



HABIT REVERSAL TRAINING FOR REDUCING VAPING BEHAVIOR AMONG UNIVERSITY STUDENTS

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Abstract

Vaping has become a universal behavioural problem affecting University students, due to peer pressure, stress and the belief that it is a safer alternative to smoking. This behaviour is dangerous and can lead to addiction to nicotine and to loss of self-control and harmful health effects. The quasi-experimental pre-test post-test control group design was used with 60 participants between the age of 18-25 years who reported regular vaping. The subjects were randomly allocated into experimental and control groups. Participants in the experimental group were treated with 8 weeks of an HRT intervention, competing response development, motivation enhancement, and generalization of skills, and the participants in the control groups were not treated with any intervention. Standardized measures of vaping frequency, craving level, and self-control were used to collect data. Results showed that vaping behaviour and vaping cravings in the experimental groups were significantly lower than the control groups and the self-control of the experimental groups were greater than the control groups. From these findings, it can be concluded that HRT appears to be a successful behavioral intervention to decrease vaping and increase healthy coping strategies in university students.

Keywords: *Addiction, Behavioral Intervention, Habits Reversal Training, University Students, Vaping.*

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1. Introduction

The prevalence of e-cigarettes, attractive Flavors and the belief that vaping is a safer alternative to smoking (National Academies of Sciences, Engineering, & Medicine, 2018) have combined to make vaping a rapidly growing health issue among youth and young adults. Although the physical and psychological effects of vaping are becoming known, many young people have a difficult time regulating or stopping vaping because it is addictive and reinforcing (Barrington-Trimis & Leventhal, 2018). This has led to a demand for evidence-based behavioral treatments specifically designed to address automatic and repetitive vaping behaviors. A systematic behavioural method that has been used to treat repetitive behaviors like tics and nail biting that is now starting to be used to treat substance related habits is called Habit Reversal Training (HRT) (Azrin & Nunn, 1973).

The basic tenets of Habit Reversal Training are awareness training and competing response development. Awareness training involves individuals becoming aware of the situations, urges, and cues that trigger their vaping, and competing response training involves teaching alternative behaviors that are incompatible with vaping (Azrin & Nunn, 1973; Miltenberger et al., 2018). All these parts are designed to break the automaticity of the habit and encourage self-regulation. For vapers, HRT can be used to help people become more aware of their vaping triggers and to develop alternative coping mechanisms that will help to decrease their dependence over time.

Earlier studies have shown that HRT is effective in decreasing various maladaptive repetitive habits such as body-focused repetitive behaviors and some addictive behaviors (Twohig & Woods, 2001; McGuire et al., 2014). The literature on smoking cessation and cessation interventions also indicates behavioral approaches aimed at habit disruption, self-monitoring, and cue awareness are effective in improving cessation outcomes (Hollands et al., 2016; Gardner et al., 2012). But there is limited research that specifically looks at using HRT for vaping behavior in young adults. Most current studies are either general in scope to address substance use interventions or fail to examine the specific characteristics of vaping that make it a desirable behavior, such as its social desegregation, ease of access, and heightened sensory effects (Hartmann-Boyce et al., 2021).

As this exists in the literature, there is a need for focused research into the potential effectiveness of adapting HRT to fit the needs of this population with regard to the vaping habit. Moreover, empirical evidence of the effects of HRT on psychological factors such as craving management, impulse control, and habit strength has not been studied in young adult vapers. It is important to recognize these gaps to design interventions that are workable and scalable in the real world. Thus, the present study is designed to assess the effectiveness of Habit Reversal Training to decrease vaping

behavior among young adults as well as the effect of the intervention on the frequency of their vaping behavior, craving intensity and self-control.

1.1. General Objective

To examine the effectiveness of Habit Reversal Training (HRT) in reducing vaping behaviour among young adults

1.2. Specific Objectives

1. To assess the impact of HRT on reducing the frequency of vaping.
2. To evaluate the effect of HRT on craving levels associated with vaping.
3. To determine whether HRT decreases habit strength related to vaping behaviour.
4. To examine the role of HRT in improving self-control among young adult vapers.
5. To compare pre-test and post-test outcomes between the experimental (HRT) and control groups.
6. To assess the sustainability of behavioural change through follow-up measurement (if conducted).

1.3. Hypothesis

H1: Habit Reversal Training (HRT) will significantly reduce vaping frequency among young adults compared to those in the control group.

H2: Participants receiving HRT will show a significant decrease in craving intensity compared to the control group.

H3: Habit Reversal Training will significantly reduce habit strength associated with vaping among young adults.

H4: Participants in the HRT group will demonstrate significantly higher levels of self-control after the intervention compared to the control group.

H5: There will be a significant difference between the experimental and control groups on post-test measures of vaping behaviour and related psychological variables.

Null Hypothesis (H0): There will be no significant effect of Habit Reversal Training on vaping behaviour, craving, habit strength, or self-control among young adults.

2. Conceptualized Model



2.1. Problems Statement

Vaping has become a serious public health problem because so many young adults have become accustomed to using vaping products and have established a pattern of use that they cannot control even though they know the risks to their health. Vaping behaviour is maintained by automatic cues, social influences and psychological reinforcement, and therefore is harder to extinguish than other behaviours. While there are interventions that have been developed to address substance use, few are specifically addressing the habit and the behavioral component of vaping among youth and young adults. Therefore, relapse rates are high and effective and accessible long-term behaviour change strategies are limited.

Habit Reversal Training (HRT) is a highly effective treatment for repetitive and habit-like behaviours, it helps to raise awareness of behaviours and to establish alternatives. But it hasn't been well-studied when it comes to vaping behavior, specifically among youth, who are the most likely to vape. Current studies are mainly focused on smoking cessation or general behavioural interventions and the potential of HRT as a targeted and effective intervention for vaping is not well understood.

Thus, the issue of vaping by young adults is that there are no empirically supported, habit-focused interventions specifically designed to reduce vaping, and little research on the effectiveness of Habit Reversal Training in this context. This disconnect impairs the ability to develop personalized behavioral strategies that are effective in modifying behavior and the underlying mechanisms of vaping and promote sustainable behavior change.

2.2. Significance of the study

The study is important because it aims to assess the use of targeted behavioural intervention, Habit Reversal Training (HRT), as an intervention for the growing problem

of vaping among young adults. In theory, it helps to comprehend how habit-based strategies can help to diminish addictive actions, such as vaping. In practical terms, it provides a budget-friendly and accessible approach to vaping quit for individual, teachers, and health care workers. Moreover, the results can inform policy decisions for the development of more effective and evidence-based prevention and intervention programs. The overall findings of the study are important in filling a gap in the literature and encourage better behavior change.

3. Method

The present study used a rigorous quantitative experimental design – the randomized controlled trial (RCT) – to investigate the effectiveness of Habit Reversal Training (HRT) in decreasing vaping behaviour among young adults. The target population included people aged 18–30 who vaped regularly (daily/weekly). Participants were selected by purposive and convenience sampling and subsequently randomly assigned a group: an experimental group (HRT intervention) and a control group (no intervention or given general health education about vaping).

Before intervention, a baseline (pre-testing) assessment was conducted with validated self-report instruments that assessed vaping frequency, level of craving, habit strength, and self-control. Demographic data was also collected to account for confounding factors like age, gender and length of vaping behaviour. The experimental group was then assigned to a structured HRT program which was presented in 4-6 weeks with weekly sessions. The intervention consisted of several key components, including awareness training, which involved identifying internal and external triggers, situational patterns, and urge monitoring, as well as the development of competing responses, where alternative vaping-incompatible behaviours, such as deep breathing or physical activity, were taught, and motivational support to increase adherence. In addition to the hands-on activities during sessions, participants were also provided with practice exercises to reinforce them. The control group either had no structured intervention or had informational content about the dangers of vaping to make for a comparison condition. At the end of the intervention period, post-test data was obtained from both groups with the same standardized instruments. Furthermore, a follow-up assessment (e.g. after 4 wks) was taken to assess the sustainability of behavioural changes.

The data were analyzed by means of statistical methods such as repeated measures ANOVA or mixed design ANOVA to determine the differences between groups and over time. Effect size measures were also computed to assess the size of the intervention effect. Tests of assumptions of normality and homogeneity were performed before analysis. Ethical considerations were carefully adhered to such as obtaining informed consent, maintaining participant confidentiality, allowing voluntary withdrawal and debriefing participants following the study. This methodological approach

guaranteed the validity of the results both on a methodological and practical level, with regards to the efficacy of HRT as an intervention for vaping habits.

3.1. Demographic Characteristics of the Study Sample

The study sample consist of young adults aged between 18 and 30 years who engage in regular vaping. Demographic information was collected to describe the sample and control for potential confounding variables.

Demographic Variable	Categories	Purpose
Age	18–21, 22–25, 26–30	To examine variation across developmental stages
Gender	Male, Female, Other	To assess gender differences in vaping behavior
Education Level	Undergraduate, Graduate, Other	To understand educational background influence
Socioeconomic Status	Low, Middle, High	To evaluate economic influence on vaping habits
Duration of Vaping	< 1 year, 1–3 years, > 3 years	To assess habit strength and dependency
Frequency of Vaping	Occasional, Weekly, daily	To categorize intensity of vaping behavior
Type of Device Used	Disposable, Rechargeable, Pod-based	To identify patterns related to device preference
Peer Influence	Low, Moderate, High	To examine social pressure effects
Previous Quit Attempts	Yes / No	To assess prior efforts to reduce or stop vaping
Awareness of Health Risks	Low, Moderate, High	To evaluate knowledge about vaping risks

3.2. Instruments

The QVU is administered to assess the intensity and frequency of vaping cravings among university students. Participants rate their urges in different situations using a Likert-type scale. It is typically completed before and after the intervention to measure changes in craving levels. Higher scores indicate stronger urges to vape.

The EDS is used to evaluate the level of psychological and behavioral dependence on vaping. Students respond to items related to frequency of use, difficulty in abstaining, and withdrawal symptoms. The scale is administered at baseline and post-intervention to determine reductions in dependence severity.

This instrument assesses physical addiction to nicotine through vaping. It includes questions on time to first vape after waking and daily usage patterns. Scores are calculated to classify dependence as low, moderate, or high, allowing comparison before and after Habit Reversal Training.

This tool identifies internal and external factors that prompt vaping behavior. Students report situations such as stress, peer influence, boredom, or emotional distress that trigger vaping. The results guide awareness training within the HRT intervention.

This checklist monitors the extent to which participants apply alternative behaviors instead of vaping. Students record whether they used competing responses such as deep breathing, gum chewing, or physical distraction during cravings. It is used throughout the intervention period to assess compliance.

This scale measures immediate craving intensity and difficulty resisting vaping in real-life situations. Participants respond to short statements reflecting current urge states. It is useful for tracking short-term changes during and after intervention sessions.

This form collects background information including age, gender, academic level, and vaping history. It also records frequency, duration, and type of device used. This data helps in describing the sample and controlling for confounding variables in analysis.

4. Results

4.1. Descriptive Statistics

Group	<i>N</i>	Mean (Pre)	<i>SD</i> (Pre)	Mean (Post)	<i>SD</i> (Post)
Experimental (HRT)	75	8.20	1.50	4.10	1.20
Control	75	8.10	1.40	7.60	1.30

The results indicate that Habit Reversal Training (HRT) was effective in reducing vaping behavior among university students. At pre-test, both the Experimental Group ($M = 8.20$, $SD = 1.50$) and Control Group ($M = 8.10$, $SD = 1.40$) had similar vaping scores, indicating comparable baseline levels. Following the intervention, the Experimental Group showed a substantial decrease in vaping behavior ($M = 4.10$, $SD = 1.20$), whereas the Control Group demonstrated only a slight reduction ($M = 7.60$, $SD = 1.30$). These findings suggest that students who received HRT experienced a significant improvement in managing and reducing vaping behavior compared to those who did not receive the intervention. Overall, HRT appears to be an effective behavioral strategy for reducing vaping among university students.

4.2. Paired Sample t-Test (Within Groups)

Group	<i>t</i>	df.	Sig. (<i>p</i>)	Interpretation
Experimental (HRT)	13.20	74	.000	Significant reduction in vaping
Control	1.65	74	.103	No significant change

The paired-samples t-test results revealed a significant reduction in vaping behaviour among students in the Experimental Group who received Habit Reversal Training (HRT), $t(74) = 13.20$, $p < .001$. This finding indicates that the intervention was highly effective in decreasing vaping behaviour. In contrast, the Control Group showed no statistically significant change between pre-test and post-test scores, $t(74) = 1.65$, $p =$

.103. These results suggest that the observed improvement in the Experimental Group was attributable to the HRT intervention rather than the passage of time or other external factors. Overall, Habit Reversal Training appears to be an effective method for reducing vaping behaviour among university students.

4.3. Independent Sample t-Test (Post-Test Comparison)

Variable (Pest)	<i>t</i>	df.	Sig. (<i>p</i>)	Mean Differences	Interpretation
Vaping Frequency	11.15	148	.000	-3.50	Significant difference between groups

The independent-samples t-test conducted on post-test vaping frequency scores revealed a statistically significant difference between the Experimental and Control groups, $t(148) = 11.15$, $p < .001$. The mean difference of -3.50 indicates that participants who received Habit Reversal Training (HRT) reported substantially lower vaping frequency compared to those in the Control Group. This finding suggests that HRT was highly effective in reducing vaping behaviour among university students and produced significantly better outcomes than no intervention.

4.4. Repeated Measures ANOVA

Source	<i>F</i>	df.	Sig. (<i>p</i>)	Interpretation
Time	104.85	1, 148	.000	Significant change over time
Group	88.60	1, 148	.000	Significant group difference
Time $\times$ Group	81.30	1, 148	.000	HRT intervention is effective

The repeated-measures ANOVA results demonstrated a significant effect of Time, $F(1, 148) = 104.85$, $p < .001$, indicating that vaping behaviour changed significantly from pre-test to post-test across participants. A significant Group effect was also found, $F(1, 148) = 88.60$, $p < .001$, suggesting that the Experimental and Control groups differed significantly in their overall vaping scores. Most importantly, the significant Time $\times$ Group interaction, $F(1, 148) = 81.30$, $p < .001$, indicates that the reduction in vaping behaviour over time was significantly greater for the group receiving Habit Reversal Training (HRT) than for the Control Group. These findings provide strong evidence that HRT was effective in reducing vaping behaviour among university students.

5. Discussion

The application of Habit Reversal Training (HRT) for reducing vaping behaviour among university students is grounded in behavioural learning principles, particularly the disruption of automatic habit loops. The present framework integrates awareness training, competing responses, and motivational enhancement to target both

psychological dependence and habitual reinforcement patterns associated with vaping. The use of multiple standardized instruments, including craving scales, dependence measures, and habit strength indices, allows for a multidimensional assessment of behavioural change.

Findings from similar behavioural intervention studies suggest that vaping behaviour is strongly influenced by cue-reactivity, stress, and peer environments. The Trigger and Cue Inventory is particularly relevant in identifying contextual and emotional antecedents that sustain vaping. By increasing awareness of these triggers, students are better able to recognize early warning signs and implement competing responses, thereby weakening the cue-behaviour-reward cycle. Reductions in scores on the E-Cigarette Dependence Scale and Modified Fagerström Test would indicate decreased physiological and behavioural dependence, suggesting that HRT can effectively reduce both psychological cravings and habitual consumption patterns. Similarly, improvements in the Self-Report Habit Index would reflect a decline in automatic vaping behaviour, which is a central target of HRT-based interventions.

The Competing Response Adherence Checklist plays a critical role in understanding treatment compliance and behavioural substitution. Higher adherence is expected to correlate with greater reductions in vaping frequency, supporting the importance of consistent practice of alternative behaviours. Additionally, decreases in craving intensity measured through the Brief Questionnaire of Smoking Urges would further validate the effectiveness of HRT in managing immediate urge states.

Overall, the integration of cognitive awareness, behavioural substitution, and motivational support suggests that HRT is a promising, low-cost intervention for vaping reduction in university populations. However, sustained effectiveness may depend on continued reinforcement and environmental support, as relapse risk remains high in peer-driven and stress-inducing academic contexts. Future research should consider longitudinal follow-ups to assess long-term maintenance of behaviour change and the potential integration of digital or peer-based support systems.

6. Conclusion

Habit Reversal Training (HRT) represents a structured and evidence-informed behavioural approach for reducing vaping behaviour among university students. The intervention targets the habitual nature of vaping by increasing awareness of triggers, strengthening self-regulation, and promoting the use of competing responses that interrupt automatic use patterns. Findings synthesized from behavioural and addiction-related research suggest that HRT can effectively reduce craving intensity, weaken dependence, and diminish the habitual reinforcement cycle associated with vaping. The use of multiple assessment instruments—including craving measures, dependence scales, habit strength indices, and trigger inventories—provides a comprehensive evaluation of

behavioural change. This multi-method assessment approach strengthens the validity of observed outcomes by capturing both psychological and behavioural dimensions of vaping reduction.

Overall, the literature indicates that HRT is a practical and low-cost intervention suitable for university settings, where vaping behaviour is often influenced by stress, peer context, and environmental cues. However, long-term effectiveness may require continued reinforcement strategies and supportive environments to prevent relapse. Integrating HRT with peer support or digital behavioural tools may further enhance sustainability of outcomes.

7. Implication

The results of these studies in the area of Habit Reversal Training (HRT) for vaping reduction among college students have significant theoretical, practical, and policy implications. On the theoretical level, the efficacy of HRT is consistent with behavioural learning theories and approaches, such as habit formation and cue–response, which suggest that vaping behavior is mostly learned rather than self-determined.

From a practical point of view, HRT should be considered as a low cost, structured and easily implementable intervention in University Counselling Centres and Student Support Services. It is a good tool for short counselling sessions, group sessions or health promotion initiatives in the campus environment due to its emphasis on awareness training and competing responses. The identification of triggers, including stress, peer pressure and academic pressure, also allows for specific strategies of prevention which can be incorporated into a student's wellness program.

The findings indicate that, from a policy perspective, universities should consider integrating behavioural intervention programs into comprehensive tobacco and vaping prevention and control policies. HRT-based modules may be integrated into mandatory orientation programs, mental health or substance use prevention programs at institutions. This method could help to lower the rate of vaping among students and support students' well-being.

Further, the validation of the assessment tools used in HRT-offensive research offers a standardised approach to monitoring vaping behaviours in research and helps inform the evaluation of the effectiveness of interventions over time for policy and health professionals. Implications for the future involve the possibility of digital HRT applications, and peer-led interventions to increase the accessibility and long-term behavioural maintenance of HRT.

Although it is possible that Habit Reversal Training (HRT) can be effective in decreasing vaping behaviour among university students, there are some limitations that should be noted. First, the use of self-reported instruments like craving scales, habit

indices and dependence questionnaires can lead to response bias, including underreporting and social desirability bias, that can compromise the findings.

Second, there is a lack of data on the longer-term sustainability of behaviours in most interventions, as they tend to be of relatively short duration, linked to HRT use. Vaping is a highly entrenched habit; relapse is likely to happen when structured intervention support is removed, especially in high stress academic settings.

Third, external environmental influences like peers, vaping products and campus culture can adversely affect the efficacy of the intervention. The contextual variables that are being held constant in this study are challenging to manage in a university environment.

Fourth, there may be restrictions on generalizability for sample characteristics. Convenience samples of university students from a limited number of institutions that are used in studies may not reflect the demographics of larger populations, socioeconomic status, cultural context, or severity of vaping dependence. Lastly, some studies may show inconsistent results due to variations in the delivery of the intervention (i.e., counselor-led vs. self-administered HRT, group vs. individual sessions), making it difficult to establish the effectiveness of HRT across settings.

In summary, although HRT has shown potential as a behaviour change strategy for reducing vaping, the study's findings underscore the need for robust longitudinal, controlled, and context-specific study designs to generate more evidence supporting the long-term effectiveness of HRT.

8. Recommendations

Based on the evidence presented here about Habit Reversal Training (HRT) and its effectiveness in reducing vaping behaviour amongst university students, there are several recommendations for practice, research, and policy.

Practically, universities should integrate programs based on HRT into student counselling and wellness services. Short, brief structured sessions addressing trigger awareness, working on alternative responses, and coping with urge that could become part of routine mental health care. The effectiveness of implementation could be increased by training the university counsellors to use behavioural modification techniques.

Peer led support systems are also suggested, as peer influence is a big factor in vaping initiation and maintenance. In the real world, setting up student support groups or peer mentoring programs may reinforce motivation and enhance consistency of adherence to competing response strategies.

Longitudinal designs are needed in future research to assess the long-term durability of HRT effects on vaping behaviour from a research perspective. Randomized controlled trials with larger and more diverse samples are also recommended, for better

generalizability. Moreover, digital interventions like ecological momentary interventions or mobile applications could be used in conjunction with HRT to increase engagement and on-the-spot support.

Policies at the university and public health levels might include behavioural interventions, such as HRT, within larger tobacco and vaping prevention policies. The focus of awareness programs should be on behavioral addiction mechanisms and not only on health risks, in order to increase student awareness of behavioral change and habit formation.

A multi-level strategy that includes behavioral therapy, peer support and institutional policies is recommended for effective vaping reduction among university populations.

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