Electronic Nicotine Delivery Systems (ENDS) Education in US Dental Hygiene Programs' Curricula

by

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Dedication

This thesis is dedicated to my husband and my family. You have been there for me through this entire journey and I cannot thank you enough for your love and support.

My husband, Jonathan Welt, thank you for your encouragement, patience, and belief in me. Your unwavering support and selflessness through this journey have been unbelievable. I would not have been able to complete this journey or this project without you. I love you very much.

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Abstract

Objectives: With the rise in popularity of electronic nicotine delivery systems (ENDS) and the serious health risks ENDS have on oral and systemic health, dental hygienists must be competent to assist patients with smoking cessation education, and the negative health effects associated with ENDS use. The objectives of this study were to assess the inclusion of information on ENDS in didactic tobacco cessation content and clinical patient education in dental hygiene (DH) programs' curricula across the United States.

Methods: The emails of 336 entry-level DH program directors were obtained from the American Dental Hygienists' Association (ADHA) website, and a web-based survey was used. An email including a recruitment letter and survey was sent to the 336 DH program directors using Qualtrics®. Follow-up emails were sent to non-respondents on four separate occasions.

Results: US DH program directors (N=150) completed a survey that assessed their perceptions of the level of importance regarding ENDS to their programs' curricula as well as their level of agreement regarding barriers to incorporating ENDS content in their programs' curricula. Respondents felt training students on how to deliver brief interventions to their smoking patients was extremely important (1.30 on 1-5 scale), they also felt ENDS as a helpful smoking cessation aid was unimportant (3.44 on 1-5 scale). Respondents strongly agreed (4.58 on 1-5 scale) newly graduated dental hygiene students should be able to give smoking cessation education regarding ENDS. They also agreed (4.00 on 1-5 scale) that there are no barriers to including ENDS content in their programs' curricula. Only eighty-five percent (N=122) of DH programs reported

their smoking cessation education curriculum included information on ENDS. The results strongly suggest the need for a standardized comprehensive smoking curriculum that includes ENDS content to enhance and expand existing DH programs.

Conclusion: DH programs must include smoking cessation education including ENDS content in their programs' curricula. They must also stay current with the latest scientific evidence related to ENDS use and incorporate this information into their smoking cessation education. In order for dental hygienists to adequately assist their smoking patients with smoking cessation, they must first receive a comprehensive smoking cessation education including ENDS content.

Chapter I Introduction

1.1 Problem Statement

An estimated 37.8 million adults in the US smoke traditional cigarettes.[1] Currently, approximately 51,540 people will develop oral cavity or oropharyngeal cancer and approximately 10,030 will eventually die, and approximately 234,030 people will develop lung cancer and approximately 154,050 will die.[2,3] Due to the negative health risks associated with traditional tobacco use and because of aggressive marketing to younger adults, electronic nicotine delivery systems (ENDS) have become an extremely fast-growing trend over the past few years. According to the Centers for Disease Control and Prevention (CDC), over nine million US adults use ENDS on a regular basis.[4] ENDS have become popular substitutions for traditional tobacco use and have been widely promoted as a safe means for smoking cessation.

Originally promoted as a safer alternative to traditional tobacco use, the American Journal of Preventive Medicine reported electronic cigarettes help people stop smoking and remain tobacco-free longer than traditional nicotine replacement products.[5] However, research has now shown that ENDS have serious negative impacts on oral and systemic health, as well as smoking cessation. ENDS users are at an increased risk for burns and injuries of the oral cavity, tooth loss due to periodontitis, dental caries, a variety of cancers, and even death.[6-14] With over nine million US adults using ENDS, it is crucial for health care professionals, especially dental hygienists, to assist patients with smoking cessation and to educate patients on the negative health effects associated with ENDS use.[15]

Dental hygienists are responsible for providing patient education and smoking cessation education to patients. In order to accomplish this, dental hygienists must be sufficiently competent to deliver smoking cessation education that includes ENDS use and their associated health risks. Before this can occur, dental hygiene (DH) students must be provided a comprehensive smoking cessation education that includes ENDS content.

In an effort to accomplish this, some DH programs' curricula include comprehensive smoking prevention and cessation content, educating students in methodologies to counsel and assist patients with smoking cessation. One of the most common and effective methodologies taught was developed by Ramseier in the early 2000's. This methodology includes (a) the stages of change, (b) the Five A's (Ask, Advise, Assess, Assist, and Arrange), (c) NRT, and (d) MI techniques.[16-20] This model helps patients move from the "pre-contemplation" stage to the "contemplation" stage regarding their tobacco use.[16] Another highly effective technique increasing in popularity in dental hygiene curricula is MI. MI is used to elicit behavior change in patients by helping them explore and resolve their ambivalence to change.[21] While these models and techniques are highly effective in assisting patients with smoking cessation they are not applied consistently in US DH programs. In order for dental hygienists to feel truly comfortable and confident providing smoking cessation education and the detrimental effects of ENDS use to patients, DH programs need to not only include extensive smoking cessation education, including ENDS use, in their programs' curricula they must also allow students opportunities to practice utilizing smoking cessation counseling with patients.

1.2 Goal Statement

The overall goals of this research project are to determine what content is included in DH programs' curricula about (a) the harms and risks of ENDS, (b) ENDS as a harm reduction

strategy, (c) ENDS as a smoking cessation aid, (d) how ENDS could serve as a gateway to other tobacco use, and (e) the impact of ENDS on systemic and oral health.

1.3 Specific Aims

Specific Aim 1: Assess the knowledge of DH program directors regarding the use of ENDS as tobacco replacement and tobacco cessation modalities, and their impact on systemic and oral health.

Hypothesis: DH program directors' knowledge will vary regarding the use of ENDS as tobacco replacement and tobacco cessation modalities, and the potential health impacts of their use.

Specific Aim 2: Determine if ENDS use as helpful harm reduction strategies are included in DH programs' curricula.

Hypothesis: There will be differences regarding the inclusion of ENDS use as helpful harm reduction strategies across DH programs' curricula.

Specific Aim 3: Determine if ENDS use as a smoking cessation aid are included in DH programs' curricula.

Hypothesis: There will be differences regarding the inclusion of ENDS use as a smoking cessation aid across DH programs' curricula.

Specific Aim 4: Determine if DH programs' curricula include content regarding the use of ENDS as a potential gateway to other tobacco use.

Hypothesis: DH programs are not teaching that ENDS could serve as a gateway to other tobacco use in their curricula.

Specific Aim 5: Determine if DH programs' curricula include content regarding the impact of ENDS use on systemic and oral health.

Hypothesis: DH programs' curricula are not including content regarding the impact of ENDS use on systemic and oral health.

1.4 Significance

Dental hygienists are responsible for educating patients on disease prevention. They also promote oral and systemic health. However, the Commission on Dental Accreditation (CODA) does not require smoking cessation education in DH programs' curricula.[22] In order for dental hygienists to be most effective, they must receive extensive education in smoking cessation education, including the risks of ENDS and their impact on oral and systemic health. This thesis research project assessed smoking cessation education, including ENDS, in all US DH programs. To the author's knowledge, only one study conducted during 2007-2008 has assessed smoking dependence curricula in all US DH programs (excluding programs in Illinois, since they participated in a previous study).[16] The results of this thesis research project will provide invaluable information on smoking cessation education, the time spent on smoking cessation education, and ENDS inclusion in DH programs' curricula.

1.5 Thesis Overview

A broad overview of this research project is provided to assist the reader. In Chapter II, Review of the Literature, the author presents an overview of the history of smoking and smoking hazards, present day health risks and statistics of smoking, the benefits of smoking cessation, NRT and their impact on oral and systemic health, an overview on the introduction of ENDS and their impact on oral and systemic health, the role dental hygienists play in patient education and smoking cessation, the role MI plays in smoking cessation, and DH programs' curricula regarding smoking cessation education and ENDS use. Chapter III discusses the Methods and Materials used in this research project. Chapter IV is the Results section, Chapter V and VI are

the Discussion and Conclusions sections, and the Appendices and Bibliography will conclude this thesis research project.

Chapter II Review of the Literature

2.1 History of smoking

The Phillip Morris company, the first company to sell cigarettes, was established in 1847 in the UK followed by the J.E. Liggett and Brother company in the US in 1849.[23] The invention of the cigarette-making machine in 1881 and the establishment of the American Tobacco Company caused cigarettes to rise in popularity.[23] Cigarettes reached the height of popularity during the First and Second World Wars due to tobacco companies sending millions of free cigarettes to soldiers on the front lines as well as the military including cigarettes in soldiers' rations.[23] During the 1920's, to expand their customer base even further, tobacco companies began marketing campaigns aimed towards women.[23]

2.2 History of "physician approved" smoking use

The public viewed physicians as the authority on health from the 1930's to the 1950's.[24] Taking advantage of this, tobacco companies began using actors dressed as physicians in marketing campaigns stating cigarettes were not harmful to diminish the public's growing fear of the negative health effects of smoking.[24] One of the most famous tobacco campaigns states, "More doctors smoke *Camels* than any other cigarette!"[24] Tobacco companies also began marketing to physicians in The New England Journal of Medicine and The Journal of the American Medical Association, they provided free cigarettes to physicians at medical conventions, and they created a medical relations division, which found researchers that would validate medical claims by the tobacco companies.[24]

2.3 History of smoking hazards

As early as the 17th century, the negative health effects of tobacco use were recognized. Chinese philosopher Fang Yizhi stated smoking caused "scorched lungs", Sir Francis Bacon stated tobacco was highly addictive in 1610, and during the 1930's American doctors first linked tobacco use to lung cancer.[23] On January 11, 1964, the US Surgeon General's Advisory Committee on Smoking and Health concluded there was a clear link between lung cancer and chronic bronchitis and cigarette smoking which led to tobacco companies being required to put warning labels on cigarette packages and advertisements warning the public of the negative health risks associated with smoking.[24]

2.4 Historical background of the "Great American Smokeout"

According to the American Cancer Society (ACS), to try and combat the negative health risks associated with smoking, the "Great American Smokeout" began in the 1970's when tobacco use and secondhand smoke were common place.[25] This event was based on an idea by Arthur P. Mullaney in 1970 when he asked people to stop smoking cigarettes for one day and to donate the money they would have used to purchase cigarettes to a local high school scholarship fund.[25] In 1974, Lynn R. Smith created the first "Don't Smoke Day" in Minnesota.[25] In 1976, the ACS of California got almost one million smokers to stop smoking for one day and due to the success of this event the ACS took this event nationwide in 1977.[25] These events helped lead to state and local governments banning smoking in public places and discouraging teen smoking throughout the 1980's and 1990's. In 1999, cigarette manufacturers were charged with "defrauding the public by lying about the risks of smoking" by the Department of Justice.[25]

2.5 Master Settlement Agreement (MSA)

The lawsuit against cigarette manufacturers led to the Master Settlement Agreement (MSA) in 1999.[25] Cigarette manufacturer were forced to pay the Medicaid costs of treating smokers to

45 states in the sum of $206 billion.[25] The MSA also forced cigarette manufacturers to stop advertising their products during cartoons and on billboards.[25] Even though great strides were made to reduce the number of smokers in the United States, a large portion of the population continued to use cigarettes, which led to the development of products to assist people with nicotine addiction.

2.6 Present day smoking statistics

According to the CDC, in 2016, 37.8 million adults in the US smoked. They also determined that cigarette smoking prevalence was highest amongst males, those between the ages of 25-44 years, American Indian/Alaska Natives, those with a GED, those living below the poverty level, those living in the Midwest, and those in the LGB community.[1]

The World Health Organization (WHO) reports that there are currently 1.1 billion smokers worldwide and of these 1.1 billion smokers, 80% live in low- and middle-income countries. The WHO also reports that more than six million people die each year as a direct result of tobacco use as well as another one million people who die each year as a result of exposure to second-hand smoke.[26] The CDC reports that for every person who dies from a smoking-related disease, 20 more people suffer with at least one serious illness from smoking.[27]

According to the CDC, in 2015 nearly seven out of every ten US adult smoker wanted to quit smoking.[28] The CDC also reports that every day 3,200 Americans under the age of 18 will try smoking for the first time and of these 2,100 will become full-time smokers.[29]

2.7 Present day health risks of smoking and prevalence of cancers associated with smoking

There are numerous significant health risks associated with smoking. In fact, smoking has been identified as a risk factor not only for lung cancers, but for a wide range of other organs and systems as well. Smoking is associated with premature death, cancer, chronic obstructive

pulmonary disease (COPD), coronary heart disease, stroke reduced fertility, increased risks for birth defects and miscarriage, tooth loss due to periodontal disease, cataracts, type 2 diabetes mellitus, and rheumatoid arthritis.[30] According to the CDC, smoking is the number one risk factor for lung cancer and 80% to 90% of all lung cancer deaths are caused by smoking. The CDC also reports that smoking has been shown to cause cancer of the mouth and throat, esophagus, stomach, colon, rectum, liver, pancreas, larynx, trachea, bronchus, kidney and renal pelvis, urinary bladder, and cervix, and causes acute myeloid leukemia (AML).[6] The ACS estimates approximately 51,540 people will develop oral cavity or oropharyngeal cancer in 2018 and 10,030 will eventually die.[2] The ACS estimates that approximately 17,290 people will develop esophageal cancer in 2018 and 15,850 people previously diagnosed with esophageal cancer will die.[31] According to the ACS, approximately 26,240 people will develop stomach cancer in 2018 and 10,800 people previously diagnosed with stomach cancer will die.[32] The ACS estimates approximately 97,220 people will develop colon cancer and approximately 43,030 people will develop rectal cancer in 2018 and 50,630 people previously diagnosed with colorectal cancer will die.[33] The ACS estimates approximately 42,220 people will develop liver cancer in 2018 and 30,200 people previously diagnosed with liver cancer will die.[34] According to the ACS, approximately 55,440 will develop pancreatic cancer in 2018 and 44,330 people previously diagnosed with pancreatic cancer will die.[35] The ACS estimates approximately 13,150 people will develop laryngeal cancer in 2018 and 3,710 previously diagnosed people will die.[36] The ACS estimates approximately 63,340 people will develop kidney cancer in 2018 and 14,970 people previously diagnosed with kidney cancer will die.[37] The ACS estimates approximately 13,240 people will develop cervical cancer in 2018 and 4,170 people previously diagnosed with

cervical cancer will die.[38] According to the ACS, approximately 19,520 people will develop AML in 2018 and 10,670 people previously diagnosed with AML will die.[39]

2.8 Benefits of smoking cessation

The negative health effects on oral and systemic health caused by smoking reduce over time with smoking cessation.[40-42] Smoking cessation lowers the risk of recurrent heart attacks and cardiovascular deaths by over 50% and it returns high blood pressure and high pulse to normal rates.[40,41] Five years after a person stops smoking their risk for developing cancer of the mouth, throat, esophagus, and bladder is cut in half and their risk for cervical cancer is the same as a person who has never smoked.[40-43] Warnakulasuriya et al. concluded several studies found the periodontal status of people who had quit smoking to be similar to that of people who had never smoked, instead of being similar to people who currently smoke.[44-59] Warnakulasuriya et al. also found several studies confirming treatment outcomes for people who quit smoking to be similar to those of people who had never smoked and better than people who currently smoked.[44-65] A study by Dietrich et al. concluded that tooth loss decreased significantly shortly after a person stops smoking.[44,66] Due to the health risks, prevalence of cancers associated with tobacco use, and the positive health benefits associated with smoking cessation led to the development of products to assist people with nicotine addiction.

2.9 Nicotine replacement therapies (NRT) and impact on systemic and oral health

The first pharmacological treatment developed and approved by the Food and Drug Administration (FDA) for smoking cessation was nicotine gum in 1984.[67] This led to the creation of the nicotine patch in the early 1990's, the nicotine inhaler in 1998, and nicotine lozenges in 2002.[67] Today, NRT consist of a variety of products including nicotine gums, transdermal patches, nasal sprays, oral inhalers, sublingual tablets, lozenges, and vaccines.[68] Wadgave et al.

reports all of these provide nicotine craving relief and are most effective in combination with cessation counseling.[68,69] Transdermal patches are placed directly on the skin and are available in different doses. This allows users to gradually decrease the amount of nicotine they are receiving until they are eventually tobacco-free.[68,69] Acute dosing nicotine products like gums, lozenges, sublingual tablets, oral inhalers, and nasal sprays allow users to control the amount and timing of nicotine release while gradually tapering down until eventually users are nicotine free.[68] Nicotine vaccines cause the users immune system to activate an immune response whenever nicotine is introduced into the body causing a reduction in the amount of nicotine that reaches the brain.[68,70] NRT are considered better for oral and systemic health, because they do not contain many of the harmful products of tobacco combustion such as nicotine, hydrogen cyanide, formaldehyde, lead, arsenic, ammonia, radioactive elements, benzene, carbon monoxide, nitrosamines, and polycyclic aromatic hydrocarbons.[71] NRT are also not associated with any serious long-term negative health effects.[72]

2.10 Introduction of electronic nicotine delivery systems (ENDS)

In the early 2000's, ENDS were introduced in North America as an additional support for smoking cessation, assisting smokers with nicotine urges, nicotine withdrawal symptoms, and the "...sensory and behavioral aspects of addiction."[73,74] ENDS include a variety of devices that produce an aerosol, which contains nicotine, flavorings, and other additives, when inhaled by users.[75] ENDS products include e-cigarettes and vapes, which heat flavored e-liquids that may or may not contain nicotine. Many physicians and health care professionals began advocating for the use of ENDS based on the promotion of ENDS as a major public health intervention for smoking cessation. A study published in 2011 in the American Journal of Preventive Medicine reported that electronic cigarettes help people stop smoking and remain tobacco-free longer than

traditional nicotine replacement products.[5] Due to the belief that ENDS were safer than traditional cigarettes, in 2016, the Royal College of Physicians in the UK endorsed the use of vaping to help patients wean off of traditional cigarettes.[76] Today, many physicians and health care professionals are advocating for the use of ENDS based on the belief that ENDS could help a large percentage of smokers quit and/or reduce the amount of nicotine consumed.[77]

Over a very short period of time, largely due to extensive marketing campaigns aimed at young people, ENDS went from being exclusively smoking cessation aids to extremely popular forms of smoking devices. In 2014, the CDC released a report stating over nine million US adults used ENDS on a regular basis, almost half of current cigarette smokers and former cigarette smokers had tried ENDS, one in six current cigarette smokers and one in four former cigarette smokers used ENDS, and 4% of adults who never smoked cigarettes had used ENDS.[4] The CDC also reported that 2.5 million US middle and high school students used ENDS and more than a quarter of a million middle and high school students who never smoked cigarettes had used ENDS.[15]

2.11 ENDS devices

ENDS are commonly referred to as "e-cigarettes," "e-cigs," "vape pens," "vapes," "e-hookahs," "cigalikes," "mods," and "tank systems."[78] ENDS use is often referred to as "vaping" due to the white vapor that is produced when the user inhales.[78] ENDS contain three main parts: a battery, cartridge, and an atomizer/vaporizer. ENDS consist of a "...stainless-steel tube that houses a control circuit, a pneumatic airflow sensor switch, and a vaporizer that has a heating device connected with a pneumatic switch and smoking liquid container, and an inhaler cartridge that connects to a container containing a liquid."[79] ENDS users can either refill the inhaler cartridge with an e-liquid containing chemicals that allow the production of an aerosol or they

can buy replacement inhaler cartridges that are pre-made with an e-liquid. E-liquids contain chemicals such as nicotine, menthol, safrole, propylene glycol, 1,3-butanediol, 1,3-propanediol, ethylene glycol, glycerol, ethyl vanillin, camphor, α-thujone, coumarin, and diethylene glycol.[79,80] As of 2018, there are over 466 different brands of ENDS and over 7,764 different flavors of e-liquids.[77] E-liquids come in a variety of flavors including strawberry, apple, chocolate, vanilla, as well as many others. Unlike traditionally manufactured cigarettes which contain 10-15 mg of nicotine per cigarette, the liquids used in ENDS devices range from 0-36 mg of nicotine.[81] ENDS users are also able to mix e-liquids to increase this range even further.[81]

2.12 Detrimental effects of ENDS use

Though originally thought to be less harmful than traditional tobacco use, the evidence is mounting that ENDS have significant detrimental health implications, and that they are actually becoming a gateway to traditional cigarette use.[70] Recent research has found that when e-liquids are heated, chemical reactions occur that form new, toxic compounds.[82] The majority of e-liquids either contain or generate carbonyl compounds like formaldehyde, acetaldehyde, acrolein, crotonaldehyde, and methyglyoxal.[82-88] ENDS aerosols also contain volatile organic compounds such as benzene, acrylonitrile, ethylbenzene, styrene, and toluene.[89-96] These toxicants and carcinogens are associated with an increased risk for a variety of cancers.[6] The ACS estimates 51,540 new cases of cancer of the oral cavity and pharynx will be diagnosed in 2018 as a result of tobacco use and tobacco related behaviors.[97]

Along with an increased risk for cancer, ENDS pose many other significant health risks. Chatham-Stephens et al. found the ten most common side effects reported to US Poison Centers during a four-year period related to ENDS were vomiting, eye irritation or pain, nausea, red eye or conjunctivitis, dizziness, tachycardia, drowsiness, agitation, headache, and cough.[7] Death

from ingestion of e-liquids in a child under the age of five and death from parenteral injection of an e-liquid in an adult over the age of 20 were also reported.[7]

ENDS users are at risk for burns and injuries of the oral cavity caused by explosions of the device. Harrison et al. reported a Colorado man spent eight days in the hospital after his mouth, face, and eyes were burned with debris and battery acid from an electronic cigarette exploding.[8,9] They also reported that a Florida man lost teeth and part of his tongue after an e-cigarette explosion.[8,9] This report also stated news articles on the Internet have documented injuries to the oral cavity due to ENDS explosion including intraoral burns, luxation injuries, and chipped and fractured teeth.[8,9] According to the Federal Emergency Management Agency (FEMA), the first case of a death caused by an exploding electronic cigarette was reported on May 5, 2018 in St. Petersburg, Florida.[10]

ENDS use has also been associated with increased risk for oral diseases such as periodontal disease and dental caries. Periodontitis occurs when microorganisms present in dental plaque cause an inflammatory disease of tooth supporting structures.[11] Smoking modifies a host's response to microbial aggression which can cause periodontitis.[11] Research has proven that tobacco use or tobacco related habits, such as ENDS, are the main environmental risk factor for periodontal disease.[11-13] Sucralose, an artificial sweetener, is being used in e-liquid commercial flavors.[98] Although further research is needed, it has been reported that artificial sweeteners like sucralose, have the potential to increase enamel show enamel demineralization leading to an increased dental caries risk.[14] A 2018 study investigated the changes in tooth surfaces when exposed to e-cigarette aerosols containing e-liquids with sweet flavors. This study reported that the experimental group, after introduction to the aerosols, demonstrated a four-fold increase in microbial adhesion to enamel, a two-fold increase in biofilm formation, and a 27% decrease in

enamel hardness. Additionally, there was consistent bacteria-initiated enamel demineralization on the surfaces exposed to the sweet e-liquid. Finally, the study reported that the viscosity of the e-liquids encouraged streptococcus mutans (S.mutans), a highly cariogenic microbe, to adhere to the tooth pits and fissures.[99]

2.13 Dental hygienists' role in patient education and smoking cessation

With nine million US adults currently using ENDS, it is crucial for dental hygienists to be competent and confident in educating patients on the negative health effects associated with ENDS use. Cigarette smoking kills more than 480,000 Americans each year, with more than 41,000 of these deaths from exposure to secondhand smoke. Smoking-related illnesses in the US also cost more than $300 billion a year.[100] Dental hygienists have long been identified as front-line deliverers of smoking cessation education during routine visits; however, significant barriers exist.

2.14 Smoking cessation in DH education

Early US DH programs' curricula included teaching about the hazards of smoking on oral and overall health, as well as intervention protocols.[16] However, as of 1990 less than one-third of all US DH programs included instruction of counselling techniques to students in their curricula.[16] DH programs cite multiple reasons for not incorporating smoking cessation education into their curricula. Koerber et al. surveyed faculty at 19 US DH programs to "...understand how programs make decisions about and provide training for smoking dependence counseling."[101] When asked what made it difficult to train students in smoking dependence counseling, faculty members reported a lack of curriculum time, trained faculty, and faculty or directors lack of interest and general feeling it was not their place to change patients smoking behavior.[101] The American Dental Association (ADA) conducted a survey regarding smoking prevention and cessation

education in the 54 dental schools in the US. It was concluded that 72% of the 54 dental schools surveyed indicated a need for faculty training on smoking use prevention techniques and 93% indicated a need for faculty training on smoking use cessation skills.[16] Before dental hygienists can educate their patients on the harmful effects of ENDS, and before dental hygienists can provide their patients with smoking cessation information, they need to be educated about these controversial devices. The Commission on Dental Accreditation (CODA) which "...serves the public and profession by developing and implementing accreditation standards that promote and monitor the continuous quality and improvement of dental education programs" does not require smoking cessation education or MI in DH programs' curricula.[22] Though not a requirement, some US DH programs are providing limited information to their students regarding ENDS. The content and amount of time spent on smoking cessation including ENDS content varies greatly between DH programs. A survey by Harris et al. asked senior dental hygiene students in all 12 accredited North Carolina DH programs their experience with smoking cessation education. The study found 95% of the respondents first learned about smoking cessation during their first year of their DH program and 68% of respondents recalled classroom instructors providing information on the 5A's of smoking cessation. This study found 73% of respondents recalled classroom instructors providing information on the ADHA smoking cessation initiative Ask, Advice, Refer. It concluded 60% of respondents learned about smoking cessation in five to eight different courses, 29% learned about smoking cessation in one to four courses, and 11% in greater than nine courses.[102] Even when dental hygienists receive education on smoking cessation and MI during entry-level dental hygiene education, research has shown they still feel undereducated and lack confidence discussing smoking cessation with their patients. Ramseier et al. surveyed dental hygienists who received smoking cessation education in their entry-level

DH education and revealed that even those dental hygienists do not provide cessation counselling to a high percentage of their patients who smoke.[16] Rauch et al. conducted a survey of registered dental hygienists in New York. The study reported that 64% of the respondents reported they "always or often" asked their patients if they smoke and 70% reported they "always or often" advised their smoking patients to quit smoking. However only 40% reported they documented their smoking cessation interventions and less than 20% reportedly referred smoking patients to the Smoker's Quitline.[103] Due to the importance of smoking cessation education including ENDS content to patients and the role dental hygienists play, the ADHA is advocating for smoking cessation training in all DH programs' curricula.[104]

2.15 Smoking cessation methods and dental hygienists comfort levels

Dental hygienists can utilize several different methods to assist smokers with smoking cessation. In 2003, Ramseier presented a comprehensive model for smoking prevention and cessation that could be incorporated into DH programs' curricula.[16] This tobacco use cessation strategy was based on: "(1) the model 'stages of change' (or transtheoretical model) by Prochaska and DiClemente, (2) the Five A's (Ask, Advise, Assess, Assist and Arrange) by Fiore et al. using nicotine replacement therapy (NRT), and (3) the main principles of Motivational Interviewing techniques by Miller and Rollnick."[17-20] Ramseier's model involved documenting every patient's smoking status and a brief intervention.[16] The goal is to help patients move from the "pre-contemplation" stage to the "contemplation" stage regarding their tobacco use.[16]

A survey asking dental hygienists about their comfort level of smoking use and cessation treatment was conducted by Studts et al. Results indicated 63% of respondents were somewhat comfortable and 19% were very comfortable discussing smoking cessation with their patients; however, respondents were reportedly less comfortable formulating a quit plan or recommending

pharmacotherapy. The study found 14% of respondents were not at all comfortable helping patients develop a smoking cessation plan while 39% of respondents were less comfortable doing so. When looking at dental hygienists' comfort levels in recommending pharmacotherapy to patients, 24% were not at all comfortable while 34% of respondents were less comfortable recommending pharmacotherapy to patients.[104]

2.16 Motivational interviewing (MI)

MI is an effective technique utilized by dental hygienists to assist patients with smoking cessation. MI is defined as: "...a directive, client-centered counselling style for eliciting behavior change by helping clients explore and resolve ambivalence."[105]

The "spirit" of MI includes: "(a) motivation to change is elicited from the client, and not imposed from without, (b) it is the client's task, not the counselor's, to articulate and resolve his or her ambivalence, (c) direct persuasion is not an effective method for resolving ambivalence, (d) the counseling style is generally a quiet and eliciting one, (e) the counselor is directive in helping the client to examine and resolve ambivalence, (f) readiness to change is not a client trait, but a fluctuating product of interpersonal interaction, and (g) the therapeutic relationship is more like a partnership or companionship than expert/recipient roles."[105]

The four major principles of MI include: "(a) express empathy, (b) develop discrepancy, (c) roll with resistance, and (d) support self-efficacy and optimism."[106] MI utilizes four main tools to build motivation for change in patients. They are summarized by the acronym OARS: "open questions," "affirmations," "reflective listening," and "summarizing."[106]

MI is incorporated into DH programs' curricula through didactic lectures, clinical instruction, and real-world experiences. Knowledge, repeated assessment and feedback, and experiences utilizing MI in practice are all crucial for DH students to build confidence and expertise.[107,108]

With ENDS having such a significant impact on oral health care, dental hygienists are posed to play a crucial role in assisting patients with smoking cessation. MI is a very useful tool that dental hygienists can utilize to help accomplish this; however, dental hygienists must first be educated on how to effectively utilize MI in clinical practice.

2.17 National smoking cessation efforts

Healthy People 2020 "provides science-based, 10-year national objectives for improving the health of all Americans."[109] One goal of Healthy People 2020 is to decrease the number of people who suffer from chronic illnesses, disability, and death due to smoking and exposure to secondhand smoke.[110] A few effective strategies that will help end the tobacco use epidemic include providing smoking cessation to all smokers in clinical settings and controlling the access to all tobacco products, including ENDS.[110,111]

In an effort to motivate patients to quit smoking, the US Public Health Service (USPHS) is calling for clinicians to assist patients who are not ready to quit by providing them with quitting strategies.[101,112] Their evidence-based model is called "the 5 A's" and consists of: 1) asking a patient about tobacco use, 2) advising a patient to quit tobacco use, 3) assessing the patient's tobacco use and readiness to quit, 4) assisting the patient to quit, and 5) arranging for support and follow-up for the patient to quit."[101,112] There is limited research on the implementation and success of this evidence-based model. One study entitled, "Effectiveness of the 5-As Tobacco Cessation Treatments in Nine HMOs," assessed the smoking status and tobacco treatments offered by clinicians and used by smokers. The authors determined that smokers were offered advice (77%) more often than the more effective assist treatments-classes/counseling (41%) or pharmacotherapy (33%). Out of 2,325 participants, one-third used pharmacotherapy, while just 16% used classes/counseling. The same study reported that after

twelve months, 8.9% of participants remained tobacco-free for more than 30 days, the participants who were offered pharmacotherapy and participants who utilized classes/counseling or pharmacotherapy were more likely to quit.[113]

In an effort to educate the public on the dangers of smoking, the CDC launched the first-ever paid national tobacco education campaign. The *"Tips From Former Smokers®* (*Tips®*)" campaign, which has run from 2012-2018, talks to real people who have experienced serious negative health effects due to smoking and exposure to secondhand smoke. During 2012-2015, the CDC estimated that approximately nine million smokers have attempted to stop smoking due to the *Tips From Former Smokers®* (*Tips®*) campaign.[114]

The ACS began the "Great American Smokeout" in the 1970's as an effort to prevent deaths and chronic illnesses caused by smoking and exposure to secondhand smoke.[25] These events led state and local governments to ban smoking in workplaces and restaurants, raising taxes on cigarettes, limiting cigarette promotions, and discouraging teen cigarette use.[25] These events also aided in the decline of cigarette use by adults in the US from 42% to 15.5% between 1965 and 2016.[25]

In an effort to help people quit smoking and ENDS use, the American Heart Association (AHA) offers smokers a "No-Smoking Contract" and encourages them to sign it in front of people who will offer them support in their efforts.[115] This contract enables smokers to select the date they will stop smoking and commit to not using traditional cigarettes or ENDS products.[115]

In an effort to educate at-risk teen on the risks of smoking, the US Food and Drug Administration (FDA) launched "The Real Cost" campaign in 2014.[116] This campaign included ads and television commercials that showed the harmful effects of smoking.[116] In an effort to educate and decrease the number of middle and high school students who use ENDS, "The Real

Cost" campaign expanded in 2018 to include the risks of using ENDS.[116] The FDA estimated between 2014 and 2016 approximately 350,000 teens ages 11 to 18 did not start smoking because of "The Real Cost" campaign.[116]

Currently the most aggressive action taken to date to protect the public health from the harmful effects of ENDS products, is the FDA's Comprehensive Plan for Tobacco and Nicotine Regulation. This plan aims to restrict the whole sale of flavored ENDS products to age-restricted, in-person locations only, to restrict the sale of flavored ENDS products that are sold online without heightened age verification processes, and to pursue the removal all ENDS products that are marketed to children and/or appealing to youth from the market.[117]

2.18 ENDS clinical trials

Currently, there are hundreds of clinical trials investigating ENDS. A randomized pilot clinical trial is studying the levels of nicotine delivered by various types and brands of ENDS to the bloodstream and comparing this to the levels delivered from conventional cigarettes.[118] A mixed method (longitudinal, trajectory, and qualitative studies) is investigating the impact of e-cigarette use on smoking and quitting among smoking youth.[119] An observational study is comparing the exposure to the potential toxicant and acrolein in smokers of conventional cigarettes, users of e-cigarettes, and people who use both products at the same time.[120] A randomized trial is evaluating early smoking reduction or cessation by means of no nicotine e-cigarettes added to standard counselling.[121] An interventional clinical trial is investigating the impact on cardiovascular function in smokers making a quit attempt using e-cigarettes compared with smokers making a quit attempt with prescription NRT.[122]

Due to a lack of quality trials, controversy exists regarding the effectiveness of ENDS in attempts to quit smoking. A systemic review and meta-analysis found that two randomized

controlled trials suggest a possible increase in tobacco smoking cessation with ENDS devices in comparison with non-ENDS devices.[123] Results from cohort studies suggested a possible reduction in quit rates with use of ENDS devices compared with no use of ENDS devices.[123] A randomized controlled trial of e-cigarettes versus nicotine replacement therapies found that 39.5% of e-cigarette users were still using them after 12 months, that 4.3% of nicotine replacement therapy users were still using them after 12 months, and that the chances of having stopped smoking were 83% higher for people who used e-cigarettes compared with nicotine replacement therapies.[124] Another randomized controlled trial examined whether ENDS could act as a cue to increase smoking desire and urges in those passively exposed.[125] The study found that passive exposure to the e-cigarette and combustible cigarette cue significantly increased observers' ratings of desire and urge to smoke a regular cigarette.[125] Exposure to the e-cigarette cue but not the regular cigarette cue also increased desire to smoke an e-cigarette.[125] The results provide evidence that ENDS exposure may evoke smoking urges in young adult daily smokers.[125] All of these studies showed low-certainty evidence and a need for well-designed trials.[123-125]

2.19 American Cancer Society's position on ENDS

In February 2018, the ACS Board of Directors released a position statement on ENDS. The ACS stated, "Based on currently available evidence, using current generation e-cigarettes is less harmful than smoking cigarettes, but the health effects of long-term use are not known."[126] The ACS also stated, "To help smokers quit, the ACS recommends that clinicians advise their patients to use FDA-approved cessation aids that have been proven to support successful quit attempts. The ACS recommends that clinicians support all attempts to quit the use of combustible tobacco and work with smokers to eventually stop using any tobacco product,

including e-cigarettes. The ACS strongly discourages the concurrent (or "dual") use of e-cigarettes and combustible cigarettes, a behavior that is far more detrimental to a person's health compared to the substantial health benefit of quitting smoking."[126]

2.20 Benefits of study

The results of the proposed study will benefit DH programs by illustrating the lack of smoking cessation education including ENDS content in programs' curricula. The study will help demonstrate the need to incorporate ENDS impact on oral and systemic health, help show that ENDS are not helpful as harm reduction strategies or smoking cessation aids, and that ENDS can serve as a potential gateway to other tobacco use. This study will also demonstrate the need for advanced smoking cessation training for DH programs' faculty and the need for a standardized DH curriculum concerning all forms of smoking cessation for all DH programs in the US.

2.21 Gaps in the literature

There is a lack of information on how many DH programs in the US include smoking cessation education in their curricula. Only one study entitled, "Assessment of Tobacco Dependence Curricula in U.S. Dental Hygiene Programs" assessed the tobacco dependence curricula in all US DH programs. This study was conducted during 2007-2008 and surveyed the program directors of 283 accredited DH programs in the US (this number excluded programs in Illinois, since they had participated in a previous study).[21]

There is also a lack of knowledge determining whether ENDS education is included in smoking cessation education in all US DH programs' curricula. No studies were found to determine if ENDS education is included in smoking cessation education in all US DH programs' curricula. Numerous studies were found that provided information on the number of

other health professions that include smoking cessation education in their programs' curricula. A study that looked at tobacco dependence education (TDE) at the 74 accredited US and Canadian dental schools found that TDE was taught at 92% of the dental schools.[127] A study that assessed the tobacco dependence curricula at every US baccalaureate and graduate nursing program that were a member of the American Association of Colleges of Nursing (AACN) determined that higher than 90% of respondents taught about cancer risks from smoking and the health effects of tobacco-related diseases.[128] A study looking at the smoking cessation counseling training in US entry-level physical therapist programs determined that 60% of programs included tobacco-related training in their curriculums.[129] A study assessing smoking education in 387 US respiratory care programs found that 63% of the programs had a median of 165 minutes of smoking education throughout the degree program.[130] As with US DH programs, there is a lack of knowledge determining whether ENDS education is included in the smoking cessation education of other health professions.

2.22 Summary

There are significant systemic health risks associated with tobacco use including COPD, coronary heart disease, stroke, cancer, and premature death.[30] There are also significant oral health risks associated with tobacco use including tooth loss due to periodontal disease, oral cancer, burns, injuries, and death.[8,10,11,97] Though first believed to be less harmful than traditional cigarettes, research is now showing that ENDS are having a negative impact on systemic and oral health.[68]

Dental hygienists need to be educated on NRT and how to utilize MI to provide smoking cessation education to patients. NRT include a wide variety of products that aid with nicotine craving relief and are most effective with some form of smoking cessation counseling. US DH

programs' curricula need to include in depth information regarding smoking cessation education including ENDS.

2.23 Recommendations

Due to the increase in tobacco users and the significant negative health effects associated with smoking, the inclusion of extensive smoking cessation training is needed in all US DH programs' curricula in order for students to feel confident and to be most effective in aiding patients.[131] Future research is also needed to explore the current level of smoking education in all US DH programs.

Chapter III Materials and Methods

3.1 General Approach and Study Design

This study used adapted versions of two student surveys. The "National survey of smoking and smoking cessation education within UK midwifery school curricula" study "aimed to identify the extent of smoking cessation training and assessment in UK midwifery schools" and "all UK undergraduate midwifery schools (n = 53) were invited to complete a web-based survey of their curricular coverage and assessment related to smoking cessation, and perceived barriers to delivering smoking cessation training."[132] The "Tobacco education in UK dental schools: a survey of current practice" study investigated "the current provision of tobacco education (tobacco use and cessation), assessment and e-cigarette education in UK dental and dental hygiene and therapy (DHT) undergraduate programmes" and "the study was conducted using a self-administered questionnaire sent to all UK institutions training dental and DHT students during the academic year 2015/2016."[133] The goal was to have a response rate of 30% or about 100 completed and returned surveys.

3.2 Recruitment and Source Population

Respondents: The respondents in the study were the 336 US DH program directors.

Inclusion and Exclusion Criteria: The inclusion criteria were DH program directors who taught at entry-level dental hygiene programs, degree-completion programs, re-entry programs, Master of Science in Dental Hygiene (MSDH) and related disciplines, and online/distance learning programs located in the US and the District of Columbia.

Participants were excluded from this study if their programs were located in US territories as well as located outside of the US.

Participants Recruitment Strategy: Surveys were emailed using Qualtrics®. A current list of directors' email addresses were obtained from the ADHA's website. The email consisted of a recruitment letter explaining the study. See appendix C for recruitment letter.

3.3 Protection of Human Subjects

IRB approval was obtained at the University of Michigan and determined to be exempt from IRB oversight on May 3, 2018 (HUM00145160) (Appendix D). The study consisted of an anonymous survey of US DH program directors. The study presented no more than a minimal risk to participants. No personal identifiers were included to maintain confidentiality. Participants were not compensated for completing the survey and there were no consequences for not completing the survey. Participation was completely voluntary. Completed and returned electronic surveys were only stored on one laptop, which was properly locked and secured. Multiple passwords were used to secure data. Paper surveys were securely stored. Data was entered into a data collection spreadsheet, and then was entered into SPSS.[134]

3.4 Survey Instrument

The survey was adapted to include questions regarding ENDS use as a tobacco replacement and tobacco cessation modality included in DH programs' curricula, ENDS use as helpful harm reduction strategies and smoking cessation aids included in DH programs' curricula, and content regarding the use of ENDS as a potential gateway to other tobacco use included in DH programs' curricula. The survey asked DH program directors to answer questions in reference to the teaching they delivered in the academic year 2017/2018.

Participants responded to a 25-question survey. The survey consisted of multiple choice, open-ended, and Likert scale questions.

Procedure: Each survey was emailed electronically using Qualtrics®. Reminder emails were sent every two weeks between July 20, 2018 and October 22, 2018 to survey non-respondents.

Questionnaire Content: The survey contained a Demographics section, which asked what state and what type of programs each DH program offered, a Background section, which asked if each DH programs' curricula taught smoking cessation education and if ENDS were included, and an Academic perspective section, which asked participants to rate the level of importance they felt ENDS were to their programs' curricula, how many hours are dedicated to smoking cessation, who is responsible for teaching smoking cessation, barriers regarding including ENDS in smoking cessation education, and what types of summative and/or formative assessments are used to assess student's knowledge. The survey was designed to take no longer than five minutes to complete. Prior to distribution of the survey, survey questions were reviewed by Nolan Kavanagh, a faculty instructor and MPH student at the University of Michigan, to identify if the questions that were being asked were appropriate for the study and for statistical interpretation. Two consultations with the University of Michigan Survey Research Center were also conducted prior to the distribution of the survey to validate survey content. The survey was also piloted via Qualtrics® by faculty from the University of Michigan, Kellogg Community College, and the University of Maine. Faculty who piloted the survey were asked to complete a feedback form. See appendix A for survey pilot test feedback form. See appendix B for questionnaire.

3.5 Statistical Analysis

Descriptive Statistics: Statistical analyses were done considering the number of participants and questions asked. Frequency distributions were done to group respondents into subcategories into which a variable can be divided. Measures of central tendency and variation were performed after data collection was completed.

Inferential Statistics: This study sampled a sizeable proportion of the DH programs in the US. Due to this, this study needed to rely less on inferential statistics, whose goal is generalizing findings to a population that is considerably larger than the study sample. As such, while statistical tests have been performed for all comparisons, the *p*-values should be interpreted with this in mind. One-way ANOVA tests using Tukey's honestly significant difference (HSD) post hoc test were done to investigate categorical data. Fisher's Exact Tests were used in the analysis of contingency tables. The *p*-value for statistical significance for all analyses was $p < 0.05$.

3.6 Limitations

Limitations to this study include potential for email addresses to be undeliverable or marked as spam. The level of participation may restrict the representativeness of the data collected. The data is self-reported by participants. Self-reporting has the potential to introduce bias. The survey does not represent all 50 US states.

3.7 Consultants and Collaborators

Nolan Kavanagh, a faculty instructor and MPH student at the University of Michigan, was consulted for the validation of the survey questions and for statistical analysis.

Two consultations with the University of Michigan Survey Research Center were conducted to validate survey content.

3.8 Timeline

The first meeting with the entire thesis committee was conducted on March 13, 2018 at the University of Michigan. IRB application submission and approval were completed in April of 2018. Qualtrics® initially distributed electronic surveys to participants on July 20, 2018. Qualtrics® distributed reminder emails to participants on August 3, 2018, August 17, 2018, September 10, 2018, September 24, 2018, October 8, 2018, and October 22, 2018. Submission of the thesis research proposal was completed at the end of the Winter 2018 semester. The thesis research study was conducted between July 2018 and October 2018. An analysis of completed and returned thesis data was conducted during the Winter 2019 semester. The thesis study was finalized and defended during the Spring 2019 and Summer 2019 semesters.

3.9 Preliminary Studies

This study does not include preliminary studies.

Chapter IV Results

4.1 Response Rate

At the time of this study, there were approximately 336 US DH program directors. Four DH program directors were excluded. One DH program had been disbanded, two DH programs required IRB approval at their institutions to participate in the survey, and one DH program director was the co-chair for this thesis research project for a total of 332 potential respondents. The response rate for the DH program directors was 45% (n = 150).

4.2 Demographic statistics for respondents

At the time of this study, there were 332 DH programs in the US, of which 150 participated in the survey from a total of 43 states (Table 1). There was equal representation from the programs (Figure 1). Forty-nine percent (n = 23) of programs in the Northeast responded, fifty-one percent (n = 42) of programs in the Midwest responded, forty-five percent (n = 56) of programs in the South responded, and thirty-two percent (n = 25) of programs in the West responded.

Out of the 146 DH programs (4 respondents did not report), 77% (n = 113) reported offering an associate degree and/or certificate, 31% (n = 46) reported offering a bachelor's degree, and 6% (n = 9) reported offering a master's degree (Table 2). Respondents were able to choose more than one degree type.

4.3 DH programs teaching smoking cessation education and the inclusion of ENDS

Ninety-six percent (n = 144) reported teaching smoking cessation education in their programs' curricula and only one program, located in Connecticut reported not teaching smoking cessation education in their programs' curricula. Eighty-five percent (n = 122) reported their programs' smoking cessation education includes information on ENDS (e.g. e-cigarettes, vaporizers, etc.).

4.4 Open-ended question

DH program directors were asked in an open-ended question, *"Is there anything else you would like to share regarding ENDS (e.g. e-cigarettes, vaporizers, etc.) inclusion in your program's curriculum?"* (Table 3). The responses were separated into three categories, (1) lack of ENDS information, (2) potential harmful effects of ENDS, and (3) clinical competency requirement. Twenty-two percent (n = 33) of respondents answered this question.

A lack of ENDS information was the first category of importance for 18% (n = 6) of respondents. The top three issues within this themed category were, (a) lack of ENDS information in current textbooks (n = 3), (b) lack of long-term ENDS research (n = 2) and (c) learning more about ENDS from continuing education courses than dental hygiene courses (n = 1). One respondent stated, "*Due to the new-found popularity and lack of long-term research, this topic (ENDS) can be more difficult to teach*."

ENDS potential harmful effects issues was the second category of importance for 15% (n = 5) of respondents. The top three issues within this themed category were, (a) not recommending ENDS as a tobacco cessation aid due to their potential harmful effects 1% (n = 3), (b) danger of burns .03% (n = 1), and (c) not recommending e-cigarettes to patients since they contain nicotine .03% (n = 1).

Clinical competency requirement issues were the third category of importance for 1% (n = 2) of respondents. The top issue was not including a clinical competency requirement related to tobacco cessation for 1% (n = 2) of program directors. One respondent stated, "*We talk about it (ENDS) in lecture, but do not include it currently in our clinic. We may offer it in the near future and are currently investigating it.*"

4.5 DH program directors' perceptions of the level of importance regarding ENDS to their programs' curricula

Descriptive statistics for the DH program directors' perceptions of the level of importance regarding ENDS to their programs' curricula are provided in Table 4. Respondents were asked to rate the level of importance they feel ENDS are to their programs' curricula on a Likert-scale 1-5, with 1 being extremely important and 5 being extremely unimportant. Respondents felt *training students on how to deliver brief interventions (e.g. the 4 A's: Ask, Advise, Assist, Arrange) to smokers* (1.30±SD0.53), *teaching students on ways to assist smoking patients to make a quit attempt (e.g. use of smoking cessation treatment and behavioral support)* (1.34±SD0.65), and *the harmful effects of ENDS use* (1.42±SD0.64) were extremely important to their programs' curricula. 97% of respondents felt *training students on how to deliver brief interventions to smokers* was extremely important/slightly important. 94% of respondents felt *teaching students on ways to assist smoking patients to make a quit attempt* was extremely important/slightly important. 92% of respondents felt *the harmful effects of ENDS use* was extremely important/slightly important. Respondents felt *ENDS as a potential gateway to other tobacco use* (1.85±SD0.96) was only slightly important to their programs' curricula. 81% of respondents felt *ENDS as a potential gateway to tobacco use* were extremely important/slightly important.

However, respondents were fairly neutral regarding *ENDS as a tobacco replacement* (2.75±SD1.46), *ENDS as a helpful harm reduction strategy (e.g. reducing the harmful consequences of tobacco use without necessarily reducing or eliminating the use itself)* (3.18±SD1.47), *ENDS as a tobacco cessation modality (e.g. nicotine replacement therapy)* (3.22±SD1.43), and *ENDS as a helpful smoking cessation aid (e.g. cold turkey, behavioral therapy, nicotine replacement therapy, medication, combination of therapies)* (3.44±SD1.35).

4.6 DH program directors rate their level of agreement regarding barriers to incorporating ENDS content in their programs' curricula

Descriptive statistics for the DH program directors level of agreement regarding barriers to including ENDS content in their programs' curricula are provided in Table 5. Respondents were asked to rate their level of agreement to questions regarding barriers to incorporating ENDS content in their programs' curricula on a Likert-scale 1-5, with 1 being strongly disagree and 5 being strongly agree. Respondents strongly agreed that *newly graduated DH students should be able to give smoking cessation education regarding ENDS* (4.58±SD0.66). 92% of respondents strongly agreed/agreed with this question. Respondents agreed that there are *no barriers to including ENDS content into their programs' curricula* (4.00±SD1.29). 72% of respondents agreed with this question. Respondents were fairly neutral regarding *there is a lack of ENDS knowledge among faculty* (3.00±1.25), *there is a lack of faculty confidence regarding ENDS* (2.97±SD1.28), and *there is a lack of knowledge among faculty about the health effects of ENDS* (2.92±SD1.30). 61% of respondents strongly disagreed/disagreed that *curriculum is too crowded to include ENDS content* in smoking cessation education (2.15±SD1.23). 68% of respondents strongly disagreed/disagreed that *it is unclear who should teach ENDS content* (1.97±SD1.01).

68% of respondents strongly disagreed/disagreed that *administrative issues make it hard to include ENDS* in smoking cessation education (1.92±SD1.14).

4.7 Average values per region regarding ENDS importance to DH programs' curricula

Table 6 provides descriptive statistics for the DH programs directors' perceptions of the level of importance regarding ENDS to their programs' curricula**.** Respondents were asked to rate the level of importance they feel ENDS are to their programs' curricula on a Likert-scale 1-5, with 1 being extremely important and 5 being extremely unimportant. When comparing the average values per region, a one-way ANOVA using Tukey's HSD post hoc test was performed. DH programs located in the Northeast (1.53±SD0.80) felt *ENDS as a potential gateway to other tobacco use* were significantly lower in regards to importance than those in the South (1.90±SD1.00) $p = 0.05$ (Figure 2). DH programs located in the Northeast (1.00±SD0.00) felt *teaching students on ways to assist smoking patients to make a quit attempt* was significantly lower in regards to importance than those in the South (1.60±SD0.81) $p = 0.01$ (Figure 3).

4.8 Average values per region regarding barriers to including ENDS content in DH programs' curricula

Descriptive statistics for DH program directors based on region in the US rating the level of importance regarding barriers to including ENDS content in their programs' curricula are provided in Table 7. Respondents were asked to rate their level of agreement to questions regarding barriers to incorporating ENDS content in their programs' curricula on a Likert-scale 1-5, with 1 being strongly disagree and 5 being strongly agree. When comparing the averages by region, a one-way ANOVA using Tukey's HSD post hoc test was performed. Though not statistically significant, there was a large variation in the raw numbers regarding *curriculum is too crowded to include ENDS content* in smoking cessation education between the Midwest

region and the Northeast region. The Midwest region more strongly disagreed that the *curriculum is too crowded to include ENDS content* in smoking cessation education (1.84±SD1.12) than the Northeast region (2.47±SD1.12).

4.9 Average values per degree type offered regarding ENDS importance to DH programs' curricula

Table 8 provides descriptive statistics for DH program directors based on degree type offered rating the level of ENDS importance to their programs' curricula. Respondents were asked to rate the level of importance they feel ENDS are to their programs' curricula on a Likert-scale 1-5, with 1 being extremely important and 5 being extremely unimportant. When comparing the averages per degree type offered, a one-way ANOVA test using Tukey's HSD post hoc test was performed. Though not statistically significant, there was a large variation in the raw numbers regarding *ENDS as a tobacco cessation modality* between associate degree and/or certificate (3.28±SD1.44) and master's degree programs (3.00±SD1.20). DH programs that offered a master's degree more strongly agreed that *ENDS as a tobacco cessation modality* (3.00±SD1.20) were important to their programs' curricula than DH programs that offered an associate degree and/or certificate (3.28±SD1.44).

4.10 Average values per degree type offered regarding barriers to including ENDS content in DH programs' curricula

Descriptive statistics for DH program directors based on degree type offered regarding barriers to including ENDS content in their programs' curricula are provided in Table 9. Respondents were asked to rate their level of agreement to questions regarding barriers to incorporating ENDS content in their programs' curricula on a Likert-scale 1-5, with 1 being strongly disagree and 5 being strongly agree. When comparing the averages per degree type

offered, a one-way ANOVA test using Tukey's HSD post hoc test was performed. Though not statistically significant, there was a large variation in the raw numbers regarding there is a *lack of ENDS usage knowledge among faculty* between master's degree programs (2.22±SD1.39) and associate degree programs and/or certificates (3.03±SD1.26). 7% of respondents whose programs offered a master's degree (n = 9) more strongly disagreed than the 67% of respondents whose programs offered an associate degree and/or certificate (n = 91). There was a large variation in the raw numbers regarding there is a *lack of knowledge among faculty about the health effects of ENDS* between master's degree programs (2.33±SD1.41) and associate degree and/or certificate programs (2.98±SD1.29). 7% of respondents whose programs offered a master's degree (n = 9) more strongly disagreed than the 67% of respondents whose programs offered an associate degree and/or certificate (n = 90). There was also a large variation in the raw numbers regarding *it is unclear who should teach ENDS content* in smoking cessation education between master's degree programs (1.44±SD1.01) and associate degree and/or certificate programs (2.06±SD0.98). 7% of respondents whose programs offered a master's degree (n = 9) more strongly disagreed than the 91% of respondents whose programs offered an associate degree and/or certificate (n = 91).

4.11 Average values per setting type regarding ENDS importance to DH programs' curricula

Table 10 provides descriptive statistics for DH program directors based on setting type (career/institute/technical programs, community colleges, dental schools, and universities) regarding ENDS importance to their programs' curricula. When comparing the averages per setting, a one-way ANOVA using Tukey's HSD post hoc test was performed. Though not statistically significant, there was a large variation in the raw numbers regarding *ENDS as a*

tobacco replacement between universities (3.20±SD1.44) and career/institute/technical programs (1.75±SD0.53). Career/institute/technical programs more strongly agreed that ENDS as a tobacco replacement were important to their programs' curricula than universities. There was also a large variation in the raw numbers regarding *ENDS as a helpful harm reduction strategy* between dental schools (3.54±SD1.45) and career/institute/technical programs (2.55±SD1.60). Career/institute/technical programs more strongly agreed that *ENDS as a helpful harm reduction strategy* to their programs' curricula than dental schools.

4.12 Average values per setting type regarding barriers to including ENDS content in DH programs' curricula

Descriptive statistics for DH program directors based on setting type (career/institute/technical programs, community colleges, dental schools, and universities) regarding barriers to including ENDS content to their programs' curricula are provided in Table 11. Respondents were asked to rate their level of agreement to questions regarding barriers to incorporating ENDS content in their programs' curricula on a Likert-scale 1-5, with 1 being strongly disagree and 5 being strongly agree. When comparing the averages per setting type, a one-way ANOVA using Tukey's HSD post hoc test was performed. The mean level of importance regarding *it is unclear who should teach ENDS content* in smoking cessation education for career/institute/technical programs was (2.46±SD0.83), for universities it was (2.00±SD1.08), for community colleges it was (1.92±SD0.99), and for dental schools it was (1.42±SD0.93). This result was statistically significant with a *p*-value of $p = 0.04$ (Figure 4). There were significant differences according to setting type regarding this survey question. DH career/institute/technical programs were significantly lower than dental schools $p = 0.02$.

4.13 Amount of time dedicated to smoking cessation education in DH programs' curricula

While all but one of the respondents stated they included smoking cessation education in their programs' curricula, the amount of time each DH program dedicated to smoking cessation education varied vastly (6.6±SD5.4). Table 12 illustrates responses from 144 respondents regarding the amount of time dedicated to smoking cessation education in DH programs. Hours ranged from one hour to 32 hours.

4.14 Smoking cessation topics included in DH programs' curricula

Descriptive statistics for DH program directors based on region, degree types offered, and settings in the US regarding smoking cessation topics included in their programs' curricula are provided in Table 13, Table 14, and Table 15. Respondents were asked which smoking cessation topics they included in their programs' curricula from a list of five choices (ENDS, Harm Reduction, Oral Cancer Risks, Oral-Systemic Connection, and NRT). A Fisher's Exact Test was performed for each question for regions degree types offered, and settings. Table 13 illustrates responses from 135 respondents what is included in smoking cessation education in their programs' curricula. Table 14 illustrates responses from 135 respondents what is included in smoking cessation education in their programs' curricula. Table 15 illustrates responses from 132 respondents what is included in smoking cessation education in their programs' curricula.

Chapter V Discussion

The overall goals of this thesis research project were to determine what content is included in DH programs' curricula about (a) the harms and risks of ENDS, (b) ENDS as a harm reduction strategy, (c) ENDS as a smoking cessation aid, (d) how ENDS could serve as a gateway to other tobacco use, and (e) the impact of ENDS on systemic and oral health. Also, to determine what barriers DH programs face regarding including ENDS content in their programs' curricula. The first aim was to assess the knowledge of DH program directors regarding the use of ENDS as tobacco replacement and tobacco cessation modalities, and their impact on systemic and oral health. The second aim was to determine if ENDS use as helpful harm reduction strategies are included in DH programs' curricula. The third aim was to determine if ENDS use as a smoking cessation aid are included in DH programs' curricula. The fourth aim was to determine if DH programs include content regarding the use of ENDS as a potential gateway to other tobacco use. The fifth aim was to determine if DH programs include content regarding the impact of ENDS use on systemic and oral health. This study suggests DH program director's knowledge regarding ENDS varied between programs, that ENDS use as helpful harm reduction strategies and smoking cessation aids are included in some DH programs' curricula, that some DH programs included content regarding the use of ENDS as a potential gateway to other tobacco use, and that some DH programs include content regarding the impact of ENDS use on systemic and oral health.

5.1 ENDS Importance

A 2011 study by the American Journal of Preventive Medicine reported electronic cigarettes help people stop smoking and remain tobacco-free longer than traditional nicotine replacement products and in 2016, the Royal College of Physicians endorsed the use of vaping to help patients wean off of traditional cigarettes.[5,76] Based on these reports, many physicians and health care professionals are advocating for the use of ENDS based on the belief that ENDS could help a large percentage of smokers quit and/or reduce the amount of nicotine consumed.[77] However, recent evidence vastly contradicts recommending ENDS as a tobacco reduction and cessation protocol. NRT have been found to be better not only for smoking cessation, but also oral and systemic health, because NRT do not contain many of the harmful products of tobacco combustion that ENDS contain.[71] Evidence continues to mount regarding ENDS and the significant detrimental health implications from their use. Additionally, ENDS use is now reported as a significant gateway to traditional cigarette use, particularly in younger populations.[70,71] This contradicting research may help explain the variation in scores by respondents in this study. The results of this study found differences in DH program directors' perceptions of the level of importance regarding ENDS as tobacco replacement and tobacco cessation modalities, and the potential health impacts of their use. The results of this study found differences regarding the inclusion of ENDS use as helpful harm reduction strategies across DH programs' curricula. The results of this study also found differences regarding the inclusion of ENDS use as a smoking cessation aid across DH programs' curricula.

Research has also shown that ENDS are recreational nicotine devices and they allow users to closely mimic the act of smoking. In addition to delivering nicotine, ENDS help address the pharmacologic and behavioral components of traditional cigarette addiction.[135] There are also multiple arguments regarding ENDS as a helpful harm reduction strategy including the liquids

used in ENDS devices can contain up to 36 mg of nicotine and users can mix liquids to further increase the nicotine content, ENDS devices contain a vaporizer that has a heating device, e-liquids either contain or generate toxicants and carcinogens such as carbonyl compounds like formaldehyde, acetaldehyde, acrolein, crotonaldehyde, methygloxal, benzene, acrylonitrile, ethylbenzene, styrene, and toluene, ENDS devices replicate the act of smoking, and a majority of ENDS brands are developed by cigarette manufacturers (i.e. MarkTen, VUSE) or ENDS brands have been acquired by cigarette manufacturers (i.e. blue, Green Smoke).[79,81-96,135,136] Previous studies have also shown that members of the public health community believes ENDS could help smokers quit and "...accelerate the smoking decline by supplementing other tobacco control measure, resulting in a net public health benefit."[137-140] These public health community members see ENDS as a threat "...that could undo progress made by the tobacco control movement over the past decades by making smoking and nicotine use socially acceptable again."[137, 141-143] Again, this contradicting research helps explain the variation of scores by respondents.

This study revealed that some DH programs are not teaching about the potential of ENDS serving as a gateway to other tobacco use in their programs' curricula. This is of concern as it contradicts recent evidence. The US National Youth Tobacco Survey reported between 2011 and 2013, the number of never-smoking youth who used e-cigarettes increased 3-fold, from 79,000 to more than 263,000.[144-146] Intention to smoke conventional cigarettes was 43.9% among ever e-cigarette users and 21.5% among never users.[144-146] Data from the US National Adult Tobacco Survey reported among young adults who had never established cigarette smoking behavior and who were not current smokers of cigarettes or other combustible tobacco products, 7.9% reported having ever tried e-cigarettes-14.6% of whom reported current use of the

product.[144-146] The survey also found nearly half (46.1%) of young adults who had ever tried an e-cigarette reported being open to smoking cigarettes compared to 14.2% of those who had never tried an e-cigarette.[144-146] It is important for dental hygienists to understand these findings and to incorporate them into their patient education.

The majority of DH programs in the US are not currently including information on the detrimental effects of ENDS on users oral and systemic health in their smoking cessation curricula. These results could limit dental hygienists' knowledge regarding the serious negative health risks associated with ENDS use on systemic and oral health. The CDC reports that nine million US adults and 2.5 million US middle and high school students are currently using ENDS.[4] ENDS users are also at an increased risk for cancer, burns and injuries, an increased risk for oral diseases such as periodontal disease and dental caries, and death.[7,11] These negative health effects on oral and systemic health can reduce over time with smoking cessation.[40-42] Dental hygienists have long been identified as front-line deliverers of smoking cessation education during routine visits; however, CODA does not require smoking cessation education or MI in DH programs' curricula.[22] Study respondents overall felt *training students on how to deliver brief interventions to smokers* was extremely important. This reinforces the ADHA's position on advocating for smoking cessation training in all DH programs' curricula.[104]

5.2 ENDS Barriers

There are significant barriers to including ENDS content in DH programs' curricula. There was a large variation in the raw numbers regarding *it is unclear who should teach ENDS content* in smoking cessation education between dental schools disagreeing more strongly to this statement than career/institute/technical programs. There may be several possible reasons why dental schools more strongly disagreed with this question. One possible reason might be because

there are significantly more instructors/dentists/residents/student teachers/clinical educators, etc. at dental schools compared to other DH program settings.

Research has shown that tobacco and nicotine dependence treatment experts have varying opinions on ENDS use.[5,15,76,77,116] Some experts support ENDS use for smoking cessation while others warn against it. Due to these varying opinions, it can be difficult for DH programs to be clear on what to include in their programs' curricula regarding ENDS. This can lead to confusion by DH students, dental hygienists, and DH faculty. The ADA surveyed faculty at 54 dental schools and found the majority of faculty needed training on smoking use prevention techniques and smoking use cessation skills.[16] A study by Studts et al. surveyed dental hygienists and discovered 53% of respondents were either not at all comfortable helping patients develop a smoking cessation plan or not too comfortable doing so (14% and 39%, respectively). When looking at dental hygienists' comfort levels in recommending pharmacotherapy to patients, some respondents were not comfortable.[104] Interestingly enough, DH program directors from this study experienced similar barriers to including ENDS content in their programs as those cited in previous studies.

5.3 Amount of time dedicated to smoking cessation education in DH programs' curricula

The amount of time dedicated to smoking cessation education in DH programs' curricula varied greatly between DH programs, with hours ranging widely from one hour to 32 hours. These results have serious implications for future dental hygienists and patients. A lack of knowledge regarding the serious health risks associated with traditional tobacco use and ENDS use could negatively impact the populations oral and systemic health.[7-14] These results also strongly indicate the need for a standardized comprehensive smoking cessation curriculum that includes ENDS content to enhance and expand existing DH programs.

5.4 Lack of ENDS information

For the open-ended question, *"Is there anything else you would like to share regarding ENDS inclusion in your program's curriculum?"* respondents felt there was a lack of ENDS information available in current textbooks and dental hygiene courses. Since ENDS devices were first introduced in North America in the early 2000's, there is a lack of well-designed randomized controlled trials and longitudinal, population studies identifying the long-term health effects associated with ENDS use. Some public health advocates recommend ENDS for smoking cessation while others condemn ENDS use, which causes confusion for DH programs on what information they should include in their programs' curricula. Without a standardized comprehensive smoking cessation education including ENDS content, DH programs can include or exclude smoking cessation topics such as (a) ENDS, (b) harm reduction, (c) oral cancer risks, (d) oral-systemic connection, and (e) nicotine replacement therapies as well as the types of summative and/or formative assessments used to assess students' knowledge including (a) clinical competency testing, (B) objective standardized clinical examination (OSCE), (c) proficiencies, (d) research paper, (e) standardized patient interview (SPI), and (f) written tests.

Harris et al. surveyed senior dental hygiene students in all 12 accredited North Carolina DH programs and found a variety of smoking cessation methods were being utilized and students were educated about smoking cessation in a range of courses.[102] A study by Pizzo et al. surveyed the 32 active public and private DH programs in Italy and found a majority of respondents offered smoking-related materials in lecture and clinic, but less than half of respondents covered smoking prevention strategies.[147] These studies indicate DH programs vary vastly in their smoking cessation education.

Based on the results of this study, randomized controlled trials and longitudinal, population studies are needed to identify the long-term health risks associated with ENDS use. Research involving all allied health programs should be conducted to determine what is included in their curricula regarding ENDS use and their impact on systemic and oral health, and to determine the comfort and confidence level of faculty regarding ENDS use and their negative health effects. Future research is needed to determine what is included in continuing education courses regarding ENDS use and their impact on systemic and oral health. Future research involving practicing dental hygienists who received smoking cessation education should be conducted to determine the comfort and confidence levels. Future research is also needed to explore the current level of smoking cessation education in all dental hygiene programs worldwide.

5.5 Limitations

This study did have some limitations. Results may have been affected by the Likert-scale questions switching from the first group of questions regarding level of importance regarding ENDS to their programs' curricula (1=extremely important and 5=extremely unimportant) to the second group of questions regarding level of agreement regarding barriers to incorporating ENDS content in their programs' curricula (1=strongly disagree and 5=strongly agree). Self-reporting surveys can introduce bias. Despite the 45% response rate, the survey results do not represent all 50 US states.

Chapter VI Conclusions

The overall objectives of this study were to determine if DH programs were including ENDS content in their smoking cessation education, what DH programs considered important regarding ENDS content, what barriers DH programs faced including ENDS content in their smoking cessation education, and if DH programs were including content regarding the negative impacts ENDS can have on systemic and oral health.

There are approximately nine million US adults using ENDS devices on a regular basis, and approximately 2.5 million US middle and high school students using ENDS devices.[1,4,15.] There are significant negative health risks associated with smoking and ENDS use.[7-9,14,30] The negative health effects on oral and systemic health caused by ENDS use reduce over time with smoking cessation.[40-42] Dental hygienists have been established as playing a crucial role in educating patients regarding the negative health risks associated with smoking and aiding patients with smoking cessation. DH programs must consider including ENDS content in any comprehensive smoking cessation curriculum.

Even though a majority of DH programs include ENDS content in their smoking cessation education, this study highlights a lack of standardization in DH programs' curricula regarding smoking cessation education. Considering the increasing use of ENDS and the related negative health risks and the results of this study, efforts must be made to support knowledge amongst DH faculty in regards to the evidence on ENDS. Determining ways to help DH programs in all regions of the US and all DH settings value the importance of the negative health risks associated

with ENDS use and the importance of preparing students to deliver brief interventions to smokers should be considered. Furthermore, determining ways to help DH programs to incorporate ENDS content in their smoking cessation education should be considered.

Tables

Table 1. DH program respondents by region[+]

Region	Frequencies (N=146)	Total number of programs in each region
Northeast	23	49%
Midwest	42	51%
South	56	45%
West	25	32%

[+]Descriptive statistics

Legend: 1 Note that the percentages might not add to 100% due to rounding.

2 Regions: Northeast (CT, ME, MA, NH, NJ, NY, PA, RI, VT), Midwest (IL, IN, IA, KS, MI, MN, MO, NE, ND, OH, SD, WI), South (AL, AR, DE, FL, GA, KY, LA, MD, MS, NC, OK, SC, TN, TX, VA, WV), West (AK, AZ, CA, CO, HI, ID, MT, NV, NM, OR, UT, WA, WY).

Table 2. DH programs degree types offered[+]

Degree	Frequencies (N = 146)	Percentages
Associate Degree	113	77%
Bachelor's Degree	46	31%
Master's Degree	9	6%

[+]Descriptive statistics

Legend: 1 Note that the percentages and N are not equal since respondents could choose more than one degree type.
2 Associate Degrees and Certificates are grouped together.

Table 3. Distributions of open-ended responses concerning other issues of importance regarding ENDS inclusion in DH programs' curricula[+]

Topics	Frequencies (N = 33)	Percentages
Lack of ENDS information	6	18%
ENDS potential harmful effects	5	15%
Lack of a Clinical Competency Requirement	2	1%
Other	20	60%

[+]Descriptive statistics

Legend: 1 Note that the percentages might not add to 100% due to rounding.

Table 4. Distributions of DH program directors' perceptions of the level of importance regarding ENDS to their programs' curricula[+]

Question	1[1]	2	3	4	5	Mean ± SD
ENDS as a tobacco replacement	27 23%	34 29%	22 19%	7 6%	26 22%	2.75±1.46
ENDS as a tobacco cessation modality	17 15%	25 22%	22 19%	20 17%	32 28%	3.22±1.43
ENDS as a helpful harm reduction strategy	20 18%	22 19%	21 18%	20 18%	31 27%	3.18±1.47
ENDS as a helpful smoking cessation aid	12 10%	18 16%	28 24%	21 18%	36 31%	3.44±1.35
ENDS as a potential gateway to tobacco use	50 44%	42 37%	12 11%	9 8%	1 1%	1.85±0.96
The harmful effects of ENDS use	76 66%	30 26%	9 8%	0 0%	0 0%	1.42±0.64
Training students on how to deliver brief interventions to smokers	85 74%	26 23%	4 4%	0 0%	0 0%	1.30±0.53
Teaching students on ways to assist smoking patients to make a quit attempt	84 74%	23 20%	5 4%	2 2%	0 0%	1.34±0.65

[+]One-way ANOVA test using Tukey's HSD

Legend: 1 The responses ranged from: 1= extremely important, 2= slightly important, 3= neutral, 4= slightly unimportant, 5= extremely unimportant.

2 Note that the percentages might not add to 100% due to rounding.

Table 5. Distributions of DH program directors rate their level of agreement regarding barriers to incorporating ENDS content in their programs' curricula[+]

Question	1[1]	2	3	4	5	Mean ± SD
No barriers to including ENDS content	13 10%	5 4%	21 15%	27 20%	70 52%	4.00±1.29
Administrative issues to including ENDS content	71 53%	20 15%	29 22%	10 8%	4 3%	1.92±1.14
Curriculum is too crowded to include ENDS content	60 44%	23 17%	28 21%	19 14%	5 4%	2.15±1.23
Lack of ENDS usage knowledge among faculty	26 19%	20 15%	26 19%	56 41%	8 6%	3.00±1.25
Lack of ENDS health effects by faculty	29 22%	25 19%	16 12%	57 42%	8 6%	2.92±1.30
Lack of faculty confidence regarding ENDS	26 19%	25 18%	23 17%	51 38%	11 8%	2.97±1.28
Unclear who should teach ENDS content	60 44%	32 24%	32 24%	12 9%	0 0%	1.97±1.01
Newly graduated dental hygiene students should be able to give smoking cessation education regarding ENDS	0 0%	1 1%	10 7%	34 25%	91 67%	4.58±0.66

[+]One-way ANOVA test using Tukey's HSD

Legend: 1 The responses ranged from: 1= strongly disagree, 2= disagree, 3= neither agree or disagree, 4= agree, 5= strongly agree.

2 Note that the percentages might not add to 100% due to rounding.

Table 6. Average values per region regarding ENDS importance to DH programs' curricula[+]

Strategy	Region	Likert-Scale 1-5 Mean±SD	*P*-value
ENDS as a tobacco replacement	Northeast Midwest South West	2.53±1.63 3.00±1.50 2.77±1.52 2.62±1.34	0.70
ENDS as a tobacco cessation modality	Northeast Midwest South West	3.06±1.56 3.65±1.30 2.87±1.54 3.22±1.40	0.20
ENDS as a helpful harm reduction strategy	Northeast Midwest South West	3.06±1.50 3.53±1.40 3.10±1.60 3.00±1.50	0.48
ENDS as a helpful smoking cessation aid	Northeast Midwest South West	3.06±1.52 3.84±1.13 3.32±1.48 3.39±1.34	0.23
ENDS as a potential gateway to other tobacco use	Northeast Midwest South West	1.53±0.80 1.61±0.80 1.90±1.00 2.17±1.10	0.05*
The harmful effects of ENDS use	Northeast Midwest South West	1.18±0.40 1.32±0.54 1.48±0.70 1.56±0.74	0.20
Training students on how to deliver brief interventions to smokers	Northeast Midwest South West	1.06±0.24 1.29±0.53 1.39±0.62 1.33±0.54	0.21
Teaching students ways to assist smoking patients to make a quit attempt	Northeast Midwest South West	1.00±0.00 1.23±0.50 1.60±0.81 1.39±0.70	0.01*

[+]One-way ANOVA test using Tukey's HSD

Legend: 1 The responses ranged from: 1= extremely important, 2= slightly important, 3= neutral, 4= slightly unimportant, 5= extremely unimportant.

2 *Statistically significant at $p<0.05$.

Table 7. Average values per region regarding barriers to including ENDS content in DH programs' curricula[+]

Strategy	Region	Likert-Scale 1-5 Mean±SD	*P*-value
No barriers to including ENDS content	Northeast Midwest South West	3.85±1.26 4.13±1.21 4.05±1.30 3.90±1.41	0.81
Administrative issues	Northeast Midwest South West	2.15±0.95 1.64±0.91 1.97±1.23 2.02±1.31	0.35
Curriculum too crowded	Northeast Midwest South West	2.47±1.12 1.84±1.12 2.22±1.33 2.23±1.28	0.26
Lack of ENDS usage knowledge among faculty	Northeast Midwest South West	3.10±1.20 2.78±1.27 3.25±1.13 2.92±1.35	0.43
Lack of faculty knowledge about ENDS health effects	Northeast Midwest South West	2.90±1.20 2.81±1.35 3.27±1.23 2.73±1.36	0.29
Lack of faculty confidence regarding ENDS content	Northeast Midwest South West	2.85±1.26 3.07±1.30 3.22±1.14 2.71±1.38	0.32
Unclear who should teach ENDS content	Northeast Midwest South West	2.30±1.08 2.02±1.05 1.77±0.92 1.92±1.02	0.31
Newly graduated DH students should be able to give smoking cessation education regarding ENDS use and potential health implications	Northeast Midwest South West	4.60±0.75 4.52±0.79 4.52±0.55 4.66±0.57	0.75

[+]One-way ANOVA test using Tukey's HSD

Legend: 1 The responses ranged from: 1= strongly disagree, 2= disagree, 3= neither agree or disagree, 4= agree, 5= strongly agree.

2 *Statistically significant at $p<0.05$.

Table 8. Average values per degree types offered regarding ENDS importance to DH programs' curricula[+]

Strategy	Region	Likert-Scale 1-5 Mean±SD	*P*-value Between Groups
ENDS as a tobacco replacement	Associate Degree Bachelor's Degree Master's Degree	2.74±1.50 2.82±1.50 2.57±1.13	0.914
ENDS as a tobacco cessation modality	Associate Degree Bachelor's Degree Master's Degree	3.28±1.44 3.12±1.50 3.00±1.20	0.806
ENDS as a helpful harm reduction strategy	Associate Degree Bachelor's Degree Master's Degree	3.11±1.42 3.27±1.63 3.43±1.30	0.778
ENDS as a helpful smoking cessation aid	Associate Degree Bachelor's Degree Master's Degree	3.52±1.33 3.30±1.50 3.29±1.11	0.711
ENDS as a potential gateway to other tobacco use	Associate Degree Bachelor's Degree Master's Degree	1.89±1.00 1.79±1.00 1.71±0.80	0.814
The harmful effects of ENDS use	Associate Degree Bachelor's Degree Master's Degree	1.40±0.64 1.42±0.66 1.57±0.54	0.80
Training students on how to deliver brief interventions to smokers	Associate Degree Bachelor's Degree Master's Degree	1.28±0.51 1.30±0.60 1.43±0.54	0.80
Teaching students ways to assist smoking patients to make a quit attempt	Associate Degree Bachelor's Degree Master's Degree	1.32±0.62 1.36±0.74 1.43±0.54	0.90

[+]One-way ANOVA test using Tukey's HSD

Legend: 1 The responses ranged from: 1= extremely important, 2= slightly important, 3 neutral, 4= slightly unimportant, 5= extremely unimportant.

2 *Statistically significant at $p<0.05$.

3 Associate Degrees and Certificates are grouped together.

Table 9. Average values per degree type offered regarding barriers to including ENDS content in DH programs' curricula[+]

Strategy	Region	Likert-Scale 1-5 Mean±SD	*P*-value
No barriers to including ENDS content	Associate Degree Bachelor's Degree Master's Degree	3.93±1.37 4.05±1.14 4.44±1.13	0.51
Administrative issues	Associate Degree Bachelor's Degree Master's Degree	2.01±1.19 1.77±1.08 1.66±0.86	0.45
Curriculum too crowded	Associate Degree Bachelor's Degree Master's Degree	2.26±1.27 2.00±1.16 1.66±1.11	0.26
Lack of ENDS usage knowledge among faculty	Associate Degree Bachelor's Degree Master's Degree	3.03±1.26 3.11±1.14 2.22±1.39	0.14
Lack of faculty knowledge about ENDS health effects	Associate Degree Bachelor's Degree Master's Degree	2.98±1.29 2.91±1.31 2.33±1.41	0.36
Lack of faculty confidence regarding ENDS content	Associate Degree Bachelor's Degree Master's Degree	3.02±1.27 2.94±1.28 2.55±1.50	0.58
Unclear who should teach ENDS content	Associate Degree Bachelor's Degree Master's Degree	2.06±0.98 1.86±1.07 1.44±1.01	0.16
Newly graduated DH students should be able to give smoking cessation education regarding ENDS use and potential health implications	Associate Degree Bachelor's Degree Master's Degree	4.54±0.67 4.61±0.64 4.77±0.66	0.58

[+]One-way ANOVA test using Tukey's HSD

Legend: 1 The responses ranged from: 1= strongly disagree, 2= disagree, 3= neither agree or disagree, 4= agree, 5= strongly agree.
2 *Statistically significant at $p<0.05$.
3 Associate Degrees and Certificates are grouped together.

Table 10. Average values per setting type regarding ENDS importance to DH programs' curricula[+]

Strategy	Region	Likert-Scale 1-5 Mean±SD	*P*-value
ENDS as a tobacco replacement	Career/Institute/Technical Programs Community Colleges Dental Schools Universities	1.75±0.53 2.70±1.51 2.31±1.44 3.20±1.44	0.29
ENDS as a tobacco cessation modality	Career/Institute/Technical Programs Community Colleges Dental Schools Universities	3.00±1.55 3.23±1.51 2.85±1.21 3.40±1.40	0.68
ENDS as a helpful harm reduction strategy	Career/Institute/Technical Programs Community Colleges Dental Schools Universities	2.55±1.60 3.19±1.50 3.54±1.45 3.28±1.51	0.41
ENDS as a helpful smoking cessation aid	Career/Institute/Technical Programs Community Colleges Dental Schools Universities	3.36±1.60 3.45±1.41 3.15±1.30 3.63±1.25	0.80
ENDS as a potential gateway to other tobacco use	Career/Institute/Technical Programs Community Colleges Dental Schools Universities	2.00±1.10 1.79±0.90 1.85±1.10 1.79±0.90	0.92
The harmful effects of ENDS use	Career/Institute/Technical Programs Community Colleges Dental Schools Universities	1.09±0.30 1.39±0.61 1.54±0.80 1.46±0.60	0.30
Training students on how to deliver brief interventions to smokers	Career/Institute/Technical Programs Community Colleges Dental Schools Universities	1.36±0.70 1.23±0.50 1.23±0.44 1.42±0.70	0.50
Teaching students ways to assist smoking patients to make a quit attempt	Career/Institute/Technical Programs Community Colleges Dental Schools Universities	1.27±0.65 1.30±0.61 1.15±0.40 1.54±0.83	0.30

[+]One-way ANOVA test using Tukey's HSD

Legend: 1 The responses ranged from: 1= extremely important, 2= slightly important, 3 neutral, 4= slightly unimportant, 5= extremely unimportant.

2 *Statistically significant at $p<0.05$.

Table 11. Average values per setting type regarding barriers to including ENDS content in DH programs' curricula[+]

Strategy	Region	Likert-Scale 1-5 Mean±SD	*P*-value
No barriers to including ENDS content	Career/Institute/Technical Programs	3.73±1.48	0.64
	Community Colleges	4.01±1.36	
	Dental Schools	4.35±1.15	
	Universities	3.96±1.17	
Administrative issues	Career/Institute/Technical Programs	1.66±0.81	0.16
	Community Colleges	1.98±1.19	
	Dental Schools	1.35±0.63	
	Universities	2.10±1.28	
Curriculum too crowded	Career/Institute/Technical Programs	2.26±0.96	0.39
	Community Colleges	2.28±1.33	
	Dental Schools	1.78±1.18	
	Universities	1.92±1.15	
Lack of ENDS usage knowledge among faculty	Career/Institute/Technical Programs	3.33±1.29	0.71
	Community Colleges	2.96±1.29	
	Dental Schools	3.07±1.26	
	Universities	2.89±1.19	
Lack of faculty knowledge about ENDS health effects	Career/Institute/Technical Programs	3.40±1.35	0.50
	Community Colleges	2.85±1.31	
	Dental Schools	2.78±1.42	
	Universities	2.89±1.25	
Lack of faculty confidence regarding ENDS content	Career/Institute/Technical Programs	3.46±1.12	0.24
	Community Colleges	2.82±1.28	
	Dental Schools	2.64±1.33	
	Universities	3.07±1.24	
Unclear who should teach ENDS content	Career/Institute/Technical Programs	2.46±0.83	0.04*
	Community Colleges	1.92±0.99	
	Dental Schools	1.42±0.93	
	Universities	2.00±1.08	
Newly graduated DH students should be able to give smoking cessation education regarding ENDS use and potential health implications	Career/Institute/Technical Programs	4.46±0.74	0.20
	Community Colleges	4.53±0.68	
	Dental Schools	4.92±0.26	
	Universities	4.57±0.69	

[+]One-way ANOVA test using Tukey's HSD

Legend: 1 The responses ranged from: 1= strongly disagree, 2= disagree, 3= neither agree or disagree, 4= agree, 5= strongly agree.

2 *Statistically significant at $p<0.05$.

Table 12. Amount of time dedicated to smoking cessation education in DH programs' curricula[+]

Hours	Frequencies (N = 144)	Percentages
32	1	1%
20	1	1%
16	2	2%
15	4	3%
13	1	1%
12	7	5%
11	2	2%
10	12	9%
9	3	2%
8	7	5%
7	1	1%
6	12	9%
5	9	7%
4	25	19%
3	22	17%
2	16	12%
1	2	2%

[+]Descriptive statistics
Legend: 1 Note that the percentages might not add to 100% due to rounding.

Table 13. Smoking cessation topics included in DH programs' curricula based on region[+]

Strategy	Region	Frequencies Yes	Frequencies No	Value	Exact Sig. (2-sided)
ENDS	Northeast	16	3	2.358	.505
	Midwest	26	12		
	South	27	9		
	West	34	8		
Harm Reduction	Northeast	14	5	.615	.922
	Midwest	30	8		
	South	29	7		
	West	34	8		
Oral Cancer Risks	Northeast	18	1	3.780	.183
	Midwest	36	2		
	South	36	0		
	West	42	0		
Oral-Systemic Connection	Northeast	18	1	3.372	.304
	Midwest	35	3		
	South	36	0		
	West	41	1		
NRT	Northeast	18	1	2.327	.492
	Midwest	34	4		
	South	32	4		
	West	34	8		

[+]Fisher's Exact Test
Legend: 1 *Statistically significant at $p<0.05$.

Table 14. Smoking cessation topics included in DH programs' curricula based on degree type offered[+]

Strategy	Degree Types	Frequencies Yes	Frequencies No	Value	Exact Sig. (2-sided)
ENDS	Associate Degree	64	27	5.209	.064
	Bachelor's Degree	31	4		
	Master's Degree	8	1		
Harm Reduction	Associate Degree	73	18	.355	.939
	Bachelor's Degree	27	8		
	Master's Degree	7	2		
Oral Cancer Risks	Associate Degree	89	2	.682	1.000
	Bachelor's Degree	34	1		
	Master's Degree	9	0		
Oral-Systemic Connection	Associate Degree	89	2	3.155	.131
	Bachelor's Degree	33	2		
	Master's Degree	8	1		
NRT	Associate Degree	79	12	.150	1.000
	Bachelor's Degree	31	4		
	Master's Degree	8	1		

[+]Fisher's Exact Test

Legend: 1 *Statistically significant at $p<0.05$.

2 Associate Degrees and Certificates are grouped together.

Table 15. Smoking cessation topics included in DH programs' curricula based on setting[+]

Strategy	Setting	Frequencies Yes	Frequencies No	Value	Exact Sig. (2-sided)
ENDS	Career/Institute/Technical Programs	10	5	7.194	.061
	Community Colleges	54	22		
	Dental Schools	14	0		
	Universities	22	5		
Harm Reduction	Career/Institute/Technical Programs	9	6	3.666	.292
	Community Colleges	62	14		
	Dental Schools	12	2		
	Universities	21	6		
Oral Cancer Risks	Career/Institute/Technical Programs	14	1	2.158	.607
	Community Colleges	74	2		
	Dental Schools	14	0		
	Universities	27	0		
Oral-Systemic Connection	Career/Institute/Technical Programs	14	1	5.083	.105
	Community Colleges	74	2		
	Dental Schools	12	2		
	Universities	27	0		
NRT	Career/Institute/Technical Programs	10	5	7.555	.038
	Community Colleges	69	7		
	Dental Schools	14	0		
	Universities	23	4		

[+]Fisher's Exact Test

Legend: 1 *Statistically significant at $p<0.05$.

Figures

Figure 1. DH programs in the US based on region

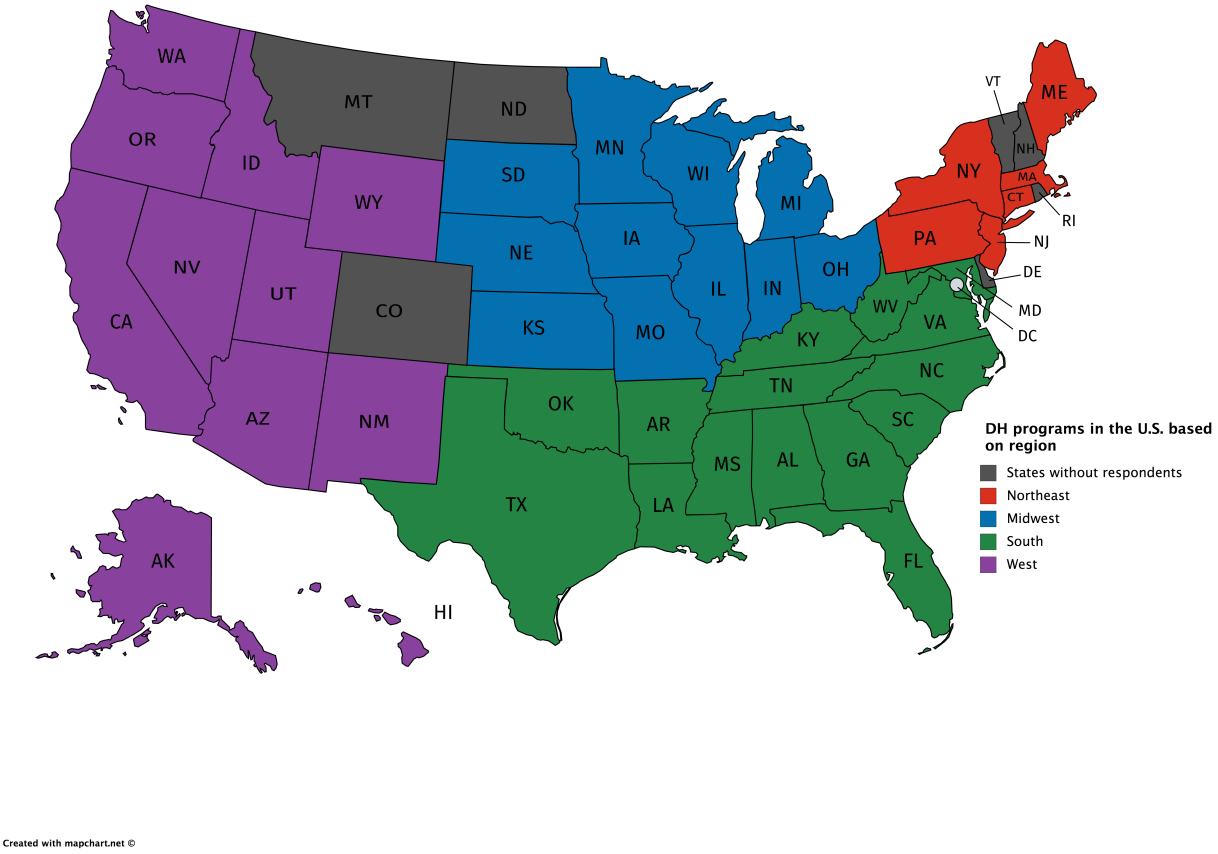
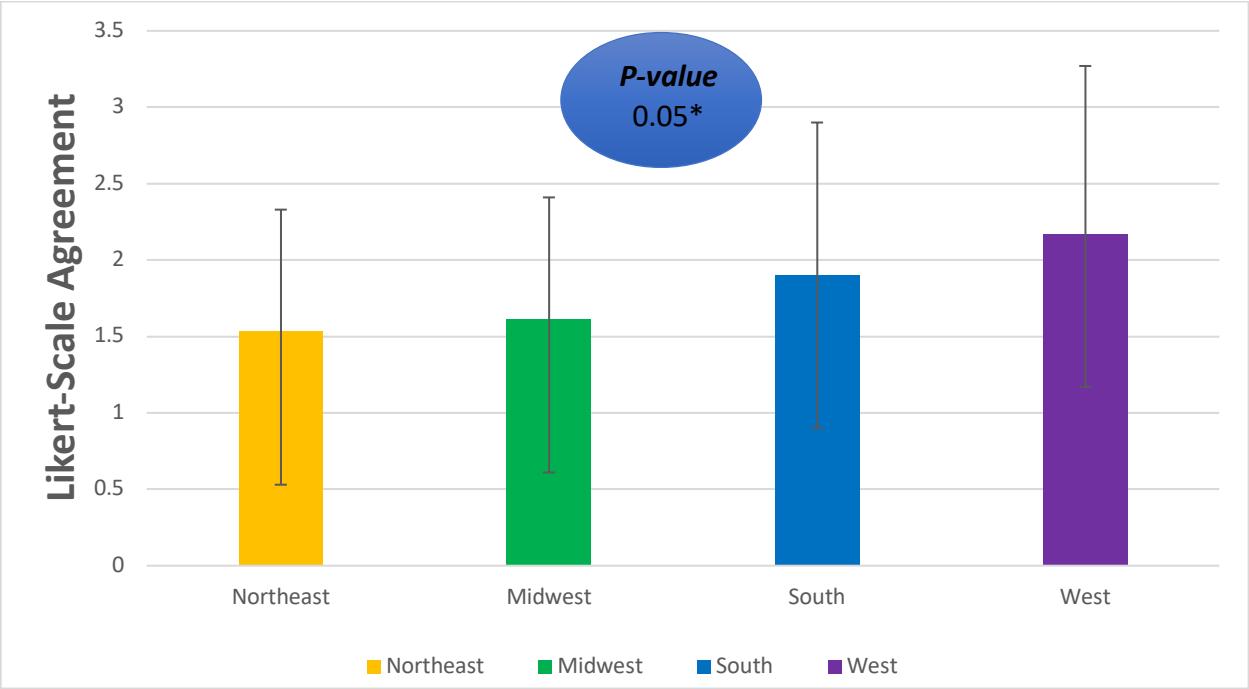


Figure 2. Average values per region regarding ENDS importance to DH programs' curricula[+]

ENDS as a potential gateway to other tobacco use

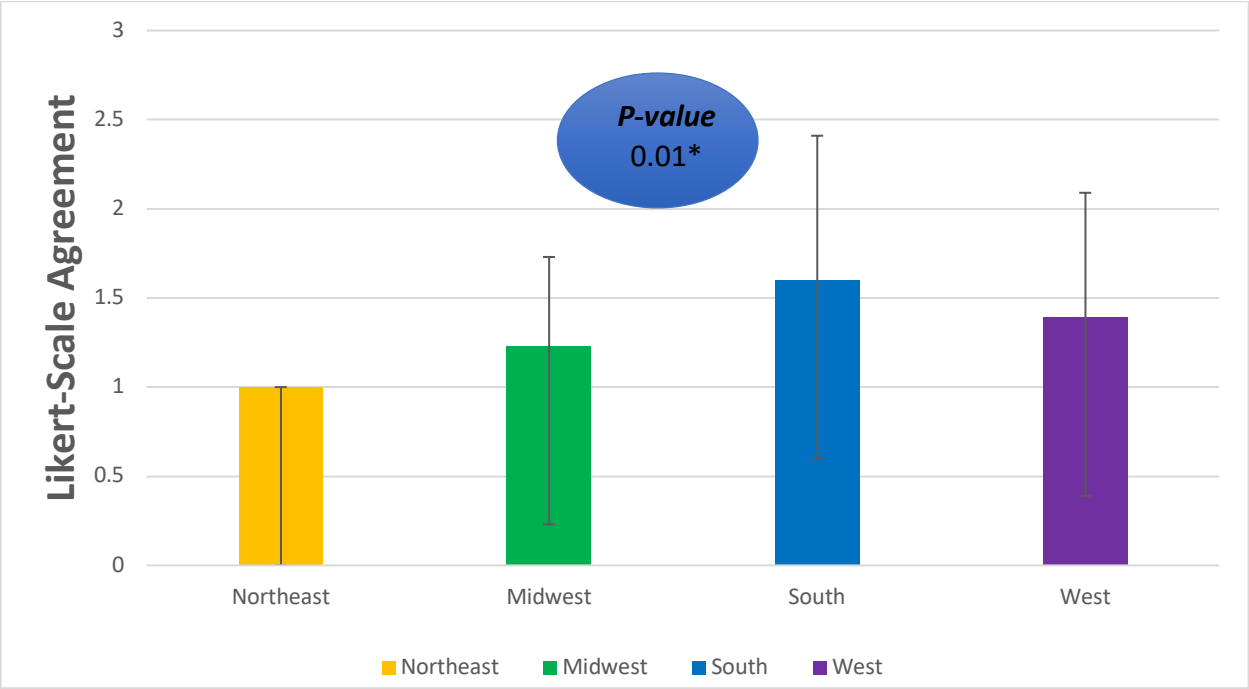


[+]One-way ANOVA test using Tukey's HSD with Standard Deviation

Legend: 1 The responses ranged from: 1=extremely important, 2=slightly important, 3=neutral, 4=slightly unimportant, 5=extremely unimportant.
2 Statistically significant at $p<0.05$.

Figure 3. Average values per region regarding ENDS importance to DH programs' curricula[+]

Teaching students on ways to assist smoking patients to make a quit attempt

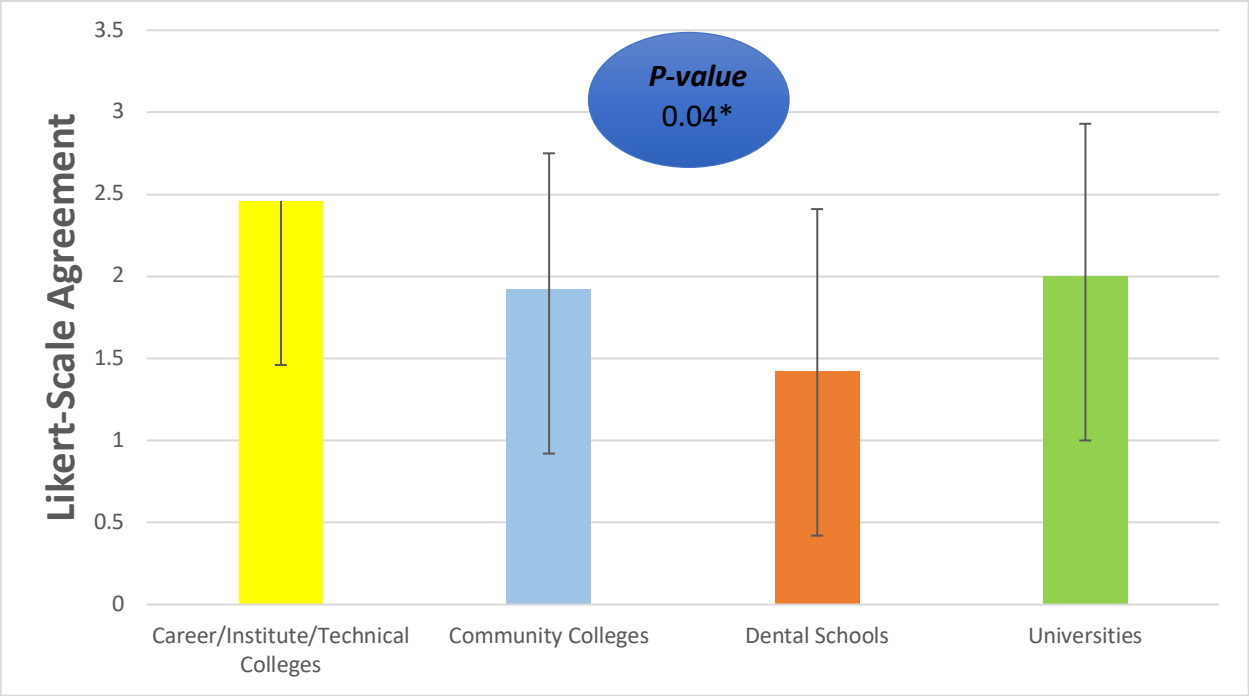


[+]One-way ANOVA test using Tukey's HSD with Standard Deviation

Legend: 1 The responses ranged from: 1=extremely important, 2=slightly important, 3=neutral, 4=slightly unimportant, 5=extremely unimportant.
2 Statistically significant at $p<0.05$.

Figure 4. Average values per setting type regarding barriers to including ENDS content in DH programs' curricula[+]

It is unclear who should teach ENDS content in smoking cessation education



[+]One-way ANOVA test using Tukey's HSD with Standard Deviation

Legend: 1 The responses ranged from: 1=strongly disagree, 2=disagree, 3=neither agree or disagree, 4=agree, 5=strongly agree.

2 *Statistically significant at $p<0.05$.

Appendix A

Thesis Survey-Pilot Test Feedback Form

As you take the "Electronic Nicotine Delivery Systems (ENDS) Education in US DH Programs' Curricula Thesis Survey-Pilot Test," please complete this "Thesis Survey-Pilot Test Feedback Form." Once completed, please return it via email to Heather Morse at hmorse@umich.edu.

Thank you for your time and your valuable feedback.

1. **Was the description of the project clear in the cover letter email?**

   Yes or No (If no, please explain)

2. **Were the survey directions clear?**

   Yes or No (If no, please explain)

3. **Overall, were the questions understandable?**

   Yes or No (If no, please explain)

4. **Were there any specific questions that may have been confusing?**

   Yes or No (If yes, please explain)

5. **Did any of the questions seem repetitive?**

   Yes or No (If yes, please explain)

6. **Did you feel comfortable answering all of the questions?**

   Yes or No (If no, please explain)

7. **Did the survey seem to flow in an effective manner?**

   Yes or No (If no, please explain)

8. **Was the categorization of the questions helpful in answering the questions?**

   Yes or No (If no, please explain)

9. **Did you encounter any technological difficulties while taking the survey?**

   Yes or No (If yes, please explain)

10. **How long did the survey take to complete?**

11. **Additional comments:**

Appendix B

Electronic Survey

Electronic Nicotine Delivery Systems (ENDS) Education in US Dental Hygiene Programs' Curricula

Your answers to the following questions should be in reference to the teaching delivered in the **academic year 2017/2018.**

Data gathered from this survey will be presented anonymously.

Thank you!

DEMOGRAPHICS-

1. **In which region is your dental hygiene program located?**

□ Alabama	□ Iowa	□ New Hampshire	□ Texas
□ Alaska	□ Kansas	□ New Jersey	□ Utah
□ Arizona	□ Kentucky	□ New Mexico	□ Vermont
□ Arkansas	□ Louisiana	□ New York	□ Virginia
□ California	□ Maine	□ North Carolina	□ Washington
□ Colorado	□ Maryland	□ North Dakota	□ West Virginia
□ Connecticut	□ Massachusetts	□ Ohio	□ Wisconsin
□ Delaware	□ Michigan	□ Oklahoma	□ Wyoming
□ Florida	□ Minnesota	□ Oregon	
□ Georgia	□ Mississippi	□ Pennsylvania	
□ Hawaii	□ Missouri	□ Rhode Island	
□ Idaho	□ Montana	□ South Carolina	
□ Illinois	□ Nebraska	□ South Dakota	
□ Indiana	□ Nevada	□ Tennessee	

2. **Which of the following does your program offer? Check all that apply.**

□ Associate Degree
□ Bachelor's Degree
□ Master's Degree
□ Certificate

BACKGROUND-

3. **Does your program's curriculum teach tobacco cessation education?**

□ Yes
□ No (Go to Question # 16)

4. **Does your program's tobacco cessation education include Electronic Nicotine Delivery Systems (ENDS: e-cigarettes, vaporizers, etc.)?**

□ Yes
□ No (Go to Question # 11)

ACADEMIC PERSPECTIVE-

Please rate the level of importance you feel the following questions regarding Electronic Nicotine Delivery Systems (ENDS: e-cigarettes, vaporizers, etc.) are to your program's curriculum.

5. **ENDS (e.g. e-cigarettes, vaporizers, etc.) as a tobacco replacement.**

1. Extremely Important 2.Slightly Important 3.Neutral 4.Slightly Unimportant 5.Extremely Unimportant

6. **ENDS (e.g. e-cigarettes, vaporizers, etc.) as a tobacco cessation modality (e.g. nicotine replacement therapy).**

1. Extremely Important 2.Slightly Important 3.Neutral 4.Slightly Unimportant 5.Extremely Unimportant

7. **ENDS (e.g. e-cigarettes, vaporizers, etc.) as a helpful harm reduction strategy (e.g. reducing the harmful consequences of tobacco use without necessarily reducing or eliminating the use itself).**

1.Extremely Important 2.Slightly Important 3.Neutral 4.Slightly Unimportant 5.Extremely Unimportant

8. **ENDS (e.g. e-cigarettes, vaporizers, etc.) as a helpful smoking cessation aid (e.g. cold turkey, behavioral therapy, nicotine replacement therapy, medication, combination of therapies).**

1.Extremely Important 2.Slightly Important 3.Neutral 4.Slightly Unimportant 5.Extremely Unimportant

9. ENDS (e.g. e-cigarettes, vaporizers, etc.) as a potential gateway to other tobacco use.

1.Extremely Important 2.Slightly Important 3.Neutral 4.Slightly Unimportant 5.Extremely Unimportant

10. The harmful effects of ENDS (e.g. e-cigarettes, vaporizers, etc.) use.

1.Extremely Important 2.Slightly Important 3.Neutral 4.Slightly Unimportant 5.Extremely Unimportant

11. Training students on how to deliver brief interventions (e.g. the 4 A's: Ask, Advise, Assist, Arrange) to smokers.

1.Extremely Important 2.Slightly Important 3.Neutral 4.Slightly Unimportant 5.Extremely Unimportant

12. Teaching students on ways to assist smoking patients to make a quit attempt. (e.g. use of smoking cessation treatment and behavioral support).

1.Extremely Important 2.Slightly Important 3.Neutral 4.Slightly Unimportant 5.Extremely Unimportant

13. Which of the following smoking cessation topics are included in your program's curriculum? Please check all that apply.

- □ Electronic Nicotine Delivery Systems (ENDS)
- □ Harm Reduction
- □ Oral Cancer Risks
- □ Oral-Systemic Connection
- □ Nicotine Replacement Therapies

14. How many hours are dedicated to smoking cessation in your program's curriculum? _____

15. Who is mainly responsible for teaching smoking cessation?

- □ Faculty
- □ External Lecturer
- □ Unsure
- □ Other

Please use the scale to indicate your level of agreement or disagreement with the following statements.

16. There are no barriers to including ENDS (e.g. e-cigarettes, vaporizers, etc.) content in smoking cessation education in my program's curriculum.

1.Strongly disagree 2.Disagree 3.Neither agree or disagree 4.Agree 5.Strongly agree

17. Administrative issues (e.g. budget, lack of resources, etc.) make it hard to include ENDS (e.g. e-cigarettes, vaporizers, etc.) in smoking cessation education.

1.Strongly disagree 2.Disagree 3.Neither agree or disagree 4.Agree 5.Strongly agree

18. Curriculum is too crowded to include ENDS (e.g. e-cigarettes, vaporizers, etc.) content in smoking cessation education.

1.Strongly disagree 2.Disagree 3.Neither agree or disagree 4.Agree 5.Strongly agree

19. There is a lack of ENDS (e.g. e-cigarettes, vaporizers, etc.) usage knowledge among faculty.

1.Strongly disagree 2.Disagree 3.Neither agree or disagree 4.Agree 5.Strongly agree

20. There is a lack of knowledge among faculty about the health effects of ENDS (e.g. e-cigarettes, vaporizers, etc.).

1.Strongly disagree 2.Disagree 3.Neither agree or disagree 4.Agree 5.Strongly agree

21. There is a lack of confidence among faculty regarding ENDS (e.g. e-cigarettes, vaporizers, etc.) content in smoking cessation.

1.Strongly disagree 2.Disagree 3.Neither agree or disagree 4.Agree 5.Strongly agree

22. It is unclear who should teach ENDS (e.g. e-cigarettes, vaporizers, etc.) content in smoking cessation education.

1.Strongly disagree 2.Disagree 3.Neither agree or disagree 4.Agree 5.Strongly agree

23. Newly graduated dental hygiene students should be able to give smoking cessation education regarding ENDS (e.g. e-cigarettes, vaporizers, etc.) use and potential health implications.

1.Strongly disagree 2.Disagree 3.Neither agree or disagree 4.Agree 5.Strongly agree

Source Materials for questions 7-18: Forman J, Harris JM, Lorencatto F, et al. National survey of smoking and smoking cessation education within UK midwifery school curricula. Nicotine Tob Res. 2017 May 1;19(5):591-6.

24. With regards to the tobacco cessation education included in your program's curriculum, what types of summative and/or formative assessments are used to assess students' knowledge?

- □ Clinical competency testing
- □ Objective Standardized Clinical Examination (OSCE)
- □ Proficiencies
- □ Research paper
- □ Standardized Patient Interview (SPI)
- □ Written test

Source Materials for question 19: Holliday R, Amin K, Lawrence V, et al. Tobacco education in UK dental schools: a survey of current practice. Eur J Dent Educ. 2017 Jun 27.

25. Is there anything else you would like to share regarding ENDS (e.g. e-cigarettes, vaporizers, etc.) inclusion in your program's curriculum? _____

Appendix C

Recruitment Letter Sample

Dear (Specific Dental Hygiene Program Director's Name),

My name is Heather Morse, RDH, BS. I am a graduate student in the Master of Science in Dental Hygiene program at the University of Michigan. I am asking for your participation in my thesis research project survey entitled, "Electronic Nicotine Delivery Systems (ENDS) Education in US Dental Hygiene Programs' Curricula." This survey is in partial fulfillment of my Master of Science in Dental Hygiene studies at the University of Michigan-School of Dentistry. ENDS have been promoted as a safer alternative to traditional tobacco use; however, research has found that they actually pose a significant health risk. The purpose of this survey is to assess the knowledge of dental hygiene program directors and co-directors regarding the use of ENDS as tobacco cessation modalities as well as to determine if dental hygiene programs include content regarding the use of ENDS in their curricula.

Your responses are vital to the success of this study, and we understand your time is very valuable. This survey should not take longer than five minutes to complete. This survey is completely anonymous and has exempt oversight by the University of Michigan Institutional Review Board for Behavioral and Health Sciences **(HUM00145160)**. Participation is voluntary and anonymous with no more than a minimal risk to participants. There is no compensation for participation, nor consequence for non-participation. Continuing to the survey link gives your consent to participate in this study.

We ask that the survey be completed and returned by August 10, 2018.

If you have any questions regarding this study, you may contact me at hmorse@umich.edu, 269-830-0713 or my Thesis Co-Chairs, Dr. Danielle Furgeson at furgeson@umich.edu, 734-764-0033 or Professor Iwonka Eagle at ilenda@umich.edu, 734-615-8507.

Sincerely,

Heather Morse, RDH, BS
University of Michigan
Division of Dental Hygiene
Master of Science Program

Appendix D

To: Danielle Furgeson
From:
Thad Polk
Cc:
Danielle Polk
Heather Morse
Iwonka Eagle

Subject: Notice of Exemption for [HUM00145160]

SUBMISSION INFORMATION:
Title: Electronic Nicotine Delivery Systems (ENDS) Education in US Dental Hygiene Programs' Curricula
Full Study Title (if applicable): Electronic Nicotine Delivery Systems (ENDS) Education in US Dental Hygiene Programs' Curricula
Study eResearch ID: HUM00145160
Date of this Notification from IRB: 5/7/2018
Date of IRB Exempt Determination: 5/7/2018
UM Federalwide Assurance: FWA00004969 (For the current FWA expiration date, please visit the UM HRPP Webpage)
OHRP IRB Registration Number(s): IRB00000245

IRB EXEMPTION STATUS:
The IRB HSBS has reviewed the study referenced above and determined that, as currently described, it is exempt from ongoing IRB review, per the following federal exemption category:

EXEMPTION #2 of the 45 CFR 46.101.(b):
Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

Note that the study is considered exempt as long as any changes to the use of human subjects (including their data) remain within the scope of the exemption category above. Any proposed

changes that may exceed the scope of this category, or the approval conditions of any other non-IRB reviewing committees, must be submitted as an amendment through eResearch.

Although an exemption determination eliminates the need for ongoing IRB review and approval, you still have an obligation to understand and abide by generally accepted principles of responsible and ethical conduct of research. Examples of these principles can be found in the Belmont Report as well as in guidance from professional societies and scientific organizations.

SUBMITTING AMENDMENTS VIA eRESEARCH:
You can access the online forms for amendments in the eResearch workspace for this exempt study, referenced above.

ACCESSING EXEMPT STUDIES IN eRESEARCH:
Click the "Exempt and Not Regulated" tab in your eResearch home workspace to access this exempt study.

Thad Polk
Chair, IRB HSBS

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