation

The following questions and response categories were created based on a report by Dyson et al on the barriers and facilitators to END use cessation.³² For barriers, participants were asked, “What makes it difficult for you to quit e-cigarettes?” and to rate the following categories on a 5-point Likert scale where 1 = strongly disagree and 5 = strongly agree: (1) low confidence of quitting, (2) high nicotine dependence, (3) many advantages of e-cigarettes (eg, stress relief, flavor), (4) social influence toward maintaining e-cigarette use, (5) environmental influence toward maintaining e-cigarette use (eg, permissive culture), (6) thoughts that e-cigarettes are less harmful than cigarettes, (7) lack of information about how to start quitting, and (8) cost for cessation treatment.

Table 2. Barriers and Facilitators to ENDS Use Cessation (N = 86)

Barrier	Mean (\pm SD)	Facilitator	Mean (\pm SD)
Low confidence in ability to quit	3.2 (\pm 1.3)	High confidence in ability to quit	2.88 (\pm 1.3)
High nicotine dependence	3.8 (\pm 1.1)	Low nicotine dependence	2.84 (\pm 1.4)
Many advantages of ENDS	3.9 (\pm 1.1)	Few advantages of ENDS	2.69 (\pm 1.3)
Social influence toward maintenance	3.0 (\pm 1.5)	Social influence toward cessation	2.59 (\pm 1.3)
Environmental influence toward maintenance	3.0 (\pm 1.3)	Environmental influence toward cessation	2.52 (\pm 1.1)
Perception ENDS is less harmful than cigarettes	3.2 (\pm 1.2)	Perception ENDS is still harmful	3.79 (\pm 1.2)
Lack of information about cessation	2.9 (\pm 1.3)	Information about cessation	2.85 (\pm 1.2)
Cost for cessation	2.8 (\pm 1.4)	Cost for ENDS use	4.15 (\pm 1.1)

Abbreviation: ENDS, electronic nicotine delivery systems.

Table 3. Perceptions of ENDS Use Cessation (N = 57)

Themes	Categories	N (%)
Exposure to and subsequent initiation of ENDS use	Informal sources (eg, family members, and friends)	2 (3.5)
	Public sources (eg, retail stores, bars, and gas stations)	3 (5.3)
Continuation of ENDS use	Social norms towards ENDS use	6 (10.5)
	Accessibility to ENDS products	3 (5.3)
	Marketing of ENDS products	2 (3.5)
	Limited entertainment resources in rural areas	4 (7.0)
Prevention and cessation of ENDS use	Suggested prevention strategies for rural areas	
	• Limit access to ENDS products	5 (9.3)
	• Denormalize ENDS use	3 (5.3)
	Recommended treatment programs for rural areas	
	• Implement or expand access to tailored quality programs and helpful resources	10 (17.5)
	• Provide alternative activities, social skill training, and support groups	9 (15.8)
	• Offer low cost and affordable treatment options	5 (9.3)
	• Emphasize harms of ENDS use and health benefits of quitting	2 (3.5)
	• Destigmatize seeking treatment	1 (1.8)
	Opposite views regarding cessation treatment targeting rural areas	2 (3.5)

Abbreviation: ENDS, electronic nicotine delivery systems.

For facilitators to ENDS use cessation, participants were asked, “What motivates you to quit e-cigarettes?” Using the same 5-point Likert scale, response categories were (1) high confidence in quitting, (2) low nicotine dependence, (3) few advantages of e-cigarettes, (4) social influence toward quitting e-cigarette use, (5) environmental influence toward quitting e-cigarette use, (6) thoughts that e-cigarettes are still harmful, (7) information about how to start quitting, and (8) cost for e-cigarette use.

Perceptions About ENDS Use Cessation

At the end of the survey, participants were asked an open-ended question: “What would you like us to consider for e-cigarette cessation treatment in terms of your residential or community area?”

Analytic Strategies

Descriptive statistics analysis using frequencies, percentages, and mean values was used to summarize survey responses. Data were

analyzed using IBM SPSS Statistics, version 26 (IBM Corp, Armonk, New York). Responses to the open-ended question were analyzed using a descriptive content analysis method³³ with assistance of NVivo 12 (Lumivero, Denver, Colorado). This method transcends free text, delving into a deeper understanding of the responses, to organize large amounts of text into categories and themes that reflect a shared meaning.³³ Three coders were oriented to the entire nature of the study, study objectives, data structure, and approach to coding. Subsequently, they coded the free-text responses by (a) identifying the meaning of the texts, (b) creating primary codes, (c) sorting texts into categories, and (d) formulating content into themes. A codebook to provide definitions and example quotes was drafted based on the primary codes and updated throughout the coding process as new codes were identified. This detailed codebook and achievement of the 80% inter-coder reliability were critical to ensure validation.

The study protocol was approved by the Institutional Review Board (IRB) at the first author's institution prior to data collection. Additional IRB reviews and discussions were made at some institutions where data were collected.

RESULTS

Characteristics of Survey Participants

Due to incomplete answers from 9 survey respondents, demographic characteristics were analyzed for 91 out of 100 total respondents (Table 1). The mean age of the participants was 20.4 years. Nearly 80% of respondents were women, and a majority (94.5%) of respondents were non-Hispanic White. Nearly 80% were from Wisconsin, followed by Minnesota (19.8%) and South Dakota (1%). The mean nicotine dependence score of participants was 11.9 (± 4.0 ; range 1-19), indicating medium dependence. The perceived proportion of similarly aged ENDS users was 6.6 (range 1-12), indicating participants perceived that approximately 60% to 70% of young adults are ENDS users. Slightly more participants perceived ENDS use to be bad (vs good), dangerous (vs safe), and awful (vs nice). Half of the participants reported a readiness to quit using ENDS within 6 months, including 13.3% reporting a readiness to quit within 1 month. Participants reported a moderate level of confidence (2.9, range 1-5) in their ability to quit. Approximately one third reported being asked about ENDS use by a health care provider in the past year. The cessation treatment delivery method most preferred was text message, followed by social media, smartphone application, and Web (internet) (Table 1).

Barriers and Facilitators to ENDS Use Cessation

Eighty-six participants answered questions about ENDS use cessation barriers and facilitators. The highest barriers were advantages of ENDS use (3.9 ± 1.1), followed by high nicotine dependence (3.9 ± 1.1), low confidence (3.2 ± 1.3), and the perception that ENDS are less harmful than cigarettes (3.2 ± 1.2). The greatest

facilitators were the cost (4.2 ± 1.1), associate harm (3.8 ± 1.2), confidence in ability to quit (2.9 ± 1.3), and low nicotine dependence (2.8 ± 1.4). See Table 2.

Perceptions About ENDS Use Cessation

In response to the open-ended question regarding perceptions about ENDS use cessation, 43 respondents left it blank or reported "N/A," or "I don't know." Responses from the remaining 57 participants were analyzed, and 3 key themes emerged: (1) exposure to and subsequent initiation of ENDS use, (2) continuation of ENDS use, and (3) prevention and cessation of ENDS use (Table 3).

Exposure to and Subsequent Initiation of ENDS Use

Five respondents (8.8%) indicated that exposure to ENDS products through informal sources (eg, friends and family members) and public sources (eg, retail stores, bars, gas stations) led to the initiation of ENDS use. Comments included the following:

"(The) majority of the students in high schools are getting nicotine products from parents, siblings, or friends; I started because my brother's friend let me try and then I ended up getting addicted."

"Vaping is allowed at the bars. They even have chargers available for people to charge their vapes at the bars if they (ENDS) die there."

Continued ENDS Use

The primary reasons for continued ENDS use in rural areas included social norms (10.5%) and easy access to ENDS products (5.3%). Comments included the following:

"It's really hard in small towns because it seems like everyone does it [vapes]. Even if you quit, if you see your friends, they will likely offer you some nicotine products and it's really hard to say no. It's also illegal to get them (nicotine products) under 21, but it's pretty easy to get them anyways."

"...how easy access can be and how long people have been doing it. Also, here vaping is actually done with its intended use of quitting cigarettes. That is...what I have noticed."

Some respondents (7.0%) cited limited entertainment options in rural areas as a reason for their ENDS use:

"It is ridiculously boring having to live in the middle of nowhere. ...there is nothing else to do" and "...there's nothing for us to do in rural areas."

A few respondents (3.5%) indicated that marketing strategies related to sales of ENDS products (eg, kits and e-liquids) contributed to continued ENDS use:

"I think the best way to help people quit is by stopping the brands from being able to make different flavors [because] if there was only tobacco [flavor] I would never vape."

ENDS Use Prevention and Cessation

The theme of ENDS use prevention and cessation consisted of 3

categories: (1) suggested prevention strategies, (2) recommended treatment programs for rural areas, and (3) opposing views regarding cessation treatment.

Suggested Prevention Strategies for Rural Areas

Respondents identified several ENDS use prevention strategies relevant to the rural context, such as limiting the availability of ENDS products (9.3%) and denormalizing ENDS use (5.3%) in rural communities. Responses included the following comments: “ban them;” “make it harder for those underaged to receive e-cigarettes;” and “try to make it harder to access; it’s so easy to go buy it.” Denormalization comments included, “make it less socially cool” and “not normalizing it.”

Recommended Treatment Programs for Rural Areas

Respondents offered various suggestions regarding treatment programs appropriate for rural settings. The need to implement or expand access to tailored programs and helpful resources (17.5%) was identified by 9 respondents. Comments included, “there’s not a lot of cessation options in smaller towns” and “make getting information and help on quitting easier than going to the gas station or smoke [vape] shop closest to you.” Two respondents specifically identified the need for online treatment programs. Their suggestions included, “more online options” and “maybe easier access for people who live far away from it [treatment] and don’t have reliable internet.”

Several respondents (15.8%) suggested providing alternative activities, social skill training, and support groups to avoid temptations. Examples included:

“Try and have a local group to help quit. I think if others see people that are the same age and trying to do the same thing (such as quitting nicotine), it would be a great way for people to see they aren’t alone in trying to quit.”

“How to avoid temptation around friends, family, and community members who do smoke [vape] and what to do when you have the urge to smoke [vape] from those people that [are] around you.”

“Something to be able to honk [sic] about all day would help me take my mind off of cravings.”

Respondents (9.3%) also noted the high cost of treatment and suggested making treatment options low cost and affordable:

“Make it more cost efficient (for nicotine patches and the care required for withdrawal). I think what turns me away mostly is the cost of being able to seek help for vaping.”

“Offering low-income, friendly, in-person treatments/advocates/meetings.”

A few respondents (3.5%) raised concerns about the lack of knowledge related to harm caused by ENDS use and the health benefits of quitting, evidenced through comments such as “most of the [people in] rural areas do not know the harm of smoking [vap-

ing], so we should publicize it and let everyone know its harm;” and “[provide] more information on what it does to you—information on the negative side effects (drowsiness, appetite issues, sleep issues).”

Differing Views for Cessation Treatment in Rural Areas

Two responses reflected opposite views regarding the need for treatment programs targeting rural areas. One respondent said, “I don’t think that the rural setting really matters that much when it comes to quitting vaping. It’s mostly just based on the individual.” The other emphasized an individual’s ability to quit: “I mean thinking about it really just kind of makes me look like a loser. I don’t know if there are many quitting methods besides holding yourself accountable.”

DISCUSSION

To our knowledge, this is the first study to report the barriers and facilitators to ENDS use cessation, as well as perceptions about ENDS use and cessation among young adult ENDS users in rural areas. Barriers to cessation reported by respondents included advantages of ENDS use, high nicotine dependence, low confidence in ability to quit using ENDS, the perception that using ENDS is less harmful than cigarettes, and social/environmental influences. The survey did not ask for specific details regarding advantages of ENDS use, but use as an aid for stress reduction, enjoyment/satisfaction,³⁴ flavors,^{35,36} and aesthetic device designs^{37,38} may attract young generations to consumption and discourage cessation. Like other tobacco products, high nicotine dependence was still a huge barrier to ENDS use cessation, and most ENDS products contain nicotine with a controllable option for its concentration levels.^{21,39}

Survey respondents also indicated that the cost of ENDS use was highly associated with cessation—a finding that differs from—another recent study that reported health concerns as the top reason for cessation.⁴⁰ Rural communities in the United States are characterized by fewer employment opportunities²² and more prevalent poverty than urban areas.⁴¹ Thus, providing more affordable or free cessation programs for young adults in rural areas is an important consideration.

Further, among our study participants, cognitive factors (eg, thoughts on ENDS’ harmful effects and cessation) and psychosocial factors (eg, confidence, social and environmental influences) were associated with barriers or facilitators to ENDS use. Improving social and cognitive skills (eg, enhancing self-efficacy), establish perceived social norms, and social support to grow behavioral capability⁴² need to be considered in future ENDS cessation treatment programs.

Study participants also shared feedback regarding ENDS use cessation specifically in rural settings. Findings indicate that young adults in rural settings experienced strong and even unavoidable social and environmental influences that contributed to the initiation and continued use of ENDS in various situations, and structural and cultural factors in rural communities appear to enhance this. For example, rural areas lack many of the entertain-

ment options young adults prefer for stress relief, and ENDS use may be related to boredom or the lack of other social activities. Additionally, rural residents may share permissive cultural attitudes toward vaping²⁴ and stigma toward cessation.⁴³

Implications for Future Cessation Study

Given our findings, we present a call to action for increased efforts toward ENDS use cessation and prevention for young adults in rural areas. First, educating health care providers about the dangers of ENDS and making sure all clinicians are addressing ENDS use prevention and cessation with young adults is critical. Clinicians in rural communities should engage with ENDS or comprehensive tobacco control coalitions and public health advocates to monitor ENDS use-related health disparities (ie, differences in prevalence between urban and rural areas) and to plan and implement strategies to reduce ENDS use. Policies toward ENDS use cessation and prevention among this population (eg, the adoption of comprehensive tobacco-free policies including ENDS) are urgently needed in places frequented by young adults in rural areas, such as restaurants and bars.

Researchers and clinicians should continue to examine ENDS use among young adults in rural areas, including their motivations and barriers to ENDS use cessation, as a foundational knowledge base for effective treatment strategies and future studies. Given the potentially unique contextual and environmental factors associated with ENDS use in rural areas, these data can be used to develop tailored ENDS use cessation intervention studies for young adults. Because a majority of young adult ENDS users in rural areas are now consuming ENDS exclusively (ie, not combining with other tobacco products) and have never been cigarette smokers, cessation interventions for these users should be prioritized and consider ENDS-specific details (eg, device, flavor, nicotine strength, battery, vape-free policy). The good news is most of the participants in our study were interested in cessation, with half indicating a desire to quit within 6 months.

Rural residents have limited access to effective tobacco cessation resources.²⁴ Thus, as indicated by our survey respondents, remotely delivered interventions may increase reach in this population. Short messaging service (SMS)-based interventions may offer a promising approach to help rural young adults quit using ENDS. Text messaging is inexpensive, easy, and anonymous. A recent empirical study documented the effectiveness of the text message-based approach in ENDS cessation for entire young adults population in the United States.⁴⁴ Text messaging interventions have been shown to be feasible, acceptable, and efficacious for smokeless tobacco cessation among rural youths⁴⁵ and other rural populations,^{29,46} and effective in general for young adults.^{47,48}

Study Limitations

While this paper presents important findings and implications for clinicians, tobacco control researchers, and public health

advocates regarding ENDS use control and cessation, there are limitations. The study's sample size was relatively small, which could potentially limit the generalizability of the findings. Data on participants' socioeconomic status (eg, education) were not collected, even though these factors could offer pertinent insights into barriers and facilitators to ENDS use and cessation. Although participants were recruited through multiple channels, the sample was skewed toward females and respondents from Wisconsin, and reliance on self-report surveys may cause response bias. The study was conducted in 1 regional location, thus curbing its broader applicability. In our survey, we drew potential facilitators and barriers from a previous report by Dyson et al,³² which used a synthesis of various types of research designs from different populations (eg, adolescents, adults, dual users, and combustible cigarettes). However, the current study's sample differed from that of Dyson et al. Contextual factors were not considered. We did not evaluate the effectiveness of specific cessation interventions. Given the study's specific focus on rural environments, the findings may not be generalizable to urban or suburban areas of the nation.

CONCLUSIONS

Clinicians, researchers, and public health advocates in rural areas should prioritize ENDS use among young adults in rural areas. Cessation programs for this population should take into account the barriers and facilitators to cessation found in this study, including decreasing the benefits of ENDS use, alternative stress relief activities in rural areas, cost savings associated with use and cessation or affordable cessation treatment options, management of nicotine craving and withdrawal symptoms, and rural-relevant social, environmental, and cultural factors associated with use and cessation. Strong social norms, acceptability and accessibility to ENDS, lack of access to cessation treatment programs, and stigma toward cessation also need to be addressed for this rural population who want to quit ENDS use.

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