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Knowledge, beliefs, attitudes, and practices of e-cigarette use among dental students: a New Zealand questionnaire-based survey

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Abstract

Background: Vaping (e-cigarette use) is a significant emerging human health risk with health professionals playing a key role in educating the population and advising on strategies to help patients to quit. Dental health professionals are particularly well positioned given the link between vaping and poor systemic and dental health, with interventions shown to lead to successful cessation. **Objectives:** This study aims to provide a snapshot of dental students' perceptions and knowledge of vaping, the extent of training received, and their level of confidence in providing vaping cessation advice with a view to assessing the preparedness of graduates in this area upon entering the workforce. **Methods:** An anonymous online questionnaire was administered in 2021 to dentistry students enrolled in New Zealand's only dentistry school. A total of 198 responses were received from across the four years of study. **Results:** Results of the study suggest that students are generally dissatisfied with the vaping training provided in the curriculum and feel unprepared to engage with patients. **Conclusion:** Re-orienting the curriculum to include effective vaping education would provide students with the confidence and knowledge to be able to engage in evidence-based discussions with patients about vaping and the associated risks with respect to oral health.

Introduction

Vapes, also known as e-cigarettes, are an electronic delivery system that creates an aerosol often containing nicotine and flavoured liquids, which the user inhales (Lindson et al., 2025). Recent studies have demonstrated that e-cigarettes pose health risks, with researchers identifying harmful effects on the respiratory, cardiovascular, and neurological systems (Benowitz & Burbank, 2026; Hamann et al., 2023). The popularity of vaping has been driven, at least in part, by the perception that it is less harmful to human health than conventional cigarettes (Sapru et al., 2020). Although vaping is generally considered less harmful than combustible tobacco, smoking is uniquely toxic, and being lower risk than smoking does not equate to safety or an absence of health risk. In New Zealand, vaping is promoted as a "reduced harm" alternative to traditional cigarettes (Ministry of Health, 2017) and is endorsed as a smoking cessation strategy (Te Whatu Ora, 2024). The uptake of vaping has been rapid, with the adult daily vaping prevalence increasing steadily from 3.5% in 2019/20 to 11.7% in 2024/25, equating to an estimated 509,000 daily vapers in 2024/25 (Ministry of Health, 2025). Vaping uptake, particularly among adolescents, driven in part by flavoured products and targeted marketing, rose especially sharply in the early years following its introduction (McGlinchy et al., 2025). Dedicated vaping legislation was not enacted until November 2020 (Ministry of Health, n.d.), by which time vaping had already become widespread across New Zealand. More recently, Action for Smokefree 2025 (2025) identified statistically significant reductions in daily and regular vaping among New Zealand

adolescents aged 14–15 years, with prevalence decreasing to 7.1% and 11.2%, respectively, in line with recent trends.

As vape products are relatively new on the market, the extent of the long-term health effects associated with their use have yet to be assessed. However, growing evidence suggests that vaping is associated with increased heart rate, elevated mean arterial pressure, oxidative stress, respiratory epithelial alterations, and increased airflow resistance (Izquierdo-Condoy et al., 2024; Yayan et al., 2024). Although research has not demonstrated a definitive association between vaping and an increased risk of lung cancer or other malignancies, a substantial body of evidence from biomarker analyses, in vitro and animal studies indicates that exposure to e-cigarette aerosols can induce oxidative stress, cellular apoptosis, DNA damage, genotoxic effects, and tumour growth. These biological effects may contribute to an increased risk of cancer development or progression (Kundu et al., 2025). Nicotine, commonly found in vaping liquids, has harmful neurocognitive effects, particularly on adolescents, impairing memory, attention, reward processing, and learning. Furthermore, the use of vapes can deliver nicotine levels comparable to conventional cigarettes, making them equally capable of leading to a nicotine addiction (Siqueira et al., 2017).

In the dental setting specifically, although limited, emerging evidence suggests that the use of vapes impacts negatively on oral health. Specifically, complaints about mouth and throat conditions, including oral and throat dryness, irritation, pain/discomfort and cough, have been found to be more common amongst those who vape compared to



those who do not (Yang et al., 2020). Moreover, several studies have demonstrated an increased risk of periodontal disease amongst those who vape compared to those who don't or those who are occasional users (Charde et al., 2024). It is hypothesised that vaping could contribute to the onset and worsening of periodontal disease by modifying the body's immune response, leading to the production of inflammatory cytokines and changes in the oral microbial community. Clinical research indicates that individuals who use e-cigarettes tend to have poorer outcomes following periodontal treatment compared to non-smokers/vapers (Charde et al., 2024). Al-Aali et al. (2018) reported that those who used vapes exhibited increased rates of plaque development, deeper probing depths, greater bone loss, increased localised inflammatory markers, and an elevated volume of sulcular fluid. Ismail et al. (2019) followed a group of vape users over six months and observed significant declines in their periodontal health. The use of vapes has also been linked to tooth decay. Those who use vapes are at greater risk of developing caries (Iacob et al., 2024; Irua et al., 2022) and are more likely to have untreated caries compared to those who have never used vapes (Vemulapalli et al., 2021). Ismail et al. (2019) also reported an increase in caries prevalence with the use of vapes over a period, as short as six months. Kim et al. (2018) found that the viscosity of e-liquids combined with its sweet flavours have similar physio-chemical characteristics as high-sucrose products, gelatinous lollies and acidic drinks – which may increase the cariogenic potential of vaping. Furthermore, they found that the aerosols produced led to a fourfold increase in the rate of microbial attachment to enamel, and promoted cariogenic bacteria, *S. mutans*, proliferation in the oral environment. Thus, the use of vapes is associated with widespread deterioration in oral health.

Well-designed tobacco cessation interventions in dental practices have been shown to lead to successful cessation of combustible tobacco use (Carr & Ebbert, 2012). However, evidence relating specifically to vaping cessation in dental practice is limited. Nonetheless, dental professionals are well placed to deliver preventive vaping counselling due to their ongoing, longitudinal relationships with patients, enabling tailored advice that may support improved cessation outcomes.

Accordingly, research highlights that there is an urgent need for the development and integration of vaping-specific resources, clinical guidance, and training for oral health practitioners to support consistent, evidence-based patient counselling (Jongenelis et al., 2025). There is therefore an urgent need to ensure that dental students, before entering the health workforce, are adequately equipped with the knowledge and tools needed to be able to provide patients with the necessary information about interventions for successful cessation. To achieve this, the appropriate training needs to be incorporated into the university curriculum.

Current literature is sparse with respect to dentistry students and their level of preparedness for discussions with patients about vaping. Salz et al. (2024) reported poor record keeping and limited engagement with patients by students at the University of Otago Faculty of Dentistry. The study also reported that dental students had limited

knowledge about vaping and providing appropriate cessation advice. Similarly, Natto (2020) estimated that 94.8% of students in their fourth to sixth year of study at King Abdulaziz University in Saudi Arabia did not feel confident that they had received sufficient education about the risk of vaping. In another study consisting of a multinational survey across 20 dentistry schools in 11 countries, nearly half (48.1%) of participants reported they felt confident to discuss the harmful effects of vaping with patients, although it was noted the surveyed students generally had poor knowledge about the risks of vaping when probed (Alhaji et al., 2022).

Given the high rate of use of vapes in New Zealand and the risk it presents to oral health, a gap exists in the understanding of the extent to which current dentistry students feel prepared to facilitate discussions about vaping cessation and the risk of vaping with patients, and the adequacy of the skills and knowledge acquired during training. This paper aims to address this gap.

Methods

Participants in the study were dental students enrolled in their second to fifth year of study in the undergraduate dentistry programme in 2021 in the Faculty of Dentistry at the University of Otago, New Zealand. The survey was sent out to 340 students (n=340), and 198 responses were received (response rate 58%). There were no financial incentives provided to participants in this study.

The survey tool consisted of an online questionnaire adapted from that developed by Natto (2020) and comprised three separate sections: knowledge of vaping and associated health risks, attitudes towards vaping, and formal education received. In addition, demographic information, including ethnicity, gender, and year of study, was collected to help identify patterns or trends across different population groups. The year of study was specifically included to assess whether the level of understanding and confidence correlated with the participants' stage of training. The questions were primarily formatted as yes/no and five-point Likert scale items, and the questionnaire was designed to be completed in under five minutes. No open-ended questions were included.

The questionnaire was distributed via the class Facebook page and Messenger group chats, to which all students had access or the opportunity to gain access. These platforms are routinely used for cohort-wide communication, and all students are typically added to the relevant class pages. The survey was administered using the Qualtrics™ platform. The survey was deployed over a four-week period between mid-July 2021 and mid-August 2021 (just past halfway through the academic year). Each participant provided informed consent at the beginning of the survey with completion of the survey considered consent after the provision of relevant participation information. Incomplete survey responses were excluded from the analysis. The Human Ethics Committee of the University of Otago granted ethical approval (D21/49).

The recorded responses were downloaded from Qualtrics into SPSS. Data analysis consisted of ANOVA and chi squared tests. For analysis, Likert scale responses were

Table 1. Basic demographic characteristics of the study participants.

		n	%
Academic year	BDS2	77	38.9%
	BDS3	19	9.6%
	BDS4	38	19.2%
	BDS5	64	32.3%
Gender	Female	128	65.0%
	Male	65	33.0%
	Nonbinary	3	1.5%
	Prefer not to say	1	0.5%

collapsed into broader categories, with “strongly agree” and “agree” combined as *agree*, and “strongly disagree” and “disagree” combined as *disagree*, while the neutral category (“neither agree nor disagree”) was retained.

Results

Table 1 presents the demographic information of the study participants. In total, 198 responses were received out of a possible 340 (58%) across all four years of the Bachelor of Dental Surgery (BDS) training programme (following a general health sciences year), known as BDS2 to BDS5. The total number of responses by year was BDS2 (77), BDS3 (19), BDS4 (38), and BDS5 (64). Female respondents ($n=128$) outnumbered males ($n=65$). Of the study participants, 51.1% indicated having tried vaping at some point in their lives. Students who reported vaping at least once per month (26.8%) were classified as current vapers, with 9.8% of respondents reporting daily vaping. Students who had never used a vape (49%) were categorised as ‘never-used’. Of the study participants, 61% indicated having immediate family members and/or close friends that currently vape, indicating that most dental students have either first/or second hand experience with vaping.

Knowledge/attitudes

Research shows that smoking conventional cigarettes is more carcinogenic than vaping (Stephens, 2018), and that vape liquid contains the addictive substance nicotine (Shehata et al., 2023). Among participants, only half (54.0%) knew that conventional cigarettes are more carcinogenic than vaping, while 23.9% were unsure. In total, 65% of the participants knew that vape liquids contained carcinogenic substances, while 59.8% believed that vaping may cause oral cancer. One in ten students (9.5%) incorrectly believed that e-liquids do not contain addictive substances.

Vaping has been shown to lead to a dry mouth/throat, periodontal disease, and dental caries (Yang et al., 2020). Vaping may also contribute to an increased risk of cancer development or progression (Kundu et al., 2025). Of the study participants, 73.0% believed that vapes might cause dry mouth/throat, 69.7% believed that vaping might cause periodontal disease, 59.8% believed that vaping might cause oral cancer, and 49.4% believed that vaping could lead to dental caries. These results indicate that many

dental students lack awareness of certain general and oral health risks associated with vaping.

Education

In total, 96% of the students believed that dentists should be prepared to treat patients that use vapes, and 97.2% believed that understanding the effects of vape use is important for future health care professionals. Only 17% of participants reported receiving education about vaping at the Faculty of Dentistry. 10.3% of participants were satisfied with their knowledge of vaping for the purpose of educating patients, and only 20% were confident about their ability to discuss the topic of vaping with their patients. Moreover, 77.7% of all participants were dissatisfied with their knowledge of vaping with only 9.14% of participants indicated being confident in their ability to consult a patient about vaping cessation. Thus, the level of preparation in this area was perceived as being low across the cohort.

A significant difference ($p = 0.023$) was found in terms of the perception about how much education had been received between years in the programme (from BDS2 to BDS5), with post-ANOVA analysis indicating a linear trend with increasing level of education levels from BDS2-BDS5. However, no difference was found between cohorts with respect to their confidence in consulting a patient about vaping cessation ($p = 0.864$), nor with the level of satisfaction with their level of knowledge regarding vaping ($p = 0.425$).

Discussion

This survey examined the knowledge, beliefs, attitudes, education, and practices related to vape use among dental students at the University of Otago in New Zealand. Overall, dental students appear aware of the potential harms of vaping, yet about half have engaged in the practice. Students considered that their level of knowledge and their confidence in discussing vaping cessation with patients was insufficient.

Knowledge/attitude

Half of participants had tried vaping, higher than rates reported at King Abdulaziz University (43.2%), University of Minnesota (14.7%), and Sindh Medical School (6.2%), (Natto 2020; Hinderaker et al., 2018; Iqbal et al., 2018). Regional regulations, cultural attitudes, public health policies, product accessibility, and peer influence may explain differences in vaping prevalence. The high prevalence of e-cigarette use at the University of Otago may reflect greater social acceptance, marketing influence, or differences in nicotine control policies within New Zealand.

Additionally, it is possible that peer influence and stress factors associated with dental education contribute to the increased usage among students. The higher prevalence observed in this study may also reflect the increased global accessibility and popularity of vaping products by 2021 when the survey was conducted, compared to earlier studies from 2018.

Nearly two thirds of participants believed vaping may cause oral cancer or recognised carcinogenic substances in e-liquids. Although current research is insufficient to establish a causal link between vaping and oral cancer,



evidence suggests that e-cigarettes may pose a potential risk for oral cancer, as they contain or produce carcinogenic components, including metals (cadmium, chromium, etc.), carbonyls (acrolein), propylene oxide, and flavouring additives, and can induce harmful changes in oral cells (Grana et al., 2014; Raj et al., 2020).

Despite awareness of carcinogenic and addictive substances in e-liquids, nearly half of dental students have experimented with vaping, with approximately 10% using vapes daily. This high prevalence of vaping, even among future healthcare professionals who are aware of the associated health risks, raises concerns about the effectiveness of current educational strategies. The results highlight a possible disconnect between knowledge of e-cigarette risks and actual vaping behaviour among dental students.

Around two thirds of participants identified vaping's impact on dry mouth/throat, periodontal disease, and oral cancer; fewer than half identified increased risk of dental caries. Despite the high degree of relevance to their profession, many students remain misinformed or unsure about the effects on oral health associated with vaping.

Education

Most students reported dissatisfaction with their vaping knowledge and felt unprepared to educate patients. Notably, the survey results suggest that students who have tried vaping share the same lack of confidence as their peers who have not. This contrasts with findings from a study conducted among dentistry students in Saudi Arabia where experience with vaping was associated with an increase in confidence (Natto, 2020). The reason for this discrepancy remains unclear and warrants further investigation.

As with the findings of Natto (2020), insufficient formal education may contribute to low confidence despite recognition of its importance (97% agreed). This lack of confidence and knowledge may be attributed to insufficient education about vaping within the New Zealand dentistry curriculum, as evidenced by the low number of students reporting they had received formal education on the topic.

Students reported more exposure to vaping education over four years, but confidence levels remained similar across cohorts. This indicates that, despite perceiving greater educational exposure as they progressed through the programme, senior students and graduates felt no more confident discussing vaping cessation or counselling patients on its potential adverse effects than peers earlier in their training. Collectively, these findings suggest that the current curriculum may not be adequately preparing students to counsel patients about vaping with confidence.

To address this gap, it is crucial that dental schools incorporate more comprehensive education on vaping into the curriculum. This could consist of evidence-based training on the health risks of e-cigarettes, including information on the carcinogenic substances present in e-liquids, and the long-term impact of vaping on oral health. Dental students should also be taught communication skills specifically tailored to discussing lifestyle changes with patients, such as vaping cessation. This would help students feel more comfortable initiating these conversations and providing guidance about quitting.

Interactive learning methods have demonstrated effectiveness in enhancing smoking cessation education. A study by Humair and Cornuz (2003) developed a curriculum incorporating active learning techniques and standardized patient interactions to train medical residents in smoking cessation. This programme included video observations, interactive workshops, role-playing, and practice with standardised patients, resulting in improved counselling quality and higher quit rates among smokers at the one-year follow-up. Interactive training methods, such as role-playing and standardized patient interactions, could improve confidence and counseling skills. Additionally, incorporating vaping cessation resources into the curriculum, such as referral programs, online tools, and counselling techniques, would equip students with practical strategies to assist patients. Collaborative training with other healthcare professionals may provide a holistic approach to vaping-related patient management.

Uncertainty about long-term vaping risks may contribute to low confidence in patient discussions. Unlike conventional tobacco smoking, which has a well-established and severe risk profile, the long-term effects of vaping remain incompletely understood. Clinicians are therefore required to communicate both the potential benefits of vaping as a harm reduction strategy for smokers, and the emerging evidence of specific harms alongside unknown long-term risks. Furthermore, It is unclear whether students' low confidence in discussing e-cigarettes with patients reflects limited knowledge of vaping specifically or a broader lack of confidence in patient interactions, and future research could explore these possibilities.

Limitations

As there is only one dentistry school in New Zealand, all dentistry students in New Zealand can be considered to have been invited to participate in the study. While the survey was anonymous and it was assumed that participants were able to answer honestly, it is possible that social desirability bias may have had an influence on the survey outcomes. Participants may have withheld certain beliefs or behaviours, or answered in a way they believed was more acceptable than the truth, biasing the results. As participants self-selected into this study, it is possible that those who responded to the survey were more interested in vaping and were more engaged individuals, hence those more knowledgeable about vaping and more engaged with any vaping cessation education provided.

The data, collected in 2021, may not reflect current knowledge and attitudes of dental students. However, this survey may provide evidence that New Zealand's current dental workforce does not feel adequately equipped to provide vaping cessation advice.

Specific modules and curriculum content on tobacco and e-cigarette education in the dentistry programme were unavailable for review during and after analysis. As such, it was not possible to determine the extent to which vaping-related knowledge is formally taught at different stages of the programme or how this may influence student knowledge levels. Furthermore, vaping cessation training may have been given but its effectiveness may be limited if students do not regularly attend class.

The study sample included a higher proportion of female students compared with the overall dental student population, which may have influenced the findings, as gender can affect health behaviours and risk perceptions. Age and gender were included in Table 1 alongside vaping status, but ethnicity was not presented, as no analyses were conducted on this variable.

The overall sample size of the study was small due to the small population of students in the dentistry programme in New Zealand. The generalisability of the study is limited to New Zealand due to the differences in curriculum between dentistry schools internationally. In order to maintain the focus of the study on the effects of vaping specifically and vaping cessation, data provided on vaping as a smoking cessation tool was not the focus of this study.

Finally, a key limitation was the potential that confounding variables, such as age, sex, and ethnicity, were not accounted for in the analyses.

Further research

The results of this study could form the basis of a larger study investigating the knowledge, attitudes and education of working dentists, as well as other health professionals, and health professional students studying about vaping and the risks to oral health. A more in-depth study is needed looking into the education provided to our health professionals and whether this is sufficient to allow professionals to deliver effective vaping cessation advice to their patients.

Conclusion

The findings highlight a significant gap in vaping education within the New Zealand dentistry curriculum. Dental students reported feeling unprepared to advise patients on vaping risks and cessation strategies. Incorporating evidence-based training would increase students' knowledge and confidence, enabling future dental professionals to counsel patients effectively and contribute to improved public health outcomes.

Author contributions

Conception and design of the study – SK, JL, AL, DR, KND
Data collection – SK, AL, JL
Data analysis and interpretation – JL
Drafting the article – SK, OM, JL, AL, KND
Critical revision of the article – all authors
Final approval of the version to be published – All authors

Conflicts of interest/competing interest

The authors have no conflicts of interest to declare.

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