Behavioral-Based Nursing Interventions: Impact on E-Cigarette Dependence , Social Media Usage, and Perceived Stress among High School Students

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Abstract

Background: Electronic cigarette use, and excessive social media usage have increased exponentially in Egypt and: all over the world. High school students facing simultaneous exposure to e-cigarette use and excessive social media engagement are at elevated risk for perceived stress and many psychological problems. **So, this study aimed** to evaluate the impact of behavioral-based nursing interventions in reducing e-cigarette dependence, social media usage, and the perceived stress level among high school students. **Subjects and method:** A quasi-experimental research design was utilized from March 2025 to July 2025. **Setting**: The study was conducted at the 4 secondary schools in Shebin El-Kom city, Menoufia Governorate, Egypt. **Subjects**: A purposive sample of 600 students was selected from the previously mentioned setting using stratified random sampling. **Tools of data collection**: four valid tools were used in data collection: **tool 1:** A structured interview questionnaire to assess socio demographic characteristics of the studied students, **tool 2:** electronic Fagerström test for nicotine dependence (eFTND) to assess degree of addiction to e-cigarettes, **tool 3:** social media usage scale (SMUS) to assess frequency and intensity of platform use, and **tool 4:** perceived stress scale (PSS) to assess psychological stress. Data was analyzed at two points: pre-intervention and post-intervention. **Results** showed no statistically significant differences between groups in the amount of e-cigarette dependence, social media usage, and the perceived stress level pre-intervention. But after the intervention, the study group exhibited significant reductions in e-cigarette dependence levels, social media usage, and perceived stress levels. **Conclusion:** Behavioral-based nursing interventions effectively reduce excessive e-cigarette dependence, social media usage, and perceived stress among high school students. **Recommendations:** The study recommends adding behavioral training modules to school curricula across the country, including modules on digital well-being, nicotine harm reduction, and managing stress.

Keywords: E-cigarette dependence, social media usage, perceived stress, high-school students

Introduction

High school students live in a critical developmental stage with increased susceptibility to risk behaviors and psychosocial problems. The dependance on electronic cigarettes (e-cigarettes) and the widespread use of social media among high school students have raised new public health issues. Studies **by Kong et al. (2021)** and **Gaiha et al. (2020)** indicate a significant increase in e-cigarette dependence, with adolescents viewing vaping as less harmful than conventional tobacco smoking, despite evidence associating it with nicotine addiction, respiratory diseases, and long-term health risks. Excessive social media use has been associated with sleep disruptions, subpar academic performance, reduced self-esteem, and increased stress levels **(Kelly et al., 2019; Keles et al., 2019).**

High school students are more likely to try vaping because they think it tastes better, their peers are using it, and they think it's safer than smoking **(Park-Lee et al., 2022).** High school students are becoming more worried about their dependance. Nicotine in e-cigarettes has been shown to affect brain development, impair memory and concentration, and induce long-term dependance **(Yuan et al., 2015).** Teenagers who become dependent on drugs early are more likely to move to other types of substance abuse. This indicates that smoking e-cigarettes can cause serious health and well-being problems disorders for the rest of their life **(Leventhal et al., 2025).**

High school students currently spend a lot of time on social media, which impacts how they see themselves, how they study, and how they talk to other people. Platforms can facilitate communication and education; however, excessive and indiscriminate usage has been associated with cyberbullying, social judgment, interrupted sleep patterns, and academic disengagement **(Keles et al., 2019).** Studies indicate that students who excessively engage online typically exhibit poorer mental health and elevated anxiety and despair levels **(Twenge & Campbell, 2018)**. Social media is addictive, which makes it tougher to establish a balance between utilizing technology and living a healthy life **(Marino et al., 2018).**

High school students commonly experience perceived stress, stemming from a combination of academic responsibilities, social interactions, and apprehensions over their future jobs **(Pascoe et al., 2019).** Adolescent stress can adversely affect physical and mental health, resulting in weariness, reduced concentration, emotional instability, and maladaptive coping mechanisms, including substance abuse and excessive screen time **(Shankar & Park, 2024).** Unregulated stress at this critical progressive phase can compromise resilience, self-efficacy, and long-term well-being, highlighting the imperative for effective interventions to foster stress management and improved coping mechanisms **(Schneiderman et al., 2025).**

Emerging research underscores a complex and reciprocal relationship between e-cigarette dependence, excessive social media usage, and elevated perceived stress among high school students. A study by **Evgin et al. (2025)** revealed that high levels of social media use disorder in adolescents correlate positively with problematic behaviors such as cyberbullying and emotional distress, suggesting that poor digital hygiene can exacerbate psychological vulnerabilities like stress and anxiety **Evgin et al. (2025)**. Concurrently, nicotine consumption through vaping has been shown to affect mood regulation and behavior. **Wamamili et al. (2025)** demonstrated that adolescent vapers, especially from lower socioeconomic backgrounds, face heightened risks of addictive behaviors and associated stressors **(Wamamili et al., 2025).** These patterns indicate a concerning synergy: as students increasingly depend on nicotine and digital platforms for coping, they may unintentionally intensify their stress levels, creating a feedback loop of dependence and psychological strain.

High school students facing simultaneous exposure to e-cigarette use and excessive social media engagement are at elevated risk for perceived stress. Behavioral-based nursing interventions, particularly educational and counseling strategies are effective in reducing these risks by enhancing awareness, emotional regulation, and resilience. Targeted programs could play a vital role in promoting adolescent health in both school and community settings **(Kong et al., 2021)**.

Behavioral-based nursing interventions particularly those focusing on psychoeducation, stress management, and motivational interviewing—have shown promising results in addressing these interconnected issues. In a recent intervention study, **Wamamili et al. (2025)** found that educational programs significantly improved high school students' understanding of vaping-related health risks and increased their expressed desire to quit, with in-person sessions being more effective than online alternatives.

Such interventions, when tailored for adolescents, not only enhance knowledge but also build critical self-regulation skills to manage stress and reduce harmful dependencies. These programs may be even more effective when integrated with strategies targeting digital literacy and emotional resilience, thereby addressing the psychosocial dimensions of both vaping and social media use. Nursing-led behavioral strategies offer a holistic, scalable approach to curbing these co-occurring risk factors in high school populations **Wamamili et al. (2025).**

Behavioral-based nursing interventions present promising approaches to alleviate the interrelated challenges of e-cigarette use, excessive social media usage, and stress among adolescents. Such interventions can promote better coping strategies and diminish dependence on maladaptive behaviors by emphasizing education, self-regulation, and

empowerment. Nurses can lead school-based programs that teach children about health, help them deal with stress, give them peer support, and teach them how to use technology in a way that helps them recognize dangers and become more resilient **(Kong et al., 2021).** These strategies go beyond punishment to get to the root of the problem by focusing on prevention, skill-building, and self-efficacy. As a result, behavioral interventions not only help people stop bad habits, but they also improve mental health and long-term health. This is in line with the World Health Organization's call for community-based, preventive health strategies and the global priorities for adolescent health **(Schneiderman et al., 2025).**

Psychiatric nurses are very important in helping high school students who are addicted to e-cigarettes, spend too much time on social media, and feel stressed. Because they are experts in mental health assessment, counseling, and changing behavior, they can create and carry out tailored interventions in schools and communities. Psychiatric nurses can do early evaluations to find children who are at risk, teach them about the mental impacts of nicotine and too much screen time, and provide them personalized ways to deal with stress. They also help with group interventions that encourage peer support and resilience, and they work with families, teachers, and other community members to create a supportive atmosphere. By combining health education with therapeutic communication

and behavioral counseling, psychiatric nurses help not only lower risky behaviors but also improve self-efficacy, emotional regulation, and overall adolescent well-being **(Schneiderman et al., 2025; Kong et al., 2021).**

Significance of the study

The significance of the study came from different aspects. First, it deals with an evolving public health problem by treating three problems that are all connected: e-cigarette dependance, social media use, and perceived stress. These issues all make it trickier for high school students to do well in school and stay healthy. Second, the study enhances preventative healthcare strategies that prioritize education, self-regulation, and empowerment better than punishment or restrictions, by utilizing behavioral-based nursing interventions.

E-cigarettes dependence during adolescence is associated with permanent cognitive deficits, addiction, and the transition to other substances **(Yuan et al., 2025; Leventhal et al., 2025)**. At the same time, too much time spent on social media has been linked to sleep problems, lower grades, higher anxiety, and more signs of depression **(Kelly et al., 2019; Twenge & Campbell, 2018).** These behaviors increase the stress that kids already feel from school and social situations, which leads to a cycle of poor mental health and unhealthy coping mechanisms including substance abuse and too much time spent on screens **(Pascoe et al., 2019; Shankar & Park, 2024).**

The outcomes will offer significant insights for policymakers, educators, and

healthcare practitioners, emphasizing the creation of school-based wellness programs tailored to adolescent needs. This study emphasizes the necessity of expanding the roles of nurses beyond clinical environments to encompass schools and communities as catalysts for behavioral change programs. The study is in line with global health goals, such as the World Health Organization's (WHO) goal of enhancing adolescent health and national goals of lowering risky behaviors and increasing the health of teens.

Subjects and Method:

The aim of the Study:

The current study aimed to evaluate the impact of behavioral-based nursing interventions in reducing e-cigarette dependence, social media usage, and the perceived stress level among high school students.

Specifically, the study sought to answer three research questions:

1. What was the incidence of e-cigarette dependence, social media usage, and perceived stress among high school students before intervention?

2. What was the impact of behavioral-based nursing interventions on e-cigarette dependence among high school students?

3. What was the effect of behavioral-based nursing interventions on social media usage scores among high school students?

4. What was the effect of behavioral-based nursing interventions on perceived stress among high school students?

Research Hypotheses:

1. High school students who will participate in the behavioral-based nursing interventions sessions (study group) will have lower levels of e-cigarette dependence after implementation of the behavioral-based nursing interventions sessions compared to students who do not receive the sessions (control group).

2. High school students who will participate in the behavioral-based nursing interventions sessions (study group) will have lower levels of social media use after implementation of the behavioral-based nursing interventions sessions compared to students who do not receive the sessions (control group).

3. High school students who will participate in the behavioral-based nursing interventions sessions (study group) will have reduced perceived stress level scores after implementation of the behavioral-based nursing interventions sessions compared to students who do not receive the sessions (control group).

Research design: A quasi-experimental research design (study/control group) (pre-test / post-test) was utilized to achieve the aim of the study.

Research setting:

The research study was carried out at 4 selected schools in Shebin El-kom city, Menoufia Governorate, Egypt. The total number of students and their distribution across all secondary schools in the city were reviewed. The researchers wrote the names of the schools on separate papers, then put them in a bowl and selected four papers through a random sampling method

to ensure representativeness and minimize selection bias. The selected schools at Menoufia governorate in Shebin El-Kom were Istibary Secondary School, El-Mai Secondary School and El-Masaa'y El-Gadeeda Secondary School for Girls.

Sample size calculation:

The sample size for this study was calculated to ensure statistical significance and representativeness of the high school students in Menoufia governorate. A total population of 39,851 students was registered at the high school during the academic year 2024–2025. To ensure feasibility and statistical power, the sample size was calculated using the standard formula:

n = [DEFF*Np(1-p)]/ [(d2/Z21-α/2*(N-1) +p*(1-p)], to be 600 students.

Where:

- n = required sample size
- N = population size (39,851 students)
- p = estimated proportion (0.5, for maximum variability)
- d = margin of error (0.05)
- $Z_{1-\alpha/2}$ = Z-score for 95% confidence level (1.96)

Research Subjects:

A purposive sample of total 600 students were recruited and included in the final analysis from the above mentioned setting, who fit the following: **Inclusion criteria:** Students were considered if they were between 15 and 18 years of age, had experience with e-cigarettes smoking, social media use, feeling stresses, were willing to participate voluntarily and provide a written consent, free from any psychiatric or chronic illness because it

may have a negative effect on the results of the study. **Exclusion criteria:** Students were excluded if they were already in a smoking cessation program nor not smoking at all, not willing to participate in the study, not willing to provide written consent, had any psychiatric or chronic illness, and not have a mobile or any access to social media.

The 600 students were then equally and randomly assigned into two groups: 300 in the study (study) group and 300 in the control-group.

Tools of data collection:

Data collection was performed using four primary tools:

Tool (1): A structured interview questionnaire: Developed by researchers to gather information about, **part 1:** The student's socio-demographic characteristics including age, gender, class of educational level. **Part 2:** Some questions regarding behavioral habits such as frequency of social media use per day, e-cigarette use per day, and the history of past quit attempts.

Tool (2): The E-cigarette Fagerström Test for Nicotine Dependence (eFTND), it was adopted from **Heatherton et al. (1991)** and translated to Arabic by **Kassim et al. (2012)** is a 6-item version. It assessed e-cigarette dependence dimensions such as frequency, need, and ill or forbidden place or situation use. In scoring the Fagerstrom Test for Nicotine Dependence, the three yes/no items are scored 0 (no) and 1 (yes). The three multiple-choice items are scored from 0 to 3. The items are summed to yield a total score of 0-10, with higher scores

reflecting greater nicotine dependence. Scores were categorized into four levels: low (0–2), low to moderate (3–4), moderate (5–7), and high dependence (8-10).

Tool (3): The Social Media Use Scale (SMUS), adopted from **Lin et al. (2015)** and translated to Arabic by **Olufadi (2016)** is a 17-item scale translated and adapted from validated instruments in behavioral research. This scale had four subscales: image-based (5 items), comparison-based (3 items), belief-based (4 items), and consumption-based behaviors (5 items). The items were rated on a 9-point frequency scale from "Never" (1) to "Hourly or more" (9). Subscale scores were the mean of corresponding items, and total scores varied between 17 and 153, with higher scores indicating more frequent and more intense social media usage. To facilitate interpretation, overall scores were divided into three levels of use: mild (17–62), moderate (63–108), and severe (109–153), with cut-off points determined by splitting the scale into roughly equal thirds to represent different levels of engagement.

Tool (4): The Perceived Stress Scale (PSS), a standard psychological scale adopted from **Cohen et al. (1983)** and translated into Arabic by **Almadi et al. (2012)** to assess the degree to which people perceive things in their lives as stressful. The PSS consists of 10 items measuring thoughts and feelings that the person has experienced during the past month, with each item rated on a 5-point Likert scale ranging from 0 ("Never") to 4 ("Very often").

Even though some of the items are negatively framed, four positively framed items (items 4, 5, 7, and 8) are reverse scored before calculating the total score. The PSS total score can range from 0 to 40, and the higher the score, the higher the perceived stress. Scores, for purposes of interpretation, are categorized into three levels: mild stress (0–13), moderate stress (14–26), and severe stress (27–40). The scale indicates that personal perceptions are exceedingly relevant to stress measurement, since the same life event is likely to be answered differently by different people based on their own experiences.

Ethical considerations:
An official approval was obtained from the Research and Ethics Committee of the Faculty of Nursing, Menoufia university No **(ERCNMA 1000/5/1/88/25).** Permission was granted by the dean of the selected schools to carry out this study. A written consent was taken from each student who was willing to participate in the study after explaining the purpose and the importance of the study. The subjects who agreed to participate in the study were assured of confidentiality and anonymity in the study. They were informed about their right to withdraw from the study at any time without giving a reason.

The aim, methods, possible benefits, and right of withdrawal without penalty at any time were made clear to the students. Anonymity and confidentiality were maintained by coding the responses and

limiting access to the data to the research team.

Validity and reliability of the tools:

Validity: Tools of data collection were reviewed for their content validity by five experts who were selected to test the content and face validity of the tools. The panel included five experts from the psychiatric nursing department, and necessary modifications were made to reach the final valid version of the tools. The tools were considered valid from the experts' perspective.

Reliability: The tools were tested for reliability by using Cronbach's alpha coefficient; it was ($\alpha = 0.93$) for the e-cigarette Fagerström test for nicotine dependence tool, ($\alpha = 0.89$) for the social media usage tool, and ($\alpha = 0.96$) for the perceived stress tool. The tools were clear, comprehensive, and applicable.

Pilot Study:

A pilot study was conducted on 60 students (10% of the calculated sample size) to examine the feasibility, clarity, and applicability of the study tools. The subjects in the pilot study were selected from high schools that were not included in the main sampling frame. The pilot was intended to determine the time required to administer the questionnaire and uncover confusion in the items. There were some slight changes in wording and sequence of some of the questions for clarity, based on feedback. Data from pilot samples were not included in the final analysis.

Data collection procedure:

- Following official approval, students were enlisted and screened for eligibility. After getting the written consent, data was collected from March 2025 to July 2025. Targeted students were recruited from four randomly selected high schools in Shebin El-Kom district, Menoufia governorate, Egypt.

- Baseline measurements were conducted using the study tools: the socio-demographic questionnaire, e-cigarette Fagerström test for nicotine dependence (eFTND), Social Media Use Scale (SMUS), and the Perceived Stress Scale (PSS).

- After baseline measurement, the 600 students were randomly divided into two equal groups: Study (Intervention) group (n = 300): received the behavioral-based nursing intervention sessions, and control group (n = 300): did not receive the behavioral-based nursing intervention sessions during the study period.

-Study group students were divided into 15 subgroups of 20 students each. Each subgroup was provided with eight structured behavioral-based nursing intervention sessions (one sessions per week for eight consecutive weeks), each lasting approximately 45 minutes.

-Sessions were run in school classrooms allocated by the school administration during non-academic time. The control group did not receive behavioral-based nursing intervention sessions but attended the post-intervention test at the same time as the study group to enable comparison of results.

Study Phases:

The implementation of the study proceeded in four distinct phases:

Phase 1: Assessment Phase

-After receiving thorough information about the study's objectives, the researchers proceeded to conduct interviews with students at their school.

-In a comfortable environment, the researchers introduced themselves to the students and were informed about the study's purpose and voluntary participation. Informed written consent was obtained before conducting individual interviews.

-Pretest questionnaires were distributed by the researchers to identify students who met the inclusion criteria. The researchers conducted baseline assessments using validated research tools, which included assessments for socio-demographic characteristics, SMUS, eFTND, and PSS.

Phase 2: Planning Phase

- After conducting a thorough review of electronic dissertations, books, articles, and journals, the researchers developed a user-friendly and inspiring Arabic guide booklet.

- Following baseline measurement, the 600 students were randomly divided into two equal groups: Study group (n = 300): received the behavior-based nursing intervention sessions, and control group (n = 300): did not receive the behavioral-based nursing intervention sessions during the study period.

- Sessions were run in school classrooms allocated by the school administration during non-academic time. The control group did not receive behavioral-based nursing intervention

sessions but attended the post-intervention test at the same time as the study group to enable comparison of results.

- Subsequently, the study group received a structured behavioral based nursing intervention session with two weekly sessions (45 minutes each) on digital mindfulness, cognitive-behavioral techniques for decreasing screen time, and urge management strategies for e-cigarettes and stress management techniques.

- As part of the behavioral-based nursing intervention sessions, a breathing control technique was incorporated to help individuals cope with acute stress and impulsive behavior, particularly those triggered by social media exposure and e-cigarette cravings.

- This skill involved training in the 4-7-8 breathing technique, in which students were told to inhale through the nose for 4 seconds, hold for 7 seconds, and then exhale slowly through the mouth for 8 seconds. This breathing skill was also practiced at each session and students were requested to use it on their own behalf during times of craving or stress. The aim of this intervention was to offer students a simple, accessible self-regulation tool to reduce physiological arousal and improve emotional regulation.

- The control group was not intervened upon at all throughout the study period. Eight weeks later, everyone completed the post-intervention assessments with the same tools.

Phase 3: Implementation Phase

- Students in the study group received structured behavioral-based nursing intervention sessions from the researchers.

- Study group students were divided into 15 subgroups of 20 students each. Each subgroup was provided with eight structured behavioral-based nursing intervention sessions (one sessions per week for eight consecutive weeks), each lasting approximately 45 minutes.

- Sessions involved a combination of psychoeducation, lectures, brainstorming, active interactive discussions, visual aids, and role-play exercises, demonstration and redemonstration of some techniques to promote behavior change, providing examples, modeling, and role-playing. The sessions covered topics concerning digital mindfulness, cognitive-behavioral strategies for reducing screen time, resisting peer influence, and stress management techniques.

- There was specific emphasis on the 4-7-8 breathing technique, which was demonstrated and practiced at the beginning of each session for stress and e-cigarette craving management.

- To support the teaching methods, booklets, data shows, pictures, and video are utilized as media. At the end of each session, feedback, summary, and time were allotted for asking any questions and explaining homework assignments for the next subsequent session.

The behavioral-based nursing intervention sessions consist of a total of eight sessions

The session outline was as follows:

Session 1: Baseline assessment of e-cigarette dependence, social media usage, and perceived stress, rules, and program orientation

The first session was an introduction to the behavioral-based nursing interventions sessions and served to set the tone for the series of sessions that followed. Students were welcomed and oriented to the format, expected outcomes, and rules of the sessions, including the creation of a safe and respectful group environment. This session also included filling baseline measures to find out students' pre-intervention e-cigarette dependence, level of social media usage, and their level of perceived stress. These measures provided a foundation for tracking progress and evaluating the effectiveness of the intervention.

Session 2: Risks and implications of overuse of e-cigarettes, social media and inability to cope with stress

In the second session, the students were educated on the possible physical, psychological, and social harm caused by intensive use of e-cigarettes, social media and inability to cope with stress. Problems such as addiction, sleep quality issues, lower grades, and respiratory disease risks were highlighted through interactive debates and multimedia displays in the session. The session was intended to increase awareness and instill intrinsic motivation for change by making it possible for students to visualize the impact of their actions in the real world.

Session 3: Minimizing screen time and regulating cravings

Session three sets out to provide students with practical solutions for minimizing screen time and regulating cravings or urges to vape. Students identified personal triggers and common habits and learned time management strategies and digital detox strategies such as app limiters, time-out breaks, and no-device zones. Cognitive-behavioral strategies were introduced to help students recognize and reframe thoughts that trigger impulsive behavior.

Session 4: Mindfulness in the digital world and breathing strategies

During session four, the students were introduced to mindfulness as a self-regulatory technique during an overwhelming online world. They practiced mindfulness exercises, including focused breathing and body scanning, to enhance awareness in the here and now and emotional control. The aim was to help the students create a sense of calm and reduce spontaneous reactions to stress or online triggers, promoting healthier engagement with technology and reducing e-cigarette dependency.

Session 5: Developing healthy substitutes for good habits in lifestyle

This session five was designed to develop long-term good habits that would replace destructive habits. Students were guided to discover enjoyable and health-promoting substitutes such as exercise, activities, or social networking. The concept of habit change was introduced, and students were guided on how to break bad habits and reinforce pleasing behavior through practice and reinforcement.

Session 6: Making better choices and resisting peer pressure

This session six highlighted the development of decision-making skills, especially when faced with social influence. Through role-playing and discussion of scenarios, they were taught how to say no firmly, balance the risks and benefits, and make decisions that align with their long-term objectives. Techniques such as delay tactics and internal arguing were presented to develop their ability to resist peer pressure in the use of e-cigarette and social media.

Session 7: Coping with stress and managing emotions

This session seven addressed the emotional reasons for excessive social media use and e-cigarette dependency, aversive mood state, and stress. Role-players explored healthy emotional coping skills, including journal writing, relaxation, and social support networks. Emphasis was placed on identifying stressors and utilizing healthy coping skills (Deep breathing, meditation, exercise) instead of using digital devices or nicotine to relax.

Session 8: Reinforcing and generalizing skills

The final session provided the opportunity to consolidate what had been achieved throughout the sessions. Students rehearsed key strategies, reflected on how they had grown, and discussed how to maintain change in everyday life beyond the program. Relapse prevention techniques and preplanning for future

conduct were discussed to allow students to implement new habits and have sustained health. Handouts and homework assignments were given after every session. Attendance was noted, and the students were reminded every week through what's up messages through the group was initiated.

Phase 4: Evaluation Phase

After completion of the 8-week training sessions, the study and control groups were reassessed using the same tools (SMUS, eFTND, PSS). The post-test phase aimed to measure changes in e-cigarette dependence, social media usage, and the perceived stress level. Data was collected, coded, and statistically analyzed to determine the program's effectiveness.

For ethical considerations, after finishing the study and collecting all data needed for the study, the intervention sessions were given to the control group as well.

Statistical analysis

Descriptive statistics (mean, standard deviation, frequency, and percentage) were used in summarizing the students' characteristics. Data was analyzed with the assistance of SPSS version 25 (IBM Corp., Armonk, NY, USA). Inferential tests involved paired t-tests to compare within-group pre-post differences, independent t-tests to compare between groups, repeated measures ANOVA to investigate group-by-time interaction, and logistic regression models to identify predictors of meaningful change in SMUS and eFTND scores. A p-value of less than 0.05 was considered statistically significant.

Results

Table 1 shows that the study and control groups (n=300 each) are comparable for all socio-demographic characteristics and behavioral habits. There is no statistically significant difference between the two groups pre-intervention.

The mean age in the study group is (16.12 ± 2.82) and (16.22 ± 2.79) with range 16-19 years old in the control group with no difference (P = 0.104), most of the study and control group are male, educational levels are similarly allocated across 1st, 2nd, and 3rd secondary grades in both groups (P = 0.559). Neither group tries to quit smoking, 70% or 75.3% for the study group and control group, respectively. Daily social media usage is more than 3 hours in both groups, 53.3% and 54.7% respectively. And the e-cigarette use is more than 5 times that for both groups, 37.7 % and 36.3%.

Figure 1 reveals the levels of social media usage (mild, moderate, and severe) are very similar in both the study and control groups and are not significantly different ($\chi^2 = 0.251$, p = 0.882) pre-intervention. Both groups have moderate social media use 44 % for the study group and 44.7 % for the control group, respectively.

Post intervention, a notable shift in the study group is observed: There is a highly statistically significant difference ($\chi^2 = 70.533$, p < 0.001) between the study and control group, reflecting that the behavioral-based nursing intervention sessions are effective in reducing excessive social media use among the studied students.

Table 2 demonstrates a significant reduction in e-cigarette dependence among the study group post-intervention, with marked improvements across all eFTND items (all $p < 0.001$), including a decrease in frequency of use, a reduction in urgency to vape after waking, and less use when sick or in restricted areas. In contrast, the control group shows no statistically significant changes in any dependence behaviors ($p > 0.05$), indicating that the intervention effectively mitigated e-cigarette dependence among the study group.

Figure 2 shows that both groups have moderate dependence on e-cigarettes, 38.7 % for the study group and 41.3% for the control group, respectively. Pre-intervention, the levels of dependence on e-cigarettes are equal in the study and control groups across all categories (mild, mild to moderate, moderate, and high) with no statistically significant difference ($\chi^2 = 0.548$, p = 0.908).

Post intervention, there is a highly statistically significant difference between the study and control group, noted reduction in the level of dependence among the study group, indicating that the behavioral-based nursing intervention sessions are effective in reducing e-cigarette dependence among high school students.

Figure 3 shows that both the study and control groups have comparable distributions of levels of perceived stress, and no statistically significant difference ($\chi^2 = 0.053$, p = 0.974) is observed pre-intervention. A large proportion of students in the two groups score moderate stress (55.3% and 56.7%), followed by severe stress (27.3 and 24.3%), while mild levels of stress are the lowest recorded (17.4 % and 19%) for the study and control group, respectively pre intervention.

Post intervention of behavioral based nursing interventions sessions, there is a highly statistically significant difference between the study and control group regarding the perceived stress levels, the study group are greatly improved, there existed difference between the groups post-intervention ($\chi^2 = 66.280$, p < 0.001), indicating that the intervention has achieved the objective of reducing perceived stress levels among the studied students. **Table 3** shows that there are a highly statistically significant relation and positive correlation (r = 0.729, p < 0.001) between e-cigarette dependence and social media usage, indicating that as the social media usage increases, the e-cigarette dependence will also increase.

Additionally, there is a highly statistically significant relation and positive correlation (r= 0.613, p < 0.001) between e-cigarette dependence and perceived stress, indicating that as perceived stress increases, e-cigarette dependence will also increase.

Moreover, there is a highly statistically significant relation and positive correlation (r = 0.608, p < 0.001) observed between perceived stress and social media usage, indicating that as perceived stress increases the social media use will also increase.

Table (1): Distribution of the studied students according to socio-demographic characteristics and behavioral habits among the studied students (N = 300 for each group)

Socio-demographic characteristics	Study (n = 300)		Control (n = 300)		Test Used	P-value
	No	%	No	%		
Age (Mean ± SD)	16.22 ± 2.79 Range 16-19		16.12 ± 2.82 Range 16-19		Mann-Whitney U = 41554.5	0.104
Gender						
- Male	220	(73.3%)	212	(70.7 %)	χ^2 = 1.956	0.162
- Female	80	(26.7%)	88	(29.3%)		
Educational Level						
- 1st Secondary	83	(27.7%)	93	(31.0%)	χ^2 = 1.163	0.559
- 2nd Secondary	109	(36.3%)	110	(36.7%)		
- 3rd Secondary	108	(36.0%)	97	(32.3%)		
Behavioral habits	Study (n = 300)		Control (n = 300)		Test Used	P-value
	No	%	No	%		
Past Quit Attempt						
- Yes	90	(30 %)	74	(24.7%)	χ^2 = 0.036	0.850
- No	210	(70 %)	226	(75.3%)		
Social Media Use per Day						
- Less than 1 hour	18	(6 %)	27	(9.0%)	χ^2 = 0.139	0.933
- 1 to 3 hours	122	(40.7%)	109	(36.3%)		
- More than 3 hours	160	(53.3%)	164	(54.7%)		
Daily E-Cigarette Use						
- 1–2 times	102	(34%)	90	(30.0%)	χ^2 = 0.115	0.944
- 3–5 times	85	(28.3%)	101	(33.7%)		
- More than 5 times	113	(37.7%)	109	(36.3%)		

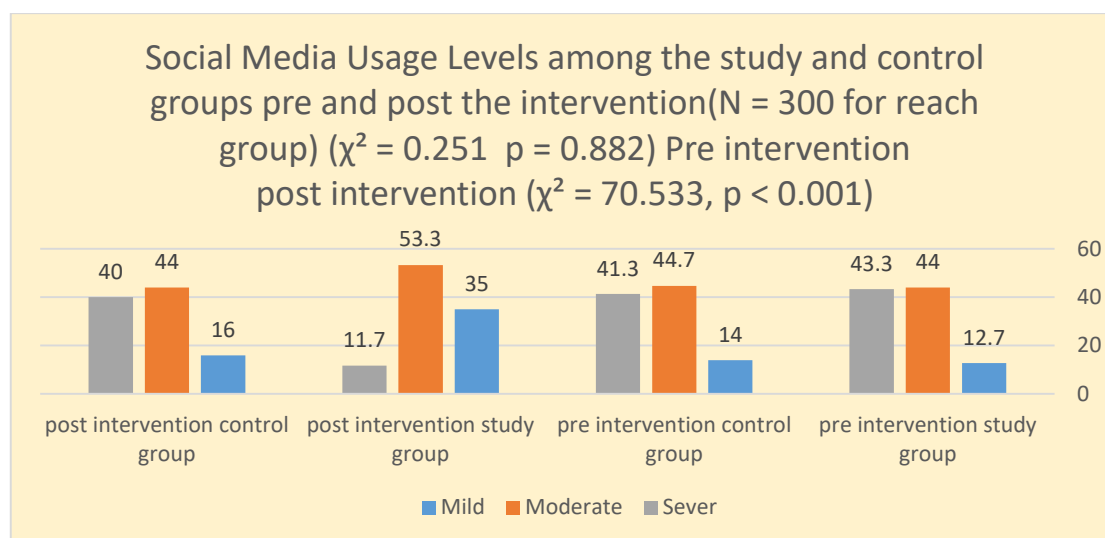**Figure (1): Distribution of social media usage levels among the study and control groups pre- and post the intervention (N = 300 for each group)**

Table (2): Distribution of the studied students according to the e-cigarette Fagerström Test for Nicotine Dependence (eFTND) responses, pre- and post-intervention (N = 300 for each group)

| E-cigarette dependence test responses (eFTND)	Pre intervention				p-value (Pre)	Post intervention				P-value (Post)
	Study N=300		Control N=300			Study N=300		Control N=300		
	No	%	No	%		No	%	No	%	
1. Frequency of use/day										
0–4 times	62	20.7%	58	19.3%	0.278	132	44%	80	26.7%	**<0.001****
5–9 times	112	37.3%	116	38.7%		129	43%	122	40.7%	
10–14 times	78	26%	80	26.7%		39	13%	98	32.6%	
2. Difficult to refrain in forbidden places?										
Yes	128	42.7%	122	40.7%	0.624	54	18%	118	39.3%	**<0.001****
No	172	57.3%	178	59.3%		246	82%	182	60.7%	
3. Hardest time to give up e-cigarette?										
Morning	94	31.3%	91	30.3%	0.663	30	10%	88	29.3%	**<0.001****
Other times	206	68.7%	209	69.7%		270	90%	212	70.7%	
4. Time to first vape after waking (free-use days)										
0–5 min	30	10%	28	9.3%	0.832	6	2%	26	8.7%	**<0.001****
6–15 min	42	14%	40	1.3%		12	4%	38	12.7%	
16–30 min	78	26%	80	26.7%		30	10%	78	26%	
31–60 min	74	24.7%	72	24%		40	13.3%	70	23.3%	
61–120 min	42	14%	44	14.7%		104	34.7%	46	15.3%	
121+ min	34	11.3%	36	12%		108	36%	42	14%	
5. Vape more in the first 2 hours?										
Yes	138	46%	130	43.3%	0.708	52	17.3%	126	42%	**<0.001****
No	162	54%	170	56.7%		248	82.7%	174	58%	
6. Vape when sick in bed?										
Yes	120	40%	116	38.7%	0.590	48	16%	112	37.3%	**<0.001****
No	180	60%	184	61.3%		252	84%	188	62.7%	
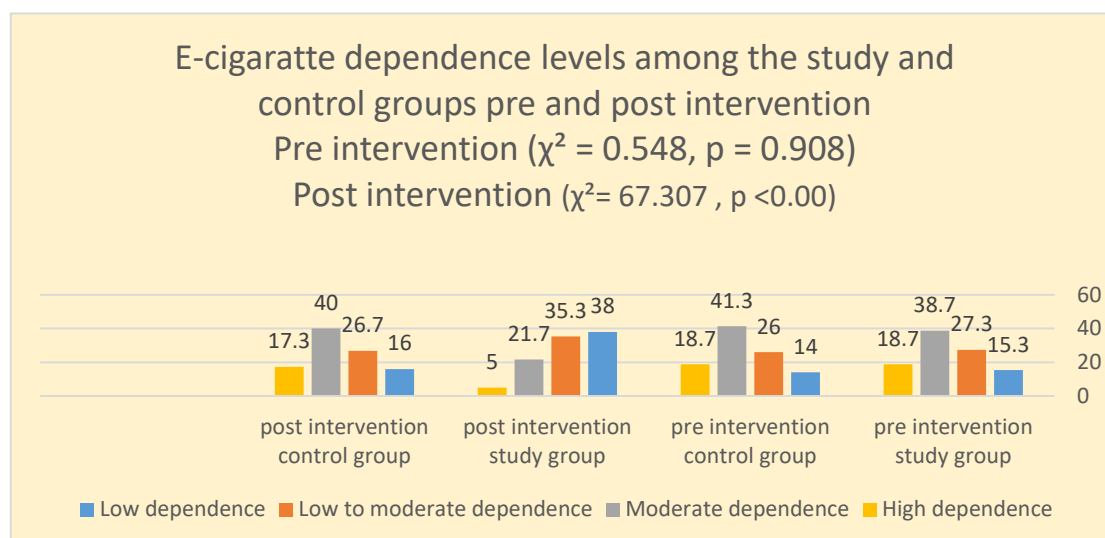
Figure (2): E-cigarette dependence levels (eFTND) among the study and control groups pre and post intervention (N = 300 for each group)
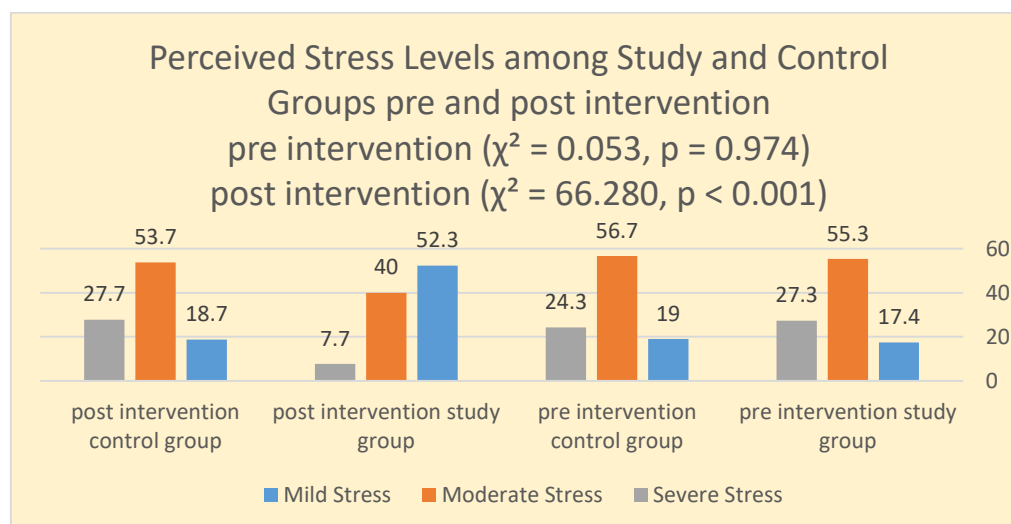

Figure (3): Perceived Stress Levels (PSS) among study and control groups pre and post intervention (N = 300 for each group)

Table (3): Relation and correlation coefficient between e-cigarette dependence, social media usage, and perceived stress scores among the study group (N = 300)

Variable	E-Cigarette dependence			
	X2	P-Value	R	P-Value
Social media usage	12.32	**0.001****	0.729	**0.001****
Perceived stress	16.02	**0.001****	0.613	**0.001****
Variable	Social media use			
	X2	P-Value	R	P-Value
Perceived stress	8.24	**0.001****	0.608	**0.001****

Discussion

This study aimed to evaluate the impact of a behavioral based nursing intervention on E- cigarette dependency, excessive social media use, and perceived stress among high school students. Overall findings revealed significant improvements in the study group post-intervention, with improvements evident across multiple behavioral and psychological parameters. This would enable them to avoid or correct addictive problematic behaviors, such as internet use, as well as other potentially addictive behaviors like eating, smoking, and emotional management, which could have a positive impact on their lives and future families.

Distribution of the studied students according to socio-demographic characteristics and behavioral habits among the studied students

The findings of the current study showed that, the two groups were well-matched at baseline regarding to sociodemographic with no statistically significant differences in age, gender, education level, quit attempts, social media use, or e-cigarette frequency **(table 1).** This might be due to the study and control groups being homogeneous, or because participants were assigned to either the study group or the control group using randomization, which made sure the two groups were the same. This equivalency strengthens the study's internal validity and provides evidence that the efficacy of the behavioral-based nursing intervention was responsible for the changes that were seen after the intervention.

Regarding to age and gender: Both groups were predominantly male adolescents, aged around 16-19 years, consistent with the demographic most vulnerable to nicotine addiction and excessive social media usage at the

same age (**table 1)**. This might be due to males in Egypt tend to have greater freedom of movement and social interaction than women, which translates into more extensive digital involvement. Additionally, smoking (e-cigarettes) is more socially acceptable for men in Egypt, whereas women may experience stigma.

These findings were consistent with **Van Zyl-Smit et al., (2024)** & who reported that most common student's gender was male with age between 15-16 yrs. On the same line **Erhabor et al., (2023)؛ Jha and Kraguliac (2021)** who revealed that the mean age of the study students was 16.4 yrs. and male gender. In contrast to the current findings the study conducted by **Gardner et al., (2024**) who found that mean age of the students were13.3 years, and female gender. Additionally, **Lee et al., (2023) and Asdigian et al., (2023)** who reported that most common student's gender was females with age17-19 yrs. The finding of the current study disagreed with **Mostafa and Taha, (2024)** who revealed that the mean age of the study sample was 22.12 ± 1.87 years. As soon as **AlDukhail et al., (2025)** reported that E-cigarette use is more prevalent among older adolescents. This contradiction might be due to different cultures, beliefs and attitude of the studied participants.

Concerning social media usage and e-cigarette dependance: Over half of the studied students used social media

for more than 3 hours daily, and over one-third of vaped students more than 5 times daily highlighting high baseline engagement in both behaviors (**table 1).** This might be due to this age trying to imitate their friends. They start using e-cigarettes because they observe their friends or peers using it. Social media is used by students to fill the time, escape from the stresses of life, or boost their sense of self-worth and community.

This result was aligned with **Zhang et al., (2024)** who noted that adolescents with high social media exposure are more likely to engage in e-cigarette use due to peer influence. The current study was in harmony with **Sreeramareddy et al., (2023) and Wężyk-Caba et al., (2022)** who showed that the prevalence of e- cigarette use is higher among younger than older adults. Additionally, the study conducted by **Mostafa and Taha, (2024)** and **Sayed et al.,** (2024) who reported that most of participants (88.3%) had heard about e-cigarettes, prevalence was higher among males and students in their clinical years. This result also matched with **Kong et al., (2023)** who observed that social media use was associated with e-cigarette use and initiation. This might be influenced by social media exposure to content about e-cigarettes.

Regarding the distribution of the studied students according to of social media usage levels pre and post intervention, the result of current study reported that, pre-intervention, both

groups had similar distributions of mild, moderate, and severe social media usage and majority of them had moderate social media usage. While post-intervention, the study group showed a dramatic shift toward milder usage (**Figure 1).**

This might be due to social media is regarded as the main way that teenagers interact with their friends and exchange ideas and experiences, amusement and leisure, as well as obtaining knowledge, help and support in fields like education or mental health. While reduction in social media usage post-intervention, indicating that the behavioral-based nursing interventions were highly effective through the effective interventions that applied during sessions as, behavioral intervention (Time management, alternative offline activities, social skills training), cognitive behavioral therapy (challenging negative beliefs and replacing them with more positive and adaptive thoughts related to social media use), dialectical behavior therapy (by teaching skills such as mindfulness techniques (as meditation and deep breathing exercises), emotion regulation, and interpersonal effectiveness), and motivational interviewing.

By combining these techniques, behavioral-based nursing intervention can empower students to reduce their excessive social media use, improve their well-being, and develop healthier relationships with technology.

These findings were consistent with **Stinson and Dallery (2023)**; **Plackett et al., (2023)** who reported that most participants had moderate social media use level pre intervention and after use of the package intervention was effective at reducing the daily duration of social media usage to goal levels, or below, for all participants. Also, this result agreed with study done by **Weaver and Swank (2024)** who concluded that adolescents after finished a 5-week mindfulness intervention resulted in decreased problematic social media use. On the other hand, these findings were incongruent with **Twenge et al., (2022) and McCrory et al., (2020)** who revealed that more than half of participants had severe level of social media usage and there was a substantial association between mental health and social media use.

Regarding the distribution of the studied students according to levels of e-cigarette dependence, pre and post intervention. The findings of the current study demonstrated that both groups have moderate dependence on e-cigarettes, pre-intervention, the levels of dependence on e-cigarettes are equal in the study and control groups across all categories (mild, mild to moderate, moderate, and high) with no statistically significant difference.

But post intervention, there was a highly statistically significant difference between the study and control group, noted reduction in the

level of dependence among the study group, with marked improvements across all eFTND scale items, indicating that the behavioral-based nursing intervention sessions were effective in reducing e-cigarette dependence among high school students **(Figure 2).**

This might be due to the effectiveness of behavioral-based nursing interventions on equip e-cigarette dependence through the effectiveness strategies that learned during intervention sessions such as, the motivational interviewing, cognitive-behavioral strategies and teach them relapse-prevention skills (e.g., relaxation techniques) and effective coping strategies to avoid smoking in the face of stressful situations.

These results were consistent with study conducted by **Gardner et al. (2025)** who revealed that students who received the intervention had lower probabilities of using e-cigarettes for 12 months after receiving the interventions, when compared with the control group. Moreover, this result was in line with **Meelarp et al. (2024)** who showed that the mean FTND scores were reduced when compared to the reference group.

Additionally, **Gardner et al. (2024)** found school-based interventions were associated with improvements in knowledge and attitude about e-cigarettes and tobacco and reduce level of e-cigarettes dependency among participants' students. Similar findings

were obtained by **Carrion-Valero et al. (2023)** who noted that the students who received the intervention smoked less or quit smoking more than those in the control group.

Concerning the distribution of the studied students according to perceived stress levels (PSS) pre and post intervention. The results of this study were illustrated with no statistically significant difference between them pre intervention, with the majority falling into moderate stress, followed by severe stress. Post-intervention, the study group had a significant decline in perceived stress levels while the control group remained unchanged (**Figure 3).** This might be due to student at this age (secondary school students) are subjected to a variety of psycho-physiological stressors because of the quick changes in their bodies, as well as the increased pressure to perform well academically and to fit in with their peers.

These results confirm the effectiveness of intervention in perceived stress reduction and effective strategies that taught to the students during sessions to manage their stress levels such as mindfulness, cognitive-behavioral strategies, behavioral strategies, time management, improved coping mechanisms, deep breathing and relaxation exercises.

These findings were convenient with **Ebrahim et al., (2024)** who reported approximately 93% of students experienced moderate to high levels of

stress, while 54.9% of them experienced moderate to concerning levels of anxiety. As well, these results were supported by **Suresh et al. (2024)** who revealed that before the intervention, most of the students had moderate stress level and severe stress level while after the intervention in the intervention group, more than half of them had mild stress, and moderate stress, and none had severe stress due to effectiveness of the intervention given. Like **Meredith & Frazier, (2019)** who observed that most of the participants fell into the moderate and severe level of perceived stress with no statistically significant difference between the experimental and control groups pre intervention while perceived stress was less after the intervention in the experimental group and no change was observed in the control group.

These results were in line with **Golshani et al. (2021)** who concluded that cognitive behavior therapy-based counselling was successful in lowering perceived stress. On the other side this result was contradicted with **Jha and Kraguljac (2021)** who found that most of the e-cigarette users reported higher stress level than non-users. Their findings suggest that high school vaping prevention strategies should focus on stress reduction and encourage healthy coping strategies.

Regarding the relation and correlation coefficient between e-cigarette dependence, and social media usage among the studied students. The results showed that there were a highly statistically significant relationship and positive correlation between e-cigarette dependence, and social media use **(table 3)**. This might be due to several factors, including the potential for social media to normalize e-cigarette use, the exposure to vaping-related content, or the use of social media as a coping mechanism for stress, which might be linked to nicotine dependence.

The current study results were on the same line with **Azagba et al. (2024)** who observed that the higher levels of social media use were associated with higher odds of e-cigarette use. Participants those who used social media for 4+ hours/day or 3–4 h/day had significantly higher odds of e-cigarette use than those who used social media sometimes or never. As well, these results were supported by **Vassey et al. (2022)** who revealed that exposure to e-cigarette content and advertisements on social media platforms, such as TikTok, can also affect e-cigarette use and initiation risk among adolescents.

In confirmation with these results **Zheng et al. (2021)** who reported that youth respondents with high social media use was directly associated with high likelihood of e-cigarette use.

Regarding the relation and correlation coefficient between social media usage, and perceived stress scores among the studied students. The results showed that there were a

highly statistically significant relationship and positive correlation between social media usage, and perceived stress level **(table 3).** This might be because of the connections that fit the stress-vulnerability model, which suggests that adolescents who are under more stress are more likely to utilize unhealthy coping strategies like vaping and excessive digital use. Students who are under stress may turn to social media for distraction, where they come across vaping and decide to adopt it.

These findings were congruent with **Sarialioglu and Oluc (2024)** who detected a positive and significant relationship between social media use/ addiction and perceived stress levels. All **Wolfers & Utz (2020)** and **Brailovskaia et al. (2019)** reported positive correlations between social media use and perceived stress. Individuals use social media for coping with stress, but in an ineffective way which further increases stress.

Regarding the relation and correlation coefficient between e-cigarette dependence, and perceived stress level among the studied students. The results showed that there were a highly statistically significant relation and positive correlation between e-cigarette dependence, and perceived stress level **(table 3).** This might be due to stress trigger or exacerbating nicotine dependence, leading individuals to use e-cigarettes as a coping mechanism, potentially creating a cycle of dependence. Conversely, nicotine dependence itself might contribute to heightened stress levels by disrupting neurotransmitter systems or causing withdrawal symptoms (Ibrahim, et al., 2025).

These results matched with the results of the study conducted by **Ahuja et al. (2025) and Mantey et al. (2022)** which revealed that high perceived stress was strongly associated with both current and lifetime e-cigarette use, with each unit increase in stress score raising the likelihood of current use. These findings suggest that students may be using e-cigarettes as a stress coping mechanism. As well, these results were supported by **Jha and Kraguliac (2021); Holliday and Gould (2016)** who found that adolescents who vape at high school are primarily motivated to vape by peer influences and for stress relief. Notably, teens who vape reported higher stress levels than non-vapers.

Conclusion: Behavior-based nursing interventions have a positive effect on reducing e-cigarette dependence, social media usage, and perceived stress among high school students.

 Recommendations:
- Conduct further research on social media use, e-cigarette dependence, and youth mental health to better understand both benefits and risks. Explore how emerging technologies can support smoking cessation.

- Implement behavioral-based nursing interventions in secondary schools across Menoufia Governorate and extend them to university students.
- Promote evidence-based smoking cessation methods, including nicotine replacement therapy (NRT), prescription medications, and counseling (e.g., CBT).
- Encourage participation in in-person or online support groups to enhance motivation and accountability.
- Guide students toward healthy alternatives—such as exercise, arts, reading, and hobbies—to manage cravings and stress.
- Reduce excessive social media use through built-in phone features, usage limits, and replacing screen time with meaningful activities and social connections.

Strengths of the study include: the use of a control group for comparability, one-to-one matching of students' baseline and end-line PSS scores using unique codes, and high compliance with behavioral-based nursing sessions. The study also provided data on feasibility, acceptability, and initial efficacy, which can guide future intervention development.

Limitations of the study: Purposive sampling focuses on selecting students with specific characteristics (e.g., using e-cigarette smoking), which may not reflect the broader population of all students.

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