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Tobacco Cessation in a Dental School Setting

Kerri T. Simpson

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Tobacco Cessation in a Dental School Setting

Kerri T. Simpson, D.D.S.

Thesis submitted to the
School of Dentistry
at West Virginia University

in partial fulfillment of the requirements

for the degree of

Master of Science
in
Periodontics

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2020

Keywords: tobacco, cessation, chart review, dental school

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Abstract

Tobacco Cessation in a Dental School Setting

Kerri T. Simpson, D.D.S.

Introduction

Tobacco use remains the single largest preventable cause of death in the United States. Currently, the prevalence of tobacco use is 20.7% in adults (≥ 18 years old) and 31.2% among high school students. According to various studies, over 60% of Americans want to quit tobacco, but it takes a person several attempts to quit before they are successful. There is limited data in the literature that discusses the effectiveness of tobacco cessation programs in US dental schools. Therefore, information on the effectiveness of a tobacco cessation program in a dental school setting could benefit this state and the problem of tobacco use.

Methods

This was a retrospective study including electronic charts from patients who were under care at the West Virginia University School of Dentistry clinic from 2009 – 2019. Tobacco users' charts were gathered by running a query on the electronic health record software. Demographics, clinical data, and tobacco cessation data were collected and analyzed.

Results

518 charts were analyzed in this retrospective study, with 262 female and 256 male patients. The ages ranged from 18-95 years old, with the average age at 67.7 years old. Pack years ranged from 1-22,500 with an average of 62 pack years. Cigarette users made up the largest proportion of users, followed by smokeless tobacco, and then cigar users; however, the average pack years was in opposite order. Eighty percent (79.9%) of tobacco users had previously attempted tobacco cessation prior to care at the dental clinic. Tobacco cessation was found to be 8.8% overall (in all patients), and 26.6% in patients who attempted cessation in the dental clinic. Cold turkey was the most utilized method in successful cessation patients. Statistical analysis revealed variables of interest in cessation, previous attempts, and number of previous attempts to be statistically significant for patients to attempt cessation in the dental clinic.

Conclusions

Tobacco cessation in the WVU dental clinic was above the reported national average. Furthermore, dental care providers are a great resource for aiding in tobacco cessation. Interest in cessation, previous attempts of cessation, and number of previous attempts are significant for those to attempt cessation in the dental clinic. Future analysis of this data is recommended.

Dedication

I would like to dedicate this thesis to my family. They have been my love and support for my entire journey.

First, I would like to dedicate this to my entire family; my sisters (Kim and Kristin) and my parents (John and Penny). You have always been there for me and supporting me through the good and the bad. I know I gave you some days of confusion or worry, but no matter what, you kept me positive and kept encouraging me to be the best I could be. I am so fortunate to have you not only as my family, but also as my best friends.

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Chapter 1

Introduction

1.1 Statement of Problem

Tobacco use remains the single largest preventable cause of death and disease in the United States. Tobacco use affects numerous organ systems and can deteriorate one's overall health. Cigarette smoking kills more than 480,000 Americans each year, with more than 41,000 of these deaths attributed to exposure from secondhand smoke.¹ In addition, lung cancer is the leading cause of death by cancer for both men and women in the United States with cigarette smoking linked to 80-90% of these cancers.² Tobacco use also negatively effects the economy and workforce in the United States as smoking-related illnesses cost more than \$300 billion a year, including nearly \$170 billion in direct medical care for adults and \$156 billion in lost productivity.³ Due to these documented negative effects of tobacco use, tobacco cessation is imperative. However, research has shown that cessation is not easy for patients. According to various studies, it takes a person several attempts to quit before they are successful. The American Cancer Society (ACS) suggests it takes 8-10 quit attempts, the Center for Disease Control and Prevention suggests it takes 8-11 attempts, and an epidemiological review showed it took 5-7 attempts.⁴ Therefore, tobacco cessation programs should be implemented to help aid in cessation and evaluated for effectiveness.

1.2 Purpose

The purpose of this study is two tiered.

1) To evaluate the effectiveness of the tobacco cessation program implemented at West Virginia University (WVU) School of Dentistry student clinics. This will be performed by analyzing tobacco users charts through the electronic health record software utilized in the dental hygiene and dental clinics.

2) To appraise the current tobacco cessation in order to evaluate if forms need to be altered to aid in cessation or data collection for further data collection.

1.3 Significance to Community and Profession

In 2017, the national average of adult smokers in the United States was 17.1%, whereas, the average prevalence of adult smokers in West Virginia is 26.0%; one and a half times the national average.⁵ The high rates of tobacco use is also seen in the younger population, as West Virginia high school students tobacco use rates are almost twice that of the national average (14.4% vs. 8.8%, respectively).⁶ This increase in youth tobacco has been seen even further in the consumption of e-cigarettes. The DHHR reported that more than 1 in 3 (35.7%) WV high school students reported current use of e-cigarettes, and this is a 150% increase from 2017.⁷ Additionally, the health care costs in West Virginia, directly related to smoking, amount to \$1 billion annually and the state loses \$1.23 billion in productivity each year due to smoking.⁸ A 2019 study evaluated the amount of reduction in Medicaid expenditure, nationally and for each state, if there was a 1% reduction in cigarette smoking. West Virginia would save an estimated \$10.3 million in Medicaid expenditures the year following a 1% decrease in cigarette smoking within the Medicaid population.⁹ This is a large concern for our state, as West Virginia is higher than the national average of population under the poverty level at 17.8% versus 11.8%, respectively.¹⁰ Furthermore, West Virginian's have been stated to have the worst oral health in the nation with double the national average of adults over the age of 65 having all their natural teeth extracted, 30.4% versus 14.4%.¹¹

Dental health care providers are a great resource to aid in tobacco cessation. A dental office visit provides an opportunity for dental professionals to point out the detrimental effects of tobacco and to discuss and aid in quitting. In 2014, 52.3% of adults reported they had visited the dentist every six months within the past few years and 15.4% reported once a year. Sixty-four percent of children under 18 were reported to have seen their dentist every six months, and 20.3% once a year.¹² Half the general public, and

more than half of the younger population, visit their dentist each year, and therefore, dental professionals can be effective in their roles for tobacco cessation.

There is limited data in the literature that discusses the effectiveness of tobacco cessation programs in US dental schools. This is especially a concern for the state of West Virginia as it has higher rates of tobacco users and periodontal disease than the national averages. Therefore, information on the effectiveness of a tobacco cessation program in a dental school setting and which method is the most successful could benefit this state and the problem of tobacco use.

Chapter 2

Background and Significance

2.1 Tobacco

Tobacco has been in existence long before history began. *Nicotiana tabacum* and *Nicotiana rustica* are native plants of the Americas and evolved from the Andes and Peru/Ecuador. Tobacco has thought to be cultivated since about 5000-3000 BC and its use was universal throughout the American continents and Cuba by the 15th century.¹³ Tobacco was originally used in every form and fashion, except smoking, in the beginning. It appears that smoking arose from “snuffing”; however, tobacco was also chewed, eaten, used in eye drops, drunk like tea, and blown into warriors’ faces before battle.¹⁴ Despite all the various ways that tobacco has been used, the ever favorite form has been smoking the plant.

Even today, we have various versions of using tobacco, but they break down into four main categories: smokeless, smoking, dissolvables, and nicotine gels. Smokeless tobacco is considered any tobacco that is chewed or snuffed rather than smoked by the user, and most smokeless tobacco use involves placing the product between the gum and cheek or lip. Smokeless tobacco comes in various forms such as dip, snuff, snus, or chewing tobacco, but it has been traditionally marketed in the US as chewing tobacco and snuff (including snus).¹⁵ The national average in 2016 of smokeless tobacco use is 3.4% or about 3 in 100 people; however, West Virginia’s average is 8.5%, with only Wyoming being higher in the nation (9.8%).¹⁶ People may believe that the “smokeless” in “smokeless tobacco” means it is safer; however, this is not the case. Smokeless tobacco contains more than 4,000 chemicals, and 30 of these chemicals have been linked to cancer.¹⁷ When the tobacco is placed in the oral tissue, the additional chemicals in the product, along with nicotine, get absorbed in the body, such as formaldehyde, carcinogens, cadmium, and arsenic.¹⁸ Each year in the U.S., more than 2,300 people are

diagnosed with oral, esophageal, and pancreatic cancers caused by smokeless tobacco, and of this number, about 70% are oral cancer.¹⁷

The most common and referenced version of tobacco use is smoking. With the advancement of technology, smoking can now be by way of “traditional” smoking (cigarettes, cigarillos, pipes, etc.), or by electronic smoking, such as “vaping”. According to the FDA, the categories of smoked tobacco products are cigarettes, cigars, hookah, pipe tobacco, roll-your-own tobacco, and vaporizers, e-cigarettes, or electronic nicotine delivery systems (ENDS). Currently, the prevalence of smoking tobacco use is 13.7% in adults (≥ 18 years old) and 31.2% among high school students. The rate of smoking has significantly decreased since the 1980’s, but there are still over 45 million Americans using tobacco.¹⁹ When consuming tobacco in cigarette form, additional features are added to tobacco. A cigarette consists of tobacco, chemical additives, a filter, and paper wrapping. There are 93 known harmful and potentially harmful chemicals in cigarettes including nicotine, cadmium, lead, acetaldehyde, ammonia, and benzene, and more than 7,000 chemicals in cigarette smoke itself.²⁰ However, not all the harmful chemicals are added when the cigarettes are made, some occur naturally in the tobacco plant and some occur naturally as the tobacco is cured.²¹

The newest addition to tobacco usage is the electronic delivery system, and it has had an immense effect on the younger generation. In 2019, over 5 million middle and high school students were current users, and almost 1 million were using e-cigarettes daily.²² One of the largest contributions to this increase in youth usage is the appealing flavors that have been presented. In 2009, the FDA banned any flavor other than menthol in cigarettes; however, enticing flavors were not banned until 2020 for vaporizing solutions.²² Major health concerns have arisen associated with electronic cigarettes, even more than traditional cigarette use. One of the matters is when the liquid is vaporized it produces noxious substances, such as formaldehyde. Formaldehyde is a group 1 carcinogen according to the International Agency for Research on Cancer.²³ It is a known degradation product of propylene glycol

that reacts with propylene glycol and glycerol during vaporization to produce hemiacetals. A study by Jensen et al. showed that using 3ml of electronic cigarette liquid per day would inhale approximately 14.4mg of formaldehyde per day in formaldehyde-releasing agents.²⁴ The average amount of formaldehyde inhalation from a pack of cigarettes (20 cigarettes) is 3mg, about one-fifth the amount from 3 electronic cartridges. Another concern that has been noted is the physical harm some ENDS cause due to the vaporizer exploding while in use. Numerous reports state the physical damage that can occur, such as burns to the mouth and face, lost teeth, and broken facial bones. The cause for this situation is the lithium-ion batteries some ENDS utilize as the source of energy for vaporizing the liquid.²⁵

There are various forms of tobacco use in the world today, every form having detrimental effects. Furthermore, there are even negative effects from secondhand smoke as well. Tobacco has been around for centuries, and even though the numbers of smoking has decreased, some new forms are on the rise.

2.2 Nicotine

Addiction is a psychological and physical inability to stop consuming a chemical, drug, activity, or substance, even though it is causing psychological or physical harm. The process of drug addiction begins with molecular interactions that alter the neurons that are sensitive to that drug, and overtime this alters the properties of individual neurons and circuits. The addictive chemical in tobacco is nicotine. *Nicotiana tabacum*, the type of nicotine found in the tobacco plant, comes from the nightshade plant, same plant family as eggplants, tomatoes, and red peppers. Nicotine is a highly addictive substance and is believed to mediate both tobacco reinforcement and dependence.²⁶ The U.S. surgeon general (2010) concluded nicotine to be as addictive as cocaine or heroin. Nicotine reaches the brain within eight seconds after being inhaled, and it can also enter the bloodstream through the mucous membranes in the nose or mouth and through the skin. It is highly lipophilic, rapidly crosses the blood-brain barrier, and

can be appropriated in lipid-rich reservoirs.²⁷ Once in the brain, it interacts with specific membrane receptors in the nervous system known as neuronal nicotinic acetylcholine receptors (nAChRs). These receptors are ion channels which pass certain ions (Na^+ , K^+ , and Ca^{2+}) into the cell, and can either directly impact cell excitability, or trigger calcium-sensitive molecules.²⁸ One unique characteristic of nicotine is the up-regulation of receptors in the face of increased agonist, which is a factor that may directly contribute to smoking relapse. A study by Cosgrove et al. found that certain nAChRs remained significantly up regulated after one month of abstinence and their density was positively correlated to cravings.²⁹ nAChRs are predominately found on presynaptic terminals and the main effect of nicotine to release neurotransmitters such as serotonin, norepinephrine, dopamine, acetylcholine, glutamate, and GABA.³⁰ Some of these neurotransmitters, dopamine specifically, are released in the nucleus accumbens, which is part of the reward center of the brain.³¹ This increases the addiction of nicotine, as this release simulates pleasure.

Nicotine also has some detrimental health effects, aside from addiction. Studies have shown that there is an increased risk of cardiovascular, respiratory, and gastrointestinal disorders, and it has carcinogenic potential.³² When consumed, nicotine immediately can cause irritation and burning sensation in the mouth and throat, increased salivation, and nausea. It can also cause an increase in pulse and blood pressure and an increase in plasma free fatty acids, hyperglycemia, and the level of catecholamines in the blood.³³ Furthermore, the stimulation of nAChRs has biologic effects on cells important for initiation and progression of cancer. It activates signal transduction pathways directly, which can allow the survival of damaged epithelial cells.³⁴ It has been noted to specifically increase the risk of lung, gastrointestinal, pancreatic, and breast cancer. Nicotine's effect on the respiratory system is both direct acting and secondary by way of a central nervous system mechanism. It causes an increased airway resistance by bronchoconstriction and it can alter the respiration through the CNS action.³⁵ Moreover, nicotine has been known to impair the immune system. It impairs antigen and receptor

mediated signal transduction and causes macrophage responses to be dysfunctional.³⁶ A more recent concern that has been revealed is the effect of nicotine on the adolescent brain. This has been brought about in recent times due to the increase in electronic cigarette usage as previously discussed. Nicotine has been shown to alter neural and behavioral development, most elicited is the change in patterns of synaptic activity.³⁷ These changes have been shown to increase the addiction for nicotine into their adult life, and also create a “more addiction-prone phenotype” which can contribute to a higher rate of other substance abuse disorders.³⁸ It has been shown that nicotine has a multitude of negative effects, both in terms of addiction and health concerns.

2.3 Effects of Tobacco

The harmful effects of tobacco have been noted through medical evidence for the last 200 years. First it was evident in relation to oral cancer, then in relation to vascular disease, and then in association with lung cancer; however, this was largely ignored until five publications came out in 1950 that related smoking to lung cancer by case-control studies.³⁹ These publications stimulated abundant research in the area of tobacco use and health effects. They were generally debated for several years, but the concept that smoking caused lung cancer was accepted by the late 1950s, and the research and associations have been continuing. It is now reported that cigarette smoking harms nearly every organ in the body and causes close to one in five deaths in the U.S. annually.¹ It causes more deaths each year than HIV, illegal drug use, alcohol use, motor vehicle injuries, and firearm-related incidents combined.⁴⁰ In addition, more than 10 times as many citizens have died prematurely than died in all wars fought by the U.S. Cigarette smoking increases risk from death from all causes in women and men and the risk has increased over the last 50 years.¹

2.3.1 Systemic Effects

The effects of tobacco on the respiratory system was the first documented association in correlation to lung cancer. Smoking causes about 90% of all lung cancer deaths and people who smoke

are 15 to 30 times more likely to get cancer or die from lung cancer than those who do not smoke. More women in the U.S. die from lung cancer each year than from breast cancer.⁴¹ However, tobacco use also affects the respiratory system other than cancer. It causes lung disease by damaging the peripheral bronchi, alveoli, and the capillaries in the lungs which causes loss of cilia, mucus gland hypertrophy, and increased number of goblet cells and macrophages. In addition, it damages the local immune system by showing an increased number of peripheral blood mononuclear phagocytes that are functionally compromised, and the B and T lymphocytes exhibit decreased proliferative capacities.⁴² One of the largest studied associations and concerns is cigarette smoking and chronic obstructive pulmonary disease (COPD). COPD includes the conditions of emphysema and chronic bronchitis. COPD is the nation's largest killer and 8 out of 10 cases of COPD are directly linked to tobacco use.⁴³ The number of Americans suffering from COPD is increasing and there is no cure for this disease. Furthermore, tobacco also increases the chance of asthma attacks or can make an attack worse. Studies have shown that cigarette smoke can increase the non-specific bronchial responsiveness and an increased sensitization to basic allergens such as house dust mites.⁴⁴ However, tobacco use not voluntarily consumed also causes problems. Involuntary smoking, or environmental tobacco smoke (ETS), is a large concern for adults and children asthmatic patients. Secondhand smoke contains more than 7,000 chemicals, with about 70 that are carcinogenic.¹⁹ ETS has been associated with exacerbation of increased prevalence of respiratory symptoms and infections and bronchial hyper-responsiveness and asthma, especially in children.⁴⁵ Studies have reported a strong association between passive smoking and emergency room visits and the presence of just one smoker in the house increases the annual frequency of children's emergency visits.⁴⁶

Smokers are at a greater risk for cardiovascular disease (CVD), and CVD is the single largest cause of death in the U.S., killing more than 800,000 a year.⁴⁷ Even people who smoke fewer than five cigarettes a day may show signs of early CVD. These effects are mainly related to nicotine and carbon

monoxide. These negative effects are seen on the structure and function of blood vessels, platelets, and inflammatory leukocytes. In addition, smokers have increased circulating levels of catecholamines and free fatty acids. When exposed to tobacco smoke, the carbon monoxide forms carboxyhemoglobin in the blood, and this decreases the blood's oxygen-carrying capacity. Oxygen supply can also be reduced due to atherosclerotic narrowing or vasoconstriction of the coronary arteries.⁴⁸ This narrowing can also develop ischemia and angina. Furthermore, blockages caused by smoking can reduce the blood flow to legs and skin, causing peripheral vascular disease (PVD). Platelets are also affected by tobacco use. Platelet aggregation is increased by various mechanisms including the increase of catecholamines release due to nicotine and the desensitization of platelets to prostaglandin I₂ and E₁, which are antiaggregatory prostaglandins.⁴⁹ There are multiple avenues in which tobacco use affects the cardiovascular system, both centrally and peripherally.

2.3.2 Oral Effects

Oral health is another area of concern for tobacco use. Some of the first signs of tobacco use are identified in the oral cavity, such as nicotine stomatitis from cigarette or pipe smokers or the corrugated vestibular mucosa described as a snuff pouch in smokeless tobacco users. Oral cancer consists of 90% as squamous cell carcinoma; 9% salivary gland carcinomas, lymphomas, or sarcomas; and 1% as metastasis from lung, breast, prostate, or kidney carcinoma.⁵⁰ Around 27,000 new cases of oral cancer are diagnosed annually, and approximately 5,500 individuals die of this disease each year. Although there are various factors that can cause oral cancer, literature shows that tobacco use is one of the top factors. At least 80% of cases are associated with the multiple cell abnormalities resulting from chronic and excessive exposure to carcinogens found in tobacco.⁵¹ Blot et al. estimated that tobacco smoking and alcohol drinking combines to account for approximately three-fourths of all oral and pharyngeal cancers in the U.S, and the synergistic relationship equals a 30-fold increased risk for individuals.⁵² A

2018 systematic review revealed that smoking was associated with lower bone mineral density, increased fracture risk, periodontitis, alveolar bone loss, and dental implant failure.⁵³

2.3.3 Effects of the Periodontium

Periodontitis is defined as a chronic infectious disease resulting in inflammation within the supporting tissues of the teeth, progressive attachment and bone loss, and is characterized by pocket formation and/or gingival recession.⁵⁴ Periodontitis is found in 47.2% of Americans age 30 and over, with 8.7% having mild, 30% having moderate, and 8.5% having severe classification.⁵⁵ According to the American Academy of Periodontology, tobacco use may be one of the most significant risk factors in the development and progression of periodontal disease.⁵⁴ Current smokers are about 4 times as likely and former smokers are twice as likely to have periodontitis compared to non-smokers.⁵⁶ Smoking attributes to poor oral health and periodontal disease in several ways. Smoking has been shown to affect the development, cytokine production, and effector function of both innate and adaptive immune cells, leading to proinflammatory responses and dysfunction of the immune response.⁵⁷ Moreover, data reveals that smoking causes a decrease in total serum immunoglobulin G2 and serum immunoglobulin G2 reactive with *Aggregatibacter actinomycetemcomitans*, which is an important immune response against periodontal destruction.⁵⁸ Furthermore, smoking effects polymorphonuclear leukocyte functions, such as phagocytosis, hydrogen peroxide generation, integrin expression, and protease inhibitor production, which play a key part in host protection and tissue destruction.^{59,60} Smoking also leads to early colonization and a greater abundance of pathogenic species (*Aggregatibacter actinomycetemcomitans*, *Porphyromonas gingivalis*, and *Tannerella forsythia*) found in the subgingival ecosystem^{60,61} and these pathogens were found in probing depths $\leq 4\text{mm}$.⁶³ Additionally, even after treatment, there is still a significantly greater pro-inflammatory response and orange complex bacteria are still present in the gingival crevice.⁶⁴ Smokers exhibit 50-75% as much improvement in clinical parameters from non-surgical and surgical therapy in smokers as compared to non-smokers.⁶⁵

2.3.4 Effects on Dental Implants

The use of implants has become a well-established and clinically accepted method to restore edentulous areas in the oral cavity.⁶⁶ Smoking has been strongly associated with chronic periodontitis, attachment loss, and tooth loss⁶⁷ and this worry carries to the concern with implants. In a 10-year cohort study, Karoussis et al. found that 18% of all implants in smokers developed peri-implantitis, while only 6% of implants in non-smokers were affected,⁶⁸ and a 15 year follow-up study by Lindquist reported that smokers revealed substantially more crestal bone loss than non-smokers.⁶⁹ The proceedings of the 2017 American Academy of Periodontology (AAP) and European Federation of Periodontology (EFP) workshop reported on the detriment of tobacco use on the periodontium and implants. The proceedings concluded that there is “no conclusive evidence that smoking constitutes a risk factor/indicator for peri-implantitis”; however, the proceedings also concluded there is strong evidence from longitudinal and cross-sectional studies that a history of periodontitis establishes a risk factor/indicator for peri-implantitis.⁷⁰ As discussed previously, smoking negatively effects the periodontium, which can in turn increase the risk for peri-implantitis.

2.4 Cessation

Due to the increasing awareness of detrimental outcomes caused by tobacco, tobacco cessation protocols are becoming more imperative. In 2008, the U.S. Department of Health and Human Resources published a clinical practice guideline for treating tobacco use and dependence.⁷¹ The clinical practice guideline encourages all health care clinicians to inquire about tobacco use every time a provider sees a patient. This guideline contains strategies and recommendations designed to assist clinicians, tobacco dependence treatment specialists, and health care administrators, insurers, and purchasers in delivering and supporting effective treatments for tobacco use and dependence. Tobacco cessation interventions are instrumental in helping patients quit. A meta-analytic comparison by Viswesvaran et al shows that, on average, 6.4% of the smokers could be expected to quit smoking without any intervention, and despite

the wide array of smoking cessation adjuncts, more than 60% will try to quit without assistance.⁷² However, fewer than 5% of those who try to quit without assistance will remain abstinent for 1 year.⁷³ According to various studies, it takes a person several attempts to quit before they are successful. The CDC suggests it takes 8-11 attempts and the ACS suggests it takes 8-10 attempts; however, a more recent longitudinal study by Chaiton et al., revealed that it may take smokers 30 or more quit attempts before being successful at quitting.⁷⁴ Furthermore, the CDC estimates that 51.5% of adult everyday smokers in West Virginia tried to quit smoking for one or more days in 2015.¹⁰ A study by Windsor et al. reveals that tailoring tobacco cessation specifically to the group you are working with significantly increases the effectiveness of tobacco cessation programs, even without actual pharmacologic methods.⁷⁵

The 2008 guideline states, “Numerous effective medications are available for tobacco dependence, and clinicians should encourage their use by all patients attempting to quit smoking—except when medically contraindicated or with specific populations for which there is insufficient evidence of effectiveness (i.e., pregnant women, smokeless tobacco users, light smokers [one who smokes fewer than ten cigarettes per day], and adolescents).”⁷¹ There are several modalities for tobacco cessation. Some aid in quitting by replacing nicotine (called nicotine replacement therapy – NRT), while others work on the chemical receptors in the brain (acetylcholine receptors that release dopamine). The NRT options include transdermal nicotine patches, nicotine chewing gum, and nicotine lozenges. These options can be obtained over the counter and do not need a prescription. The other NRT options, a nasal spray and an oral inhaler, are by prescription only. The other form of tobacco cessation adjuncts works on the acetylcholine receptors in the brain and do not contain any nicotine. These are available in tablet form and are prescription only. The FDA has approved all the above tobacco cessation products and has also approved the combination use of lozenges/patches and gum/patches. According to the 2018 American College of Cardiology (ACC) Task Force, combination therapy is now considered the

standard of care when using NRT as therapy and should be recommended as initial therapy when NRT is chosen between the patient and provider.⁷⁶

Chapter 3

Materials and Methods

This retrospective study was approved by the Institutional Review Board at West Virginia University (WVU) (IRB #1901430375). Since the study involved retrospective analyses of existing charts, a waiver of written informed consent was granted. An electronic chart review was performed from the WVU School of Dentistry dental clinics axiUm system from the years 2009 to 2019. Charts were assessed if the patient's chart was marked as a tobacco user, due to a tobacco form being completed in the electronic health record. The subset of patients was gathered by running a query on the patient management software (axiUm) based on the entry code "tobacco counseling for the control and prevention of oral disease". Charts were included if a patient had a tobacco use history, tobacco cessation form 1 (TB1) completed, and ≥ 1 tobacco cessation forms 2 (TB2) completed. Charts were excluded if they had incomplete tobacco cessation forms or <1 TB2 forms. The data was deidentified to protect the identity of individual patients and exported to a secure Excel spreadsheet only accessible to authorized personnel to perform the necessary sorting and numeric calculations.

3.1 Demographic Data

Demographic data collected from the patients' charts were gender and age. Gender was recorded as male or female as reported by patient on their EHR. Age was calculated from the patient's date of birth to the date when the tobacco forms were completed.

3.2 Clinical Data

Dentition was identified as either fully dentate, partially dentate, or fully edentulous according to the odontogram in the EHR at the time the forms were completed. Prior to 2011, odontograms were not collaborated with treatments completed in the EHR. Therefore, charts with dates prior to 2011, a thorough review of all completed treatments was performed to determine the dentition classification.

Partial edentulism was further divided into classifications I-IV according to the partial edentulism classification guidelines presented by the ACP.⁷⁷

3.3 Tobacco Data

In 2009, a tobacco-use initial questionnaire and a tobacco counseling/ intervention questionnaire were incorporated into patients' electronic dental records. TB1 is comprised of eleven questions and discusses the patient's tobacco use history (Figure 1). The first information obtained on the form is gender and if the patient uses tobacco. Questions 1 and 2 address the amount used per day and how long the patient has been using tobacco. Question 3 asks about the age range when the patient began using tobacco. Questions 4, 5, and 6 investigate the patient's past cessation history and what methods were attempted. Question 7 identifies the primary reason a patient wants to quit tobacco use. Question 8 inquires about the patient's experiences with side effects from their tobacco use. Question 9 asks if the patient will allow us to assist with his or her cessation effort. If the patient responds "no," the student/faculty member informs the patient that assistance for quitting is available when they are interested to quit. If the patient responds "yes," the student/faculty member proceeds with the cessation protocol. Questions 10 and 11 address potential issues that may preclude the prescribing of pharmacotherapy. Once this form is completed, the student provider enters the CDT code D1320. TB2 is a tobacco intervention/counseling questionnaire and is comprised of four questions regarding the tobacco cessation methods recommended by students (under faculty supervision) along with follow-up evaluations of tobacco utilization (Figure 2). Question 1 documents interventions and recommendations made to the patient, including referrals to the quit line; referrals to FAX-TO-QUIT that are completed and faxed to the state tobacco quit line; the availability of educational pamphlets; the use of an intraoral camera to show the patient the effects of tobacco; and the need for a physician referral. Question 2 asks about last tobacco use, if any use. Question 3 identifies tobacco cessation strategies, including pharmacological options recommended and/or prescribed. Question 4 is the same as question 3 but is for

smokeless tobacco users specifically. The last section is for follow up appointments and records information about continued cessation or if the patient has relapsed. At each patient recall and during any appointment in which the patient indicates a change in his or her tobacco habit, information is recorded. Once this form is completed, the student provider enters the CDT code D1320.1.

Pack years was calculated by the number of packs smoked per day multiplied by the number of years the patient has used tobacco. If a patient did not smoke an entire pack per day, the amount was pro-rated and still multiplied by the number of years used. Furthermore, if the patient utilized a tobacco product other than cigarettes, the amount of nicotine in that product was averaged into a pack of cigarettes (pack = 20 cigarettes = 20mg nicotine).

3.4 Cessation Data

Previous attempts of cessation were recorded as yes or no, depending on if they had or had not previously attempted cessation prior to coming to the dental school clinic. If the patient had previously attempted, the number of cessation attempts was also recorded (1 – 4 or more). Willingness of cessation was measured yes or no as the patient was asked if they were interested or willing for help with tobacco cessation. Attempted cessation was recorded yes or no depending if they physically attempted cessation while being a patient in the dental school clinic. Furthermore, if cessation was attempted, it was then recorded if they had a relapse or were a “true success”. True success was defined as a patient who reported cessation and did not report any relapse for the duration of the documentation. Relapse was defined as any reported lapse of tobacco use since the documentation of the original cessation.

3.5 Statistical Analysis

Descriptive data was collected and analyzed recording gender, age, pack years, and dentition in relation to interested/attempted cessation, relapse, and true success. For statistical analyses, outcomes were identified as attempted cessation, relapse, and true success. All the outcomes were categorical (yes/no). A chi-square test was performed when the predictor was also categorical (dentition, interested

in cessation, previously attempted cessation), and a logistic regression analysis was performed when the predictor was numerical (age, average pack years, partial dentition, number of previous attempts). Measure of variability is being reported as a 95% confidence interval.

Form Question	Answer	Date
West Virginia University School of Dentistry		
Tobacco Use History - Initial Questionnaire		
Check all that apply and indicate number per day of cigarettes, snuff, chewing tobacco, or other.		
Is the patient male or female?		
Is the patient a tobacco user?		
☐ 1. How much tobacco does the patient use per day?		
☐ 2. Indicate approximately how long the patient has been using tobacco?		
☐ 3. Indicate approximately what age the patient began using tobacco on a regular basis.		
☐ 4. If the patient attempted tobacco cessation in the past, for how long were they successful?		
☐ 5. If the patient attempted tobacco cessation, how many times have they attempted to quit the use of tobacco?		
☐ 6. If applicable, what method(s) did the patient use to assist with tobacco cessation? (Check all that apply).		
☐ 7. If applicable, what is that patient's major reason for wanting to quit?		
☐ 8. Is the patient currently experiencing any side effects from tobacco use?		
☐ 9. IS THE PATIENT WILLING TO ALLOW US TO ASSIST THEM WITH QUITTING TOBACCO?		
☐ 10. As the patient's provider, are there any conditions or medications being taken that require a medical consultation prior to initiating tobacco cessation? (question modified on 1/14/10 per SM)		
☐ 11. As the patient's provider, which of the following medical conditions requires further consultation prior to tobacco cessation? (Check all that apply).		
DENTAL PROVIDER - YOU MUST NOW ENTER PROCEDURE CODE D1320 TO THE PATIENT'S EHR.		

Figure 1. Tobacco use initial questionnaire (TB1)

Form Question	Answer	Date
West Virginia University School of Dentistry		
Tobacco Counseling / Intervention Form		
☐ 1. Check all that apply for today's tobacco intervention:		
2. Patient last used smoke tobacco product:		
☐ 3. Recommended tobacco cessation pharmacotherapy/approach for smokers:		
Comments:		
☐ 4. Recommended tobacco cessation pharmacotherapy/approach for smokeless tobacco users:		
Comments:		
Follow Up Appointment		
☐ Smoker has:		
☐ What method did the patient try for smoking cessation?		
☐ Smokeless tobacco user has:		
☐ What method did the patient try for smokeless tobacco cessation?		
The ability to see an image of a change occurring in my mouth makes me want to quit smoking or has influenced me to quit smoking.		
The ability to see an image of change occurring in my mouth makes me want to quit using smokeless tobacco or has influenced me to quit using this product.		
DENTAL PROVIDER - YOU MUST NOW ENTER PROCEDURE CODE D1320.1 TO THE PATIENT'S EHR.		
Comments:		

Figure 2. Tobacco use/counseling form (TB2)

Chapter 4

Results

Eight hundred charts out of the subset of tobacco users were included for review in this retrospective study. After excluding charts for no TB2 form completed (n=170) and for incomplete data on either TB1 or TB2 forms (n=112), a total of 518 charts were analyzed.

4.1 Demographic Data

Data collected regarding all tobacco users' reported gender and age are described in table 1.

Gender	Female = 262
	Male = 256
Age Range (years)	18 – 95
Average Age (years)	67.7

Table 1. Demographic data of tobacco users' in dental school clinic

4.2 Tobacco Use Data

Tobacco users in this study reported 3 methods of tobacco consumption: cigarettes, smokeless tobacco, or cigars. Table 2 shows the breakdown of the tobacco methods and average pack years.

Tobacco Method	Number of Patients	Average Pack Years
Cigarettes	455	11.71
Smokeless	52	28.78
Cigars	11	2,301.14
Total	518	62.04

Table 2. Tobacco methods and average pack years reported by patients in the dental clinic

4.3 Tobacco Cessation Data

The tobacco cessation data is reported in tables 3 and 4. The effectiveness of tobacco cessation in the dental clinic was reported in two aspects: cessation in respect to all charts, and cessation in relation to patients who attempted. Overall tobacco cessation was found to be 8.8% (45/518) when all charts

were included. When the charts were controlled for cessation rate in patients who attempted only, the rate showed to be 26.6% (45/169). Figure 1 displays the cessation methods utilized by the true success group of patients.

	All Charts	Interested	Attempted	Relapse	True Success	Cessation Rate
Cigarette	455	164	148	108	40	8.8%
Smokeless	52	18	20	15	5	9.6%
Cigar	11	2	1	1	0	0%
Total	518	184	169	124	45	8.7%

Table 3. Tobacco cessation data in the dental clinic out of all charts

	All Charts	Interested	Attempted	Relapse	True Success	Cessation Rate
Cigarette	455	164	148	108	40	27.0%
Smokeless	52	18	20	15	5	25.0%
Cigar	11	2	1	1	0	0%
Total	518	184	169	124	45	26.6%

Table 4. Tobacco cessation data in the dental clinic out of attempted data

Figure 1. Reported cessation methods for true success patients

4.3.1 Cessation categorized by interest

Table 5 highlights the cessation outcome in relation to the patient's initial reported interest. Chi square analysis found a statistical significance for patients who initially reported interest in cessation and those who physically attempted cessation in the dental clinic ($p<.0001$). No other variables were found to be significant with the patient's initial reported interest.

Interest in cessation	Attempted in clinic	Relapse during cessation	True Success
Yes (interested)	124 ($p<.0001$ *)	95 ($p=0.12$)	29 ($p=0.14$)
No (not interested)	45 ($p=0.90$)	29 ($p=0.95$)	16 ($p=0.10$)

Table 5. Cessation outcomes related to patient's initial interest

4.3.2 Cessation categorized by dentition

Table 6 and 7 represent the cessation results according to the patient's documented dentition. Statistical analysis revealed there was no statistically significant associations between dentition and tobacco cessation.

Dentition	Attempted in clinic	Relapse during cessation	True Success
Dentate	38 ($p=0.13$)	25 ($p=0.48$)	13 ($p=0.47$)
Edentate	19 ($p=0.13$)	15 ($p=0.48$)	4 ($p=0.47$)
Partially edentulous	112 ($p=0.30$)	84 ($p=0.12$)	28 ($p=0.12$)

Table 6. Cessation outcomes according to patient's dentition

Partial Class	Attempted in clinic	Relapse during cessation	True Success
Partial I	23 ($p=0.30$)	14 ($p=0.12$)	9 ($p=0.12$)
Partial II	16 ($p=0.31$)	12 ($p=0.13$)	4 ($p=0.12$)
Partial III	31 ($p=0.30$)	24 ($p=0.13$)	7 ($p=0.12$)
Partial IV	42 ($P=0.30$)	34 ($p=0.12$)	8 ($p=0.12$)

Table 7. Cessation outcomes according to partial edentulous classification

4.3.3 Cessation categorized by previous attempts

Figure 2 represents the number of patients who previously attempted cessation and the number of the previous attempts. Table 8 highlights the results of tobacco cessation according to the patient's previous attempts of cessation and number of previous attempts. Chi square analysis found statistical significance for patients who attempted in the clinic and who had previously attempted cessation ($p =$

0.0013); and logistic regression found statistical significance for those who attempted cessation in the clinic and for the number of previous attempts ($p=0.0007$, $p<.0001$). None of the other variables were shown to be significant.

Figure 2. Patients who previously attempted cessation and number of attempts reported

	Did not attempt in clinic	Attempted in clinic	Relapsed during cessation	True Success
Previously attempted cessation	264	150 ($p=.0013$)*	111 ($p=0.29$)	39 ($p=0.28$)
Attempted 1	—	25 ($p=.0007$)*	17 ($p=0.31$)	8 ($p=0.29$)
Attempted 2	—	34 ($p<.0001$)*	24 ($p=0.32$)	10 ($p=0.29$)
Attempted 3	—	33 ($p<.0001$)*	27 ($p=0.31$)	6 ($p=0.30$)
Attempted 4 or more	—	58 ($p<.0001$)*	43 ($p=0.32$)	15 ($p=0.33$)

Table 8. Cessation outcomes in relation to patients who previously attempted cessation

Chapter 5

Discussion

This retrospective study analyzed electronic health records in a dental school setting to evaluate the current implemented tobacco cessation program. Data was collected in terms of demographics, clinical, and tobacco cessation information and statistical analysis was performed to determine if there was any significance between the variables.

The gender ratio was about even for percentage of tobacco users (females 50.6%, males 49.4%) and this trend carried through all the outcomes reported. Age did not show any correlation with respect to tobacco cessation. An interesting finding was that for the attempting cessation group, a trend was seen that as age increased, the number of patients who attempted in the clinic also increased; however, this was not statistically significant.

Pack years ranged from 1 to 22,500 with an average of 62 pack years. When organizing the tobacco according to usage, cigar smokers and smokeless tobacco users had higher average pack years than cigarette smokers (2,301 vs. 28.8 vs 11.7, respectively). The percentage of smokeless tobacco users in this study was 10%, which is higher than our state average as reported previously (8.5% statewide) and is higher than the number one state in the US.¹⁶

The tobacco cessation rate was analyzed in two ways due to the design of the tobacco forms (TB1/TB2). The five A's of tobacco cessation are: Ask, Advise, Assess, Assist, and Arrange. TB1 form performs the first three A's (ask, advise, assess), and is part of tobacco cessation counseling; therefore, all charts were included in the first assessment to be fully encompassing. The results of this analysis found that the tobacco cessation rate in the dental clinic was 8.8% when including all charts analyzed in the study. This rate is higher than the national average reported by the CDC at 7.4%.⁷⁸ The second analysis was performed from protocol reported in previous studies, analyzing the ratio of "true success" patients to those who physically attempted in the dental clinic. This analysis revealed the cessation rate

at 26.6%, and this rate is also higher than previously reported studies of 15-20%.^{79,80} A possible explanation for this finding may be that the student provider sees the patient regularly for dental appointments and can continuously check on the patient's cessation. At the student clinic, patients are sometimes seen several times in one week, therefore the communication and encouragement are continual. However, the percentage of attempts in the clinic within this population was lower than the reported national average (32.6% vs. 55%) as well as the reported national average of those interested (35.5% vs. 68.0%).⁷⁸ A possible explanation for this discrepancy may be the older population that is seen in the dental clinic. When reviewing the forms from the clinic, there were multiple narratives transcribed describing an attitude of no interest due to the longevity of tobacco use or the lack of health concerns associated with tobacco.

The methods of successful tobacco cessation reported in this study show that the largest method utilized was the cold turkey method. This differs than reported literature from the CDC⁷⁸ and FDA⁸¹ as the most effective cessation method is with NRT adjuncts, as NRT increases success rates 50-60%. However, this is not a surprising finding, as these patients have attempted multiple times before without success, and each time an attempt is made, the patient finds out more about themselves and what does or does not work for them.

Multiple variables were not found to be associated with cessation. Gender, age, pack years and dentition were not significantly associated with any of the outcome variables. However, previous attempts of tobacco cessation, both the act of previous attempts and the number of attempts, were significantly associated with the outcome variable 'attempted cessation' in the dental clinic. Furthermore, interest in tobacco cessation was another factor that was significantly associated with the outcome of 'attempting cessation' while under care at the dental clinic. Although this does not seem to be a surprising finding, it was particularly interesting to find within the true success group, almost one-third originally reported no interest in cessation (16/45).

The findings in this study are subject to limitations. One limitation is that the results are reported by providers in the clinic and are subject to human error. When performing the exclusion/inclusion criteria, it was noted numerous forms that were not completed or incomplete and they had to be excluded. Another limitation is that the tobacco cessation was self-reported. No biochemical testing was performed to ensure cessation and therefore they may have been some over reporting of cessation or under reporting of relapse. Furthermore, the tobacco forms (TB1 and TB2) are not precise in certain aspects of cessation information. One of these areas is the documentation of length of time the patient has been smoking. The question is a range and therefore makes it difficult to precisely calculate the pack years, resulting in over- or under- estimation of pack years for the patients. Another area that may need refinement is the first section on the TB2 form. This area is a yes/no section for all tobacco cessation interventions discussed or recommended during the dental appointment. This section is too broad and allows for the section to be completed without detail that could be useful for future data collection.

Chapter 6

Conclusions

Within the limitations of this study, tobacco cessation effectiveness in the WVU dental school clinic was 8.8% overall, and 26.6% when classified to success in those who physically attempted in the dental clinic. This study supports the idea that dental healthcare providers are an excellent resource to aid in tobacco cessation, as the cessation shown in this dental clinic was higher than previously reported cessation rates. When analyzing the predictors and the outcomes of tobacco cessation, interest in quitting, previous attempts, and number of previous attempts were found to be statistically significant in relation to physically attempting cessation in the dental clinic. Further analysis of the current data and continuation of analysis of charts is recommended to gain more insight into tobacco cessation in the dental school clinic.

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