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Fourth year dental students' barriers to tobacco intervention services

Bhagyashree Pendharkar
University of Iowa

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FOURTH YEAR DENTAL STUDENTS' BARRIERS TO TOBACCO
INTERVENTION SERVICES

by

Bhagyashree Pendharkar

A thesis submitted in partial fulfillment
of the requirements for the Master of
Science degree in Dental Public Health
in the Graduate College of
The University of Iowa

December 2009

Thesis Supervisor: Professor Steven M. Levy

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CERTIFICATE OF APPROVAL

MASTER'S THESIS

This is to certify that the Master's thesis of

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CHAPTER I INTRODUCTION

Progress in tobacco control has been recognized as one of the 10 greatest public health achievements of the century, but we still have a long way to go.

Richard H. Carmona, MD, MPH, FACS
Former U.S. Surgeon General¹

Cigarette smoking is associated with approximately 438,000 deaths each year in the United States.² Current trends show that more than 8 million deaths will be associated with tobacco use worldwide by 2030.³

Nearly 21% of adults⁴ and 20% of high school students⁵ are current smokers in the United States and approximately 1,100 young people start smoking on a daily basis.⁶

While many community-based interventions have been effective in preventing or reducing tobacco use or increasing cessation rates, health care professionals can also play an integral role in tobacco cessation. For example, health care professionals can identify users, provide brief cessation counseling and refer those patients willing to quit smoking to either quitlines or social support groups as recommended by the clinical practice guidelines.^{7,8}

Given the consequences of tobacco use on dental and oral tissues⁹ and greater perceived dental needs of the current smokers compared to non-smokers¹⁰, dentists can play a vital role in the cessation process. Additionally, dentists have exclusive opportunities to provide cessation services to their patients due to the increased duration of dental treatment compared to other health care professionals. Tobacco intervention can be introduced to patients in the dental office when patients seek care for problem-oriented visits (e.g., periodontal treatment, extractions, etc.) or for cosmetic purposes.¹¹

Furthermore, 59% of patients (including smokers) expect their dentists to routinely offer cessation services.¹²

However, there seems to be a disconnect between advising patients regarding hazards of tobacco use on oral and general health and assisting patients with specific cessation strategies. Only 48% of the current smokers claimed that they were advised by health professionals and 28% reported that they were offered assistance to quit in 2005.¹³ The Partnership for Prevention also estimated that 42,000 additional lives would be saved each year in the U.S. if the advice to patients were increased to 90%.¹³

Key factors that hinder provision of cessation services include provider's lack of confidence/preparedness due to lack of tobacco cessation knowledge/training. Many health professionals have emphasized the importance of tobacco cessation training in dental schools as one of the major facilitators for successful tobacco cessation services in future clinical settings.^{14,15,16} Research studies have consistently tracked and reported increased tobacco intervention curricula implementation and tobacco cessation-related school policies in the U.S. dental schools.^{17,18}

The College of Dentistry at the University of Iowa (UI) first implemented a tobacco intervention curriculum in 1992 and the curriculum was updated several times. However, no formal program evaluation was conducted since its implementation.

Additionally, Iowa is one of the eight high-risk geographic regions where oral cancer death rates are increasing among older white males.¹⁹ Since 75% of the UI dental graduates stay in Iowa and practice, these students should be well trained to identify tobacco users and provide cessation services in the college clinics and in future private practice settings.

Thus, there was a need to assess: 1) the perceived or real barriers associated with provision of tobacco intervention services, 2) the current curriculum and 3) related factors (such as knowledge, attitudes, behaviors related to tobacco cessation, etc.). The students might be more comfortable providing cessation services when barriers are identified and appropriate steps are taken to either reduce or eliminate barriers. It is also stated that, if the barriers to provision of any intervention services are not studied thoroughly, then the intervention is less likely to be successful.²⁰ Furthermore, identification of barriers is important for program implementation, increasing team member/patient participation, and increasing the effectiveness of an existing program.²¹

Very few U.S. dental and dental hygiene student studies have assessed the barriers related to providing tobacco intervention services.^{22,23,24} Only one of the above studies had implemented a tobacco intervention curriculum prior to assessing dental hygiene students.²⁴ Since the barriers identified in each study could be similar, but vary in magnitude or differ with time and settings, it is essential to identify the tobacco intervention-related barriers encountered by University of Iowa dental students.²¹

Thus, the current study assessed the University of Iowa fourth year dental students in 2008 regarding perceived barriers and related factors.

CHAPTER II LITERATURE REVIEW

The purpose of this section is to summarize appropriate information related to factors associated with tobacco intervention services which form the basis for the development of the survey for the fourth year dental students. The literature review is divided into six main components. The document briefly mentions very briefly regarding the role of health professionals in tobacco cessation, followed by studies related to knowledge, attitudes and behaviors of health professionals and health care students. The main emphasis of this section then includes studies that have examined the real and perceived barriers perceived faced by health professionals and students. This section also includes studies related to the development and progress of tobacco cessation curricula in U.S. dental and dental hygiene schools and various tobacco cessation teaching methods employed to educate health professional students. The document concludes with an overall summary of the chapter.

The health professional studies are mentioned first, followed by student studies in the literature review section, since the gaps addressed in the health professional studies encouraged researchers to assess health professional students regarding tobacco intervention services.

The literature indicates that effective tobacco intervention requires co-ordinated efforts from various health professionals and non-health professionals, i.e., insurers, policy-makers, etc.⁸ The following section addresses the importance of involvement of health professionals in treating tobacco dependence.

Involvement of Health Professionals in Treating Tobacco Dependence

Role of Dentists and Dental Hygienists

Dentists are essential health care providers of tobacco intervention services. A dentist who recognizes a patient as a smoker has a duty to inform the patient of the options available to them.²⁵ Tobacco use impact on oral and dental tissues, greater perceived need of current smokers compared to non-smokers and increased duration and frequency of patient visits allow dentists to provide cessation services consistently. Furthermore, dentists should be able to anticipate smoking associated risk factors in adolescents and provide necessary preventive services to children and parents, as mentioned by the NCI guidelines. Dental offices are well suited for applying a “team approach,” as they are comprised of dentists, dental staff and dental hygienists.²⁶ Dental team members’ clarity in terms of tobacco cessation roles and responsibilities, tobacco use tracking systems and non-smoking reception areas are some of the key elements required to facilitate effective intervention services in dental offices. The minimum a dentist should do is use a three step approach of Ask, Advise, and Refer to quitlines after assessing willingness to quit. Dentists can also refer the patients to general practitioners if they have tobacco-related general health complications.

Similarly, dental hygienists have longer duration of dental hygiene appointments (45-75 minutes) and place greater emphasis on oral health prevention activities.²⁷ Additionally, mandatory tobacco cessation training as part of the hygiene curriculum and incorporation of the three step cessation model into the curriculum makes them well suited to provide tobacco cessation services. The literature also states that dental

hygienists demonstrate positive attitudes and behaviors in terms of health education and tobacco cessation promotion and are receptive to adopting and implementing tobacco cessation activities as compared to other health care providers.²⁶ They can also lead cessation services in busy dental offices, if required.

Role of Other Health Professionals

Medical general practitioners (GPs) can easily connect with the general population, as they after have looked after the patients for years and are familiar with a patient's health history, occupation, living conditions and lifestyle.²⁸ Thus, it is critical for the GPs to provide cessation services. Additionally, it is expected that they refer patients to dentists for tobacco associated oral pathological conditions.

Pharmacists have an advantage of interacting with large numbers of patients without requiring appointments.²⁹ Additionally, most of the cessation aids are available without prescriptions, so pharmacists can provide cessation services and incorporate tracking systems for tobacco using patients.

Thus, each health professional is uniquely suited to provide intervention services and brief cessation advice in each profession has been shown to be effective.³⁰ However, health professionals do not provide tobacco cessation services consistently and there are gaps in their knowledge, attitudes and practices related to intervention services. These gaps are addressed in the subsequent sections.

Studies Assessing Health Professionals' Knowledge Related to Tobacco Intervention

This section includes studies related to tobacco intervention knowledge of health professionals and students.

Practitioners

Dentists and Dental Hygienists

Block et al³¹ surveyed health care providers from Minnesota and Wisconsin in order to assess their knowledge, attitudes, behaviors and barriers related to tobacco cessation practices prior to 2000 (year of data collection not provided). There were significant differences among different health professionals concerning the three questions asked related to tobacco knowledge/skills: tobacco counseling skills, awareness of tobacco cessation resources in the community and educational materials for patients. Overall, the dentists reported less favorable responses in the knowledge/skills section (46%) compared to primary care physicians (91%) and nurses (86%). Awareness regarding tobacco cessation resources in the community was highest among nurses (88%), public health nurses (86%) and primary care physicians (83%) compared to 57% of dentists. Similarly, 71% of public health nurses, 62% of nurses and 53% of primary care physicians had educational materials for patients compared to 37% of dentists.

Hu et al³² surveyed 1,500 dentists in East Texas in 2003-2004 to assess their practices and adherence to the Agency of Health Care Policy and Research (AHCPR) tobacco intervention services guidelines and barriers to adherence. The knowledge component was assessed on two questions using a three-point Likert scale. The first question was related to how well the dentists knew the 5A's (Ask, Assess, Advice, Assist

and Arrange follow-up) and 5R's (Relevance, Risks, Rewards, Roadblocks, and Repetition) of the AHCPR guidelines and the second question was related to formal training in using the guidelines either in school or as part of continuing education courses. Almost 89% were unaware of the clinical practice guidelines for tobacco cessation, 10% knew something about the guidelines and only 1% were familiar with the guidelines. Dentists who knew something about the guidelines were twice as likely to assess patients' willingness to quit smoking, two-four times as likely to take various steps to assist smokers with cessation and five times as likely to arrange follow-up visit with the dentist. Almost 11% had received formal training in tobacco cessation and were more likely to practice cessation services. Knowledge of guidelines and training in using the guidelines were also significantly associated with time spent in counseling.

Other Health Professionals

Vaughn et al³³ surveyed the Veterans Health Administration (VHA) physicians for their knowledge, adherence and attitudes related to VHA/AHCPR smoking cessation guidelines and smoking cessation practices. The survey was mailed to 21 of the 22 VHA acute care medical centers in 1999 and yielded a response rate of 50%. Two knowledge-related questions were asked regarding familiarity with the VA smoking cessation guidelines and familiarity regarding the external peer review program (EPRP) data. The EPRP is a VHA-specific quality of care performance measure and also includes smoking cessation guidelines. Forty-four percent indicated unfamiliarity regarding the guidelines, while 44% were very little familiar with the guidelines and 28% were familiar to a great or very great extent. Additionally, only 39% were familiar to a great extent or a very

great extent with the EPRP. However, these physicians provided significant tobacco cessation counseling, pharmacotherapy and follow-up with their patients.

Mas et al³⁴ collected information from New Mexico Hispanic physicians in 2001 regarding tobacco cessation practices, knowledge, self-efficacy and attitudes. Knowledge and skills were assessed based on the physician's familiarity with various guidelines such as those of the AHCPR, NCI, the American Lung Association's (ALA) "Freedom from Smoking" and American Cancer Society's (ACS) "Fresh Start Family". Additionally, participants were also asked regarding their familiarity with the Transtheoretical Model or Stages of Change Model. The questions were assessed on a three-point scale. Sixty-eight percent were not familiar with the 4As or ALA guidelines, 80% weren't aware of ACS guidelines and 78% weren't familiar with the stages of change theory.

Meshack et al³⁵ surveyed 1,500 East Texas pharmacists in 2006 and found that pharmacists trained in the 5As and 5Rs of the clinical practice guidelines for tobacco cessation provided significantly ($p < 0.05$) more cessation counseling as compared to non-trained pharmacists. Additionally, trained pharmacists were more motivated to counsel patients at every visit to quit.

Students

Dental and Dental Hygiene Students

Polychonopoulou et al³⁶ surveyed first and final year dental students in 1999-2000 at the University of Athens dental school. Specifically, 84 entry level and 81 graduating students participated. The students were assessed on ten knowledge-related questions about the effects of tobacco use on general and oral health (type of scale used to assess

knowledge-related responses not specified). The responses of first year and final year students, respectively, included the relationship of smoking and periodontal disease (58% and 96%), impairment of wound healing (41% and 86%), implant failure (13% and 54%), oral candidiasis (17% and 56%), leukoplakia (30% and 98%), oral cancer (91% and 99%), coronary diseases (86% and 96%), lung cancer (99% and 100%), laryngeal carcinoma (92% and 98%), and peripheral arterial disease (91% and 91%). Only 54% of the final year students had knowledge regarding smoking and implant failure association. There was no difference in first and final year knowledge scores for oral cancer, laryngeal carcinoma, and peripheral arterial disease (adjusted for smoking and gender).

Rickard-Bell et al³⁷ assessed Australian dental students' views about smoking cessation counseling and their skills as counselors. The authors surveyed 283 dental students from first to fifth year at the University of Sydney in 2000. The survey included four knowledge-related and seven questions related to policies and practices (scale not specified). Almost 64% of the respondents did not know if the dental school had a written smoking policy. However, most of the students were aware that smoking was prohibited in clinical facilities (89%), non-clinical teaching areas (72%) and public areas associated with clinical facilities (63%). They also indicated that smoking cessation information was not displayed within their teaching institution (68%).

Regarding knowledge-related questions, the majority of the students reported correctly regarding national guideline recommendations for routine assessment of patients' tobacco use (60%), smoking history relevance for patients undergoing implant placement surgery (79%) and advising patients about refraining from smoking if they were about to have oral surgery (80%) and a few students indicated that routine screening

of asymptomatic patients for oral cancer is not recommended (10%). Seventy-three percent of students reported that they were taught oral cancer etiology. However, only 45% indicated that they were taught smoking cessation counseling strategies.

Other Health Professional Students

Schkrohowsky et al³⁸ evaluated attitudes, knowledge and beliefs of first and fourth year medical students in 2003-2004 at three medical schools: Vanderbilt, Colombia and John Hopkins universities. The initial mode of administration was via on-campus mail service for all the three schools. However, the response rates were low for Colombia and John Hopkins universities, hence alternative modes of survey administration were implemented. These included distribution of surveys in class rooms (Colombia), on website (first year John Hopkins students) and via combined campus mail and emails (fourth year John Hopkins students). There were four categories of knowledge-related items (Likert scale not specified) and included smoking related morbidity/mortality (12 items), smoking cessation modalities and effectiveness (10 items), role of physician in smoking cessation (9 items) and tobacco pharmacology (5 items). More than 80% of students reportedly had no previous tobacco cessation training. The mean knowledge score for fourth year medical students was significantly higher than for first year students ($p < 0.001$). Overall, less than 65% of students were aware that smoking was associated with cancers of the kidney, bladder, and pancreas, but significantly more fourth year students were aware as compared to first year students.

Concerning five of the nine physicians' roles in cessation-related questions, patients preferred their physicians for assistance in quit attempts, follow-up visits were efficacious, setting a specific stop date was beneficial, physicians counsel > 75% of their

patients and detect 80% of their patients who smoke, there were significant differences between first and final year students. However, only one question of the five related to nicotine pharmacology (nicotine is a primary stimulant) showed a significant difference between first and final year students. Two of the ten questions on smoking cessation modalities and effectiveness (nicotine replacement therapy was not contraindicated in heart disease and patients with recent myocardial infarction were more likely to quit) showed significant differences between first and final year students. The students tended to underestimate the proportion of smokers who wanted to quit, the average number of quit attempts prior to successful quitting, the value of assistance to smokers attempting to quit and value of nicotine replacement therapy.

The New York City Department of Health and Mental Hygiene conducted a web-based survey of six medical schools in New York in 2004 concerning fourth year students' knowledge related to tobacco cessation.³⁹ The response rate was 50% (469/943). Information was collected regarding knowledge of smoking epidemiology (3 questions), knowledge of treatment and cessation (11 questions), and other related factors (9 questions). Under the knowledge of smoking epidemiology section, 67% correctly estimated the percentage of U.S. adults who smoke. About 87% correctly reported that more than two thirds of smokers start smoking before they are 18. Sixty-five percent had a fair level of knowledge of the health risks of smoking, 35% had excellent knowledge regarding the health risks of secondhand smoke and 27% had excellent knowledge of the health risks of smoking during pregnancy. Under the knowledge of benefits of cessation section, 79% knew that 0 to 15 years were needed for the risk of heart disease to return to normal. About 20% correctly identified the time frame in which the health risk to a

former smoker for developing lung cancer would return to that of a non-smoker and 90% knew that stopping smoking at any age reduces the risk of premature death. Under the knowledge of treatment of nicotine addiction section, 64% correctly estimated the percentage of U.S. smokers who want to quit and 57% correctly estimated the percentage of smokers expected to quit on their own. About 91% recognized that doctors should discuss smoking with their patients at every visit and 69% correctly reported to the statement “it’s true that smokers’ chances of quitting smoking are doubled if a health professional advises him or her to quit.” Forty-eight percent correctly reported the percentage of smokers who quit with provider counseling and NRTs, 99% correctly reported that NRTs are effective for treating nicotine addiction and 96% did not know that bupropion is a helpful cessation medication. About 69% correctly reported that it is false that NRTs are contraindicated for a cardiovascular disease, 23% correctly reported the contraindications of bupropion use in pregnancy, 55% correctly reported that counseling is somewhat ineffective and 16% correctly reported that hypnosis is ineffective. The results indicated that the students had good understanding of smoking epidemiology (79%) and fair understanding of benefits of cessation (67%) and treatment of nicotine addiction (61%). The authors concluded that gaps in the knowledge related to tobacco epidemiology and cessation methods could hamper students’ decision making. The authors also felt that the medical schools were doing a great job in teaching health-related effects of tobacco use, but should also focus more on teaching tobacco cessation methods in the future.

Summary of Knowledge-Related Studies

The nine knowledge-related student and health professional studies above were conducted from 1999-2006 and included U.S. as well as international studies. These studies varied by the type of knowledge-related questions (guidelines, oral and systemic health) asked, settings in which they were conducted and health professional groups surveyed. The health professional studies assessed health professionals' knowledge related to various tobacco cessation guidelines and knowledge about community resources for cessation. However, the student studies asked specific questions about oral and systemic health conditions associated with tobacco use, tobacco cessation methods available and school smoking policies. Tobacco cessation training/knowledge of guidelines was associated with increased tobacco cessation services, time spent in cessation counseling and increased motivation to counsel smokers at every visit to quit in the knowledge-related studies. Health professionals trained in these services were more likely to provide tobacco cessation services. Additionally, student-related studies highlighted the importance of having a strong knowledge in different tobacco cessation methods besides knowledge of health effects related to tobacco use. None of the U.S. dental studies looked at the knowledge component. Knowledge-related questions for the current study were put together after studying the above articles.

Studies Assessing Health Professionals' Attitudes Related to Tobacco Intervention

This section includes studies related to tobacco intervention attitudes of health professionals and students.

Practitioners

Dentists and Dental Hygienists

Fried et al⁴⁰ examined the relationships among dental hygienists' smoking status, attitudes and behaviors toward tobacco intervention in 1988. The surveyed hygienists were from Delaware, Maryland, Pennsylvania, Virginia, West Virginia and the District of Columbia. The respondents showed favorable responses ($\geq 50\%$ agreed+ strongly agreed) for seven of the eight attitudinal statements. Eight-six percent felt that dental professionals should not smoke, 71% of hygienists agreed to their responsibility to counsel, however, less than 60% were prepared to provide counseling services and felt that tobacco counseling was a priority. Forty-nine percent reported that patients would continue to use tobacco despite counseling; however, 66% were ready to repeat counseling attempts despite continued tobacco use by patients. Eighty-one percent agreed to support legislation restricting tobacco advertisement, while only 66% agreed to participate in community programs. Significant differences existed in overall attitudes and behaviors among smokers and non-smokers.

Fried et al⁴¹ also studied smoking behaviors, attitudes and tobacco cessation practices of dentists prior to 1992 (year of data collection not provided). The authors mailed the survey questionnaire to 700 dentists in Maryland had a response rate of 30%. Almost 59% of respondents indicated interest in providing cessation services by their staff and were interested in getting their staff trained in providing cessation services. A five-point Likert scale was used to assess seven attitudinal statements. The attitudinal responses (Agree + Strongly Agree) included importance of tobacco cessation articles in the journals (60%), ban on smoking in dental office reception areas (93%), addressing

tobacco cessation with patient as a potential practice builder (39%), preparedness of tobacco counseling (68%), dentist's responsibility to advise patient to quit smoking (82%), support legislation in restricting the advertisements and usage of tobacco products (83%), and attending continued education courses on cessation (51%). The smoking behavior of the dentists significantly influenced their attitudes.

As mentioned earlier under knowledge-related studies, Block et al³¹ surveyed health care providers from Minnesota and Wisconsin prior to 2000 (year of data collection not provided) and found that there were significant differences among different health professionals on the 10 attitudinal statements. The health professionals who strongly supported tobacco intervention and were interested in receiving training were primary care physicians (94%), public health nurses (95%) and nurses/physician assistants (95%), while fewer specialist physicians (79%), chiropractors (55%), and dentists (53%) supported tobacco intervention ($p < 0.00001$).

Simoyan et al⁴² assessed opinions, attitudes, practices and barriers related to tobacco cessation services of 700 New York state dentists from 1999- 2000. The responses on attitudinal statements (strongly agree + somewhat agree) included dentists' responsibility to encourage tobacco users to quit (72%), most tobacco users would not stop even if their dentist tells them (78%) and smokers have a hard time quitting as they are addicted to nicotine (89%). Seventy-five percent of the dentists were never trained and almost 58% of the respondents were "very willing" to receive training. Attitudinal factors that were significantly associated with tobacco cessation services ($p < 0.05$) were preparedness and agreeing with the opinion that dentists are responsible for helping patients who wish to stop tobacco use.

Albert et al⁴³ administered their survey to dentists recruited for evaluating a CD-ROM and supportive electronic detailing to promote increase in tobacco cessation activities in U.S. The dentists from a large managed care plan (n=184) were assessed in 2003 on knowledge, attitudes, behaviors and related factors. These dentists were randomized either to a CD-ROM group or control group. All the dentists answered a baseline survey prior to randomization. The responses to the four questions under the self-efficacy component included ability to succeed (somewhat successful + successful) in helping patients stop using tobacco (28%), confidence (somewhat confident + confident) in their ability about helping people stop (47%), rating their knowledge about helping people stop using tobacco as good to excellent (45%) and lack of knowledge as a barrier in incorporating tobacco cessation activities (30%). Overall, dentists' knowledge about tobacco intervention was low.

Brady et al⁴⁴ surveyed attitudes, practices, barriers, and level of interest in future training in smoking cessation of New Zealand dentists. A self-administered survey was mailed to all 341 practicing dentists prior to 2004 (year of data collection not provided), resulting in a response rate of 61% (204/341). A three-point Likert scale (very prepared, prepared and not at all prepared) was used to assess preparedness of respondents to provide tobacco intervention services. Sixty-two percent reported that they did not feel prepared to help their patients stop smoking. Fewer younger than older dentists felt prepared to provide cessation services and the proportion of dentists feeling prepared to help increased with each consecutive age group ($p < 0.05$).

Stacey et al⁴⁵ conducted a survey in the United Kingdom to determine the views and activities of dentists, dental hygienists, and dental nurses with respect to delivering

smoking cessation interventions in their own practices prior to 2006 (year of data collection not provided). Two questions were asked related to importance of the smoking cessation role for the dental team and general medical practitioners. Ninety-six percent of the dentists, 94% of dental hygienists and 89% of dental nurses felt that dental team should provide cessation advice, while 100% of dentists, 100% of dental hygienists and 99% of dental nurses felt that it was important for physicians to offer cessation advice. Overall, 90% of dentists, dental hygienists and dental nurses reported that dental hygienists should provide cessation services.

Edwards et al⁴⁶ assessed dentists' and dental hygienists' confidence and barriers related to tobacco intervention services. All 661 dentists and 73 dental hygienists registered in South Australia were mailed surveys prior to 2006 (year of the data collection not provided). The authors reported mean values for eight confidence-related statements regarding tobacco intervention services. The lowest four mean values (data reported in mean values and percentages not provided) for the confidence statements reported by the dentists and dental hygienists, respectively, included increased patient motivation to quit (2.36, 2.86), spending time assessing patients to quit (2.21, 2.86), engaging all staff members in the process (2.07, 2.60) and assessing and referring to pharmacist or medical general practitioners (2.00, 2.34).

Other Health Professionals

Young et al⁴⁷ surveyed randomly selected medical general practitioners (GPs) in New South Wales to ascertain opinions, current practices, likely readiness to change and perceived barriers to change in 1997. The responses to the four attitudinal statements (strongly agree + agree) included “my anti-smoking advice is more effective when it is

linked to individual's presenting problem" (81%), "I can be very effective in persuading some of my patients to stop smoking" (57%), "when patients continue to smoke despite repeated advice to stop, my anti-smoking advice can still have a worthwhile effect" (42%), and "my anti-smoking advice is more effective than any other anti-smoking education my patients receive" (28%).

As mentioned earlier under knowledge-related studies, Mas et al³⁴ collected information regarding tobacco cessation counseling self-efficacy and attitudes from New Mexico Hispanic physicians in 2001. Three attitudinal and three self-efficacy questions were asked that were assessed on a four-point Likert scale. Ninety percent felt that it was the physician's responsibility to provide counseling to patients who smoke, 71% agreed to the statement that "most patients expect them to provide counseling" and 73% agreed that "the advice of a physician increases quitting rates". However, only 27% were confident about getting patients to reduce smoking, 11% were confident about being able to get their patients to quit and 20% were confident about being able to reduce patients' exposure to secondhand smoke. The two variables "self-efficacy" and "female gender" were strongly associated with provision of tobacco intervention services in the final model.

Aquilino et al⁴⁸ surveyed the Iowa community pharmacies related to tobacco cessation practices in 2002. Seventy-eight percent of the pharmacists indicated that they were prepared to provide counseling, but fewer than 25 percent had received formal training or were aware of national clinical practice guidelines. Ninety-nine percent reported the importance of pharmacists providing cessation services, 75% felt that it was "moderately to extremely important" for them to know if a patient smoked and 67% of

pharmacists felt that they were able to respond at least most of the time to patient requests concerning smoking cessation and discuss specific treatment options for smoking cessation.

Students

Dental and Dental Hygiene Students

Yip et al²² intended to plan a didactic program related to tobacco cessation. To do so, the authors conducted a survey of fourth year dental students at the New York University College of Dentistry prior to 2000 (year of data collection not provided). Demographic information was collected and questions were asked about their personal tobacco use history, prior formal training in tobacco cessation, the degree to which they felt prepared to help patients stop using tobacco, and their attitudes, practices and barriers related to tobacco intervention services. The 29-item questionnaire was adapted from the work of the National Dental Tobacco Free Steering Committee (NDTFSC). The response rate was 81% (244/302).

A five-point Likert scale was used to assess nine attitudinal statements and the responses included dental professionals' responsibility to convince smokers to stop (71%), dental professionals' responsibility to aid smokers in quitting (73%), dental professionals should set an example by avoiding tobacco (74%), dental professionals' time is better spent on doing other things (39%) and dental professionals should speak to lay groups about tobacco use (71%).

Although, 85% agreed that most tobacco users have a hard time quitting due to addiction, 78% of dental students reported they thought that most patients would continue to use tobacco despite the dentist's advice to quit. While 41% agreed that most tobacco

users can stop if they want to, 32% reported that people have enough problems without adding to them by trying to quit. Only 12% of students had received formal tobacco cessation training. However, 60% students felt that they were adequately prepared to assist in cessation. Students who reported more favorable attitudes toward dentists' roles in tobacco cessation services were more likely to provide counseling. The results indicated that dental students had favorable attitudes toward dentists providing cessation services. However, they were unsure about patient-related factors.

As mentioned earlier under knowledge-related studies, Polychonopoulou et al³⁶ surveyed first and final year dental students regarding tobacco intervention services at the University of Athens dental school in 1999-2000. Eighty-nine percent of students considered tobacco counseling as a duty of every dentist and 88% reported cessation as an important activity. However, attitudes between ever smokers and never smokers differed significantly for these statements: “most smokers will not stop just because the dentist advises them” ($p < 0.02$), “patient will accept advice from the dentist on tobacco cessation” ($p < 0.05$) and “healthcare workers must present a good example by not smoking” ($p < 0.01$). Overall, 51% of students responded as being unprepared for giving tobacco cessation advice to patients and 92% of the students stated that they had not received any training related to tobacco cessation. Eighty-six percent were willing to attend special training on tobacco cessation and more entry level students showed interest in the training as compared to the graduating students.

As mentioned earlier under knowledge-related studies, Rikard-Bell et al³⁷ surveyed Australian dental students at the University of Sydney in 2000. Three questions concerning attitudes were assessed on a three-point Likert scale. Eighty-eight percent of

students planned to advise their patients regarding tobacco use in the future. More students in their final year (89%) agreed to advise compared to students in their first year (83%) ($p=0.04$). Overall, only 52% of students agreed that such counseling would assist patients to quit. The authors did not provide responses for the third question, “whether such counseling would alienate the patients.”

Cannick et al⁴⁹ assessed South Carolina dental students’ views on tobacco intervention services. This study was a part of a larger study on oral cancer prevention and detection where first through fourth year dental students answered a questionnaire in 2002. The overall response rate was 80%. However, the response rate from the senior class alone was only 41%. The knowledge-related questions were concerning oral cancer prevention and early detection and were reported in a separate study⁵⁰ by the same authors.

The dental students were assessed on nine tobacco intervention related questions that were assessed on a five-point Likert scale and included agreement about their training in tobacco cessation education, perceived role of dentists in prevention and cessation counseling, and confidence in their ability to assess and treat tobacco use and nicotine dependence. It was found that females had more favorable responses about the role and training of dentists compared to males. Likewise, freshman had more favorable attitudes than sophomores. Students who believed that type and amount of tobacco use should be assessed when taking a medical history reported more favorable attitudes than those who did not think it was part of the history taking process. Overall, majority of the students reported lack of training (61%) and being uncomfortable (only 14% confident) during provision of tobacco intervention services.

Victoroff et al²³ surveyed incoming dental students' attitudes at the Case Western Reserve University, School of Dental Medicine. The authors used a 26-item survey and administered it to 140 incoming dental students during orientation weeks in 2002 and 2003. The students' attitudes were assessed on the 5As of the Clinical Practice Guidelines and a five-point Likert scale was used. The attitudinal statements were modified from the Yip et al²² study that surveyed fourth year dental students. Seventy-six percent reported agreement (agree + strongly agree) to educate patients about the risks of tobacco use related to overall health and well-being, 92% reported agreement to educate patients about the risks of tobacco use related to oral health and 81% reported agreement to encourage patients to quit using tobacco. Almost, 87% reported agreement to ask patients if they use tobacco, 85% reported agreement to advise patients to quit using tobacco, 94% reported agreement to discuss health hazards of tobacco use and 91% reported agreement to discuss benefits of stopping. However, less than 75% reported agreement to assist the patients in quitting related strategies. For example, 70% reported agreement to discuss specific strategies for stopping, 45% reported agreement to prescribe nicotine gum, 42% reported agreement to prescribe nicotine transdermal patch and 70% reported agreement to refer to cessation clinic or other health care professional. Similarly, 69% reported agreement with the statement that tobacco use cessation counseling offered in the dental office can have an impact on patients' quitting and 21% reported agreement with the statement that dental professional's time can be much better spent doing things other than trying to reduce tobacco use in patients. However, 78% reported agreement with the statement that it is not worth discussing tobacco use with patients since most people already know they should quit. Nearly one quarter (23%) of the students were "only

slightly interested” or “not interested” in receiving tobacco cessation training. The students agreed that dentists have an important role in cessation services; however, they were more comfortable advising and referring the patients rather than assisting them to quit.

Fried et al⁵¹ surveyed health professional students at the University of Maryland, Baltimore campus. A 22-item close-ended and pilot tested survey was distributed to the students during their didactic classes prior to 2004 (year of data collection not provided). The sample size and response rate for each school were: senior students from dental hygiene (n=19, 95%), dentistry (n=60, 62%), nursing (n=62, 87%), pharmacy (n=61, 98%) and physical therapy (n=57, 100%) and junior students from medical school (n=84, 60%). Responses to four attitudinal statements were collected from the students (scale not specified). Although many students agreed to their responsibility to help smokers quit (90%) and smokeless tobacco users quit (88%), very few students agreed that their programs adequately prepared them to help smokers quit (47%) or smokeless tobacco users quit (31%). Almost 72% of students agreed that their professional program contained course content concerning their role in helping tobacco users quit. At least 70% of the students from each of the six professions agreed that it was their professional responsibility to help smokers quit and at least 65% agreed to help smokeless tobacco users quit. All dental hygiene and 85% of dental students agreed that their programs had course content describing their role in helping patients quit tobacco use. About 95% of dental hygiene students and less than 40% of dental students agreed that they were adequately prepared to help smokers quit. Almost 90% of dental hygiene students agreed

significantly ($p < 0.001$) that they were adequately trained to help smokeless tobacco users quit, compared to other health professionals ($< 34\%$).

Boyd et al²⁴ surveyed the entire graduating class of 30 female dental hygiene students at the Oregon Health and Science University prior to 2006 (year of data collection not provided). The university had a two-hour tobacco intervention training program which included a one hour didactic lecture on tobacco and oral diseases, methods for assisting patients to quit, and relapse prevention strategies, while the second hour included group discussions and role-playing in order to improve clinical skills. Students were also provided with resources for independent learning and were expected to counsel patients in the clinics. The response rate was 67%. The 30-item questionnaire explored the adequacy of training these students had in their undergraduate dental education and was administered in one of the seminar classes prior to 2006 (year of data collection not provided). The response rate was 67%. The students rated their tobacco cessation skills between 3 and 4 on a six-point Likert scale (1 = highly skilled to 6 = inadequately prepared). All the students strongly agreed that intervention services were appropriate for dental practice and nearly 70% reported delivering a preventive message for up to half of patients with no history of tobacco dependence.

Harris et al⁵² surveyed the senior students in 2006–07 from all the 12 North Carolina dental hygiene programs. The goal of their study was to gather baseline data in order to assess whether these schools were integrating tobacco use cessation programs into their curricula. A 26-item survey was developed and included the three domains of didactic course coverage of tobacco use cessation education topics, tobacco use cessation education for patients in the teaching clinics and students' attitudes. The response rate

was 65% (n=156/241). Ten statements related to students' comfort level with specific tobacco cessation actions were assessed. These statements were (strongly agree or agree): asking patients if they use tobacco (100%), discussing with the patient potential benefits of quitting (100%), discussing the oral health effects of tobacco use with the patient (100%), discussing the general health effects of tobacco use (99%), providing referral resources to patients (95%), providing tobacco cessation education to spit tobacco users (93%), providing tobacco cessation education to smokers (92%), providing tailored cessation messages to patients who want to quit (91%), identifying barriers that the patient may face while quitting tobacco use (89%) and providing quit messages to patients who are unwilling to quit (74%). Sixty-six percent reported their interest in attending a continuing education (CE) course related to tobacco intervention in the future. Respondents were significantly more likely to be interested in taking a CE course if they reported feeling comfortable with discussing the adverse oral health effects of tobacco use (OR=3.5, $p<0.003$), potential benefits of quitting (OR=2.6, $p<0.001$), identifying barriers patients may face while quitting tobacco (OR=3.4, $p<0.02$) and providing quit messages to patients who are unwilling to quit (OR=3.1, $p<0.005$). Most of the respondents agreed that dental hygienists should be trained to provide tobacco cessation education (99%). Ninety-nine percent of the respondents agreed that they will know how to obtain patient tobacco cessation education materials in private practice and 90% agreed that they were adequately trained to provide tobacco intervention services.

Other Health Professional Students

As mentioned previously under knowledge-related studies, Schkrohowsky et al³⁸ evaluated attitudes, knowledge and beliefs of first and fourth year medical students in

2003-2004. Six attitudinal statements were assessed on a three-point Likert scale. More than 90% of students reported their cessation efforts to be worthwhile. In comparison to first year students, fourth year students were significantly less likely to report need for further training and fear of losing patients by discussing smoking cessation. They also reported having more counseling skills compared to other health professionals, reported being more capable of helping patients stop smoking and greater ease talking about smoking with patients. However, 74% of fourth year students reported that they still required further skills in counseling their patients to quit smoking. Overall, students indicated favorable attitudes about smoking cessation efforts.

As mentioned under above acknowledged attitude-related studies, Fried et al⁵¹ surveyed the health professional students at the University of Maryland, Baltimore campus prior to 2004 (year of data collection not provided). Eighty-six percent of medical students, all pharmacy students, 59% of nursing students and 15% of physical therapy students agreed that their program had course content describing their role in helping patients quit tobacco, while 54% of medical students, 84% of pharmacy students, and less than 40% of the physical therapy and nursing students felt adequately prepared to help smokers quit.

Geller et al⁵³ examined second and fourth year medical students' self-reported skills and practice opportunities to provide cessation services in 10 U.S. medical schools participating in the Prevention and Cessation Education project (PACE). Currently, 12 medical schools are part of PACE project. The survey was administered to 1,229 second and 1,181 fourth year students at 10 medical schools in 2004-2005. The combined response rate was 70% (860- second, 827-fourth year students). The students were

assessed on courses and training for tobacco cessation and prevention they received in various medical departments, self-reported skills, practice opportunities, observation of services under faculty member and confidence in the ability to change behavior. Six questions related to skills were asked on a four point Likert scale. The second year students reported being “very” or “moderately” skilled (assessed on a four-point scale) in asking patients about tobacco use (73%), but less skilled in specific cessation activities (Advise - 60%, Assess – 54%, Assist – 34% and Arrange - 44%). The fourth year students reported being “very” or “moderately” skilled in advising patients (80%), however, they reported less skills in other cessation activities (Assist – 60% and Arrange – 63%). Confidence and self-efficacy skills were low in fourth year students as compared to second year students. Fourth year students were less likely to strongly agree that they could prevent young people from smoking ($p < 0.001$), convince patients to quit ($p = 0.0019$) or have impact on smoking behaviors ($p = 0.03$).

Summary of Attitude-Related Studies

Overall, 21 studies from 1988 – 2007 assessed health professionals’ and students’ attitudes related to tobacco intervention services. These studies included U.S. as well as international studies. The key components examined under the attitude domain included importance of health professionals’/students’ role in providing cessation services, self-efficacy/preparedness related to providing cessation services, belief that the cessation services would be effective and willingness/preparedness in receiving tobacco cessation related training. Additionally, the studies also looked at health professionals’/students’ participation in community programs, supporting of legislation in restricting the advertisements and usage of tobacco products, views regarding health professionals using

tobacco and attitudes toward patient-related factors like resistance and impact of cessation services on the health professional–patient relationship.

Almost all the health professionals and health professional students agreed favorably to their role or their importance in tobacco cessation services. Preparedness to provide cessation services was in the range of 27% - 78% for all health professional groups. Likewise, preparedness to provide cessation services was reportedly in the range of 51% to 90% for different groups of health professional students. Willingness to receive training was about 58% for health professionals^{41,42}, but varied for student studies. One study reported incoming students' lack of interest in receiving training.²³ Sixty-six percent of dentists⁴⁰ and 71% of fourth year dental students²² indicated interest in community programs related to tobacco intervention services/speaking to lay groups regarding intervention services. All the studies that looked at patient-related attitudes of health professionals and students indicated less favorable attitudes toward patients' willingness to quit compared to attitudes related to their roles and responsibilities in providing intervention services.

Some studies also looked at combined attitudes of all the dental students from first to last year of their study^{36,37} and reported significant differences in attitudes by year of study, with senior students showing more favorable attitudes toward tobacco cessation services³⁸. Differences in the attitudes between smokers and non-smokers were found toward tobacco intervention services.^{36,40,41} Increase in age was associated with increased preparedness of New Zealand dentists⁴⁴ and increase in self-efficacy of Mexican physicians³⁴ was associated with increased cessation counseling. Fourth year dental students with more favorable attitudes toward dentists providing cessation services were

associated with an increase in tobacco cessation counseling.²² Additionally, gender (females) and students who believed that type and amount of tobacco use should be assessed when taking a medical history also reported more favorable attitudes.⁴⁹

Each study differed in terms of location, purpose for assessing attitudes and population assessed (comparison among different health professionals, comparison among dental team members, etc.). Health professionals accept the importance of their role in providing cessation services. However, low patient-related attitudes and lack of preparedness remain the key factors that caused variability in the attitude-related responses. All the above studies provided comprehensive understanding of various attitudinal factors associated with cessation services that helped in developing the attitudes composite related to the current study questionnaire.

Studies Assessing Health Professionals’ Behaviors Related to Tobacco Intervention

This section includes studies related to tobacco intervention practices of health professionals and students.

Practitioners

Dentists and Dental Hygienists

Dolan et al⁵⁴ surveyed dentists (general practitioners, Periodontists, Pediatric dentists) and dental hygienists from three U.S. geographical regions in 1994. They collected data on tobacco cessation attitudes, practices, and barriers and compared practice behaviors by provider type, specialty, region and other provider characteristics. Factors associated with greater tobacco cessation activities for smokers were race, i.e.,

whites (74%), U.S. geographic locations (Region 1: New England, Middle Atlantic and South Atlantic states advised more compared to Region 2: East south Central, East North Central, West North Central and West South Central and Region 3: Mountain and Pacific states) and dentists not using any tobacco (76%) ($p < 0.05$). Factors associated with greater tobacco cessation activities for smokeless tobacco users were gender, i.e., males (79%), race, i.e., white dentists (30%), and dentists employing one or more dental hygienists (34%) ($p < 0.05$). Only Periodontists routinely asked their patients about tobacco use, had received formal training and were more prepared to provide cessation services as compared to others. Overall, very few dentists routinely offered cessation services to their patients.

As mentioned earlier under knowledge-related studies, Hu et al³² surveyed 1,500 dentists in East Texas to assess their tobacco cessation practices (five-point Likert scale used) in 2003-2004. The percentage of dentists who usually or always counseled were dentists who had received formal training, female dentists and dentists who had graduated less than 27 years earlier. Training was a crucial factor in providing cessation counseling.

As mentioned previously under attitude-related studies, Simoyan et al⁴² assessed opinions and attitudes of dentists in New York State in 1999-2000 related to tobacco intervention services and related barriers. Factors that were significantly associated with tobacco cessation services ($p < 0.05$) were preparedness, availability of educational materials in the reception area, being a Periodontist and agreeing with the opinion that dentists are responsible for helping patients who wish to stop tobacco use. The authors concluded by stating that New York dentists did not routinely engage in the provision of

tobacco cessation services, despite recommendations to do so, and training was an important factor to prepare dentists to provide cessation services.

Albert et al⁵⁵ surveyed the dental offices enrolled in the Aetna dental insurance plan in 2000-2001 regarding tobacco intervention services. Eighty-two percent of patients were informed regarding the association between tobacco and general health. Ninety-five percent of dentists were willing or very willing to get trained in tobacco intervention services. Almost 13% reported that lack of time was not an issue for them and around 25% of dentists felt that reimbursement was not a barrier. Only 9% were trained to provide cessation services. Around 19% asked about tobacco use, 26% advised, 12% recorded counseling behaviors in the chart and 10% assisted patients with nicotine replacement therapies (NRTs) use during the past month with more than 80% of their patients. Average time spent in counseling was associated with discussions of specific strategies to quit and NRTs-related advice and dentists who were confident about their cessation knowledge advised their patients to quit more frequently.

Baker et al⁵⁶ assessed tobacco intervention practice behaviors and attitudes of alumni trained in the didactic and clinical program at University of Missouri-Kansas City, School of Dentistry (UMKC). A total of 113 dental hygienists and 338 dental alumni who graduated from 1993-1997 were surveyed prior to 2001 (year of data collection not provided). The questions were asked about the type of activities respondents were utilizing in clinical practice, based upon UMKC's tobacco cessation clinic program format suggested by NCI guidelines. A large proportion of respondents reportedly asked their patients about tobacco use (100% RDH, 88% DDS) documented their tobacco use (96% RDH, 82% DDS) and advised patients about tobacco cessation

options (98% RDH, 87% DDS). Dental hygienists provided more counseling services as compared to the dentists. Smaller proportions of respondents in both groups implemented activities such as referring patients to cessation counselors/support groups, setting a “quit date” and distributing self-help materials in their practices. A large proportion of alumni gave credit to the scientific evidence of tobacco’s effect on oral health (94% RDH and 94% DDS) and involvement in the school of dentistry’s tobacco cessation clinical program (78% RDH and 83% DDS).

Watt et al⁵⁷ did a two phase project, initially comprised of a baseline survey of the U.K. dental team, followed by focus group discussions on barriers encountered during provision of cessation services. The aim of this study was to assess experiences, attitudes and perceived barriers toward tobacco cessation services. The authors mailed surveys to all 250 general practitioner dentists in South Essex, England from 2001-2002. In the second phase of the study, ten dental practices from South Essex were selected for focus group discussion. The focus group selection was done with a stratified sampling method to ensure a diverse range of practices in the discussion. Each group was comprised of 3-8 total members and included dentists, dental hygienists, dental nurses, receptionists, and practice managers. All the conversations were tape-recorded and themes were developed and refined to correspond with the data of the study. Results on current practices in relation to smoking cessation (scale not specified) indicated that a high percentage of dentists asked their patients about tobacco use (90%), while almost 82% of the dentists reportedly advised patients. The advice was mainly focused on patients with poor periodontal health, and activities like giving support to stop smoking, giving advice on

NRT, and referrals to specialists for smoking cessation services were conducted on very small scale.

Brothwell et al⁵⁸ assessed brief intervention counseling (BIC) practices and perceived barriers encountered by Manitoba dentists and dental hygienists in 2003. Five hundred and forty-seven dentists and 566 dental hygienists were eligible to participate. The response rate was 46% (514/1113). Only 33% of respondents reported asking most ($\geq 75\%$) patients regarding smoking status. Women were more likely to ask ($p < 0.01$) as compared to men. There was no significant difference between the dentists and dental hygienists. Almost 55% advised patients most of the time. Forty percent assessed willingness to quit, with more women and dental hygienists doing so as compared to men and dentists ($p < 0.05$). The mean age of those assessing most patients' interest in quitting was significantly lower than that of those who assessed less often ($p < 0.001$). Only 23% assisted patients in quitting, and women and hygienists were more likely to assist as compared to men and dentists ($p < 0.01$). Overall, the oral health professionals were not providing BIC to most of their tobacco-using patients. Only 37% of practitioners reported feeling at least adequately prepared to assist their smokers to quit.

As mentioned previously under attitude-related studies, Albert et al⁴³ administered their survey to U.S. dentists recruited for evaluating a CD-ROM and supportive electronic detailing to promote increase in tobacco cessation activities in 2003. Confidence in the effectiveness of counseling on tobacco cessation was the strongest predictor of *Ask* behavior. When dentists were confident in their cessation knowledge, they were six times as likely ($OR = 5.83$, $p < 0.001$) to ask their patients about tobacco use. Asking patients about tobacco use was the strongest predictor of *Advice* behavior. When

dentists asked the patients about tobacco use, they were seven times as likely (OR=7.15, $p<0.001$) to advise their patients to quit. Advising patients to quit was the strongest predictor of *Assist* behavior. When dentists advised about tobacco use, they were 13 times as likely (OR=12.77, $p<0.001$) to assist or discuss specific strategies for quitting with their patients. The discussion of specific strategies to quit was the strongest predictor of *Arrange* behavior. When dentists discussed specific strategies to quit, they were 12 times as likely (OR=12.29, $p<0.001$) to engage in *Arrange* behavior or follow-up with their patients. Overall, the tobacco cessation behaviors of the dentists were very low.

As mentioned earlier under attitude-related studies, Brady et al⁴⁴ surveyed attitudes, practices, barriers, and level of interest in future smoking cessation training of New Zealand dentists prior to 2004 (year of data collection not provided). A three-point Likert scale was used to assess practices. Forty percent of dentists routinely asked, routinely recorded smoking status (35%), routinely asked if patients wanted to quit (31%) routinely advised (47%). Concerning tobacco intervention practices, more male dentists “seldom” or “never” asked or recorded patient’s smoking status as compared to females ($p<0.01$). The frequency of asking the patients regarding their tobacco use status also varied by geographic location in New Zealand.

As mentioned earlier under attitude-related studies, Stacey et al⁴⁵ conducted a survey in the United Kingdom to determine the views and activities of dentists, dental hygienists, and dental nurses with respect to the delivering of smoking cessation interventions in their own practices prior to 2006 (year of data collection not provided). It is not known about the scale used to assess practices. Ninety-two percent of dentists inquired about smoking status when patients presented with white lesions and 67%

inquired of those when patients presented with periodontal disease. Seventy-four percent of hygienists inquired about smoking status of their patients when patients presented with periodontal disease. Fewer dental nurses (26%) had knowledge of smoking cessation activities as compared to dentists (42%) and dental hygienists (47%) ($p < 0.005$).

Other Health Professionals

Gottlieb et al⁵⁹ assessed one hundred and ten family practice residents from four Texas residency programs for tobacco cessation counseling practices in 1997-1998. The behaviors were assessed on a six-point Likert scale. A lower percentage of residents reported that they “usually” or “always” advised patients to set a specific quit date (22%), prepared a patient for withdrawal symptoms (17%), and provided self-help material (15%) as compared to the Ask and Advise steps of the cessation intervention. A large proportion of residents (76%) never telephoned a patient after the quit date and 54% of residents never referred patients to smoking-cessation programs. The third-year residents did more counseling compared to first year-residents. The majority of residents reported that they were “somewhat” (61%) or “quite” (15%) effective at changing their patients’ behaviors with respect to smoking cessation. Overall, year of residency, perceived effectiveness of tobacco cessation counseling and the interaction between perceived effectiveness and residency year were significantly associated with number of counseling behaviors. Year of residency and perceived effectiveness were also significantly associated with counseling duration.

As mentioned earlier under attitude-related studies, Young et al⁶⁵ surveyed randomly selected Australian medical General Practitioners (GPs) regarding tobacco cessation practices in 1997. Six of the 17 cessation approaches stated were used by the

practitioners (“always” and “frequently” combined) to help patients to stop smoking. The approaches included personal advice (92%), recommending nicotine replacement therapy (75%), assessing patient’s stage of change (72%), advising about withdrawal symptoms (66%), discussing effects of passive smoking on other family members (65%) and giving behavioral advice about quitting (57%). Only 34% of respondents reported providing cessation advice during every routine consultation with a smoker, in accordance with national guidelines. Respondents who ‘always’ used a reminder system in their offices were significantly ($p=0.002$) more likely to provide advice. Only 54% ‘always’ or ‘frequently’ arranged follow-up, 32% provided written materials and 28% set a ‘quit date.’ Twenty-eight percent of GPs wanted to increase tobacco cessation services, while almost 50% perceived that they already provided this advice routinely.

As mentioned previously under knowledge- and attitude-related studies, Block et al³¹ surveyed health care providers from Minnesota and Wisconsin in order to assess their knowledge, attitudes, behaviors and barriers related to tobacco cessation practices prior to 2000 (year of data collection not provided). The tobacco cessation practices were divided into two categories- “assessment” and “intervention” practices. Overall, 59% of health providers consistently asked patients regarding tobacco use. Public health nurses, primary care physicians, and nurses were more likely to ask the patients as compared to other healthcare providers ($p<0.00001$). Providers’ intervention practices included recommendations of pharmacological aids (4 items about recommending nicotine patch, gum, nasal spray or inhaler) and referral to community resources. The overall rate for consistently providing pharmacological recommendations was much lower (10%) as compared to asking the patients ($p<0.00001$). Routine referrals were more consistently

provided by public health nurses, primary care physicians and nurses as compared to other health care practitioners ($p < 0.00001$).

Hu et al⁶⁰ surveyed 1,955 East Texas physicians regarding their views and practices about tobacco cessation in 2000. About 49% reportedly always asked, 55% always advised, and 16% always prepared the patients regarding withdrawal symptoms. About 19% always helped the patients in obtaining extra-treatment social support, 26% always provided intra-treatment social support, and 13% always provided practical counseling to cope with triggers and help quit. About 46% reported that they found bupropion to be effective as compared to other drugs. Overall, 45% never did follow-up for tobacco-using patients. Only 26% felt that they were effective in changing patients' smoking behaviors. However, 76% were confident regarding their counseling knowledge and skills.

As mentioned earlier under knowledge-, attitude-related studies, Mas et al³⁴ collected information regarding tobacco cessation practices from New Mexico Hispanic physicians in 2001. Nine items assessed tobacco counseling behaviors and included cigarette smoking, exposure to secondhand smoke, nicotine replacement drugs (NRTs), and other cessation treatments and behavioral change programs. About 44% routinely asked, 24% routinely assisted, 3% routinely arranged follow-up visits and 36% routinely prescribed NRTs. About 4% used behavior change techniques or referred to programs that used these approaches and 15% asked patients regarding their exposure to secondhand smoke. Overall, the respondents reported low levels of compliance with the AHCPR guidelines.

As mentioned earlier under attitude-related studies, Aquilino et al⁴⁸ surveyed the Iowa Community Pharmacies in 2002. Characteristics of pharmacists who routinely offered cessation services were staff pharmacists as compared to owners, full-time pharmacists, those who received specific training ($p=0.02$) and those who had recently attended an educational program on smoking cessation ($p=0.014$). The pharmacists were more likely to write prescriptions compared to counseling patients related to smoking cessation. Moreover, pharmacists with the highest levels of education provided the least counseling. Future recommendations given by the authors included inclusion of a tracking system in the pharmacy to track tobacco using patients and incorporating behavior modification and the Transtheoretical Model into pharmacy schools, which would help the pharmacists in assessing various stages of smokers and helping them in selecting appropriate cessation strategies.

Students

Dental and Dental Hygiene Students

As mentioned earlier under attitude-related studies, Yip et al²² surveyed the fourth year dental students regarding their tobacco cessation practices prior to 2000 (year of data collection not provided). Concerning their previous three month's clinical experience, the fourth-year students estimated their frequency of delivering specific cessation counseling practices regarding cigarette smoking and smokeless tobacco on a scale ranging from nearly all (91-100%), most (75-90%), majority (51-74%), some (25-50%), a few (1-24%) to none (0%) of the time. They also created a summary score for the 4As (Ask, Advise, Assist and Arrange follow-up related to tobacco intervention services),

in order to assess the magnitude of adherence. The summary score ranged from a maximum of 4 to a minimum of 0.

Sixty-nine percent asked about smoking status, 58% advised, 24% offered assistance and 22% provided follow-up on routine basis (>75% of the time). Current smokers provided more counseling and were more likely to have undergone formal training ($p<0.05$). Those students who did not feel that the time factor was a barrier and those who had more favorable attitudes toward the dentist's role in promoting cessation services provided more tobacco intervention. The mean summary score for providing counseling was 1.45 (on a scale of 0-4). Only 6% reported routine adherence to full cessation guidelines. Twenty-two percent did not provide any cessation counseling.

As mentioned earlier under knowledge- and attitude-related studies, Rikard-Bell et al³⁷ surveyed Australian dental students at the University of Sydney in 2000. Although the majority of the students indicated that they were expected to give anti-smoking advice to their patients (82%), only 45% indicated that they were taught smoking cessation counseling strategies. The behaviors were assessed on a five-point Likert scale. Students were significantly more likely to ask about patients' smoking status than counsel about the effects of smoking on oral health ($p<0.001$). Students' confidence in asking the patients about smoking status increased with the year of study ($p<0.001$), however, the confidence to counsel regarding quitting remained low and did not differ by year of study ($p=0.42$). Only 22% of students had assisted smoking patients to quit during their training.

As mentioned earlier under attitude-related studies, Boyd et al²⁴ surveyed the entire graduating class of 30 dental hygiene students at the Oregon Health and Science

University prior to 2006 (year of data collection not provided). The behaviors were assessed on a six-point Likert scale. Only one student reported assisting the patients *nearly all* of the time. The combined responses for “*a few*” (1-24%) and “*some*” categories (25-50%) assessing behaviors related to tobacco intervention services included asking about tobacco use (n=13, 65%), advising regarding quitting (n=16, 80%), assessing level of readiness to quit (n=8, 40%). Additionally, for “*a few*” (1-24%) and “*some*” (25-50%) responses combined, 60% (n=12) assessed quitting attempts, 40% (n=8) assessed level of nicotine addiction, 50% (n=10) assessed contraindications of pharmacologic smoking cessation aids and 35% (n=7) discussed patient’s personal risks and barriers. Sixty-five percent (n=13) provided educational pamphlets for cessation and 60% (n=12) provided pamphlets on periodontal disease and tobacco use. Small proportions of students provided lists of web-based tobacco information sites, information on Zyban, and information on and prescription of nicotine replacement therapy. Fifteen percent of the students reported assisting patients in cessation on three or more occasions and 35% of the students arranged follow-up with the patient trying to quit at an appointment rather than making a call or emailing or mailing the patients.

As mentioned previously under attitude-related studies, Harris et al⁵² surveyed senior students in 2006–07 from all 12 North Carolina dental hygiene programs. Eighty-two percent of the respondents indicated that their clinics’ medical history form asked patients regarding their tobacco use status. Nearly all respondents reported treating patients who smoked and 81% reported treating patients who used smokeless tobacco. The tobacco intervention behaviors for all tobacco-using patients were (always): discussed the oral health effects of tobacco use (67%), encouraged their patients to quit (66%),

discussed potential benefits of quitting (63%), discussed the general health effects of tobacco (58%) and talked with their patients about the patient's tobacco use (58%). For more than half of their clinic patients (often) the responses were: 68% tailored cessation messages, 56% helped the patient identify barriers to quitting, 53% provided tobacco cessation handouts, 53% repeated messages to patients unwilling to quit, 43% followed up on the progress of a patient's quit attempt, 40% recommended over-the-counter nicotine replacement products and 30% created a quit plan. However, 26% reported never creating a quit plan with a patient, 23% indicated that they never followed-up on the progress of a patient's quit attempt and 19% never recommended over-the-counter nicotine replacement products to their patients. Students who attended a greater number of tobacco cessation didactic classes were significantly more likely to report creating a quit plan with patients ($p=0.02$), tailoring cessation messages to patients ($p=0.01$), providing patients with tobacco cessation handouts ($p=0.01$) and recommending over-the-counter nicotine replacement products to patients ($p=0.04$).

Respondents who did not use tobacco were three times more likely to encourage tobacco-using patients to quit, 2.9 times more likely to discuss potential benefits of quitting and 2.7 times more likely to discuss general adverse health effects of tobacco with the patient. Respondents who did not use tobacco were 3.3 times more likely to tailor cessation messages to the patient who was trying to quit and 3.6 times more likely to help the patient identify barriers to quitting tobacco use. Respondents who did not use tobacco were 2.7 times more likely to strongly agree with being comfortable discussing the benefits of quitting than respondents who use tobacco ($p=0.02$).

Other Health Professional Students

As mentioned previously under knowledge- and attitude-related studies, Schkrohowsky et al³⁸ evaluated attitudes, knowledge and beliefs of first and fourth year students of three U.S. medical schools in 2003-2004. Two questions regarding anticipated behaviors indicated that fourth year students were significantly more likely than first-year students to report that they would detect 70% or more of their patients who smoked ($p < 0.001$) and reported that they would ask 70% or more of their patients about tobacco use ($p = 0.018$).

As mentioned previously under attitude studies, Geller et al⁵³ examined second and fourth year medical students' self-reported skills and practice opportunities to provide cessation services in 2004-2005. Five questions assessed on a five-point scale were asked related to practices. The second as well as fourth year students reported that, compared to asking patients about smoking status (second year - 55%, fourth year - 94%), they had less practice opportunities for advising (second year - 21%, fourth year - 83%), assessing willingness to quit (second year - 20%, fourth year - 75%), assisting the patients with a quit plan (second year - 5%, fourth year - 30%) and arranging follow-up (second year - 3%, fourth year - 22%).

Summary of Behavior-Related Studies

Twenty-two studies reviewed from 1988–2007 reported practices of health professionals and students toward tobacco cessation. These studies included U.S. as well as international studies. The studies mostly assessed tobacco cessation practices according to the clinical practice guidelines that included 5As (Ask, Assess, Advice, Assist and Arrange follow-up) and sometimes 5Rs (Relevance, Risks, Rewards,

Roadblocks, and Repetition) of tobacco cessation. Overall, the health professionals and students reported that they provided specific cessation strategies less frequently as compared to the Ask, Advise and Assess steps of tobacco status assessment. Geller et al⁵³ explained that this observation could be due to the fact that fewer patients are willing to quit. Hence, the Assist step of tobacco cessation is a patient-driven procedure, while the Ask, Advise and Assess steps are mostly driven by practitioners. Thus, it was suggested that more opportunities or clinical experiences should be given to students. Additionally, there is lack of data regarding the percentages of tobacco using patients seen by students. Some students might see more tobacco-using patients compared to others, and this would affect the behavior component. Moreover, cessation services provided by students could also vary by the support or guidance received from various medical/dental departments.

The studies above found several factors that were associated with more tobacco cessation counseling. These factors included being Caucasian, male, certain U.S. geographic locations for example dentists in region 1 (New England, Middle Atlantic and South Atlantic states) advised more compared to region 2 (East south Central, East North Central, West North Central and West South Central) and region 3 (Mountain and Pacific states), type of practitioners and availability of patient educational materials. Thus, key factors that drive cessation services are training and clinical experiences that lead to increased confidence and motivate practitioners to provide cessation services. Albert et al⁴³ pointed out that training, confidence, Ask, Advise, Assess, Assist, and Arrange are all linked, and each factor promotes the subsequent factor or cessation step.

The current concept of cessation services is to utilize the three step approach: Ask, Advise and Refer to quitlines. However, limited pilot data are available from private

dental offices and more studies are required to assess whether it is effective compared to the traditional five step approach.^{61,62} The current study assessed fourth year dental students concerning the five step approach (5As).

Studies Assessing Health Professionals' Barriers Related to Tobacco Intervention

This section includes studies related to perceived barriers reported by health professionals and students.

Practitioners

Dentists, Dental Hygienists and Dental Nurses

As mentioned earlier under behavior-related studies, Dolan et al⁵⁴ surveyed dentists regarding tobacco cessation practices in 1994. The responses for the five barrier-related questions were assessed on a three-point Likert scale. Forty-nine percent reported (strong + somewhat barriers combined) that the insurance companies did not reimburse for the services they provided, 45% reported that there was lack of adequate reimbursement for the time it took to get the patients to quit and 51% reported not knowing where to refer the patients for counseling as a barrier. Fifty-four percent reported lack of confidence to effectively help patients to quit using tobacco as a barrier, and 46% reported that the amount of time required for counseling was a barrier. Thus, about half of the respondents perceived the above stated barriers, while the other half did not. The authors did not categorize the barriers reported according to the specialization of the dentists or according to dentists vs. dental hygienists.

Hayes et al⁶³ surveyed both Massachusetts dentists and a national sample of dentists in 1994. The responses for the five barrier-related questions were assessed on the three-point scale (regularly, sometimes and never). The most frequently reported barrier (regularly + sometimes combined) by the Massachusetts dentists was concern about its effectiveness (52%), followed by the amount of time required (51%), lack of reimbursement (38%), inadequate referral sources (39%) and others (6%). Similar barrier-related results were obtained at the national level.

Gould et al⁶⁴ surveyed participants from the tobacco cessation training program conducted by the NCI (National Cancer Institute) to assess the participants' confidence, tobacco cessation activities and barriers to cessation services, both pre- and post-training in 1995. There were six statements under perceived barriers (the authors did not mention about the scale used to assess barrier-related responses). The perceived strong barrier-related responses pre- and post-training included the amount of time required (pre-training 20%, post-training 22%), lack of adequate reimbursement for professional counseling time (20%, 24%), lack of confidence in ability to effectively help patients quit (29%, 5%), patient resistance (33%, 32%), lack of knowledge about referrals (27%, 27%) and insurance companies not reimbursing for services (20%, 26%). Of the six perceived barriers, only one barrier, "lack of confidence in ability to effectively help patients quit", decreased significantly ($p < 0.01$) post-training. Overall, the program was beneficial in training dentists regarding intervention services and resulted in increased cessation activities post-training.

As mentioned earlier under attitude- and behavior-related studies, Simoyan et al⁴² assessed barriers encountered by New York dentists from 1999-2000. The authors did not

mention about the Likert scale used for assessing barriers. Perceived major barriers by dentists answering the long form of the survey included lack of time (52%), reimbursement issues (58%) and patient resistance (66%). Approximately 60% agreed that not knowing where to refer was a barrier, while 50% agreed that lack of confidence in ability to provide tobacco cessation services was a barrier. Those dentists who felt that time was a barrier spent 5.5 minutes on average providing cessation services, as compared to the rest who spent an average of 3.6 minutes ($p=0.009$). Other reasons for not providing cessation services included concerns about offending the patients or losing patients, lack of patient interest, inadequate training, tobacco cessation services being beyond the scope of dentistry, having seen too many failures, fear of drug interactions and dentists who were current smokers did not want to appear hypocritical by advising their patients regarding tobacco cessation.

As mentioned earlier under behavior-related studies, Baker et al⁵⁶ assessed tobacco intervention practice behaviors and attitudes of alumni trained in the didactic and clinical program at the University of Missouri-Kansas City, School of Dentistry (UMKC) prior to 2001 (year of the data collection not provided). Sixty-one respondents provided answers to the open-ended barrier-related question, “our dental practice does not provide assistance with tobacco cessation.” Twenty-four respondents (39%) indicated the lack of autonomy (most common barrier) due to being a graduate student, an associate, “not the boss” or working in a military or public health clinic. Thirteen respondents (21%) stated that TUCS were not a priority, 13 (21%) referred to tobacco cessation as either the patient’s responsibility or an issue the provider did not want to discuss. The remaining 11 (18%) identified lack of time for TUCS. Only two (3%) individuals stated that their

practice charges for the TUCS. The study did not differentiate between perceived barriers reported by the dentists and dental hygienists.

As mentioned previously under attitude- and behavior-related studies, Watt et al⁵⁷ assessed experiences, attitudes and perceived barriers toward tobacco cessation services. The authors mailed surveys to all 250 general practitioner dentists in South Essex, United Kingdom during the first phase of study from 2001-2002. One hundred forty-nine of the 250 questionnaires were returned, yielding a response rate of 60%. Nine barrier-related statements were asked (the authors did not mention the scale used for assessing barrier-related statements). The four most frequently reported barriers were lack of time (80%), lack of resources (76%), lack of payment (73%), and inadequate knowledge on how to incorporate smoking cessation into consultations (72%).

In the second phase of the study, ten dental practices were chosen for focus group discussions (the authors did not mention the method for choosing focus group participants). The key barriers were divided into *seven themes* and included negative attitudes toward the concept of prevention in general and in relation to tobacco cessation, perceived lack of relevance of smoking cessation to dentistry, patient resistance, impact on patient-dentist relationship, time and cost factors associated with counseling, organizational issues within the practice settings, and disconnect between dentists and dental nurses in terms of tobacco cessation responsibility.

Monson et al⁶⁵ did a pilot study on a sample of 60 dental hygiene alumni of Minnesota State University to assess the percentage and frequency of graduates providing cessation counseling after receiving training from the school, and to identify their stage of

change based on the Transtheoretical Model of Change regarding cessation counseling. The authors also wanted to identify the factors related to counseling.

The survey questionnaire was based upon the Goldstein et al⁶⁶ study and a comparison of results between the two studies was also done to assess cessation counseling-related differences. The Minnesota alumni from 2000-2002 were selected for the study as each batch had received training in the fall of their senior year. The training was comprised of a two hour didactic education session and an intensive counseling session with at least one patient in the first part of the year and the students were required to complete tobacco assessment forms in the clinic for the fall and spring semester of the remaining senior year. The survey was conducted in 2003, with a response rate of 88%. A total of 67 items were asked. The questionnaire was divided into four sections, including general information, four cessation activities recommended by NCI (modified to derive their stage of change), frequency of cessation activities and factors related to cessation counseling. The last section was derived from the Park et al⁶⁷ study and included facilitator and barrier statements related to cessation. The results indicated that the graduates advised tobacco using patients with periodontal disease in greater proportion compared to tobacco using patients without periodontal disease ($p < 0.05$). Tobacco cessation counseling was offered more than 80% of the time for all tobacco-using patients and patients with periodontal disease, respectively, that included asking (6%, 45%), advising (33%, 61%), assisting (6%, 18%), and arranging follow-up (2%, 6%).

Eighty-eight percent of the dental hygienists felt that they can be effective in helping patients to stop smoking, 82% felt that office prompts can be useful reminders about cessation counseling, while 72% reported knowing at least one source of referral

within their community. Almost 67% felt that there was lack of tobacco cessation educational material in the dental office and 55% felt that counseling patients about smoking is frustrating.

The authors concluded by stating that, although the hygienists were trained in providing cessation services, they did not counsel patients in their practice. Most of the graduates were at early stages (among pre-contemplation, contemplation, preparation, action, and maintenance) for asking, assisting and arranging follow-up and at later stages of change for advising the patient to quit. Thus, tobacco cessation training/material constructed upon the stage of change of the provider could be more effective in preparing the practitioner to provide cessation services. Recommendations made by the authors included providing case-related examples to the hygienists, providing a cessation-related material packet to each graduate student and also encouraging them to attend continuing education courses related to cessation.

As mentioned previously under behavior-related studies, Brothwell et al⁵⁸ assessed brief intervention counseling (BIC) practices and perceived barriers encountered by Manitoba dentists and dental hygienists in 2003. Seven questions were asked regarding barriers to provision of tobacco intervention services. The barrier-related statements (Likert scale not specified) included lack of time, lack of training, patient resistance, fear of alienating patients, being unfamiliar with referral options, lack of inadequate reimbursement and no insurance coverage for services. Most providers reported lack of time, patient resistance and lack of training as barriers. Female gender and participants from dental hygiene profession were more likely to report patient resistance ($p < 0.01$) and fear of alienating patients ($p < 0.01$) compared to male gender and

dentists. Male gender and dentists were more likely to report lack of reimbursement as a barrier ($p < 0.001$). However, when the barrier composite scores were created and compared, there were no significant differences by gender or provider type.

As mentioned previously under attitude- and behavior-related studies, Albert et al⁴³ administered their survey to U.S. dentists in 2003, recruited for evaluating a CD-ROM and supportive electronic detailing to promote increase in tobacco cessation activities. The total number of barrier-related questions and the scale used to assess barriers were not stated. Patient resistance as a barrier was indicated by 60%, 75% indicated lack of time, 76% indicated lack of reimbursement, 69% indicated concerns about effectiveness, 62% indicated lack of educational materials and 72% indicated lack of referral sources as barriers. Forty-nine percent indicated staff concerns regarding incorporating tobacco cessation into practice.

Albert et al⁶⁸ focused on use of ‘academic detailing’ to promote tobacco-use cessation counseling in dental offices. The aim of this study was to ascertain the feasibility of face-to-face educational outreach visits, also called “academic detailing”, as a methodology to promote dentists’ adoption and incorporation of tobacco-use cessation counseling activities into their practices. The authors surveyed dentists who practiced in one of four Northeastern states (New York, New Jersey, Connecticut and Pennsylvania) and who had more than 300 dental health maintenance organization (DHMO) patients before 2004 (year of the data collection not provided). Of the 507 eligible dentists, 88 agreed to participate, and the authors randomly assigned them to either the academic detailing program (intervention) or usual practice group (control). The authors did not state the total number of barrier questions asked, scale used to assess barriers and whether

these questions were asked to both the groups. The authors encountered resistance to the detailing program from the dentists' staff members. Issues reported included patient confidentiality (percentage not reported), having to deal with additional paperwork (percentage not reported), uncooperative patients (25%), the perception that few patients use tobacco (22%) and that counseling does not work (percentage not reported). Some dentists also expressed concern about their lack of tobacco use cessation knowledge (3%).

As mentioned previously under knowledge- and behavior-related studies, Hu et al³² surveyed 1,500 dentists in East Texas to assess their practices related to tobacco intervention in 2003-2004. The authors used a five-point Likert scale (strongly disagree, disagree, hard to say, agree, and strongly agree) to assess responses to barrier statements. These barrier-related responses were averages of statement-specific results and included fear of losing patients (~3%), lack of time (~7%), fear of upsetting patients (~10%), preference to diagnose and treat patients rather than give preventive advice, i.e., prefer treatment to prevention (~30%) and lack of training (~60%). Males as compared to females ($p < 0.01$), older dentists as compared to young dentists ($p < 0.05$) and those unfamiliar with the guidelines more than those who were familiar ($p < 0.05$) were more likely to agree with the statement 'prefer treatment to prevention.' Females, younger dentists and those without formal knowledge of guidelines and training ($p < 0.05$) were more likely to agree with the 'lack of training' barrier-related statement. Overall, 61% of the dentists agreed or strongly agreed that training was essential to counsel patients.

As mentioned previously under attitude- and behavior-related studies, Brady et al⁴⁴ surveyed attitudes, practices, barriers, and level of interest in future training in

smoking cessation of all the New Zealand dental staff prior to 2004 (year of data collection not provided). There were 13 barrier-related statements and a three-point Likert scale (not a barrier, small barrier or strong barrier) was used to assess the responses. The five highest reported barriers (strong barriers) were lack of training (53%), concern about effectiveness of counseling (44%), concern about alienating patients (43%), amount of time required (43%) and patient resistance (39%). More male dentists considered “smoking cessation not to be part of the practice” as a barrier compared to females ($p < 0.05$). Patient resistance, lack of time, concerns about alienating patients, and lack of reimbursement were more commonly perceived barriers by younger dentists ($p < 0.05$). Patient resistance was a more frequent concern of non-smoking dentists as compared to current and ex-smokers ($p < 0.05$).

As mentioned previously under attitude- and behavior-related studies, Stacey et al⁴⁵ surveyed dentists, dental hygienists, and dental nurses regarding cessation interventions in their own practices prior to 2006 (year of data collection not provided). The authors assessed barrier-related responses on a six-point Likert scale and these responses were combined into two categories “less important” (0 to 2) and “more important” (3 to 5). The responses provided by the dentists, dental hygienists and dental nurses, respectively, for “more important” barriers included lack of training (90%, 94%, 93%), little chance of success (58%, 64%, 67%) lack of remuneration (75%, 50%, 52%), possibility of losing patients (32%, 35%, 46%) and not perceived as their role (39%, 35%, 48%). Of these barrier statements, lack of training was considered a more important barrier by almost all the respondents. Lack of time (responses not provided) was reported as a barrier by the dental hygienists ($p = 0.01$) and lack of remuneration was a significant

barrier reported by the dentists only, compared to dental hygienists and dental nurses ($p < 0.001$).

As mentioned previously under attitude-related studies, Edwards et al⁴⁶ examined barriers experienced by Australian dental professionals in providing smoking cessation services and compared differences between dentists and dental hygienists prior to 2006 (year of the data collection not provided). The barriers were divided into two main parts, i.e., system-based (8), and practitioner-based (5), and were assessed on a five-point Likert scale. The authors did not provide percentages for the barriers reported, but reported mean values. The two (of the eight) most important system barriers faced by both groups were a lack of a co-ordinated plan to implement smoking cessation protocols or guidelines and lack of smoking cessation protocols or guidelines. Similarly, the two (of the five) most important practitioner barriers were lack of necessary skills to assist patients to quit and low perceived efficacy in regards to helping patients quit.

Other Health Professionals

As mentioned previously under behavior-related studies, Gottlieb et al⁵⁹ assessed one hundred and ten family practice residents for tobacco cessation counseling practices from four Texas residency programs in 1997-1998. The authors did not state the total number of barrier-related statements asked, whether they were open- or close-ended barrier-related questions and if a Likert scale was used to assess the responses. The most frequently reported barriers were lack of time (62%), lack of patient interest in prevention (58%), lack of health educators (34%) and lack of tracking and promoting preventive care (34%). Fewer residents reported lack of financial reimbursement (20%), lack of effective

patient education materials (18%) and uncertainty about what preventive services to provide (6%) as barriers.

As mentioned previously under attitude- and behavior-related studies, Young et al⁴⁷ surveyed randomly selected General Practitioners (GPs) in New South Wales in 1997. Fourteen potential perceived barrier-related statements to provision of smoking cessation were asked using a four-point Likert scale (very important, somewhat important, slightly important and not a problem). These barrier-related statements were divided into patient-based (5), practitioner-based (6) and structural (3) barriers categories. The two most frequently reported patient-based barriers were patients' lack of motivation to quit (23%) and patients not seeing quitting smoking as an immediate concern (19%). The two most frequently reported practitioner-based barriers were lack of training in lifestyle counseling (9%) and forgetting to discuss smoking (7%). The two most frequently reported structural barriers were lack of time (15%) and lack of reimbursement (7%).

As mentioned previously under knowledge-, attitude- and behavior-related studies, Block et al³¹ surveyed health care providers from Minnesota and Wisconsin in order to assess barriers related to tobacco cessation practices prior to 2000 (year of data collection not provided). Significant differences existed among different health care providers regarding all the five barrier-related statements. Overall, 20% indicated that tobacco cessation was a low priority for health care practitioners, with highest percentages for chiropractors (37%) and dentists (40%). About 47% indicated that tobacco cessation was a low priority for their patients. Lack of time was indicated by 29% of the providers and 14% felt that their patients would seek another provider if they

discussed tobacco use. Additionally, more chiropractors (24%) and dentists (24%) reported lack of reimbursement as a barrier compared to other health professionals.

Margolis et al⁶⁹ contacted 1,606 East Texas pharmacists about tobacco intervention related barriers prior to 2002 (year of data collection not provided), with a response rate of 12% (188/1,606). There were 57 questions regarding tobacco intervention and related factors. The authors did not specify the total number of barrier-related questions or scale used to assess barriers. The positive barriers-related responses included difficulty in getting patients to quit (59%), insufficient time (43%), lack of reimbursement (32%), tobacco counseling to be frustrating process (31%), there is little a pharmacists can do if patients can't quit tobacco (21%) and tobacco counseling to be a thankless task (18%).

As mentioned previously under attitude- and behavior-related studies, Aquilino et al⁴⁸ surveyed the Iowa Community Pharmacies regarding tobacco cessation behaviors in 2002. The barrier-related statements were assessed on a four point Likert scale (extremely interferes, moderately interferes, somewhat interferes, and never interferes). These statements were divided into pharmacist-related barriers (4), pharmacy environment-related barriers (3) and external environment-related barriers (4). When the responses were combined (extremely interferes + moderately interferes + somewhat interferes), the two most commonly reported pharmacist-related barriers were lack of knowledge of community resources (81%) and lack of treatment effectiveness knowledge (61%). The two most commonly reported pharmacy environment-related barriers were lack of time (91%) and inability to identify smokers (87%), and the two most commonly

reported external environment-related barriers were lack of educational material availability (79%) and lack of availability of cessation programs (77%).

Students

Dental and Dental Hygiene Students

As mentioned previously under attitude- and behavior-related studies, Yip et al²² surveyed New York fourth year dental students regarding tobacco intervention services and related factors prior to 2000 (year of data collection not provided). There were six barrier-related statements and the responses were measured using a three-point Likert scale (strong barrier, somewhat a barrier or not a barrier). Lack of confidence to help patients quit (62%), patient resistance (83%), lack of referral knowledge (84%), lack of insurance reimbursement (67%), amount of time required (66%), and lack of adequate reimbursement for the time taken to get patients to quit (72%) were the potential barriers reported most frequently by the students.

As mentioned previously under knowledge-, attitude- and behavior-related studies, Polychonopoulou et al³⁶ surveyed first and final year dental students in 1999-2000 at the University of Athens dental school. Five barrier-related statements were assessed on a four-point Likert scale (always, sometimes, never or no option). Barriers commonly identified included lack of relevant training (83%), lack of patient education materials (80%), lack of reimbursement (42%), time required (60%), and patient resistance (75%).

As mentioned previously under knowledge-, attitude- and behavior-related studies, Rikard-Bell et al³⁷ assessed Australian dental student's views about smoking cessation counseling and their skills as counselors in 2000. Thirteen questions were asked

concerning barriers perceived during provision of cessation services. The barrier-related statements were assessed on a five-point Likert scale (strongly agree to strongly disagree). The barrier-related results were divided into three sections according to questions concerning students' agreement with the barriers (2), questions concerning students' disagreement with the barriers (6), and questions concerning indifference (they neither agreed nor disagreed, 5) to the barriers. Lack of patient motivation was cited as the most common barrier (59%) and this did not vary with the student's year of study. Students earlier in their education were less likely to respond to the statement lack of sufficient skills as a barrier compared with students further on in their training ($p=0.003$). Students with low confidence scores were significantly more likely to report 'insufficient skills' as a barrier compared to students with high confidence scores (50% vs. 34%, $p = 0.009$). Almost 53% disagreed that smoking cessation counseling may alienate patients. Overall, students reported patients have no motivation to quit (89%) and lack of their skills (72%) as common encountered barriers.

As mentioned previously under attitude-related studies, Victoroff et al²³ surveyed attitudes of incoming first year dental students toward tobacco cessation promotion in the dental setting at Case Western Reserve University in 2002 and 2003. There was one barrier-related question and the responses were assessed on a three-point Likert scale. Seventy-one percent anticipated that patient resistance could be a barrier to tobacco cessation promotion.

As mentioned previously under attitude- and behavior-related studies, Boyd et al²⁴, surveyed the entire graduating class of dental hygiene students at the Oregon Health and Science University prior to 2006 (year of data collection not provided). There were seven

barrier-related questions assessed on a three-point Likert scale (strong barrier, somewhat a barrier or not a barrier). When strong or somewhat barriers were combined, 83% reported patient resistance as a barrier, 75% indicated lack of knowledge/confidence in tobacco cessation techniques, 65% reported lack of time, 55% reported emphasis placed on completing graduation requirements as a barrier, 50% indicated fear of negative response from patients, 45% felt lack of faculty support and 35% felt that their own disinterest or discomfort was a barrier.

Studies Assessing Curricular Barriers

Baker et al⁷⁰ surveyed the U.S. dental and dental hygiene clinics regarding tobacco use cessation activities. The survey was mailed to 53 dental and 237 dental hygiene programs prior to 1999 (year of data collection not provided). The questionnaires included 30-items and were similar to the Fried et al (Fried, 1990) survey. Twenty-three dental schools and 110 dental hygiene programs had tobacco use cessation curriculum activities (TUCCA) in their clinics. Lack of faculty experience was reported by four schools and lack of interest in the cessation program was reported by three schools (percentages were not stated in the article and not specified whether dental or dental hygiene schools) and lack of time was reported by 32% of the dental hygiene schools.

Weaver et al⁷¹ surveyed fifty-four dental schools in the United States in 2001. The goal of this study was to provide an overview of accomplishments of dental schools in terms of tobacco cessation implementation and examination of barriers. Fifty-four dental academic institutions in the United States were mailed the questionnaires in 2001. Barrier-related responses regarding willingness to provide patient counseling on tobacco use and cessation in clinics included time constraints 67% (36/54), lack of training 61%

(33/54), lack of reimbursement 43% (23/54), and patient sensitivities 26% (14/54). Other barriers (percentages/responses not provided) included student/faculty perceived ability to be successful, patient understanding that dentists can provide cessation and counseling, faculty resources, curriculum constraints, patient resources, student priorities, and lack of faculty reinforcement.

The barriers regarding preparation of students included insufficient course time 78% (42/54), lack of materials 20% (11/54), student disinterest 7% (4/54), a need for faculty training on tobacco prevention techniques 91% (49/54), a need for faculty training on the oral health risks to patients who use tobacco products 72% (39/54) and others (percentages/responses not provided in the article) such as funding needs and culturally competent curriculum requirements.

Summary of Barrier-Related Studies

The section above included 26 U.S. or international barrier-related studies from 1994 - 2005. These studies could be classified into three main categories: practitioner-related, patient-related and system-related barriers. An alternative classification suggested by Needleman et al²¹ includes barriers to implementing tobacco use cessation counseling, barriers to participation in tobacco use cessation (by clinicians or patients) and barriers to effectiveness of tobacco use cessation counseling. Overall barriers perceived by the health professionals included patient resistance, lack of time, lack of training and lack of reimbursement. Some of the studies also indicated that health professionals rated patient resistance as an important barrier despite their lack of training or skills. These barriers remained largely unchanged in studies from 1994 to 2005, and are in accordance with

barriers reported by Angela Monson.⁷² Factors associated with barriers included gender, type of profession, age, and training.

However, very few dental student-related studies have assessed the barriers encountered during the provision of tobacco intervention services. From the above student-related barrier studies, patient resistance and lack of training/skills/confidence were the most common barriers encountered during the provision of tobacco intervention services. Only one study had a tobacco intervention program prior to surveying the students, but this two hour program was not sufficient to prepare students to provide tobacco intervention training.²⁴

Some barrier-related statements from the health professional studies were incorporated into the current study, since very few student studies looked at the barrier component systematically. Moreover, some of the barrier-related statements did not apply to the students, like 'lack of reimbursement' and 'lack of adequate reimbursement for the time taken to get the patients to quit' and were not used for the current survey.

Additionally, previous studies have not considered barriers encountered while providing tobacco intervention services to *smoking* and *smokeless tobacco* using patients separately. It is not known whether students lack knowledge related to nicotine replacement drugs, lack confidence to prescribe/recommend them, or can demonstrate adequate skills while providing tobacco preventive services to teenagers or patients who do not use tobacco. Likewise, it is not known whether lack of faculty support and lack of curricular incentives like grades for tobacco cessation curriculum are reported as barriers by the dental students. Other structural factors that need to be assessed for dental studies

include presence of a tracking system in the college for tobacco-using patients, and the presence of adequate space and privacy to counsel patients.

Studies Related to Tobacco Intervention
Curriculum and Preferred Methods
of Learning Tobacco Intervention

This section includes studies looking at content in and development of U.S. dental and dental hygiene schools' tobacco intervention curricula, followed by studies that included various tobacco intervention teaching methods employed by health professional schools in order to reduce tobacco cessation-related barriers.

Dental and Dental Hygiene School
Curricula Related to Tobacco Intervention

Fried et al⁷³ surveyed all the U.S. dental and dental hygiene schools regarding the existence and extent of tobacco intervention curricula in 1989. Almost 60% of the dental and dental hygiene schools then permitted smoking in their schools. At least 50% of each of dental and dental hygiene programs had a separate tobacco cessation curriculum for 1 to 3 hours, 17% of each of dental and dental hygiene schools had tobacco cessation teaching incorporated in some other dental subject curriculum and did not devote separate teaching hours for tobacco cessation, while approximately 33% of these schools did not have a tobacco cessation curriculum. The majority of the schools (81% of dental and 72% of dental hygiene schools) did not then expect their students to counsel patients in the clinics. Almost 71% of the dental and 66% of the dental hygiene schools then anticipated the same curriculum in the future, without any changes or new additions.

Grinstead et al⁷⁴ surveyed 54 U.S. dental schools regarding tobacco cessation curricula in their schools in 1993. It was found that more schools were tobacco-free and had a tobacco policy in the schools, as compared to the 1989 survey.⁷³ Two percent of the schools had a tobacco cessation didactic curriculum while 56% had some tobacco cessation counseling curriculum incorporated into didactic courses. However, only 41% had a clinical program solely dedicated to cessation. Sixty-one percent perceived educating students about assuming tobacco use cessation role as important or very important, as compared to 47% in the 1989 survey. About 53% reported that educating students on how to counsel patients to stop tobacco was important or very important, as compared to 41% in 1989. The authors stressed that more emphasis should be placed on counseling techniques, nicotine replacement medications and referral programs in the dental schools as the practitioners feel unprepared in these areas.

As mentioned previously under curricular-barriers studies, Baker et al⁷⁰ surveyed the U.S. dental and dental hygiene clinics regarding tobacco use cessation activities prior to 1999 (year of data collection not provided). Forty-seven percent of the dental schools and 55% of dental hygiene programs had tobacco use cessation curriculum activities (TUCCA) in their clinics. All the responding dental schools said that they inquired, documented and advised against tobacco use. Similarly, 99% of dental hygiene programs inquired and 96% documented tobacco use. Twenty-one percent of the dental schools were planning to start a program according to the TUCCA guidelines. Four dental schools reported that they didn't have the program, but encouraged students to talk about the hazards of tobacco use with patients, while two schools referred patients to existing community programs. The study reported that "adverse effects of tobacco on oral

health” had the strongest influence on providing cessation services in the clinics, followed by the National Cancer Institute training. Students who participated in TUCCA also participated in a wide variety of community tobacco cessation programs.

As mentioned previously under curricular-barrier studies, Weaver et al⁷¹ surveyed fifty-four dental schools in the United States in 2001. Eighty-three percent of schools gave instructions in tobacco prevention in their curriculum, and 83% included instructions related to tobacco cessation. Ninety-six percent used a tobacco use evaluation form as part of the patient examination process. Ninety-one percent provided materials regarding tobacco control, use, prevention and cessation. Ninety-four percent of schools made referrals for patients with tobacco-related pathology. Seventy-six percent schools provided information about the nicotine patch and gum, and fewer schools (50%) provided information about bupropion. Forty-six percent of schools participated in community-based programs, while thirty-seven percent schools participated in multidisciplinary programs.

The schools reported that they evaluated tobacco cessation course content by using the standard curriculum review process, including evaluation by the students, faculty, course directors and curriculum committees. Some schools evaluated the patients, conducted written exams, group papers, or clinical assessments and online quizzes.

Thus, the tobacco cessation curriculum in dental schools has evolved from 1989 to 2000. There is a need to do a new national curriculum evaluation, since it was last done almost nine years ago. The new evaluation should include questions regarding number of schools incorporating didactic and clinical instruction and clinical

requirement, hours devoted to teaching didactic and clinical training, methods employed to teach NRTs to students, and whether students are taught to refer to quitlines or other cessation programs. Additionally, information should be sought about specific training given to students to improve their tobacco cessation skills, and whether their cessation program is restricted to dental schools or uses multidisciplinary approach.

Studies Related to Various Tobacco
Intervention Teaching Methods
Employed by Health Professional Schools

Dental and Dental Hygiene Schools

As mentioned previously under behavior- and barrier-related studies, Baker et al⁵⁶ assessed tobacco intervention practice behaviors and attitudes of alumni trained in the didactic and clinical program at the University of Missouri-Kansas City, School of Dentistry (UMKC) prior to 2001 (year of data collection not provided). A large proportion of alumni gave credit (in the range of moderate to strong on the Likert scale) to the scientific evidence of tobacco's effect on oral health (94% RDH, 94% DDS), involvement in the school of dentistry's tobacco cessation clinical program (78% RDH, 83% DDS) and continuing education (53% RDH, 38% DDS). Additional factors that facilitated cessation services included encouragement from staff (55% RDH, 42% DDS), materials from health agencies (38% RDH, 48% DDS) and professional journal articles related to tobacco interventions (78% RDH, 63% DDS).

Seidman et al⁷⁵ have stated the importance of cessation clinics in a school setting as the smokers present with multiple risk factors and co-morbid conditions (dental, medical and psychiatric). The authors describe the multidisciplinary approach used to

treat tobacco-using patients at the University of Colombia. The tobacco cessation clinic utilizes the bio-psycho-social model that views addiction as complex interactions of three factors: individual, environment and drug. The cessation clinic team is comprised of dentists, psychiatrists, gerontologists, internists and trainees. The patients are referred from either the hospital or dental clinics or through self-referrals. The patient population is predominantly Latino and African-American, with low socioeconomic status and multiple risk factors. Patients are assigned to the health professional team members depending upon the medical history of the patient and at the end of initial assessment, are offered an individual treatment plan that includes behavioral and pharmacological recommendations. Follow-up visits are scheduled to assess medication use and behavioral support to prevent relapse. Patients are seen weekly during active cessation attempts.

The dental residents are encouraged to spend a half-day observing interviews and receive brief didactic instruction while the dental students provide cessation services independently only after getting adequate cessation experience by working under faculty supervision. The third year dental students receive classroom training in the form of didactic sessions (three hours), video-taped patient scenarios, and patient case presentations. The students are also required to formulate a treatment plan for an existing smoker. They also receive clinic instructions and training for 40-45 minutes, with the main emphasis on pharmacotherapy related to cessation. All the generic and individual therapies in various doses are covered, so that students become familiar with the medications.

The authors did a program evaluation for 51 patients seen in the clinic over a six-month period in 1999. The patients were mostly female (63%), in the age range of 36-70 years, 57% had existing co-morbid psychiatric symptoms and 82% had medical illness. The overall success rate at the clinic was 39%, and it was 58% for patients who visited more than once. Patients with both the success rates were contacted again for follow-up (minimum of three months and a maximum of 12 months after the clinic cessation treatment ended) and 33/51 patients were reachable. The success rate for both the previous success rate categories was 24%. The authors concluded by stating that their clinic was a good example of effectively addressing smoking cessation in patients with multiple dental, medical and psychiatric problems that required co-ordinated care from various professionals.

Gelskey et al⁷⁶ studied the correlation of comprehensive tobacco cessation curriculum implementation and tobacco cessation counseling in patients at the University of Manitoba dental school. The tobacco cessation curriculum was implemented in August 1998 and was based on U.S. Public Health Service clinical practice guidelines recommendations.

A patient chart audit was conducted from August 1997- May 1998 (pre-test). It was found that 302 patients had indicated tobacco use on the charts, of which three declined to participate in the interview. Thus, of the 299 patients, 256 (86%) were current smokers. Forty-six percent said that they had been informed regarding the oral health effects related to tobacco and 40% reported that they had been advised to quit smoking.

In a follow-up evaluation from August 1999-May 2000, the audit showed 407 patients with tobacco use and 406 confirmed current tobacco use when interviewed.

Fifty-seven percent of users had been informed of the consequences of smoking, while 65% had been advised to quit. Thus, there were significant differences in pre- and post-evaluations.

Koerber et al⁷⁷ conducted a pilot study to examine the differences between randomly assigned experimental groups, i.e., students trained in Brief Motivational Interviewing (BMI) and the control group. Twenty-two dental students from the junior and senior classes at the University of Chicago volunteered for this study and were paid for participation. All the students attended two-to-three seminar hours on oral health effects of tobacco use and principles of smoking cessation. The students in the experimental group received 12 hours of additional BMI training. A pre-test was conducted for both groups using standardized patients, followed by a post-test after the training. The students spent five to ten minutes counseling the patient and all the sessions were videotaped. Additionally, the students and the patients rated various aspects of the session on a questionnaire.

The evaluation was done on the basis of five domains that included student behavior from videotapes, patient involvement in the treatment, and establishment of good doctor-patient relationship, perceived efficacy in promoting patient change and student's confidence and interest in the task. Significant differences ($p=0.018$) were found between the experimental and control group in terms two of the five domains - students' use of BMI and patient actively involved activities. There were several limitations in the study in terms of sample size, interest of the students in the study as they volunteered for the study, prior training experience, and probability of discussion

among experimental and control groups. Students in the experimental group utilized more BMI techniques compared to the control group.

Gordon et al⁷⁸ assessed changes in the knowledge and attitudes of dental and dental hygiene students from Oregon, New York and Washington. The aim was to develop, implement and evaluate an interactive computer-based program using CD-ROM. The program content was derived from U.S. Public Health Service clinical practice guidelines. Thirty-five dental students and 42 dental hygiene students participated in the study from the above mentioned universities, as tobacco cessation was not part of the regular curriculum in their programs. The pre- and post- tests were comprised of 32 items each, and students were also thoroughly assessed on the new program implemented. Significant change was observed for the 32-item measure pre- and post-intervention ($p < 0.001$). The program use was significantly associated with change in knowledge, attitudes and behaviors related to tobacco cessation ($p < 0.001$). Participants reported being highly satisfied with the program.

Coan et al⁷⁹ surveyed the dental hygiene students of the Indiana University School of Dentistry (IUSD) in 2006 regarding tobacco cessation curriculum. The Indiana University School of Dentistry five-member tobacco cessation team launched the Indiana University Nicotine Dependence Program (IUNDP) in October 1992. It was based on the Mayo Clinic Nicotine Dependence Program. This program was expanded in April 1997 in terms of staffing, scope of services, and treatment locations. Forty-six dental hygiene students were required to complete a tobacco cessation experience with a tobacco using patient. Students were encouraged to choose a friend or family member, as the person to assist in quitting tobacco. Students were given two options for completing the tobacco

cessation experience. Two plans were suggested for providing cessation counseling. One included making a cessation presentation to a patient in the clinic while being observed by the faculty member and the other included one-on-one training and evaluation with a cessation expert prior to making any presentation to the patient and utilized a Patient Assessment Questionnaire (PAQ). Ninety-six percent (44/46) of students completed the survey. Fifteen (34%) reported having attended the one-on-one training session with the tobacco cessation expert, eight (18%) reported having completed the clinical option and two (5%) responded "did not apply." Almost 88% "agreed" or "strongly agreed" that they were experienced enough to make a cessation presentation to a patient who used tobacco based on the didactic educational materials alone, while 84% agreed that one-on-one interaction was useful in learning tobacco cessation and helping patients quit and 83% reported that this session helped to boost their confidence levels. Almost 83% believed that they would use the one-on-one technique in the future with other patients. The authors indicated that use of a personalized in-depth analysis/questionnaire will not only benefit students, but also help patients to consider quitting.

Walsh et al⁸⁰ conducted a pilot study at the University of Louisville (medical and dental schools) to assess tobacco cessation counseling training using standardized patients (SPs). The one-day training program included a baseline survey, one-to two-hour lecture on important aspects of Treating Tobacco Use and Dependence (TTUD), interactions with three SPs and completion of a post-program survey. The SPs had undergone two hours of training in tobacco cessation in order to answer the students' queries after the lectures. The SPs presented three scenarios: one included the patient not willing to quit, another was the patient thinking about quitting and lastly a patient ready

to quit in the study. A total of 66 students volunteered for the study. However, only 36 participants were included in the analysis due to incomplete information. The participants indicated that the practice sessions increased their confidence in providing cessation, the feedback from the SPs was helpful and the respondents also indicated that they would recommend this training to others interested in improving their skills in smoking cessation counseling. Limitations of the project included small sample size, participation of volunteers depended on the willingness of the medical and dental program faculty. There were unequal numbers of students participating from medical and dental schools and, lastly, there were varied levels of training (graduate and undergraduate students participated) and chosen profession (medical and dental schools participated).

As mentioned previously under attitude- and behavior-related studies, Harris et al⁵² surveyed senior students in 2006–07 from all the 12 North Carolina dental hygiene programs. Seventy-four percent of the respondents did not recall having a clinical competency evaluation or assessment of their tobacco cessation education skills learned in the classroom with a tobacco-using patient. However, 69% reported that their clinical instructors reinforced classroom material in the clinical setting, 96% reported first learning about tobacco cessation during the first year of their program, 68% recalled the classroom instructors providing information on the 5As of tobacco cessation and 73% recalled the ADHA's smoking cessation initiative (Ask, Advise and Refer). Sixty percent reported learning about tobacco cessation in five to eight different courses, 29% reported learning about tobacco cessation in one to four courses and 11% reported learning in greater than nine courses. The main forms of instruction concerning tobacco cessation were lecture (99%), health organization pamphlets (63%), case studies (54%) and in-class

audiovisual slides/video (42%). Dental hygiene textbooks (99%) and journal articles (54%) were the main resources used for instruction of tobacco cessation education.

Other Health Professional Schools

Brown et al⁸¹ described the design and evaluation of the Wisconsin Tobacco Intervention Basic Skills curriculum (TIBS) administered to 147 first-year medical students at the University of Wisconsin. The curriculum was based on motivational interviewing, guidelines on smoking cessation and the University of Arizona's cessation skills certification guide. Main emphasis was placed on skill development. Observed and graded exercises were used as incentives for learning, and retention of the curriculum was promoted through repetitive practice with a pocket-sized skills checklist and resource summary so as to eliminate memorization.

The curriculum was taught in the second of four semesters of a required course on basic interviewing and physical exam skills. The content of the curriculum included a 2-hour lecture, TIBS manual reading, TIBS pocket review, 20-item, open-book internet-based quiz, 4-hour workshop, and application of TIBS skills in clinical settings (implement TIBS with actual patients). A quiz was conducted before the workshop in order to assess adequate knowledge attainment. The final workshop was conducted as a modified Objective Structured Clinical Skills Examination (OSCE) that provided feedback to the student from the instructor and other students. Students were also encouraged to apply TIBS skills by seeing patients with a primary care physician for three and a half days per semester.

The evaluation of students' knowledge, attitudes, and self-confidence was assessed by a pre- and post-test confidence evaluation questionnaire. Sixty percent completed the pre-test that was conducted before the first lecture, while 88% completed the post-test questionnaire that was conducted two months after the workshop, 47% completed both the tests and 70% completed the questions after applying TIBS in clinical practice. Fifty-two percent of the 109 post-test students applied TIBS in clinical settings for behavior change other than tobacco use. The first year students found the curriculum appropriate for their level of training and accepted it favorably.

Pederson et al⁸² evaluated a web-based tobacco curriculum program for medical students at both the Mercer and Morehouse schools of medicine in Georgia. The medium of tobacco cessation instruction at Morehouse was lecture-based learning, while Mercer used problem-based learning. However, both schools relied on a web-based medium for posting their curriculum content. The intent of this program was to teach medical students to counsel smokers to quit smoking and counsel non-smokers (adolescents) not to start smoking. The web-based curriculum was based on clinical practice guidelines and was divided into two components, tutorial and practical sessions. The practical sessions included eight patient scenarios and the interactions were video-taped. A baseline survey was conducted and included a 52-item questionnaire. All the students studying in the year 2003 were eligible for the study. The post-test followed two weeks after exposure to the curriculum. The outcomes assessed were differences in pre- and post- test knowledge scores, self-rated ability to perform six counseling skills and overall difference in the pre- and post- tests. The authors concluded by stating that, although the knowledge and

clinical skill scores increased significantly post-curricular exposure, there was no difference between the web-based and traditional teaching method.

As mentioned previously under attitude- and behavior-related studies, Geller et al⁵³ examined second and fourth year medical students' self-reported skills, and practice opportunities to provide cessation services at 10 U.S. medical schools in 2004-2005. All the students were taught tobacco counseling at least once in a case-based discussion (82%), a clinical skills course (81%), and/or simulated patient encounters (77%). Fourth year students were more likely to report receiving instructions from Family Medicine (79%) or Internal Medicine (70%) compared to Pediatrics (54%), Obstetrics/Gynecology (41%) and Surgery (16%). Six questions assessed on a five-point scale were asked related to observing faculty members. Fourth and second year students, respectively, had at least four observation opportunities with the faculty members, in cessation counseling (80%, 38%), taking smoking history (77%, 49%), environmental tobacco smoking counseling (51%, 12%), and cessation counseling for pregnant women (46%, 7%).

Health Professionals' and Health Professional Students' Preferred Methods of Learning Tobacco Intervention Information

Practitioners

As mentioned earlier under attitude-related studies, Brady et al⁴⁴ surveyed attitudes, practices, barriers, and level of interest in future smoking cessation training of New Zealand dentists prior to 2004 (year of data collection not provided). Concerning the type of training they were interested in receiving, they were more interested in self-help booklets (69%), journal updates (49%), and mail updates (49%). Video training course

(40%), full-day training course (36%), computer-based updates (33%), lecture updates (28%) and brief training course (19%) received less favorable responses.

Students

As mentioned earlier under knowledge-, attitude-, behavior- and barrier-related studies, Rikard-Bell et al³⁷ surveyed Australian dental students regarding tobacco cessation practices in 2000. The educational resources were divided into three approaches: patient-based (2), innovative (3) and educational opportunities (7). Access to patient self-help materials (63%) and free nicotine replacement therapy for patients (51%) were reported under *patient-based* approaches. Coordinated care between dentists and other community accredited antismoking clinics (51%), ADA-sponsored advertising campaign (49%) and high-profile political involvement of the ADA in smoking issues (38%) were reported under *innovative approaches*. Seminars with experts (50%), practical training in skills to promote smoking cessation (49%), evidence-based guidelines (48%), access to smoking-cessation research literature in summarized form via CD-Room or Internet (40%), national dental conference on smoking and oral health organized by the Australian Dental Association (39%), teaching audiotapes or videotapes (33%) and professional distance learning or self-study module (23%) were reported under *educational opportunities*. The most useful counseling resource reported by the students was access to patient self-help pamphlets (63%), and the least useful approach was professional distance learning or self-study module (23%). Students were more likely to rate 'self-help' pamphlets as useful compared to coordinated care ($p < 0.001$) and seminars with experts ($p < 0.001$). Current nonsmokers ($p = 0.01$) and female nonsmokers ($p = 0.004$) were more likely to agree with the usefulness of practical skills training.

As mentioned earlier under knowledge-, attitude-, behavior- and barrier-related studies, Polychonopoulou et al³⁶ surveyed first and final year dental students at the University of Athens dental school in 1999-2000. The students indicated formal education (56%) as the preferred method for learning about tobacco cessation, as compared to leaflets (22%), magazines (7%), books (7%), internet (6%), and CD-ROM (2%).

The following paragraph summarizes information related to the development and content of tobacco intervention curriculum at the University of Iowa, College of dentistry.

The University of Iowa Tobacco Intervention Curriculum

The tobacco intervention curriculum at the University of Iowa, College of Dentistry has evolved and expanded since its initiation in 1992. The tobacco cessation counseling was offered only in the Department of Periodontics initially and was expanded later to include the Family Dentistry Department in 1997. Eventually, more formal tobacco cessation curriculum was incorporated into the dental curricula. Currently, the curriculum consists of a total of six hours dispersed throughout all four years. The curriculum has been adapted from the National Cancer Institute (NCI) "Train the Trainer guidelines." The greater portion of the curriculum is taught by Nancy Slach, RDH, B.S. The curriculum has been personalized and updated according to the students' needs, new additions to the NCI and Agency for Health Care Policy and Research (AHCPR) guidelines and current literature.

The D1 (first year dental students) are taught for two hours throughout the year by Ms. Slach and Dr. Rhys Jones. By the end of the first year, the D1 students are expected to use and interpret the two questions related to tobacco use in the health history form that include “Do you smoke or use tobacco products?” and “Are you a past user of tobacco products?” They are also expected to be familiar with the proven methods of tobacco cessation and be able to refer patients to the Quitline Iowa or the National or state-specific quitlines for tobacco cessation counseling. The students are also taught oral cancer screening during the first year. The second year dental students are taught by Nancy Slach for an hour during the year to mostly reinforce the information from the first year. Beginning in 2008, the D1 students were taught for four hours by Nancy Slach alone. The D2 students do not receive any training and are expected to provide counseling in the Preventive Clinic.

The D3 students are taught for two hours during the year. Dr. Georgia Johnson provides information about dental and oral effects of tobacco use for one hour and Ms. Slach provides specific tobacco cessation information for an additional hour. The D3 students are divided into two groups and half of the D3 students that rotate during the first part of the year in Periodontics, Endodontics and Prosthodontics Departments, also known as the ‘Superblock rotation’, receive tobacco intervention didactic training in the months of September/October, while the other half receive training in the later months of March/April. So students that rotate in the part of the Superblock for the first half of the D3 year are expected to counsel in depth during the remaining part of the D3 year. The other half of the students are expected to inquire regarding tobacco status, advise and refer to quitlines only during the first part of the year prior to their instruction.

The D4 students (fourth year dental students) are taught for one hour, which is mostly a review of the curriculum taught in the previous three years, but also includes updates about new information on nicotine replacement drugs, current information related to cessation guidelines and information tailored to their future private clinical practice. Like the D3 students, D4 students are divided into two groups. The first half that provides clinical services in the Family Dentistry during the first part of D4 year receives tobacco intervention training in the months of September/October, while the other half that does extramural rotations during the first part of the D4 year receives tobacco intervention training in the later months of March/April.

In the clinics, the D1 and D2 students are expected to screen all patients for tobacco use and refer. D3 and D4 students, in addition to screening, are expected to provide limited tobacco cessation counseling in the time allowed and refer. By the end of third year, the D3 students are expected to independently counsel the patients and stage their patients' tobacco use, offer suggestions for behavior change and use motivational interviewing techniques in tobacco counseling, offer suggestions for medications and nicotine replacement therapy in tobacco cessation and refer patients for tobacco counseling, as necessary. Fourth year dental students also refer those patients who are interested in quitting to the tobacco cessation program in the Department of Periodontics or the Quitline Iowa and participate in the counseling and follow-up with these patients.

The students are provided with handouts for the courses and the information is also available online on the university's web-based course management system ICON. The students are assessed on the didactic portion in the form of multiple choice examinations each year. Clinically, the students are assessed overall on the clinical activities they

conduct in the Department of Periodontics, but not on tobacco cessation specifically. Two forms, the “Daily Evaluation” and “Periodontal Worksheet,” are used for the evaluation in the Periodontics and Family Dentistry Department.

Patients at the College of Dentistry are first assessed clinically in the Admissions Department and then referred to the various departments for treatment. Thus, patients are asked tobacco use-related questions on the health history form in the Admissions Department and students are expected to ask the patients again in each department at every visit. The students are expected to counsel the patient if he or she is interested in receiving cessation therapy. They are then referred to the state-specific quitline, depending upon patient’s residential address, mostly Iowa or Illinois.

The D3 and D4 students are not assessed clinically on tobacco intervention services, and there are no specific course requirements to complete a certain number of clinical experiences with patients related to tobacco intervention services. Thus, there is no record of students treating tobacco-using patients. There is no tracking system available for patients referred to quitlines or for follow-up visits of patients at the College. It is also not known about the extent of tobacco cessation guidance provided by various dental departments to the students at an individual patient level or how frequently tobacco use or cessation is re-assessed at the follow-up appointments in the individual departments.

Summary of Tobacco Intervention Curriculum

All the 11 articles above on health professional schools indicated that students were prepared to provide cessation services through clinical experience gained from adopting various teaching methods.

Spangler et al⁸³ have highlighted the need for using patient-centered counseling approaches, like standardized patient instruction, role playing, or a combination of these for medical students, as these were found more effective than traditional didactic materials alone. These authors also indicated that there is lack of long-term studies showing retention of cessation training, absence of studies showing application of intervention skills learned in clinical settings, and absence of research on best teaching method related to smokeless tobacco and cigar smoking intervention in medical students. Additionally, there is lack of integration of tobacco dependence information throughout all the four years of medical school curricula and lack of culturally relevant tobacco cessation material.

Geller et al⁸⁴ had proposed tobacco control competencies for U.S. medical students. These competencies were developed as a part of the Tobacco Prevention and Cessation Education Project and input was received from 12 U.S. medical schools. The competencies were organized according to training in adult cessation and prevention, pediatric cessation and prevention, public health advocacy/population science, support systems in clinical/medical settings, and professional development/ global competencies.

Ramseier et al⁸⁵ suggested that the curriculum content for dental and dental hygiene students should include biological effects of tobacco use, the history of tobacco culture and psychosocial aspects of tobacco use, prevention and treatment of tobacco and dependence, and development of clinical skills for tobacco use prevention and cessation. These authors also pointed out that it is essential to document type of tobacco used, intensity of use, duration of use, and time since cessation. This helps in documenting and monitoring of tobacco-using patients. These authors also highlighted the importance of

using multidisciplinary approaches to teach tobacco cessation in dental and dental hygiene schools that includes internal (dental faculty) as well as external (e.g., psychology, pharmacology) cessation experts. They also underscored the importance of didactic learning achieved through lectures, problem-based learning, and/or E-learning and clinical skills achieved through clinical instruction and practice.

Much progress has been made in tobacco curriculum development and adopting various teaching methods by medical schools. There is a need to evaluate and gain current tobacco cessation curriculum information employed by various U.S. dental schools. These schools could also be assessed regarding their attitudes toward standardizing dental tobacco cessation curricula and making cessation training a requirement to obtain licensure.

Overall Summary

High smoking prevalence exists among certain ethnicity groups, men, adults in the range of 18-44 years of age, and people with low education levels and income levels.⁸⁶ Tobacco use is associated with various systemic and oral diseases and cancers.^{9,87} Secondhand smoke exposure affects systemic health of the non-smoking population.⁸⁸ Nicotine dependence associated with any form of tobacco use makes the quitting process complicated.⁸⁹

Each health professional should be encouraged to provide cessation services individually, as well as through cooperative efforts. Dentists are well suited to provide tobacco intervention services and dental offices are ideal locations to apply a “team approach” method due to the availability of varied dental staff.

There are numerous gaps in the literature concerning health professionals' knowledge, attitudes and behaviors related to tobacco intervention. There are very few studies in the literature that have assessed health professionals' knowledge regarding oral and systemic effects of smoking, systemic effects of smoking on pregnancy, systemic effects of passive smoking, knowledge regarding nicotine replacement medications available for quitting, and knowledge regarding cessation programs available in the community, including quitlines. Health professionals' who lack knowledge in any of the above-mentioned areas related to tobacco intervention will not be able to provide tobacco intervention services successfully. There are no studies in the literature that have assessed whether students can correctly identify pathological conditions associated with tobacco use, as this information would help in cessation counseling.

Previous studies have thoroughly assessed health professionals' attitudes related to tobacco intervention. However, very few studies have assessed attitudes by gender, tobacco use status, years of private practice experience or by year in dental school. Very few studies have done comprehensive assessment of health professionals' patient-related attitudes in terms of cessation.

There are many studies in the literature that have assessed tobacco intervention behaviors of health professionals. However, these studies were mostly self-reported by the health professionals and there are very few studies that have correlated and confirmed these intervention behaviors with the patients. Additionally, no study has asked whether the health professionals did not provide tobacco intervention assistance due to refusal from the patients or because the health professionals did not feel comfortable in assisting the patients and, hence, did not perform this step. The same holds true for students, as

students will lack clinical experiences in provide cessation counseling if patients refuse to be counseled. Additionally, some students might see more tobacco-using patients compared to others, and this would also affect the behavior component. Moreover, cessation services provided by students could also vary by the support or guidance received from various medical/dental departments and faculty.

The literature indicates that health professional schools provide a solid foundation for students to learn cessation counseling. However, very few studies have assessed students in terms of adequacy of tobacco intervention topics covered didactically and clinically during their education in dental or medical schools. If the tobacco intervention topics are not covered thoroughly, then this could be a barrier in providing intervention services.

Besides the above-mentioned gaps, it is not known whether students lack confidence or skills to provide tobacco intervention services in specific areas, for example, in prescribing medications, setting a quit date, or asking patients regarding tobacco use, etc. Likewise, it is not known whether various medical/dental departments support cessation services and guide students.

Other structural barriers that were not assessed in the earlier student studies were lack of a tracking system in the college for tobacco-using patients, lack of adequate space and lack privacy to counsel patients. Thus, very few student studies have assessed factors associated with barriers to provision of tobacco intervention services. The current study has addressed some of the above-mentioned gaps in the literature and has assessed perceived barriers faced by the University of Iowa fourth year dental students in providing tobacco intervention services.

CHAPTER III MATERIALS and METHODS

Overview

The goal of the current study was to identify the barriers related to the provision of tobacco intervention services by fourth year dental students at the College of Dentistry, University of Iowa. This study also assessed aspects of the fourth year dental students' knowledge, attitudes, and behaviors related to tobacco intervention services and the tobacco cessation curriculum covered as a whole in the four years of dental school at the University of Iowa. The information collected in the study could be used to make recommendations for changes in the tobacco cessation curriculum that would benefit students in providing tobacco intervention services in the College of Dentistry's dental clinics, as well as in future private clinical practice. These efforts may ultimately improve the public's oral health in Iowa.

A cross-sectional study design was used in this study. Informal pilot testing was conducted with seven soon be graduating fourth year dental students on May 1, 2008, and necessary revisions were made in the survey questionnaire. The study was approved by the Institutional Review Board (IRB) at the University of Iowa. A total of 70 incoming fourth year dental students were invited to participate in the study on July 25, 2008 during their academic orientation at the University of Iowa. The inclusion criterion for the study was being a fourth year dental student. A self-administered questionnaire was given to the fourth year dental students at the University of Iowa.

Institutional Review Board Approval

An Institutional Review Board (IRB) application was prepared and submitted to the University of Iowa IRB prior to surveying the students. The consent form submitted to the IRB included information regarding the purpose of the study, consent information and time required to complete the questionnaire. This form stated that completion of the survey represented students' consent to participate in the study. The information provided to the IRB regarding privacy included not allowing the faculty to enter the room during the administration of the survey and allowing the students to put the survey in the envelope provided to them so that no one would know whether they had answered or not. The IRB information related to confidentiality included coding each person's survey with a unique identification number and keeping the answered surveys, student IDs and coded ID numbers locked in the Dean's office area after data entry. Additionally, it was also stated that only the PI would have access to the surveys and the results of the survey would be reported as aggregate and not individual data. After revisions and clarifications, the study was approved by the IRB.

Pilot Study

Note: The draft questionnaire with 10 pages and 17 questions is shown in Appendix A.

Informal pilot testing of the draft questionnaire with 10 pages and 17 questions was conducted with seven soon be graduating fourth year dental students on May 1, 2008. The intent of pilot testing was to evaluate the content and organization of survey questions and gain suggestions and input from the students on current questions and any information they thought was necessary to be included in the questionnaire and time

taken to complete the survey. Based on pilot testing, the term “barrier” was replaced by “aspects that interfered with students’ provision of tobacco intervention services.” Thus, this was the only revision were made in the survey instrument.

Research Questions

The main research questions were:

1. What are the barriers reported by the entering fourth-year dental students at the University of Iowa concerning provision of tobacco intervention services?
2. What are the relationships between the barriers overall (composite measure) and each of the following: knowledge, attitudes, behaviors, tobacco intervention curriculum coverage of specific topics, overall assessment of the tobacco intervention curriculum, level of guidance received at the individual patient level from the different dental departmental faculty, tobacco use status, gender and time spent on tobacco intervention services domains?

Key Categories of Data Collection

The key categories of data collection are summarized below.

1. Barriers related to students’ provision of tobacco intervention services.
2. Selected knowledge related to adverse effects of smoking on general and oral health.
3. Selected attitudes related to dentists’ provision of tobacco intervention services.

4. Selected behaviors related to fourth year dental students' provision of tobacco intervention services.
5. Students' assessments of the tobacco intervention curriculum coverage of specific topics at the College of Dentistry, University of Iowa.
6. Students' overall assessments of the tobacco intervention curriculum at the College of Dentistry, University of Iowa.
7. Level of guidance received at the individual patient level from the different dental departmental faculty at the University of Iowa, College of Dentistry.
8. Tobacco use status of the fourth year dental students providing tobacco intervention services.
9. Gender of fourth year dental students providing tobacco intervention services.
10. Time spent per patient per visit in tobacco intervention counseling by the fourth year dental students.

Hypotheses

Note: "overall barriers" refers to a composite barrier variable, as described further later.

The study hypotheses (null hypotheses) were:

1. There are no **barriers** reported by fourth year dental students concerning provision of tobacco intervention services.
2. There is no relationship between **overall barriers** reported by the fourth year dental students concerning provision of tobacco intervention services and the fourth year dental students' **knowledge** concerning adverse effects caused by smoking on general and oral health.

3. There is no relationship between **overall barriers** reported by the fourth year dental students concerning provision of tobacco intervention services and the fourth year dental students' **attitudes** concerning dentists' provision of tobacco intervention services.
4. There is no relationship between **overall barriers** reported by the fourth year dental students concerning provision of tobacco intervention services and the fourth year dental students' **behaviors** concerning provision of tobacco intervention services.
5. There is no relationship between **overall barriers** reported by the fourth year dental students concerning provision of tobacco intervention services and the fourth year dental students' **assessments of tobacco intervention curriculum coverage of specific topics**.
6. There is no relationship between **overall barriers** reported by the fourth year dental students concerning provision of tobacco intervention services and the fourth year dental students' **overall assessments of the tobacco intervention curriculum**.
7. There is no relationship between **overall barriers** reported by the fourth year dental students concerning provision of tobacco intervention services and **the levels of guidance received by the fourth year dental students at the individual patient level** from the dental departments at the University of Iowa, College of Dentistry.
8. There is no relationship between **overall barriers** reported by the fourth year dental students concerning provision of tobacco intervention services and the **tobacco use status** of the fourth year dental students.
9. There is no relationship between **overall barriers** reported by the fourth year dental students concerning provision of tobacco intervention services and **the time spent per patient per visit by the fourth year dental students in tobacco intervention counseling**.

10. There is no relationship between **overall barriers** reported by the fourth year dental students concerning provision of tobacco intervention services and **gender** of the fourth year students concerning provision of tobacco intervention services.

Survey Instrument

Note: Appendix B summarizes the sources of the questions used.

The survey instrument was created exclusively for assessing the variables associated with the barriers to the provision of tobacco intervention services. Key sources used for the development of the survey included Yip et al²², Victoroff et al²³ and Polychonopoulou et al³⁶ studies. Many private-practitioner based studies were reviewed in developing barrier-related questions. Most of the studies assessing students or private practitioners regarding tobacco intervention services focused on the behavior domain and found significant associations between tobacco counseling behaviors and key variables like attitudes related to tobacco intervention services, age, gender, race, tobacco use status, training, geographic location and specialty.^{22,32,48,49,54,59}

Knowledge, attitudes, behaviors, and curricular domains related to tobacco intervention services were thought to be appropriate for studying associations with the barrier domain, since the focus of the current study was assessing factors associated with barriers to provision of tobacco intervention services by the fourth year dental students. The sub-questions under each individual domain were developed based on the literature, after reviewing their relevance to the current study, and were approved by the thesis committee members.

Additional factors like age, gender, tobacco use status, and faculty support to provide cessation counseling from various dental departments were also thought to be appropriate for assessing their associations with barriers to tobacco intervention.

The survey included self-reported responses from the students and there was no way of knowing whether the students actually provided cessation services or had favorable attitudes related to cessation services or they were reporting socially desirable responses. Thus, the social desirability scale (scale that includes statements related to personal attitudes and traits) developed by Strahan and Gerbasi⁹⁰ was included in order to allow for adjustment of their high attitudinal or behavior-related responses in the final model. This was the shorter version of the scale also known as 'M-C 2(10)' that included 10 statements. This scale was more acceptable in the surveyed population compared to the 'M-C 1(10)' short scale developed by the same authors. Both the scales could be used when the survey interview time was limited and when the loss of reliability was tolerable. Half of the statements in the scale were true and half of them were false. If the respondents' answers matched the statements then they would score a one or else a zero. Thus, the total score ranged from 0 (when no responses matched) to 10 (when all responses matched). A score of six and above would indicate having a high social desirability.

Recruitment of the Subjects and Survey Distribution

All the fourth year dental students were informed about the research study at the time of distribution of the survey questionnaire during their academic orientation in July 2008. The total duration of time to distribute, explain/answer questions, obtain consent,

complete and turn in the survey questionnaire was 25-30 minutes. The primary investigator of the study explained the research study and the intent to study fourth year dental students. During this procedure, information was disseminated in the form of a group presentation and the students were told that their participation was completely voluntary, their non-participation or response to the questions would not affect their grades, and that they could skip any questions they felt uncomfortable answering.

Students were told verbally and it was mentioned in the consent letter that they would be contacted several years in the future to complete a similar survey (adapted to practice instead of dental school) to assess their perceived barriers to provide tobacco intervention services in their private dental practice. Questions concerning the survey were answered prior to the distribution, and then the students were invited to complete the questionnaire.

The students were asked to put the consent form and the questionnaire into the envelope provided to each student separately after they had completed the questionnaire or not completed it. The non-responders were not contacted again. During the orientation and at the time of survey, faculty members were not allowed to be present. All students were informed to put their eight digit University ID number on the questionnaires so that they could be contacted in the future (after several years in practice), but that all individual data would remain confidential and results only would be reported in aggregate.

Variables and Operational Definitions

Note: The final survey instrument with 11 pages and 18 questions is shown in Appendix C.

Dependent Variables

Main Dependent Variable – Barrier Composite

The main dependent variable was an overall summary assessment of barriers (Question 5, Appendix C). It was a composite variable defined as the sum of the scores for 14 questions, with possible range from 14 to 70. A five-point Likert scale was used to assess the responses to each question: never (1), sometimes (2), about half of the time (3), often (4), and almost always (5). Thus, a score of 14 would mean never for all (low barriers) and 70 almost always for all (high barriers).

The 14 barrier-related questions were concerning: A) inadequate knowledge about nicotine replacement therapy, B) inadequate knowledge about quit lines, C) lack of training to counsel patients who use smoked tobacco (cigarettes, cigars, pipes, etc.), D) lack of training to counsel patients who use smokeless tobacco, E) inadequate skills in providing tobacco intervention services, F) forgetting to give tobacco intervention counseling, G) lack of incentive (no curricular requirement/minimal impact on grades) for providing tobacco intervention services, H) patients' resistance to tobacco intervention services, I) inadequate time available for providing intervention services, J) inadequate availability of patient educational materials related to tobacco intervention, K) inadequate space to hold confidential conversations related to tobacco intervention with the patients, L) lack of a formal tracking system about tobacco-using patients in the

College, M) inadequate faculty support for providing tobacco intervention services at the individual patient level, and N) some patients feeling that dentists should not be involved with tobacco intervention services. Further dichotomization of the dependent variable was done for the descriptive statistics according to the distribution of responses for each question. Thus, categories “sometimes, about half the time, often and almost always” (2+3+4+5) were combined vs. “never” (1), so the score for (2+3+4+5) was $Y = 1$ and for (1), $Y = 0$. Thus, for this alternate composite of 14 dichotomous items, the sum was from 0-14, with lower scores again meaning lower barriers. For statistical analysis, the scale was redefined from 0-4, such that the sum of scores for 14 questions was in the range of 0-56.

Independent Variables

Knowledge Composite

Five questions in the *knowledge* composite (Question 2, Appendix C) assessed fourth year dental students' knowledge concerning adverse effects of smoking associated with oral health or systemic health: A) implant failure, B) chronic heart disease, C) delayed wound healing, D) bleeding on probing and E) Necrotizing Ulcerative Gingivitis (NUG). A five-point Likert scale (ordinal scale) was used to assess the responses: strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5). Each knowledge question was scored separately from one to five, and the results were aggregated into a sum of the scores for the five knowledge questions, such that the possible range varied from 5-25. Question D had responses reverse-coded before summing all the responses. Thus, a score of 5 would mean strongly disagree for all (low

knowledge) and 25 strongly agree for all (high knowledge). Further dichotomization of the knowledge variables was done according to the distribution of responses for each question. Thus, for Q2 A, B, C, and E, the categories “agree and strongly agree” (4+5) were combined vs. “strongly disagree, disagree and neutral” (1+2+3), for the descriptive statistics, so the score for (4+5) was $Y=1$ and for (1+2+3), $Y=0$. However, Q2D was reverse-coded, so categories “strongly disagree and disagree” (1+2) were combined vs. “neutral, agree, strongly agree” (3+4+5), and thus, the score for (1+2) was $Y=1$ and for (3+4+5), $Y=0$. Overall, for this composite of 5 dichotomous items, the sum was from 0-5, with lower scores again meaning lower knowledge. For statistical analysis, the scale was redefined from 0-4, such that the sum of scores for 5 questions was in the range of 0-20.

Attitude Composite

Four questions in the *attitudes* composite (Question 1, Appendix C) assessed fourth year dental students' attitudes concerning tobacco intervention services: A) role of dentists in provision of tobacco intervention services, B) impact of provision of cessation services offered in dental offices on patient's quitting, C) setting a good example by not using tobacco, and D) actively supporting and promoting tobacco intervention services in community programs. A five-point Likert scale (ordinal scale) was used to assess the responses for each question: strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5). Each attitude question was scored separately from one to five, and the results were aggregated into one composite score for the four questions, such that the possible range varied from 4-20. Thus, a score of 4 would mean strongly disagree for all (unfavorable/low attitudes) and 20 strongly agree for all (favorable/high attitudes).

Further dichotomization of the attitude variables was done according to the distribution of

responses for each question. Thus, categories “agree and strongly agree” (4+5) were combined vs. “strongly disagree, disagree and neutral” (1+2+3), for the descriptive statistics, so the score for (4+5) was $Y=1$ and for (1+2+3), $Y=0$. Thus, for this alternate composite of 4 dichotomous items, the sum was from 0-4, with lower scores again meaning lower/unfavorable attitudes. For statistical analysis, the scale was redefined from 0-4, such that the sum of scores for 4 questions was in the range of 0-16.

Behavior Composite

Nine questions in the *behavior* composite (Question 4, Appendix C) assessed fourth year dental students' behaviors concerning tobacco intervention services: A) reviewing patient's chart information related to tobacco use, B) asking patients verbally about tobacco use, C) advising patients who use tobacco, D) assessing patient's willingness to quit, E) assisting them in quitting by setting a specific quit date, F) providing educational material, G) prescribing nicotine replacement therapy, Zyban®, Chantix® etc, H) arranging follow-up visits for them and I) referring patients to quit lines. A six-point Likert scale (ordinal scale) was used to assess the responses for each question: 0% (1), 1-24% (2), 25-50% (3), 51-74% (4) 75-90% (5) and 91-100% (6). Each behavior question was scored separately from one to six and the results were aggregated into one composite score for the nine questions by summing the individual scores, such that the possible range varied from 9-54. Thus, a score of 9 would mean *1-24% of the time* for all questions (low behaviors) and 70 would mean *91-100% of the time* for all questions (high behaviors).

Further dichotomization of the behavior variables was done for the descriptive statistics according to the distribution of responses for each question. Thus, categories “51-74%, 75-90% and 91-100%” (4+5+6) were combined vs. “0%, 1-24%, 25-50%” (1+2+3), so the score for (4+5+6) was $Y=1$ and for (1+2+3), $Y=0$. Thus, for this alternate composite of 9 dichotomous items, the sum was from 0-9, with lower scores again meaning lower behaviors. For statistical analysis, the scale was redefined from 0-5, such that the sum of scores for 9 questions was in the range of 0-45.

Students’ Assessment of the Tobacco Intervention Curriculum

Questions in this area assessed the *adequacy of coverage of topics* (Question 6, Appendix C) in the tobacco intervention curriculum as a whole over the previous three years. It included teaching the curriculum (lectures) by leader Ms. Nancy Slach in Periodontics and didactic content presented by Dr. Rhys Jones and Dr. Georgia Johnson. A four-point Likert scale was used to assess the responses to each question: not covered at all (1), covered minimally (2), covered moderately well (3) and covered very well (4).

Ten questions were asked related to adequacy of coverage on the following topics: A) historical, social and economic factors associated with tobacco use and the tobacco industry, B) a review of general tobacco-related diseases, C) a review of oral tobacco-related diseases, D) the nature of nicotine dependency and addiction, E) the Public Health Service’s 5As and 5Rs for conducting tobacco cessation counseling, F) brief motivational interviewing, G) how to develop a comprehensive tobacco intervention program in a clinical setting, H) FDA-approved pharmacotherapy to assist cessation attempts, I)

strategies for how to become involved in community-based tobacco control, and J) addressing dental students' own tobacco use.

Three additional questions (Question 7, Appendix C) were asked related to curriculum concerning A) *relevancy*, B) *currency of information* about tobacco intervention curriculum and C) “based on the tobacco intervention curriculum, I feel prepared to provide tobacco intervention services”. A five-point Likert scale was used to assess these responses: strongly disagree (1), disagree (2), neutral (3), agree (4) and strongly agree (5). Each question was scored separately from one to five, and the results were aggregated into one composite score for the three questions, such that the possible range varied from 3-15. Thus, a score of 3 would mean strongly disagree for all (unfavorable/low responses toward curriculum) and 15 strongly agree for all (favorable/high responses toward curriculum). Further dichotomization of these variables was done for the descriptive statistics according to the distribution of responses for each question. Thus, categories “agree and strongly agree” (4+5) were combined vs. “strongly disagree, disagree and neutral” (1+2+3), so the score for (4+5) was $Y=1$ and for (1+2+3), $Y=0$. Thus, for this alternate composite of 3 dichotomous items, the sum was from 0-3, with lower scores again meaning lower/unfavorable responses toward curriculum. For statistical analysis, the scale was redefined from 0-4, such that the sum of scores for 3 questions was in the range of 0-12.

Level of Guidance Received at the Individual
Patient Level from the Dental Departments
at the University of Iowa, College of Dentistry

Questions were asked regarding guidance received from each of the eight departments at the individual patient level (Question 8, Appendix C) concerning provision of tobacco intervention services. The departments were Endodontics; Operative Dentistry; Oral and Maxillofacial Surgery; Oral Diagnosis, Pathology, Oral Radiology, and Medicine; Orthodontics; Pediatric Dentistry; Periodontics; and Prosthodontics. A six-point Likert scale was used to assess the responses: 0% (1), 1-24% (2), 25-50% (3), 51-74% (4) 75-100% (5) and not applicable (meaning no tobacco use among any patients in the clinic) (6). Each question was scored from one to five. The sixth category was not included as it meant “not applicable” and so the score did not mean anything. Further dichotomization of this variable was done according to the distribution of responses for each question. Thus, categories “0%, 1-24%, 25-50%” (1+2+3) were combined vs. “51-74%, 75-100%” (4+5), so the score for (4+5) was Y=1 and for (1+2+3), Y=0. Thus, the sum for all the 8 questions was from 0-8.

Gender

Gender (Question 10, Appendix C) was categorized into males (1) and females (2).

Tobacco Use Status

Tobacco use status (Question 11, Appendix C) was categorized into current user – use of tobacco in the last 30 days (1), former user – use of tobacco in the past, but not in the last 30 days (2) and never user – not used tobacco at all (3).

Time Spent per Visit, per Patient in Providing Tobacco Intervention Services

Time spent per visit, per patient in providing tobacco intervention services (Question 12, Appendix C) was categorized into less than one minute (1), two minutes (2), three minutes (3) and four or more minutes (4).

Data Management

Data Clean-up

The returned surveys were examined for completeness and accuracy by the PI. All the surveys were assigned unique ID numbers and the information related to open-ended responses was entered separately. One student who had marked an answer between two different responses per question was contacted again by campus mail for clarifications. The new information received from this student after re-contacting was updated. Additionally, three students did not report values for three different questions i.e., one student did not answer a question from the curriculum topics (Q6D), another student did not answer one question from the support received through dental departments (Q8F) and the third student did not report gender (Q11). No outliers were found in the answered survey during the data clean-up.

Data Entry

The Department of Biostatistics in the College of Public Health offers a data entry service for those conducting research at the University of Iowa. All data were sent there after data clean-up double-entered and verified using a blind verification process. Blind

verification means the second person doesn't get to see what the first person entered. The verified data were provided to the principal investigator in a standard ASCII text flat file.

Analysis Plan

Descriptive statistics were used to summarize the students' responses to both *individual* questions and *composites* for the perceived barriers (dependent variable) in providing tobacco intervention services, as well as independent variables concerning knowledge, attitudes, behaviors, tobacco intervention curriculum coverage assessment, overall assessment of tobacco intervention curriculum and guidance received from each dental departmental faculty. Information was also sought about percentage of tobacco using patients seen in the previous year, time spent in tobacco intervention, age, gender, tobacco use status and types of tobacco cessation curriculum teaching methods preferred by the dental students.

Tests of normality and internal consistency were conducted. Internal consistency of scale responses was assessed by using Cronbach's alpha prior to doing bivariate analyses for the composite variables in the study. A reliability coefficient of 0.70 or higher was considered, based on the widely used rule of thumb of 0.70 suggested by Nunnally (1978). The coefficient was less than 0.70 for the knowledge composite and social desirability variable. Thus, the bivariate analyses between the dependent variable i.e., the barrier composite and each of the five knowledge statements under the knowledge composite were conducted and reported separately. However, the bivariate analyses for the social desirability scale (SDS) were performed separately for each statement under the scale and as aggregate score. The SDS was reported as an aggregate score from 0-10 as this is how the authors of this scale wanted it to be reported in spite of

its compromised reliability, so that the scale and scores were uniform on all the sites.⁹⁰ Additionally, question six about “adequacy of specific tobacco cessation topics curriculum covered” included many statements that showed significant associations with the barrier composite hence, the internal consistency was assessed for this question. This question showed a high internal consistency and hence it was treated as a composite variable. Each curriculum question was scored separately from one to four, and the results were aggregated into one composite score for the 10 questions, such that the possible range varied from 10-40. Thus, a score of 10 would mean not covered at all (curriculum topics not covered very well) and 40 covered very well for all (curriculum topics covered very well). Further dichotomization of the curriculum variables was done according to the distribution of responses for each question. Thus, categories “covered moderately well and covered very well” (3+4) were combined vs. “not covered at all, covered minimally” (1+2), so the score for (3+4) was $Y=1$ and for (1+2), $Y=0$. Thus, for this alternate composite of 10 dichotomous items, the sum was from 0-10, with lower scores again meaning curriculum topics not covered very well. For statistical analysis, the scale was redefined from 0-3, such that the sum of scores for 10 questions was in the range of 0-30.

Bivariate analyses were conducted using three different approaches. The non-parametric Wilcoxon rank-sum, Kruskal-Wallis, and Spearman correlation tests were used to separately evaluate associations between barriers to providing tobacco intervention services (composite score) and each of the independent variables.

In the *first* approach, bivariate associations were explored between the composite barrier score and the composite independent variable scores using non-parametric Wilcoxon rank-sum, Kruskal-Wallis and Spearman correlation tests.

In the *second* approach, bivariate associations were explored between the composite barrier score and each sub-question under the composite score using non-parametric Wilcoxon rank-sum tests, Kruskal-Wallis tests, and Spearman correlation tests.

In the *third* approach bivariate associations were explored between composite barrier score and dichotomous sub-questions under independent variables (for example Disagree + Strongly Disagree + Neutral categories vs. Agree + Strongly Agree categories) using Wilcoxon Rank-Sum and Spearman correlation tests.

The final bivariate approach chosen for model analysis was the first approach i.e., using the association between the composite independent variables and the barrier composite. Each statement under the independent variable was associated with the composite barrier score separately, when composite scores could not be created for some independent variables due to low internal consistency. This approach was chosen as it was one of the two current research questions. Additionally, the bivariate analysis approach using separate statements under independent variables and the barrier composite could not be used to build the final statistical model as, 23 statements under independent variables showed significant associations with the barrier composite using $p < 0.20$ and all these variables could not be put into the final model as the sample size was small ($n=68$), so a maximum of 6 to 7 variables ($68/10$) could be used for building the final model by a good rule of thumb. The bivariate approach using dichotomous sub-

questions under the independent variables and the composite barrier scores could not be used to build the final statistical model as, this approach indicated whether there was statistically significant difference between the dichotomous responses, but did not show whether the reported barriers increased or decreased when associated with the independent variables.

As mentioned previously in the method section under the ‘survey instrument section’, associations between the social desirability scale (SDS) composite and individual question under the SDS scale and each of the barriers, attitudes and behaviors were explored using Wilcoxon rank-sum and Spearman correlation tests. Collinearity and potential interactions were assessed before and after entering in the final model.

Multiple linear regression models were developed to identify significant factors associated with barriers concerning provision of tobacco intervention services. For the inclusion of any variables in the multiple regression models, the criteria of a bivariate association with $p \leq 0.20$ were used. The forward, backward, and stepwise regression analyses were performed with the criteria of a P -value < 0.20 to enter and a P -value < 0.20 and P -value < 0.05 to remain in the models. Moreover, collinearity between the independent variables that showed significant bivariate associations was assessed before entering in the final model.

Two linear regression models were created, since it was an exploratory analysis and the sample size was limited. These two models showed final variables that had significant associations with the barrier composite at $p < 0.05$ and $p < 0.20$. Potential interactions between the independent variables were also assessed in the final model.

Data analyses were conducted using SAS (SAS® 9.1. for Microsoft Windows®, Cary, NC, SAS Institute, 2004).

CHAPTER IV RESULTS

Overview

All the incoming fourth year dental students were invited to participate in the study during their academic orientation at the University of Iowa on July 25, 2008. A self-administered questionnaire was completed by 70 fourth year dental students. The findings of this study are presented in four sections: Response rate, Descriptive data, Bivariate analyses and Multivariable analyses.

Response Rate

Sixty-eight students completed the questionnaire, as two students were absent on that day. Thus, the response rate was 100% for those who attended and 97% overall.

Descriptive Data

A total of 18 questions and many sub-questions were asked in the survey questionnaire. Thus, descriptive statistics were computed and frequency tables were generated for dependent (barriers) as well as independent variables (knowledge, attitudes, behaviors, gender, curriculum, dental departments, etc.) that included both *individual* questions and *composites*.

Table 1 summarizes the study respondents' selected characteristics. There were 66% (n=45) males and 34% (n=23) females. The age range was 24-38 (mean = ± 26.38) years. There were four (6%) current tobacco users, 14 (21%) former users and 49 (73%) had never used tobacco.

Responses to additional characteristics included percentage of tobacco using patients seen by the students during the last year, time spent in counseling per patient per visit and intentions of providing cessation counseling in the future. Forty-one percent of the students reported that 21-30% of their patients used tobacco in the past year, 34% reported that 30% or more of their patients used tobacco in the past year, 21% reported that 11-20% of their patients used tobacco in the past year and 4% reported that 1-10% of their patients used tobacco in the past year. About 34% reported spending *two minutes* in tobacco cessation counseling per patient per visit, followed by 25% spending *three minutes*, 22% spending *less than one minute* and 19% spending *more than four minutes*. Almost 88% reported planning to provide tobacco intervention services in future, with 10% not yet decided.

Table 2 summarizes the study respondents' knowledge related to oral and systemic health effects of smoking. Students reported generally favorable responses for three of the five knowledge questions. Highest agreements for combined "strongly agree" and "agree" responses were reported related to the statements "smoking is associated with chronic heart disease" (99%) and "smoking is associated with delayed wound healing" (97%). However, 56% reported "strongly agree" related to "smoking is associated with delayed wound healing" compared to 49% for "smoking is associated with chronic heart disease." Only 18% strongly disagreed with the statement that smokers have greater bleeding on probing than non-smokers and very few strongly agreed (3%) that smoking is associated with Necrotizing Ulcerative Gingivitis.

Table 3 summarizes the study respondents' attitudes toward tobacco intervention services. The students reported generally favorable attitudes toward tobacco intervention

services. At least 81% reported agreement (agree + strongly agree) for each of the four attitudinal items, with a high of 92% related to “dentists have an important role to play in tobacco intervention services” (agree + strongly agree). A high of 47% was reported for “dental professionals should set a good example by not using tobacco” when only the “strongly agree” category was considered.

Table 4 summarizes the study respondents’ behaviors related to tobacco intervention services. High responses were obtained for patients’ *assessment behaviors* related to tobacco intervention services (reviewed charts, asked verbally, advised and assessed patients’ willingness to quit) and were in the range of 70-93% for assessing patients *more than 50% of the time*. Low responses were reported for *specific intervention behaviors* compared to assessment behaviors, and were in the range of 0-30% for providing intervention services *more than 50% of the time*.

Table 5 summarizes barriers perceived by the study respondents’ toward tobacco intervention services. The barrier-related responses address the first of the two current study’s research questions, “What are the barriers reported by the entering fourth-year dental students at the University of Iowa concerning provision of tobacco intervention services?”

The most commonly perceived barriers (“sometimes,” “about half of the time,” “often,” and “almost always” categories combined) included patient’s resistance to tobacco intervention services (96%), inadequate time available for tobacco intervention services (96%), forgetting to give tobacco intervention counseling (91%), inadequate knowledge about nicotine replacement drugs (75%), and inadequate skills in providing

tobacco intervention services (75%). The highest response of 21% was obtained for patient resistance when only the “almost always” category was considered.

Table 6 summarizes responses concerning adequacy of specific tobacco intervention topics covered over the past three years at the University of Iowa, College of Dentistry. The responses related to the “covered very well” category ranged from 7-59%, with highest responses of 59% and 43% obtained for “review of oral tobacco-related diseases” and “review of general tobacco-related diseases,” respectively. The combined responses related to “covered moderately well” and “covered very well” ranged from 20-93% and were highest for the above curriculum topics “review of oral tobacco-related diseases” (93%) and “review of general tobacco-related diseases,” respectively (90%).

Less than 50% reported that the curriculum adequately covered student’s tobacco use, strategies for how to become involved in community-based tobacco control, and how to develop a comprehensive tobacco intervention program in a clinical setting.

Table 7 summarizes responses for additional curriculum–related responses and preparedness of the students. Most of the students reported (agree + strongly agree) that the UI curriculum included relevant (93%) and current (96%) tobacco intervention-related information. However, only 55% reported feeling prepared for providing intervention services based on the curriculum.

Table 8 summarizes responses for percentages of time the different departmental faculty worked or encouraged students to provide intervention services. The students reported that faculty from the Periodontics (71%) followed by Oral Diagnosis, Oral Pathology, Oral Radiology and Medicine (49%) Departments encouraged them to provide tobacco intervention services during their third year *more than 50% of the time*.

The students reported very low responses from the Departments of Endodontics (0%), Orthodontics (0%), Pediatric Dentistry (1%), Prosthodontics (3%), Oral and Maxillofacial Surgery (16%) and Operative Dentistry (26%).

Table 9 summarizes the perceived importance by the students of incorporating different teaching methods for learning tobacco intervention. Ninety-one percent reported that didactic lectures were a valuable method of learning tobacco intervention (“somewhat valuable”, “moderately valuable” and “very valuable” categories combined). Substantial percentages reported the “moderately valuable” category for didactic lectures (47%) and “somewhat valuable” category for the web-based learning (50%). Responses in the “very valuable” category ranged from 0-9%, with a high of 9% for both didactic lectures and web-based learning.

Additional Descriptive Data

Fifty-three of the 68 students responded to the open-ended question related to their views about grading dental students on didactic and clinical work related to tobacco intervention services. Almost 47% reported that students should be graded on didactic work only, followed by 36% who reported that students should be graded for didactic as well as clinical work, 8% who reported clinical only and 6% who reported neither.

Twenty-six of the 68 students responded to the open-ended question related to their suggestions regarding UI tobacco intervention curriculum and services. Almost 31% reported that they needed more clinical experience and 23% reported that they needed more information related to nicotine replacement therapy use. About one percent (1.47%) commented that “patients mostly see different dental students each time, thus difficult to do follow-up and loss of clinic time as well,” “do not move to clinical grading,” “best

learning method is to watch Nancy Slach,” “provide free nicotine samples to students so that they can prescribe it to patients,” “overbearing to patients” and “patient resistance”.

Thirty-eight of the 68 students responded to open-ended question related to tobacco intervention barriers anticipated in future private practice clinical settings. Almost 58% reported that patient resistance would be a barrier to providing tobacco intervention services in future private practice clinical settings. About one percent (1.47%) reported “unknown side-effects of Chantix,” “costs associated with quitting,” “lack of incentive to provide cessation services,” “difficult to follow-up,” “low success rate,” “learning tobacco use prevention in young patients.”

Table 10 summarizes the distribution of responses to the attitude, behavior and barrier composites and each of the knowledge questions. The ranges of mean, median and maximum for the knowledge questions are 2.10-3.53, 2-4 and 4 (for all the knowledge questions), respectively.

Table 11 summarizes the responses to the social desirability scale. The highlighted responses indicate agreement with the authors’ responses (Strahan, 1972).

Bivariate Data Analyses

The second research question was “What are the relationships between the barriers overall (composite measure) and each of the following: knowledge, attitudes, behaviors, tobacco intervention curriculum coverage of specific topics, overall assessment of the tobacco intervention curriculum, level of guidance received at the individual patient level from the dental departments, tobacco use status, gender and time spent on tobacco intervention services domains?”

The bivariate responses to the second research question are addressed below.

For each bivariate results section, the results with traditional p-value of $p < 0.05$ are presented first, followed by additional variables reaching significance at $p < 0.20$ due to the exploratory nature of the study and small sample size. Non-parametric tests used for the bivariate analyses included Wilcoxon rank-sum, Kruskal-Wallis and Spearman correlation tests in order to separately evaluate associations between barriers to providing tobacco intervention services (composite score) and each of the independent variables.

Bivariate Results: Evaluation of
Associations between
Composite Barrier Score
(Dependent Variable)
and Independent Variables
(by Domain and by Each Question
under the Domains)

Note: Table 12 summarizes the bivariate associations of the dependent variable barrier composite with age, gender, tobacco use status and tobacco intervention services provided per patient per visit.

Association between Students' Age
and Barriers to Provision of
Tobacco Intervention Services

There was not a statistically significant correlation between students' age and the barrier composite ($r_s = 0.12$, $p = 0.32$) using $p < 0.05$ and $p < 0.20$.

Association between Gender and
Barriers to Provision of
Tobacco Intervention Services

There was not a statistically significant association between gender and the barrier composite ($p = 0.79$) using $p < 0.05$ and $p < 0.20$.

Association between Students’
Tobacco Use Status and Barriers to
Provision of Tobacco Intervention Services

There was not a statistically significant association between tobacco use status and the barrier composite ($p=0.55$) using $p<0.05$ and $p<0.20$.

Association between Time Spent on Tobacco
Intervention Services per Visit per Patient and
Barriers to Provision of Tobacco Intervention Services

There was not a statistically significant association between time spent in counseling per patient per visit and the barrier composite ($p=0.51$) using $p<0.05$ and $p<0.20$.

Note: Table 13 summarizes the bivariate associations of the dependent variable barrier composite with other independent variables (by Composite and by Each Question under the Composite)

Association between Knowledge of Oral and
Systemic Health Effects of Smoking and
Barriers to Provision of Tobacco Intervention Services

The internal consistency of the knowledge composite was low (less than 0.70), as assessed by Cronbach’s alpha. Thus, each knowledge question was correlated separately with barrier composite. Using $p<0.05$, there was a weak, statistically significant negative correlation ($r_s=-0.29$, $p=0.02$) between the knowledge question “smoking is associated with delayed wound healing” and the barrier composite. This meant that perceived barriers to provision of tobacco intervention *decreased* as the knowledge related to smoking associated with delayed wound healing *increased*. There was not a statistically significant correlation between the other four knowledge questions and the barrier

composite using $p < 0.05$. Using a significant level of $p < 0.20$, there also was a statistically significant weak negative correlation between the barrier composite and the above statement and also the statement “smoking is associated with heart disease” ($r_s = -0.18$, $p = 0.14$). This meant that perceived barriers to provision of tobacco intervention *decreased* as the knowledge related to the each of the two statements *increased*.

Association between Attitudes Related to Tobacco Intervention Services and Barriers to Provision of Tobacco Intervention Services

There was not a statistically significant correlation between the attitude composite and the barrier composite ($r_s = 0.14$, $p = 0.24$) using $p < 0.05$ and $p < 0.20$. Using $p < 0.05$, there was not a statistically significant correlation between any of the four attitudinal statements and the barrier composite. Using $p < 0.20$, there was a statistically significant positive correlation ($r_s = 0.19$, $p = 0.11$) between the attitudinal statement “dental professionals should set a good example by not using tobacco” and the barrier composite. This meant that perceived barriers to providing tobacco intervention services decreased as the students reported disagreement with the above attitudinal statement toward tobacco cessation.

Association between Behaviors Related to Tobacco Intervention Services and Barriers to Provision of Tobacco Intervention Services

There was not a statistically significant correlation between the behavior composite and the barrier composite ($r_s = -0.11$, $p = 0.38$) using $p < 0.05$ and $p < 0.20$. Using $p < 0.05$, there was a statistically significant negative correlation ($r_s = -0.36$, $p = 0.002$) between one

of the nine behavior questions, i.e., “I assessed patients’ willingness to quit” behavior and the barrier composite. This meant that perceived barriers to provision of tobacco intervention services *decreased* as “assessing patients’ willingness to quit” behavior *increased*. Using $p < 0.20$, there also was a statistically significant negative correlation between the above statement and barrier composite and two other statements “I assisted patients by prescribing NRTs” ($r_s = -0.22$, $p = 0.0597$) and “I arranged follow-up visits” ($r_s = -0.16$, $p = 0.18$). This meant that perceived barriers to provision of tobacco intervention services *decreased* as each of the three behaviors *increased*.

Association between adequacy of Tobacco Intervention Curriculum Coverage of Specific Topics Reported by the Students and Barriers to Provision of Tobacco Intervention Services

Using $p < 0.05$, there was a statistically significant negative correlation ($r_s = -0.38$, $p = 0.0012$) between University of Iowa tobacco curriculum topic coverage composite over the past three years and the barrier composite. This meant that perceived barriers to provision of tobacco intervention services *decreased* as the adequacy of the topics covered over the past three years as part of tobacco intervention curriculum *increased*.

Using $p < 0.05$, there were statistically significant negative correlations between seven of the ten curriculum topics covered over the past three years and the barrier composite. The statements were: “A review of oral tobacco-related diseases” ($r_s = -0.32$, $p = 0.006$), “Public Health Service’s 5As and 5Rs for conducting tobacco cessation counseling” ($r_s = -0.24$, $p = 0.04$), “Brief motivational interviewing” ($r_s = -0.39$, $p = 0.0008$) and “How to develop a comprehensive tobacco intervention program in a clinical setting” ($r_s = -0.39$, $p = 0.0008$), “FDA-approved pharmacotherapies to assist cessation attempts”

($r_s=-0.40$, $p=0.0006$), “Strategies for how to become involved in community-based tobacco control” ($r_s=-0.26$, $p=0.02$) and “Addressing dental students’ own tobacco use” ($r_s=-0.25$, $p=0.03$). This meant that perceived barriers to provision of tobacco intervention services *decreased* as the adequacy of each of the above mentioned seven topics covered over the past three years as part of tobacco intervention curriculum *increased*.

Using $p<0.20$, there also were statistically significant negative correlations between the barrier composite and the above seven statements and two other curriculum topics, “A review of general tobacco-related diseases” ($r_s=-0.16$, $p=0.18$) and “The nature of nicotine dependency and addiction” ($r_s=-0.20$, $p=0.09$). This meant that perceived barriers to provision of tobacco intervention services *decreased* as the adequacy of each of the above mentioned nine topics covered over the past three years as part of tobacco intervention curriculum *increased*.

Association between Overall Tobacco Intervention Curriculum Assessment and Barriers to Provision of Tobacco Intervention Services

Using $p<0.05$, there was a statistically significant negative correlation ($r_s=-0.42$, $p=0.0003$) between the overall curriculum assessment composite and the barrier composite. This meant that perceived barriers to provision of tobacco intervention services *decreased* as the students’ reported overall tobacco intervention curriculum assessment *increased*. Using $p<0.05$, there were statistically significant negative correlations between the barrier composite and two of the three overall curriculum statements, “The tobacco intervention curriculum included relevant information” ($r_s=-0.29$, $p=0.01$) and “Based on the tobacco intervention curriculum, I feel prepared to

provide tobacco intervention services” ($r_s=-0.49$, $p<0.0001$). This meant that perceived barriers to provision of tobacco intervention services *decreased* as each of the two student reported statements about overall tobacco intervention curriculum assessment *increased*. Using $p<0.20$, there also were statistically significant negative correlations between the barrier composite and the above two statements and the statement “The tobacco intervention curriculum included relevant information” ($r_s=-0.29$, $p=0.01$). This meant that perceived barriers to provision of tobacco intervention services *decreased* as each of the three overall tobacco intervention curriculum assessment related statements *increased*.

Association between Perceived Importance by the Students of Incorporating Different Teaching Methods for Learning Tobacco Intervention and Barriers to Provision of Tobacco Intervention Services

Each statement under this question was different and related to specific teaching method, so a composite score was not created.

Using $p<0.05$, there was a statistically significant positive correlation between the barrier composite and perceived importance of incorporating Objective Structured Clinical Examination (OSCE) for learning tobacco intervention ($r_s=0.34$, $p=0.004$). This meant that perceived barriers decreased as students reported OSCE as a less favorable teaching method for tobacco intervention curriculum. Using $p<0.20$, there also were statistically significant positive correlations between the barrier composite and perceived importance of incorporating OSCE method as well as two different methods “Problem-based learning” ($r_s=0.20$, $p=0.10$) and “CD-ROM instructions” ($r_s=0.19$, $p=0.12$) for

learning tobacco intervention. This meant that perceived barriers decreased as students reported each of the three methods to be less favorable teaching methods for the tobacco intervention curriculum.

Association between level of Guidance
Received from The Dental Departmental
Faculty at the Individual Patient level and
Barriers to Provision of Tobacco Intervention Services

A composite score was not created for this question as each statement under this question represented different dental departments and hence couldn't be aggregated.

Using $p < 0.05$, there was a statistically significant negative correlation ($r_s = -0.40$, $p = 0.008$) between the barrier composite and the faculty support received from the Pediatric Dentistry Department to provide tobacco intervention services. This meant that perceived barriers to provision of tobacco intervention services *decreased* as the reported support to provide tobacco intervention services from Pediatric Dentistry *increased*.

Using $p < 0.20$, there also were statistically significant negative correlations ($r_s = -0.17$, $p = 0.17$) between the barrier composite and the faculty support received from the above department and Endodontic Department to provide tobacco intervention services. This meant that perceived barriers to provision of tobacco intervention services *decreased* as the reported support to provide tobacco intervention services from each of these departments *increased*.

The following sections summarize the results about the bivariate associations between the composite barrier score and dichotomous sub-questions under independent variables using Wilcoxon Rank-Sum and Spearman Correlation Tests.

Bivariate Results: Evaluation of Associations
between the Composite Barrier Score
(Dependent Variable) and Dichotomous
Sub-Questions under Independent
Variables Using Wilcoxon Rank-Sum Test

Note: Table 14 summarizes the bivariate associations of the barrier composite with independent variables using Wilcoxon Rank-Sum Test

Association between Knowledge of Oral and Systemic Health Effects of Smoking and Barriers to Provision of Tobacco Intervention Services

The combined category responses “Disagree” + “Strongly Disagree” + “Neutral” were compared to combined category responses “Agree” + “Strongly Agree.” Using $p < 0.05$, there was not a statistically significant difference in the mean barrier composite score between the students who agreed and disagreed on the five different knowledge-related questions. Using $p < 0.20$, there was a statistically significant difference in the mean perceived barrier composite score between the students who agreed to the knowledge statement “smoking is associated with delayed wound healing” compared to those who did not agree ($p = 0.13$).

Association between Attitudes Related to Tobacco Intervention Services and Barriers to Provision of Tobacco Intervention Services

The combined category responses “Disagree” + “Strongly Disagree” + “Neutral” were compared to combined category responses “Agree” + “Strongly Agree.” Using $p < 0.05$, there was a statistically significant association ($p = 0.03$) between “dental professionals should set a good example by not smoking” attitudinal statement and the

barrier composite. This meant that a significant difference in the mean barrier composite score was found between the students who agreed (Agree + Strongly Agree) and disagreed (Neutral + Disagree + Strongly Disagree) to this attitudinal statement. Using $p < 0.20$, there also was a statistically significant difference in the mean barrier composite score between the students who agreed and disagreed for the above attitudinal statement not a statistically significant difference for other attitudinal statements.

Association between Behaviors Related to Tobacco Intervention Services and Barriers to Provision of Tobacco Intervention Services

The combined category responses (<50%) “0%” + “1-24%” + “25-50%” were compared to combined category responses (>50%) “51-74%” + “75-90%” + “91-100%.” Using $p < 0.05$, there was a statistically significant association ($p = 0.02$) between “I asked patients verbally whether they use tobacco” and the barrier composite. This meant that a significant difference in the mean barrier composite score was found between the students who reported asking their patients verbally about their tobacco use more than 50% of the time last year and those who reported asking less than 50% of the time. Using $p < 0.20$, there also was a statistically significant difference in the mean barrier composite score for the above statement but not a statistically significant difference for other behavior related statements.

Association between adequacy of Tobacco
Intervention Curriculum Coverage of Specific
Topics Reported by the Students and
Barriers to Provision of Tobacco Intervention Services

The combined category responses “Not covered at all” + “Covered minimally” were compared to combined category responses “Covered moderately well” + “Covered very well.” Using $p < 0.05$, there was a statistically significant association between three of the UI tobacco intervention curriculum topics covered over the past three years and the barrier composite. These statements were: “how to develop a comprehensive tobacco intervention program in a clinical setting” ($p = 0.002$), “FDA-approved pharmacotherapy to assist cessation attempts” ($p = 0.02$) and “addressing dental students’ own tobacco use” ($p = 0.01$) topics. This meant that a significant difference in the mean barrier scores was found between the students who reported “adequately covered” (Covered moderately well + Covered very well categories) for each of the above three curriculum topics, over the past three years and those who did not report adequately covered (Not covered at all + Covered minimally categories). Using $p < 0.20$, the above three topics and other three curriculum topics “Brief Motivational Interviewing” ($p = 0.07$), “Public Health Service’s 5As and 5Rs for conducting tobacco cessation counseling” ($p = 0.17$) and “strategies for how to become involved in community-based tobacco control” ($p = 0.14$) also showed a statistically significant association with the barrier composite. This meant that there was a statistically significant difference in the mean barrier score between the students who reported “adequately covered” for each of the six topics and those who did not report adequately covered.

Association between Overall Tobacco
Intervention Curriculum Assessment and Barriers
to Provision of Tobacco Intervention Services

The combined category responses “Disagree” + “Strongly Disagree” + “Neutral” were compared to combined category responses “Agree” + “Strongly Agree.” Using $p < 0.05$, there was a statistically significant association between “Based on the tobacco intervention curriculum, I feel prepared to provide tobacco intervention services” statement and the barrier composite ($p = 0.0008$). This meant that a significant difference in the mean barrier composite score was found between the students who agreed (Agree + Strongly Agree categories) to the above statement and those who disagreed (Disagree + Strongly Disagree + Neutral categories). There was also a statistically significant association between the above statement and the barrier composite using $p < 0.20$.

Association between Perceived Importance
by the Students of Incorporating Different
Teaching Methods for Learning Tobacco
Intervention and Barriers to Provision
of Tobacco Intervention Services

The responses to “Not valuable at all” category were compared to combined category responses “Somewhat valuable” + “Moderately valuable” + “Very valuable.” Using $p < 0.05$, there was a statistically significant association ($p = 0.03$) between perceived importance by the students of incorporating “Problem-based learning” for learning tobacco intervention and the barrier composite. This meant that a significant difference in the mean barrier composite score was found between the students who preferred this learning method (Somewhat valuable + Moderately valuable + Very valuable categories) and those who did not prefer (Not valuable at all category). Using $p < 0.20$, students’

preferred methods of learning tobacco intervention i.e. CD-ROM instructions ($p=0.11$) and OSCE ($p=0.15$) also showed a statistically significant association with the barrier composite besides Problem-based learning. This meant that there was a statistically significant difference in the mean barrier composite score between the students who preferred each of the above three teaching methods and those who did not prefer them.

Association between Level of Guidance Received from The Dental Departmental Faculty at the Individual Patient Level and Barriers to Provision of Tobacco Intervention Services

The combined category responses ($<50\%$) “0%” + “1-24%” + “25-50%” were compared to combined category responses ($>50\%$) “51-74%” + “75-100%.” Using $p<0.05$, there was not a statistically significant difference in the mean barrier composite scores between the students who reported receiving faculty guidance from different dental departments $>50\%$ of the times and those who reported receiving $<50\%$ guidance for providing tobacco intervention services last year. Using $p<0.20$, faculty support received from the Pediatric Dentistry department and the barrier composite showed a statistically significant association ($p=0.18$). This meant that there was a statistically significant difference in the mean barrier score between the students who reported receiving faculty support from the above department $>50\%$ of the time and those who reported receiving support $<50\%$ of the time.

Bivariate Results: Evaluation of
Associations between the Composite
Barrier Score (Dependent Variable) and
Dichotomous Sub-Questions under
Independent Variables Using Spearman Correlation

Note: Table 15 summarizes the bivariate associations of the barrier composite with independent variables using Spearman Correlation.

Association between Knowledge of Oral
and Systemic Health Effects of
Smoking and Barriers to
Provision of Tobacco Intervention Services

The combined category responses “Disagree” + “Strongly Disagree” + “Neutral” were compared to combined category responses “Agree” + “Strongly Agree.” Using $p < 0.05$, there was not a statistically significant correlation between any of the individual knowledge questions and the barrier composite. Using $p < 0.20$, there was a statistically significant negative correlation between the knowledge statement “smoking is associated with delayed wound healing” and the barrier composite ($r_s = -0.18, p = 0.12$). This meant that perceived barriers to provision of tobacco intervention services were lower for students who reported agreement (“Agree” + “Strongly Agree”) for this knowledge question increased compared to students’ reported disagreement (“Disagree” + “Strongly Disagree” + “Neutral”).

Association between Attitudes Related to Tobacco Intervention Services and Barriers to Provision of Tobacco Intervention Services

The combined category responses “Disagree” + “Strongly Disagree” + “Neutral” were compared to combined category responses “Agree” + “Strongly Agree.” Using $p < 0.05$, there was a statistically significant positive correlation ($r_s = 0.26$, $p = 0.03$) between “dental professionals should set a good example by not smoking” attitudinal statement and the barrier composite. This meant that perceived barriers to provision of tobacco intervention services were lower for students who reported disagreement (“Disagree” + “Strongly Disagree” + “Neutral”) with the above attitudinal statement toward tobacco cessation increased compared to students who agreed (“Agree” + “Strongly Agree”). Using $p < 0.20$, there was a statistically significant correlation between the above statement and the barrier composite.

Association between Behaviors Related to Tobacco Intervention Services and Barriers to Provision of Tobacco Intervention Services

The combined category responses ($< 50\%$) “0%” + “1-24%” + “25-50%” were compared to combined category responses ($> 50\%$) “51-74%” + “75-90%” + “91-100%.” Using $p < 0.05$, there was a statistically significant positive correlation ($r_s = 0.27$, $p = 0.02$) between “I asked patients verbally whether they use tobacco” and the barrier composite. This meant that perceived barriers to providing tobacco intervention services were lower for students who reported asking patients verbally about their tobacco use “less than 50% of the times” during the past year increased compared to those who reported asking for

more than 50% of the time last year. Using $p < 0.20$, there was a statistically significant correlation between the above statement and the barrier composite.

Association between adequacy of Tobacco Intervention Curriculum Coverage of Specific Topics Reported by the Students and Barriers to Provision of Tobacco Intervention Services

The combined category responses “Not covered at all” + “Covered minimally” were compared to combined category responses “Covered moderately well” + “Covered very well.” Using $p < 0.05$, there were statistically significant negative correlations between the three UI tobacco intervention curriculum topics covered over the past three years and the barrier composite. These statements were: “how to develop a comprehensive tobacco intervention program in a clinical setting” ($r_s = -0.39$, $p = 0.001$), “FDA-approved pharmacotherapy to assist cessation attempts” ($r_s = -0.28$, $p = 0.01$), and “addressing dental students’ own tobacco use” ($r_s = -0.29$, $p = 0.01$) topics. This meant that perceived barriers to provision of tobacco intervention services were lower for students who reported agreement for each of the three tobacco cessation topics to be adequately covered (“Covered moderately well” + “Covered very well”) during the past three years increased compared to those who did not report them to be adequately covered (“Not covered at all” + “Covered minimally”). Using $p < 0.20$, the curriculum topics “Brief Motivational Interviewing” ($r_s = -0.22$, $p = 0.06$), “Public Health Service’s 5As and 5Rs for conducting tobacco cessation counseling” ($r_s = -0.16$, $p = 0.17$) and “strategies for how to become involved in community-based tobacco control” ($r_s = -0.18$, $p = 0.13$) showed statistically significant negative correlations with the barrier composite besides the above three topics. This meant that perceived barriers to provision of tobacco intervention

services was lower for students who reported agreement for each of the six tobacco cessation topics to be adequately covered during the past three years increased compared to those who did not report them to be adequately covered.

Association between Overall Tobacco Intervention Curriculum Assessment and Barriers to Provision of Tobacco Intervention Services

The combined category responses “Disagree” + “Strongly Disagree” + “Neutral” were compared to combined category responses “Agree” + “Strongly Agree.” Using $p < 0.05$, there was a statistically significant negative correlation between “Based on the tobacco intervention curriculum, I feel prepared to provide tobacco intervention services” statement and the barrier composite ($r_s = -0.43$, $p = 0.0002$). This meant that perceived barriers to provision of tobacco intervention services were lower for students who reported agreement (Agree + Strongly Agree categories) for the above statement increased compared to those who disagreed on the above statement (Disagree + Strongly Disagree + Neutral categories). There was also a statistically significant association between the above statement and the barrier composite using $p < 0.20$.

Association between Perceived Importance by the Students of Incorporating Different Teaching Methods for Learning Tobacco Intervention and Barriers to Provision of Tobacco Intervention Services

The responses to “Not valuable at all” category were compared to combined category responses “Somewhat valuable” + “Moderately valuable” + “Very valuable.” Using $p < 0.05$, there was a statistically significant positive correlation ($r_s = 0.26$, $p = 0.02$) between perceived importance by the students of incorporating “Problem-based learning”

for learning tobacco intervention and the barrier composite. This meant that perceived barriers to provision of tobacco intervention services were lower for students who reported agreement about Problem-based learning to be less favorable teaching method for tobacco intervention curriculum increased compared to those who did not report. Using $p < 0.20$, students' preferred methods of learning tobacco intervention i.e. CD-ROM instructions ($r_s = 0.19$, $p = 0.10$) and OSCE ($r_s = 0.17$, $p = 0.15$) showed statistically significant positive correlations with the barrier composite besides Problem-based learning. This meant that perceived barriers to provision of tobacco intervention services were lower for students who reported agreement for each of the three teaching methods to be less favorable for tobacco intervention curriculum increased compared to those who did not report.

Association between Level of Guidance
Received from The Dental Departmental
Faculty at the Individual Patient Level
and Barriers to Provision of
Tobacco Intervention Services

The combined category responses (<50%) "0%" + "1-24%" + "25-50%" were compared to combined category responses (>50%) "51-74%" + "75-100%." Using $p < 0.05$, there was not a statistically significant difference in the barrier composite by dichotomized level of guidance received from the dental departmental faculty at the individual patient level for providing tobacco intervention services. Using $p < 0.20$, there was a statistically significant negative correlation between the faculty support received from the Pediatric Dentistry department and the barrier composite ($r_s = -0.16$, $p = 0.17$). This meant that perceived barriers to provision of tobacco intervention services were lower for students who reported receiving faculty support for more than 50% of the time

from the Pediatric Dentistry department for providing tobacco intervention services compared to those who reported receiving support less than 50% of the time.

Bivariate Results Summary

Summary of Bivariate Results:
Evaluation of Associations between
the Barrier Composite and the
Independent Variables and
Independent Variables
(by composite and by each
question under the composite)
(Table 13)

By Composite

Using $p < 0.05$, *two* composite independent variables “tobacco intervention curriculum topics covered over the past three years” and “overall assessment of the tobacco intervention curriculum” showed statistically significant associations with the barrier composite. *Three* statements under different independent variables “knowledge related to oral and systemic effects of smoking,” “perceived importance by the students of incorporating different teaching methods for learning tobacco intervention” and “level of guidance received from the dental departmental faculty at the individual patient level” also showed significant associations with the barrier composite. The knowledge variable could not be combined into a composite score, as the internal consistency was low, similarly the teaching methods and dental departments could not be combined into composite scores, as each teaching method and each dental department was different. The statements under these three independent variables that showed significant associations with the barrier composite were: “smoking associated with delayed wound healing,”

“Objective-structured clinical examination (OSCE)” and “Pediatric Dentistry department.” Thus, five total independent variables showed significant associations with the barrier composite. Using $p < 0.20$, the above five independent variables and *four* more statements showed a statistically significant association with the barrier composite. These statements were: reported knowledge regarding smoking is associated with heart disease, perceived importance by the students of incorporating each of the problem-based learning, computer-based learning through CD-ROM instructions for learning tobacco intervention and reported level of guidance received from the Endodontics Departmental faculty for providing tobacco intervention services at the individual patient level.

By Each Question under the Composite

Thirteen statements under different independent variables showed statistically significant associations with the barrier composite, when the p-value was set at $p < 0.05$. These statements were: reported knowledge related to smoking is associated with delayed wound healing, reported behaviors related to “I assessed patients’ willingness to quit,” reported tobacco intervention topics covered over the past three years “a review of oral tobacco-related diseases,” “Public Health Service’s 5As and 5Rs for conducting tobacco cessation counseling,” “Brief Motivational Interviewing,” “how to develop a comprehensive tobacco intervention program in a clinical setting,” “FDA-approved pharmacotherapy to assist cessation attempts”, “strategies for how to become involved in community-based tobacco control” and “addressing dental students’ own tobacco use.” Additional statements included reported overall tobacco intervention curriculum assessment “the tobacco intervention curriculum included relevant information,” “based on the tobacco intervention curriculum, I feel prepared to provide tobacco intervention

services,” perceived importance of incorporating objective-structured clinical examination (OSCE) for teaching tobacco intervention curriculum and reported level of support received from the Pediatric Dentistry department for providing tobacco intervention services at individual patient level. Using $p < 0.20$, the above 13 statements and *ten* more statements showed statistically significant associations with the barrier composite. These statements were: reported knowledge related to smoking is associated with heart disease, reported attitudes related to “dental professionals should set a good example by not using tobacco,” reported behaviors related to “I assisted patients by prescribing nicotine replacement therapy,” “I arranged follow-up visits for the patients concerning tobacco intervention services in the College of Dentistry.” Additional statements included reported tobacco intervention topics covered over the past three years “A review of general tobacco-related diseases,” and “the nature of nicotine dependency and addiction,” reported overall tobacco intervention assessment statement “the tobacco intervention curriculum included current information,” perceived importance of incorporating each of the problem-based learning and computer-based training and learning (CD-ROM instruction) as part of teaching tobacco intervention and reported level of support received from the Endodontics department for providing tobacco intervention services at individual patient level.

Summary of Bivariate Results:
 Evaluation of Associations between the
 Composite Barrier Score (Dependent Variable)
 and Dichotomous Sub-Questions under
 the Independent Variables Using Wilcoxon
 Rank-Sum and Spearman Correlation Tests
 (Tables 14 & 15)

Seven statements showed a statistically significant association with the barrier composite, when the p-value was set at $p < 0.05$. These statements were: reported attitudes related to “dental professionals should set a good example by not using tobacco,” reported behaviors related to “I asked patients verbally whether they use tobacco,” reported tobacco intervention topics covered over the past three years “how to develop a comprehensive tobacco intervention program in a clinical setting,” “FDA-approved pharmacotherapy to assist cessation attempts” and “addressing dental students’ own tobacco use,” reported overall tobacco intervention assessment statement “based on the tobacco intervention curriculum, I feel prepared to provide tobacco intervention services” and perceived importance of incorporating problem-based learning as part of teaching tobacco intervention. Using $p < 0.20$, the above seven statements and *seven* more independent variables showed a statistically significant association with the barrier composite. These statements were: reported knowledge related to smoking is associated with delayed wound healing, reported tobacco intervention topics covered over the past three years “Public Health Service’s 5As and 5Rs for conducting tobacco cessation counseling,” “Brief Motivational Interviewing” and “strategies for how to become involved in community-based tobacco control,” perceived importance of incorporating computer-based training and learning (CD-ROM instruction) and objective-structured clinical examination (OSCE) as part of teaching tobacco intervention and reported level

of support received from the Pediatric Dentistry department for providing tobacco intervention services at individual patient level.

The following section summarizes the bivariate associations between the Social Desirability Scale (SDS) as a composite and as individual statements under the SDS composite and the attitude, behavior and barrier composite scores.

Bivariate Association between the
Social Desirability Scale (SDS) used as a
Composite and as Individual Statements
under the SDS Composite and
the Barrier, Attitude and Behavior Composite

Bivariate Association between the
Barrier Composite and the Individual
Statements under the SDS Composite
Using Wilcoxon Rank-Sum Test
(Refer to Table 16)

There was not a statistically significant association between the barrier composite and each of the SDS statement, when the p-value was set at $p < 0.05$. Using $p < 0.20$, there were statistically significant associations between the barrier composite and each of the two SDS statements, “There have been times when I felt like rebelling against people in authority even though I knew they were right” ($p = 0.06$), and “I am sometimes irritated by people who ask favors of me” ($p = 0.13$). This meant that there were statistically significant associations between the mean barrier scores for students who reported yes and no for the above two SDS statements.

Bivariate Association between the
Barrier Composite and the Individual
Statements under the SDS Composite
Using Spearman Correlation
(Refer to Table 17)

There was not a statistically significant correlation between the barrier composite and each of the SDS statement, when the p-value was set at $p < 0.05$. Using $p < 0.20$, there were statistically significant correlations between the barrier composite and each of the two SDS statements, “There have been times when I felt like rebelling against people in authority even though I knew they were right” ($r_s = -0.22$, $p = 0.06$), and “I am sometimes irritated by people who ask favors of me” ($r_s = 0.18$, $p = 0.13$). This meant that the perceived barriers to provision of tobacco intervention services decreased as the reported agreement to the first statement increased and the reported agreement to the second statement decreased.

Bivariate Association between the
Barrier Composite and the Social Desirability
Composite Using Wilcoxon Rank-Sum Test
(Refer to Table 22)

There was not a statistically significant association between the SDS composite and the barrier composite ($p = 0.93$).

Bivariate Association between the Attitude
Composite and the Individual Statements
under the SDS Composite Using Wilcoxon
Rank-Sum Test (Refer to Table 18)

There was not a statistically significant association between the attitude composite and each of the SDS questions, for $p < 0.05$. There was a statistically significant

association between one of the SDS question “When I don’t know something, I don’t at all mind admitting it” ($p=0.19$) and the attitude composite, for $p<0.20$. This meant that there was a statistically significant association between the mean attitudinal score for students who reported yes and no for the above SDS statement.

Bivariate Association between the Attitude Composite and the Individual Statements under the SDS Composite Using Spearman Correlation (Refer to Table 19)

Using $p<0.05$, there was not a statistically significant correlation between the attitude composite and each of the SDS questions. Using $p<0.20$, there was a statistically significant negative correlation ($r_s=-0.16$, $p=0.19$) between one of the SDS question “When I don’t know something, I don’t at all mind admitting it” and the attitude composite. This meant that the reported attitudes toward provision of tobacco intervention services increased as the reported agreement to the above statement decreased.

Bivariate Association between the Attitude Composite and the Social Desirability Composite Using Wilcoxon Rank-Sum Test (Refer to Table 22)

There was not a statistically significant association between the SDS composite and the attitude composite ($p=0.49$).

Bivariate Association between the Behavior Composite and the Social Desirability Scale (SDS) Using Wilcoxon Rank-Sum Test (Refer to Table 20)

Using $p < 0.05$, there was not a statistically significant association between the behavior composite and each of the SDS statements. Using $p < 0.20$, there were statistically significant associations between the behavior composite and each of the two SDS statements, “I would never think of letting someone else be punished for my wrong doings” ($p = 0.08$), and “When I don’t know something, I don’t at all mind admitting it” ($p = 0.17$). This meant that there were statistically significant associations between the mean behavior scores for students who reported yes and no for the each of the two SDS statements.

Bivariate Association between the Behavior Composite and the Social Desirability Scale (SDS) Using Spearman Correlation (Refer to Table 21)

Using $p < 0.05$, there was not a statistically significant correlation between the behavior composite and each of the SDS questions. Using $p < 0.20$, there was a statistically significant correlation between the behavior composite and two of the SDS statements, “I would never think of letting someone else be punished for my wrong doings” ($r_s = 0.21$, $p = 0.08$), and “When I don’t know something, I don’t at all mind admitting it” ($r_s = -0.16$, $p = 0.17$). This meant that the reported behaviors toward provision of tobacco intervention services increased as the reported agreement to the first statement decreased and the reported agreement for the second statement increased.

Bivariate Association between the Behavior Composite and the Social Desirability Score Using Wilcoxon Rank-Sum Test
(Refer to Table 22)

There was not a statistically significant association between the SDS score and the Behavior composite ($p=0.92$).

The SDS scale was used as a composite score by the authors Strahan and Gerbasi (Strahan, 1972) that ranged from 0 (low) – 10 (high) scores. The current study did not show statistically significant associations between the SDS composite and each of the attitudes, behavior and barrier composite scores. Thus, SDS composite score was not included into the final model.

Results of Multivariable Model Analysis

The final bivariate approach chosen for the model analysis used the association between the composite independent variables and the barrier composite.

Multiple linear regression models were developed to identify factors associated with the barriers concerning provision of tobacco intervention services. Nine independent variables showed statistically significant associations with the barrier composite using $p<0.20$. This p-value was chosen due to exploratory nature and limited sample size of the study. The nine statistically significant variables included the two composite scores “tobacco intervention curriculum topics covered over the past three years (Q6)” and “overall assessment of the tobacco intervention curriculum (Q7)” and seven statements under the different independent variables “knowledge related to oral and systemic effects of smoking (Q2B=smoking associated with delayed wound healing and Q2C=smoking is associated with heart disease),” “perceived importance by the students of incorporating

different teaching methods for learning tobacco intervention (Q13D=objective-structured clinical examination, Q13B=problem-based learning, Q13C=computer-based learning through CD-ROM instructions)” and “level of guidance received from the dental departmental faculty at the individual patient level (Q8F=Pediatric Dentistry and Q8A=Endodontics departments).” However, there were many missing values for the statement “level of guidance received from the Pediatric departmental faculty at the individual patient level,” hence; this variable was not entered into the final model.

Different techniques of regression were used such as forward, backward and stepwise regression to identify the best model to predict barriers concerning provision of tobacco intervention services. A screening collinearity test was done using Spearman correlations between the independent variables that showed significant bivariate associations before entering in the final model. It was found that there were significant correlations between these variables, but not highly correlated and the correlation coefficients were below 0.60. Thus, all the variables were put in the final model. Additionally, potential two-way interactions between the independent variables that showed significant associations in the final model were also explored and none of these interactions were statistically significant. Confirmatory collinearity test for the final model was done using variance inflation factor (VIF), as the model contained many independent variables. It was found that there was no collinearity between these variables.

Table 23A summarizes the final model using $p\text{-value} < 0.05$. Only one independent variable i.e., adequacy of tobacco intervention curriculum coverage of specific topics (Q6) was found to be significantly associated with the barrier composite ($p=0.0003$). The regression model explained 17.8% of variability in the barrier result due to adequacy of

tobacco intervention curriculum coverage of specific topics composite score. Thus, change in this variable was associated with 17.8% change in the barrier composite. The coefficient of -0.69 indicated that the estimated barrier composite will decrease by 0.69 for one score increase in adequacy of tobacco intervention curriculum coverage of specific topics (See Table 23B).

Table 24A summarizes the final model using p -values < 0.05 , when subject with ID 57 was removed before building the final model. This was done as the subject was identified as an outlier. The Cook's D test for assessing outliers indicated that, this subject had the highest residual value compared to others. Two variables i.e., adequacy of tobacco intervention curriculum coverage of specific topics (Q6) ($p=0.003$) and perceived importance by the students of incorporating objective structured clinical exam (Q13D) for learning tobacco intervention ($p=0.023$) were found to be significantly associated with the barrier composite. The regression model explained 28.7% of variability in barrier result due to adequacy of tobacco intervention curriculum coverage of specific topics composite score. Thus, change in the above two variables was associated with 28.7% change in the barrier composite. The coefficient of -0.52 indicated that the estimated barrier composite will decrease by 0.52 for one score increase in adequacy of tobacco intervention curriculum coverage of specific topics while controlling for other variable in the model (See Table 24B). The barrier composite score was 5.94 times higher for students who reported "moderate valuable" for learning tobacco intervention through objective structured clinical exam compared to students who reported "not valuable at all." However, there was not a significant difference in the barrier composite score

between the students who reported “somewhat” and “not valuable at all” for learning tobacco intervention through objective structured clinical exam (See Table 24B).

Table 25A summarizes the final model using p -values <0.20 . Three independent variables i.e., adequacy of tobacco intervention curriculum coverage of specific topics (Q6) ($p=0.02$), perceived importance by the students of incorporating objective structured clinical exam (Q13D) for learning tobacco intervention ($p=0.03$) and smoking is associated with delayed wound healing (Q2C) ($p=0.13$) were found to be significantly associated with the barrier composite. The regression model explained 28.9% of variability in the barrier result due to the above three factors. Thus, change in the above three variables was associated with 28.9% change in the barrier composite. The coefficient of -0.44 indicated that the estimated barrier composite will decrease by 0.44 for one score increase in adequacy of tobacco intervention curriculum coverage of specific topics while controlling for other variables in the model (See Table 25B). The barrier composite score was 4.93 times higher for students who reported “moderate valuable” for learning tobacco intervention through objective structured clinical exam compared to students who reported “not valuable at all.” However, there was not a significant difference in the barrier composite score between the students who reported “somewhat” and “not valuable at all” for learning tobacco intervention through objective structured clinical exam (See Table 25B). Additionally, the barrier composite score was 2.81 times higher for students who “agreed” that smoking is associated with delayed wound healing compared to those who “strongly agreed” (See Table 25B).

Table 26A summarizes the final model using p -values <0.20 , when subject with ID 57 was removed before building the final model. Three independent variables i.e.,

adequacy of tobacco intervention curriculum coverage of specific topics (Q6) ($p=0.11$), perceived importance by the students of incorporating objective structured clinical exam (Q13D) for learning tobacco intervention ($p=0.03$), and overall tobacco intervention curriculum assessment (Q7) ($p=0.06$) were found to be significantly associated with the barrier composite. The regression model explained 32.6% of variability in the barrier result due to the above three factors. Thus, change in the above three variables was associated with 32.6% change in the barrier composite. The coefficient of -0.31 indicated that the estimated barrier composite will decrease by 0.31 for one score increase in adequacy of tobacco intervention curriculum coverage of specific topics while controlling for other variables in the model (See Table 26B). The coefficient of -1.22 indicated that the estimated barrier composite will decrease by 1.22 for one score increase in overall tobacco intervention curriculum assessment while controlling for other variables in the model (See Table 26B). The barrier composite score was 5.53 times higher for students who reported “moderate valuable” for learning tobacco intervention through objective structured clinical exam compared to students who reported “not valuable at all.” However, there was not a significant difference in the barrier composite score between the students who reported “somewhat” and “not valuable at all” for learning tobacco intervention through objective structured clinical exam (See Table 26B).

Correlation and Association tests were done in order to see why some variables dropped from the model and some remained significant (See Table 27). It was found that Q6 (Curriculum topics) showed significant correlations with five of the seven variables. Similarly, Q13D (OSCE teaching method) showed associations with five of the seven variables. Thus, Q13B and 13C dropped from the model, as they probably conveyed the

same information. Likewise, Q7 (overall curriculum assessment) could have shown some association with Q6, as it was present in the final model using $p < 0.20$, but dropped when model using $p < 0.05$ was created.

Table 1. Selected Characteristics of Fourth Year Dental Students Surveyed in 2008

Fourth Year Dental Students' Characteristics	Number	Percentage
Gender		
Males	45	66
Females	23	34
Tobacco use status		
Current user	4	6
Former user	14	21
Never user	29	73
Time spent in providing tobacco intervention services per patient per visit		
Less than or equal to 1 minute	15	22
2 minutes	23	34
3 minutes	17	25
4 or more minutes	13	19
Planning to provide tobacco intervention services in future		
Yes	60	88
No	1	1
Not yet decided	7	10
What percentage of your patients used tobacco last year?		
1-10%	3	4
11-20%	14	21
21-30%	28	41
30% or more	23	34

Table 2. Knowledge Related to Oral and Systemic Effects of Smoking (Percentages in each category)

Q2	Statement	SD	D	N	A	SA	A + SA
A	Smoking is associated with implant failure.	0	6	12	57	25	82
B	Smoking is associated with chronic heart disease.	0	0	1	50	49	99
C	Smoking is associated with delayed wound healing.	0	0	3	41	56	97
D*	Smokers have greater bleeding on probing than non-smokers.	18	34	9	32	7	52*
E	Smoking is associated with Necrotizing Ulcerative Gingivitis (NUG).	6	19	37	35	3	38

* SD – Strongly Disagree, D – Disagree, N – Neutral, A – Agree, SA – Strongly Agree

* Statement D was reverse-coded for direction than the other four items, so the final column sharing agreement with correct answer is “Strongly Disagree + Disagree” and not “Agree + Strongly Agree.”

Table 3. Attitudes Related to Tobacco Intervention Services (Percentages in each category)

Q1	Statement	SD	D	N	A	SA	A + SA
A	Dentists have an important role to play in tobacco intervention services.	1	0	6	66	26	92
B	Tobacco intervention counseling offered in the dental office can have an impact on patients' quitting.	1	0	18	59	22	81
C	Dental professionals should set a good example by not using tobacco.	3	1	12	37	47	84
D	Dentists should actively support and promote community programs related to tobacco intervention services.	3	0	15	63	19	82

* SD – Strongly Disagree, D – Disagree, N – Neutral, A – Agree, SA – Strongly Agree

Table 4. Behaviors Related to Tobacco Intervention Services

Q4	Statement	0%	1-24%	25-50%	51-74%	75-90%	91-100%	>50%
For statements A and B, choose the best percentage concerning <i>all</i> your patients.								
A	I reviewed the patient's chart information related to tobacco use.	1	1	4	3	22	68	93
B	I asked patients verbally whether they use tobacco.	1	1	16	25	28	28	81
For statements C to I, answer only about your <i>tobacco-using</i> patients.								
	Statement	0%	1-24%	25-50%	51-74%	75-90%	91-100%	>50%
C	I advised patients who use tobacco to quit.	0	12	18	25	26	19	70
D	I assessed patients' willingness to quit.	0	7	9	15	41	28	84
E	I assisted patients in quitting by setting a specific quit date.	74	16	4	3	1	1	5
F	I provided tobacco intervention educational materials to patients.	6	41	28	9	13	3	25
G	I assisted patients by prescribing nicotine replacement therapy, Zyban®, Chantix®, etc.	69	25	6	0	0	0	0
H	I arranged follow-up visits for the patients concerning tobacco intervention services in the College of Dentistry.	74	41	1	4	0	0	4
I	I referred patients to quitlines.	18	31	22	9	15	6	30

Table 5. Perceived Barriers Related To Tobacco Intervention Services (Percentages in each category)

Q5	Statement	(1)	(2)	(3)	(4)	(5)	2+3+4+5*
A	Inadequate knowledge about nicotine replacement drugs.	25	46	12	13	4	75
B	Inadequate knowledge about quitlines.	53	28	7	9	3	47
C	Lack of training to counsel patients who use smoked tobacco (cigarettes, cigars, pipes, etc.).	26	43	16	12	3	64
D	Lack of training to counsel patients who use smokeless tobacco.	35	44	9	6	6	65
E	Inadequate skills in providing tobacco intervention services.	25	43	21	10	1	75
F	Forgetting to give tobacco intervention counseling.	9	59	13	19	0	91
G	Lack of incentive (no curricular requirements or minimal impact on grades) for providing tobacco intervention services.	47	26	9	18	0	53
H	Patients' resistance to tobacco intervention services.	4	18	15	43	21	96
I	Inadequate time available for providing intervention services.	4	41	16	31	7	96
J	Inadequate availability of patient education materials related to tobacco intervention.	35	44	12	7	1	65

Table 5. (Continued).

Q5	Statement	(1)	(2)	(3)	(4)	(5)	2+3+4+5*
K	Inadequate space to hold confidential conversations related to tobacco intervention with the patients.	40	38	10	9	3	60
L	Lack of a formal tracking system for tobacco-using patients in the College.	41	34	7	15	3	59
M	Inadequate faculty support for providing tobacco intervention services at the individual patient level.	38	29	16	13	3	62
N	Some patients feel that dentists should not be involved with tobacco intervention services.	32	49	13	6	0	68

Never – 1, Sometimes – 2, About half the time – 3, Often – 4, Almost Always – 5

*Sometimes (2) + About half the time (3) + Often (4) + Almost Always (5)

Table 6. Adequacy of Tobacco Intervention Curriculum Topics Covered over the Past Three Years at the University of Iowa, College of Dentistry (Percentages in each category)

Q6	Statement	Not covered at all	Covered minimally	Covered moderately well	Covered very well	Covered moderately well + Covered very well
A	Historical, social and economic factors associated with tobacco use and the tobacco industry.	3	24	56	18	74
B	A review of general tobacco-related diseases.	0	10	47	43	90
C	A review of oral tobacco-related diseases.	1	6	34	59	93
D	The nature of nicotine dependency and addiction.	4	33	42	21	63
E	Public Health Service's 5As and 5Rs for conducting tobacco cessation counseling.	15	28	38	19	57
F	Brief Motivational Interviewing.	13	32	38	16	54
G	How to develop a comprehensive tobacco intervention program in a clinical setting.	9	49	31	12	43
H	FDA-approved pharmacotherapies to assist cessation attempts.	1	25	58	16	74
I	Strategies for how to become involved in community-based tobacco control.	12	59	22	7	29
J	Addressing dental students' own tobacco use.	34	46	13	7	20

Table 7. Additional Information Related to UI Tobacco Intervention Curriculum
(Percentages in each category)

Q7	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Agree + Strongly Agree
A	The tobacco intervention curriculum included relevant information.	0	1	6	77	16	93
B	The tobacco intervention curriculum included current information.	0	0	4	74	22	96
C	Based on the tobacco intervention curriculum, I feel prepared to provide tobacco intervention services.	0	13	32	46	9	55

Table 8. Percentages of the Time the Faculty Work with and/or Encouraged Students to Provide Tobacco Intervention Services During their Third Year (Percentages in each category)

Q8	Departments	0%	1-24%	25-50%	51-74%	75-100%	N/A ^o	≥ 50%
A	Endodontics	72	24	4	0	0	-	0
B	Operative Dentistry	19	35	19	13	13	-	26
C	Oral and Maxillofacial Surgery	54	18	12	4	12	-	16
D	Oral Diagnosis, Oral Pathology, Oral Radiology and Medicine	9	19	24	31	18	-	49
E	Orthodontics	66	3	3	0	0	28	0
F	Pediatic Dentistry	57	4	1	0	1	36	1
G	Periodontics	0	12	18	35	35	-	71
H	Prosthodontics	47	31	19	1	1	-	3

^oN/A= meaning no tobacco use among any patients in the clinic

Table 9. Importance of Incorporating the Following Teaching Methods into the Tobacco Intervention Curriculum at the University of Iowa, College of Dentistry (Percentages in each category)

Q 13	Statement	Not valuable at all (1)	Somewhat valuable (2)	Moderately valuable (3)	Very valuable (4)	2 + 3 + 4*
A	Web-based learning	18	50	24	9	83
B	Problem-based learning	21	41	31	7	79
C	Computer-based training and learning (CD-ROM instructions)	32	47	15	6	68
D	Objective-structured clinical examination (OSCE)	34	43	24	0	67
E	Didactic lectures	9	35	47	9	91

*Somewhat valuable (2) + Moderately valuable (3) + Very valuable (4)

Table 10. Descriptive Statistics on the Composite Scores and the Knowledge Questions

Variables	Number of Questions	Mean (std)	Minimum	Maximum	Median
Attitudes	4	12.37 (2.41)	0	16	12
Behaviors	9	20.04(5.97)	3	36	20
Barriers	14	17.48(8.43)	4	43	16
Knowledge					
Knowledge Q2a	1	3.01(0.78)	1	4	3
Knowledge Q2b	1	3.47(0.53)	2	4	3
Knowledge Q2c	1	3.53(0.56)	2	4	4
Knowledge Q2d	1	2.22(1.28)	0	4	3
Knowledge Q2e	1	2.10(0.95)	0	4	2

Table 11. Responses to Statements Concerning Personal Attitudes and Traits/Social Desirability Scale (Percentages in each category)

	Statement	True	False
A	I never hesitate to go out of my way to help someone in trouble.	44(64.71)	24(35.29)
B	I have never intensely disliked anyone.	25(36.76)	43(63.24)
C	There have been times when I was quite jealous of the good fortune of others.	32(47.06)	36(52.94)
D	I would never think of letting someone else be punished for my wrong doings.	61(89.71)	7(10.29)
E	I sometimes feel resentful when I don't get my way.	44(64.71)	24(35.29)
F	There have been times when I felt like rebelling against people in authority even though I knew they were right.	21(30.88)	47(69.12)
G	I am always courteous, even to people who are disagreeable.	47(69.12)	21(30.88)
H	When I don't know something, I don't at all mind admitting it.	48(70.59)	20(29.41)
I	I can remember "playing sick" to get out of something.	22(32.35)	46(67.65)
J	I am sometimes irritated by people who ask favors of me.	38(55.88)	30(44.12)

Note: The highlighted responses indicate matched responses with that of the authors Strahan and Gerbasi.

Source: Strahan R, Gerbasi KC. Short, homogenous versions of the Marlowe-Crowne Social Desirability Scale. *J Clin Psychol.* 1972;28:191-193.

Table 12. Evaluation of Associations between the Composite Barrier Score Concerning Provision of Tobacco Intervention Services and Selected Characteristics of Fourth Year Dental Students

Variable	Barriers [¶] (correlation coefficient)	P-value*
Age	0.12	0.32 [†]
Gender	(mean composite barrier score)	0.79 ^{††}
Female	17.48	
Male	17.49	
Tobacco use status	(mean composite barrier score)	0.55 ^{†††}
Current users	18.50	
Former users	14.93	
Never users	18.08	
Tobacco intervention services provided per patient per visit	(mean composite barrier score)	0.51 ^{†††}
Less than or equal to 1 min	19.47	
2 minutes	18.26	
3 minutes	16.65	
4 or more minutes	14.92	

Spearman Rank Correlation test[†], Wilcoxon rank-sum test^{††}, Kruskal-Wallis test^{†††}

¶ Barriers was a composite score defined as the sum of the scores for 14 questions, with possible range from 14 to 70 and actual range of 4 to 43. Thus, a score of 14 would mean never for all (low barriers) and 70 almost always for all (high barriers). For statistically analysis, the scale was redefined from 0-4, such that the sum of the scores for 14 questions was in the range of 0-56.

Table 13. Evaluation of Associations between the Composite Barrier Score (Dependent Variable) and Independent Variables (by Composite and by Each Question under the Composite)

Variables	Spearman Rank Correlation Coefficients	P-value*
Knowledge of Oral and Systemic Health Effects of Smoking		
Could not use Composite Score as low Internal Consistency		
Barriers and smoking associated with implant failure.	-0.14	0.24
Barriers and smoking associated with heart disease.	-0.18	0.14*
Barriers and smoking associated with delayed wound healing.	-0.29	0.02*
Barriers and smoking associated with greater bleeding on probing in smokers compared to non-smokers.	0.03	0.84
Barriers and smoking associated NUG.	-0.06	0.60
Attitudes Related to Tobacco Intervention Services		
Composite Score		
	0.14	0.24
Dentists have an important role to play in tobacco intervention services.	-0.04	0.73
Tobacco intervention counseling offered in the dental office can have an impact on patients' quitting.	-0.01	0.87
Dental professionals should set a good example by not using tobacco.	0.19	0.11*
Dentists should actively support and promote community programs related to tobacco intervention services.	0.07	0.54
Behaviors Related to Tobacco Intervention Services		
Composite Score		
	-0.11	0.38
I reviewed the patient's chart information related to tobacco use.	-0.10	0.37
I asked patients verbally whether they use tobacco.	0.10	0.41
I advised patients who use tobacco to quit.	-0.14	0.22
I assessed patients' willingness to quit.	-0.36	0.002*
I assisted patients in quitting by setting a specific quit date.	0.07	0.54
I provided tobacco intervention educational materials to patients.	-0.01	0.87
I assisted patients by prescribing nicotine replacement therapy, Zyban®, Chantix®, etc.	-0.22	0.0597*
I arranged follow-up visits for the patients concerning tobacco intervention services in the College of Dentistry.	-0.16	0.18*
I referred patients to quitlines.	-0.02	0.82

Table 13. (Continued).

Adequacy of Tobacco Intervention Curriculum Coverage of Specific Topics		
Composite Score	-0.38	0.0012*
Historical, social and economic factors associated with tobacco use and the tobacco industry.	-0.08	0.48
A review of general tobacco-related diseases.	-0.16	0.18*
A review of oral tobacco-related diseases.	-0.32	0.006*
The nature of nicotine dependency and addiction.	-0.20	0.09*
Public Health Service's 5As and 5Rs for conducting tobacco cessation counseling.	-0.24	0.04*
Brief Motivational Interviewing.	-0.39	0.0008*
How to develop a comprehensive tobacco intervention program in a clinical setting.	-0.39	0.0008*
FDA-approved pharmacotherapies to assist cessation attempts.	-0.40	0.0006*
Strategies for how to become involved in community-based tobacco control.	-0.26	0.02*
Addressing dental students' own tobacco use.	-0.25	0.03*
Overall Tobacco Intervention Curriculum Assessment		
Composite Score	-0.42	0.0003*
The tobacco intervention curriculum included relevant information.	-0.29	0.01*
The tobacco intervention curriculum included current information.	-0.21	0.07*
Based on the tobacco intervention curriculum, I feel prepared to provide tobacco intervention services.	-0.49	<0.0001*
Perceived Importance by the Students of Incorporating Different Teaching Methods for Learning Tobacco Intervention		
Web-based learning.	-0.05	0.69
Problem-based learning.	0.20	0.10*
Computer-based training and learning.(CD-ROM instruction)	0.19	0.12*
Objective-structured clinical examination (OSCE).	0.34	0.004*
Didactic lectures.	0.02	0.86

Table 13. (Continued).

Level of Guidance Received From The Dental Departmental Faculty at the Individual Patient Level		
Endodontics	-0.17	0.17*
Operative Dentistry	-0.02	0.89
Oral and Maxillofacial Surgery	-0.02	0.87
Oral Diagnosis, Oral Pathology, Oral Radiology and Medicine	-0.05	0.68
Orthodontics	-0.01	0.98
Pediatric Dentistry	-0.4	0.008*
Periodontics	-0.10	0.40
Prosthodontics	-0.13	0.28

*P-value < 0.20 has been considered significant due to small sample size and exploratory nature of the analysis. P-values < 0.05 have been highlighted.

- Knowledge related to adverse effects of smoking on general and oral health. Scale: 5-point Likert scale, Questions: 5, Possible Range: 5-25, Actual Range: N/A, composite score was not created, since the internal consistency was low.
- Attitudes related to dentists' provision of tobacco intervention services. Scale: 5-point Likert scale, Questions: 4, Possible Range: 4-20, Actual Range: 0-16.
- Behaviors related to fourth year dental students' provision of tobacco intervention services. Scale: 6-point Likert scale, Questions: 9, Possible Range: 9-54, Actual Range: 3-36.
- Students' assessments of the adequacy of tobacco intervention curriculum coverage of specific topics at the College of Dentistry, University of Iowa. Scale: 4-point Likert scale, Questions: 10, Possible Range: 10-40, Actual Range: 5-30.
- Students' overall assessments of the tobacco intervention curriculum at the College of Dentistry, University of Iowa. Scale: 5-point Likert scale, Questions: 3, Possible Range: 3-15, Actual Range: 5-12.
- Level of guidance received at the individual patient level from the different dental departmental faculty the University of Iowa, College of Dentistry. Scale: 6-point Likert scale, Questions: 8.
- Perceived importance by the students of incorporating different teaching methods for learning tobacco intervention. Scale: 4-point Likert scale, Questions: 5.

Table 14. Evaluation of Associations between the Composite Barrier Score (Dependent Variable) and Dichotomous Sub-Questions under Independent Variables Using Wilcoxon Rank-Sum Test

Variables	P-value*
Knowledge of Oral and Systemic Health Effects of Smoking (Disagree + Strongly Disagree + Neutral categories vs. Agree + Strongly Agree categories)	
Barriers and smoking associated with implant failure.	0.74
Barriers and smoking associated with heart disease.	0.81
Barriers and smoking associated with delayed wound healing.	0.13*
± Barriers and smoking associated with greater bleeding on probing in smokers compared to non-smokers.	1.00
Barriers and smoking associated NUG.	0.80
Attitudes Related to Tobacco Intervention Services (Disagree + Strongly Disagree + Neutral categories vs. Agree + Strongly Agree categories)	
Dentists have an important role to play in tobacco intervention services.	0.55
Tobacco intervention counseling offered in the dental office can have an impact on patients' quitting.	0.76
Dental professionals should set a good example by not using tobacco.	0.03*
Dentists should actively support and promote community programs related to tobacco intervention services.	0.36
Behaviors Related to Tobacco Intervention Services (<50% vs. >50% of the time)	
I reviewed the patient's chart information related to tobacco use.	0.92
I asked patients verbally whether they use tobacco.	0.02*
I advised patients who use tobacco to quit.	0.53
I assessed patients' willingness to quit.	0.94
I assisted patients in quitting by setting a specific quit date.	0.82
I provided tobacco intervention educational materials to patients.	0.36
I assisted patients by prescribing nicotine replacement therapy, Zyban®, Chantix®, etc.	N/A ^o
I arranged follow-up visits for the patients concerning tobacco intervention services in the College of Dentistry.	0.36
I referred patients to quitlines.	0.51

Table 14. (Continued).

Adequacy of Tobacco Intervention Curriculum Coverage of Specific Topics (Not covered at all + Covered minimally categories vs. Covered moderately well + Covered very well categories)	
Historical, social and economic factors associated with tobacco use and the tobacco industry.	0.47
A review of general tobacco-related diseases.	0.74
A review of oral tobacco-related diseases.	0.24
The nature of nicotine dependency and addiction.	0.22
Public Health Service's 5As and 5Rs for conducting tobacco cessation counseling.	0.17*
Brief Motivational Interviewing.	0.07*
How to develop a comprehensive tobacco intervention program in a clinical setting.	0.002*
FDA-approved pharmacotherapies to assist cessation attempts.	0.02*
Strategies for how to become involved in community-based tobacco control.	0.14*
Addressing dental students' own tobacco use.	0.01*
Overall Tobacco Intervention Curriculum Assessment (Disagree + Strongly Disagree + Neutral categories vs. Agree + Strongly Agree categories)	
The tobacco intervention curriculum included relevant information.	0.59
The tobacco intervention curriculum included current information.	0.42
Based on the tobacco intervention curriculum, I feel prepared to provide tobacco intervention services.	0.0008*
Perceived Importance by the Students of Incorporating Different Teaching Methods for Learning Tobacco Intervention (Not valuable at all category vs. Somewhat valuable + Moderately valuable + Very valuable categories)	
Web-based learning.	0.84
Problem-based learning.	0.03*
Computer-based training and learning.(CD-ROM instruction)	0.11*
Objective-structured clinical examination (OSCE).	0.15*
Didactic lectures.	0.78

Table 14. (Continued).

Level of Guidance Received From The Dental Departmental Faculty at the Individual Patient Level (<50% vs. >50% of the time)	
Endodontics	N/A ^o
Operative Dentistry	0.44
Oral and Maxillofacial Surgery	0.63
Oral Diagnosis, Oral Pathology, Oral Radiology and Medicine	0.76
Orthodontics	N/A ^o
Pediatric Dentistry	0.18*
Periodontics	0.78
Prosthodontics	0.78

± This statement was reverse-coded so the comparison for this category was Disagree + Strongly Disagree categories vs. Neutral + Agree + Strongly Agree categories)

^o N/A means it was not possible to explore the relationship between barriers and these variables due to the presence of only one category of class variables.

*P-value < 0.20 has been considered significant due to small sample size and exploratory nature of the analysis. P-values < 0.05 have been highlighted.

Table 15. Evaluation of Associations between the Composite Barrier Score (Dependent Variable) and Dichotomous Sub-Questions under Independent Variables Using Spearman Correlation

Variables	Spearman Rank Correlation Coefficients	P-value*
Knowledge of Oral and Systemic Health Effects of Smoking (Disagree + Strongly Disagree + Neutral categories vs. Agree + Strongly Agree categories)		
Barriers and smoking associated with implant failure.	-0.04	0.73
Barriers and smoking associated with heart disease.	0.031	0.80
Barriers and smoking associated with delayed wound healing.	-0.18	0.12*
± Barriers and smoking associated with greater bleeding on probing in smokers compared to non-smokers.	-0.0007	0.99
Barriers and smoking associated NUG.	-0.03	0.80
Attitudes Related to Tobacco Intervention Services (Disagree + Strongly Disagree + Neutral categories vs. Agree + Strongly Agree categories)		
Dentists have an important role to play in tobacco intervention services.	0.074	0.54
Tobacco intervention counseling offered in the dental office can have an impact on patients' quitting.	0.037	0.76
Dental professionals should set a good example by not using tobacco.	0.26	0.03*
Dentists should actively support and promote community programs related to tobacco intervention services.	0.11	0.35
Behaviors Related to Tobacco Intervention Services (<50% vs. >50% of the time)		
I reviewed the patient's chart information related to tobacco use.	-0.012	0.91
I asked patients verbally whether they use tobacco.	0.27	0.02*
I advised patients who use tobacco to quit.	-0.07	0.53
I assessed patients' willingness to quit.	-0.010	0.93
I assisted patients in quitting by setting a specific quit date.	0.02	0.81
I provided tobacco intervention educational materials to patients.	-0.11	0.36
I assisted patients by prescribing nicotine replacement therapy, Zyban®, Chantix®, etc.	N/A ^o	
I arranged follow-up visits for the patients concerning tobacco intervention services in the College of Dentistry.	0.11	0.36
I referred patients to quitlines.	-0.08	0.50

Table 15. (Continued).

Adequacy of Tobacco Intervention Curriculum Coverage of Specific Topics (Not covered at all + Covered minimally categories vs. Covered moderately well + Covered very well categories)		
Historical, social and economic factors associated with tobacco use and the tobacco industry.	0.09	0.47
A review of general tobacco-related diseases.	0.04	0.74
A review of oral tobacco-related diseases.	-0.14	0.23
The nature of nicotine dependency and addiction.	-0.14	0.22
Public Health Service's 5As and 5Rs for conducting tobacco cessation counseling.	-0.16	0.17*
Brief Motivational Interviewing.	-0.22	0.06*
How to develop a comprehensive tobacco intervention program in a clinical setting.	-0.39	0.001*
FDA-approved pharmacotherapies to assist cessation attempts.	-0.28	0.018*
Strategies for how to become involved in community-based tobacco control.	-0.18	0.13*
Addressing dental students' own tobacco use.	-0.29	0.015*
Overall Tobacco Intervention Curriculum Assessment (Disagree + Strongly Disagree + Neutral categories vs. Agree + Strongly Agree categories)		
The tobacco intervention curriculum included relevant information.	-0.06	0.58
The tobacco intervention curriculum included current information.	0.1	0.41
Based on the tobacco intervention curriculum, I feel prepared to provide tobacco intervention services.	-0.43	0.0002*
Perceived Importance by the Students of Incorporating Different Teaching Methods for Learning Tobacco Intervention (Not valuable at all category vs. Somewhat valuable + Moderately valuable + Very valuable categories)		
Web-based learning.	0.024	0.84
Problem-based learning.	0.26	0.02*
Computer-based training and learning.(CD-ROM instruction)	0.19	0.10*
Objective-structured clinical examination (OSCE).	0.17	0.15*
Didactic lectures.	0.03	0.78

Table 15. (Continued).

Level of Guidance Received From The Dental Departmental Faculty at the Individual Patient Level (<50% vs. >50% of the time)		
Endodontics	N/A ^o	
Operative Dentistry	-0.09	0.44
Oral and Maxillofacial Surgery	0.06	0.62
Oral Diagnosis, Oral Pathology, Oral Radiology and Medicine	0.03	0.76
Orthodontics	N/A ^o	
Pediatric Dentistry	-0.16	0.17*
Periodontics	0.03	0.77
Prosthodontics	-0.03	0.77

± This statement was reverse-coded so the comparison for this category was Disagree + Strongly Disagree categories vs. Neutral + Agree + Strongly Agree categories)

^o N/A means it was not possible to explore the relationship between barriers and these independent variables due to the presence of only one category.

*P-value < 0.20 has been considered significant due to small sample size and exploratory nature of the analysis. P-values < 0.05 have been highlighted.

Table 16. Evaluation of Associations between the Composite Barrier Score and Sub-Questions under the Social Desirability Scale Using Wilcoxon Rank-Sum Test

Variables	P-value*
I never hesitate to go out of my way to help someone in trouble.	0.60
I have never intensely disliked anyone.	0.51
There have been times when I was quite jealous of the good fortune of others.	0.78
I would never think of letting someone else be punished for my wrong doings.	0.84
I sometimes feel resentful when I don't get my way.	0.22
There have been times when I felt like rebelling against people in authority even though I knew they were right.	0.06*
I am always courteous, even to people who are disagreeable.	0.88
When I don't know something, I don't at all mind admitting it.	0.81
I can remember "playing sick" to get out of something.	0.81
I am sometimes irritated by people who ask favors of me.	0.13*

*P-value < 0.20 has been considered significant due to small sample size and exploratory nature of the analysis.

Table 17. Evaluation of Associations between the Composite Barrier Score and Sub-Questions under the Social Desirability Scale Using Spearman Correlation

Variables	Spearman Rank Correlation Coefficients	P-value*
I never hesitate to go out of my way to help someone in trouble.	0.06	0.59
I have never intensely disliked anyone.	0.08	0.51
There have been times when I was quite jealous of the good fortune of others.	-0.03	0.77
I would never think of letting someone else be punished for my wrong doings.	0.02	0.84
I sometimes feel resentful when I don't get my way.	0.15	0.21
There have been times when I felt like rebelling against people in authority even though I knew they were right.	-0.22	0.06*
I am always courteous, even to people who are disagreeable.	0.01	0.87
When I don't know something, I don't at all mind admitting it.	-0.02	0.81
I can remember "playing sick" to get out of something.	-0.02	0.81
I am sometimes irritated by people who ask favors of me.	0.18	0.13*

*P-value < 0.20 has been considered significant due to small sample size and exploratory nature of the analysis.

Table 18. Evaluation of Associations between the Composite Attitude Score and Sub-Questions under the Social Desirability Scale Using Wilcoxon Rank-Sum Test

Variables	P-value*
I never hesitate to go out of my way to help someone in trouble.	0.92
I have never intensely disliked anyone.	0.79
There have been times when I was quite jealous of the good fortune of others.	0.91
I would never think of letting someone else be punished for my wrong doings.	0.27
I sometimes feel resentful when I don't get my way.	0.94
There have been times when I felt like rebelling against people in authority even though I knew they were right.	0.81
I am always courteous, even to people who are disagreeable.	0.38
When I don't know something, I don't at all mind admitting it.	0.19*
I can remember "playing sick" to get out of something.	0.64
I am sometimes irritated by people who ask favors of me.	0.93

*P-value < 0.20 has been considered significant due to small sample size and exploratory nature of the analysis.

Table 19. Evaluation of Associations between the Composite Attitude Score and Sub-Questions under the Social Desirability Scale Using Spearman Correlation

Variables	Spearman Rank Correlation Coefficients	P-value*
I never hesitate to go out of my way to help someone in trouble.	-0.012	0.91
I have never intensely disliked anyone.	0.032	0.79
There have been times when I was quite jealous of the good fortune of others.	0.013	0.91
I would never think of letting someone else be punished for my wrong doings.	0.13	0.26
I sometimes feel resentful when I don't get my way.	-0.009	0.93
There have been times when I felt like rebelling against people in authority even though I knew they were right.	0.03	0.80
I am always courteous, even to people who are disagreeable.	0.10	0.38
When I don't know something, I don't at all mind admitting it.	-0.16	0.19*
I can remember "playing sick" to get out of something.	0.05	0.64
I am sometimes irritated by people who ask favors of me.	0.01	0.92

*P-value < 0.20 has been considered significant due to small sample size and exploratory nature of the analysis.

Table 20. Evaluation of Associations between the Composite Behavior Score and Sub-Questions under the Social Desirability Scale Using Wilcoxon Rank-Sum Test

Variables	P-value*
I never hesitate to go out of my way to help someone in trouble.	0.38
I have never intensely disliked anyone.	0.55
There have been times when I was quite jealous of the good fortune of others.	0.58
I would never think of letting someone else be punished for my wrong doings.	0.08*
I sometimes feel resentful when I don't get my way.	0.22
There have been times when I felt like rebelling against people in authority even though I knew they were right.	0.60
I am always courteous, even to people who are disagreeable.	0.86
When I don't know something, I don't at all mind admitting it.	0.17*
I can remember "playing sick" to get out of something.	0.22
I am sometimes irritated by people who ask favors of me.	0.64

P-value < 0.20 has been considered significant due to small sample size and exploratory nature of the analysis.

Table 21. Evaluation of Associations between the Composite Behavior Score and Sub-Questions under the Social Desirability Scale Using Spearman Correlation

Variables	Spearman Rank Correlation Coefficients	P-value*
I never hesitate to go out of my way to help someone in trouble.	0.10	0.38
I have never intensely disliked anyone.	-0.07	0.54
There have been times when I was quite jealous of the good fortune of others.	0.068	0.57
I would never think of letting someone else be punished for my wrong doings.	0.21	0.08*
I sometimes feel resentful when I don't get my way.	-0.15	0.22
There have been times when I felt like rebelling against people in authority even though I knew they were right.	-0.06	0.60
I am always courteous, even to people who are disagreeable.	-0.02	0.85
When I don't know something, I don't at all mind admitting it.	-0.16	0.17*
I can remember "playing sick" to get out of something.	0.15	0.21
I am sometimes irritated by people who ask favors of me.	0.05	0.64

*P-value < 0.20 has been considered significant due to small sample size and exploratory nature of the analysis.

Table 22. Evaluation of Associations between the Composite Attitudes, Behavior and Barrier Scores and the Social Desirability Score Using Wilcoxon Rank-Sum Test

Mean Composite Attitude, Behavior and Barriers Scores			
Social Desirability	Attitudes	Behaviors	Barriers
Low	21.68	23.78	17.94
High	24.46	23.35	17.11
P-value*	0.49	0.92	0.93

Table 23. Final Multiple Linear Regression Analysis Concerning Factors that Were Associated with Barrier Composite to Provision of Tobacco Intervention Services ($p < 0.05$)

A. Analysis of Variance

Variables	d.f.	F-value	P-value
Adequacy of tobacco intervention curriculum coverage of specific topics (Q6) [△]	1	14.32	0.0003*
d.f = degrees of freedom			
R-square is 0.178, indicating that regression model explained 17.8 percent of variability in the barrier result due to adequacy of tobacco intervention curriculum coverage of specific topics composite score			

B. Parameter Estimates

Variables	Coefficients	Standard Error	t-value	P-value
Intercept	29.29	3.26	9.00	<0.0001*
Adequacy of tobacco intervention curriculum coverage of specific topics (Q6) [△]	-0.69	0.18	-3.78	0.0003*

△ - Students' assessments of the adequacy of tobacco intervention curriculum coverage of specific topics at the College of Dentistry, University of Iowa. Scale: 4-point Likert scale, Questions: 10, Possible Range: 10-40, Actual Range: 5-30.

Table 24. Final Multiple Linear Regression Analysis Concerning Factors that Were Associated with Barrier Composite to Provision of Tobacco Intervention Services ($p < 0.05$) (Subject with ID 57 Was Excluded from the Final Model)

A. Analysis of Variance

Variables	df	F-value	P-value
Adequacy of tobacco intervention curriculum coverage of specific topics (Q6) [△]	1	9.17	0.003*
Perceived importance by the students of incorporating objective structured clinical exam (Q13D) ^ι for learning tobacco intervention	2	3.99	0.02*
df = degrees of freedom			
R-square is 0.287, indicating that regression model explained 28.7 percent of variability in the barrier composite due to the above two variables.			

B. Parameter Estimates

Variables	Coefficients	Standard Error	t-value	P-value	
Intercept	24.47	3.50	6.99	<0.0001*	
Adequacy of tobacco intervention curriculum coverage of specific topics (Q6) [△]	-0.52	0.17	-3.03	0.003*	
Perceived importance by the students of incorporating objective structured clinical exam (Q13D) ^ι for learning tobacco intervention					
Moderately valuable	5.94	2.36	2.51	0.01*	0.91
Somewhat valuable	0.20	1.93	0.10	-	
Not valuable at all [±]	0.00	-	-		

[±]Reference groups: objective structured clinical examination = not valuable at all

[△] = Students' assessments of the adequacy of tobacco intervention curriculum coverage of specific topics at the College of Dentistry, University of Iowa. Scale: 4-point Likert scale, Questions: 10, Possible Range: 10-40, Actual Range: 5-30.

^ι = was one of the five questions regarding Perceived importance by the students of incorporating different teaching methods for learning tobacco intervention

Table 25. Final Multiple Linear Regression Analysis Concerning Factors that Were Associated with Barrier Composite to Provision of Tobacco Intervention Services ($p < 0.20$)

A. Analysis of Variance

Variables	df	F-value	P-value
Smoking is associated with delayed wound healing (Q2C) ^γ	1	2.30	0.13*
Adequacy of tobacco intervention curriculum coverage of specific topics (Q6) ^δ	1	5.39	0.02*
Perceived importance by the students of incorporating objective structured clinical exam (Q13D) ^ι for learning tobacco intervention	2	3.72	0.03*
df = degrees of freedom			
R-square is 0.289, indicating that regression model explains 28.9 percent of variability in barrier composite due to the above three independent variables.			

B. Parameter Estimates

Variables	Coefficients	Standard Error	t-value	P-value
Intercept	22.94	4.06	5.65	<0.0001*
Smoking is associated with delayed wound healing (Q2C) ^γ				
Agree	2.81	1.85	1.52	0.13*
Strongly Agree [±]	0.00	-	-	-
Adequacy of tobacco intervention curriculum coverage of specific topics (Q6) ^δ	-0.44	0.19	-2.32	0.02*
Perceived importance by the students of incorporating objective structured clinical exam (Q13D) ^ι for learning tobacco intervention				
Moderately valuable	4.93	2.46	2.00	0.04*
Somewhat valuable	-1.47	2.04	-0.72	0.47
Not valuable at all [±]	0.00	-	-	-

±Reference groups: smoking is associated delayed wound healing = strongly agree; objective structured clinical examination = not valuable at all

γ = Knowledge question related to smoking is associated with delayed wound healing. Scale: 5-point Likert scale, Questions: 5, Possible Range: 5-25, Actual Range: N/A, composite score was not created, since the internal consistency was low.

δ = Students' assessments of the adequacy of tobacco intervention curriculum coverage of specific topics at the College of Dentistry, University of Iowa. Scale: 4-point Likert scale, Questions: 10, Possible Range: 10-40, Actual Range: 5-30.

ι = was one of the five questions regarding Perceived importance by the students of incorporating different teaching methods for learning tobacco intervention

Table 26. Final Multiple Linear Regression Analysis Concerning Factors that Were Associated with Barrier Composite to Provision of Tobacco Intervention Services ($p < 0.20$) (Subject with ID 57 Was Excluded from the Final Model)

A. Analysis of Variance

Variables	df	F-value	P-value
Overall tobacco intervention curriculum assessment (Q7) ^Φ	1	3.56	0.06*
Adequacy of tobacco intervention curriculum coverage of specific topics (Q6) ^Δ	1	2.51	0.11*
Perceived importance by the students of incorporating objective structured clinical exam (Q13D) ^ζ for learning tobacco intervention	2	3.70	0.03*
df= degrees of freedom			
R-square is 0.326, indicating that regression model explained 32.6 percent of variability in the barrier result due to these three independent variables.			

B. Parameter Estimates

Variables	Coefficients	Standard Error	t-value	P-value
Intercept	31.86	5.21	6.11	<0.0001*
Overall tobacco intervention curriculum assessment (Q7) ^Φ	-1.22	0.65	-1.89	0.06*
Adequacy of tobacco intervention curriculum coverage of specific topics (Q6) ^Δ	-0.31	0.20	-1.58	0.11*
Perceived importance by the students of incorporating objective structured clinical exam (Q13D) ^ζ for learning tobacco intervention				
Moderate valuable	5.53	2.33	2.37	0.02*
Somewhat	0.03	1.90	0.02	0.98
Not valuable at all [±]	0.00	-	-	-

±Reference groups: objective structured clinical examination = not valuable at all

Φ = Students' overall assessments of the tobacco intervention curriculum at the College of Dentistry, University of Iowa. Scale: 5-point Likert scale, Questions: 3, Possible Range: 3-15, Actual Range: 5-12.

Δ = Students' assessments of the adequacy of tobacco intervention curriculum coverage of specific topics at the College of Dentistry, University of Iowa. Scale: 4-point Likert scale, Questions: 10, Possible Range: 10-40, Actual Range: 5-30.

ζ = was one of the five questions regarding Perceived importance by the students of incorporating different teaching methods for learning tobacco intervention

Table 27. Associations between Variables that Showed Significant Bivariate Associations Using $p < 0.20$

	Q2B	Q2C	Q6	Q7	Q13B	Q13C	Q13D	Q8A
Q2B	-	<0.0001*	0.20*	0.03*	0.45	0.83	0.70	0.46
Q2C	<0.0001*	-	0.03*	0.01*	0.66	0.60	0.93	0.62
Q6	0.20*	0.03*	-	$r_s = 0.61,$ <0.0001* [■]	0.078*	0.21	0.02*	0.17*
Q7	0.03*	0.01*	$r_s = 0.61,$ <0.0001* [■]	-	0.35	0.71	0.02*	0.12*
Q13 B	0.45	0.66	0.078	0.35	-	0.001*	<0.0001*	0.46
Q13 C	0.83	0.60	0.21	0.71	0.001*	-	<0.0001*	0.38
Q13 D	0.70	0.93	0.02*	0.02*	<0.0001*	<0.0001*	-	0.11*
Q8A	0.46	0.62	0.17*	0.12*	0.46	0.38	0.11*	-

- *p-values shown for each cell. When appropriate, statistical significance and spearman correlation coefficients (r_s) shown.
- For assessing relationship between composites (Q6, Q7), Spearman correlation test was used.
- For assessing relationship between non-composite variables from same questions (e.g., Q2C vs. Q2B), Chi square/Fisher exact test was used.
- For assessing relationship between non-composite variables from different questions (e.g., Q2C vs. Q13B), Cochran Mantel Haenszel test was used.
- For assessing relationship between each of the non-composite and composite variables from different questions, Wilcoxon rank-sum test was used.
- Q2B - knowledge question related to smoking is associated with delayed wound healing
- Q2C - knowledge question related to smoking is associated with heart disease
- Q6 - tobacco intervention curriculum topics covered over the past three years
- Q7 - overall assessment of the tobacco intervention curriculum
- Q13B - perceived importance by the students of incorporating problem-based learning method for learning tobacco intervention
- Q13C - perceived importance by the students of incorporating computer-based learning through CD-ROM instructions for learning tobacco intervention
- Q13D - perceived importance by the students of incorporating objective-structured clinical examination for learning tobacco intervention
- Q8A - level of guidance received from the Endodontics departmental faculty at the individual patient level
- Correlation between Q2B and Q2C assessed using Chi square/Fisher exact test
- Correlation between Q13B, Q13C, Q13D assessed using Chi square/Fisher exact test

- Correlation between Q2B and each of Q13B, Q13C, Q13D and Q8A assessed using Cochran Mantel Haenszel test
- Correlation between Q2C and each of Q13B, Q13C, Q13D and Q8A assessed using Cochran Mantel Haenszel test
- Correlation between Q8A and each of Q13B, Q13C, and Q13D assessed using Cochran Mantel Haenszel test
- Correlation between Q6 and Q7 assessed using Spearman correlation test
- Correlation between Q6 and each of Q2B, Q2C, Q13B, Q13C, Q13D and Q8A assessed using Wilcoxon rank-sum tests
- Correlation between Q7 and each of Q2B, Q2C, Q13B, Q13C, Q13D and Q8A assessed using Wilcoxon rank-sum tests

CHAPTER V DISCUSSION

Overview of the Study and its Significance

The current study did an exploratory analysis of the factors associated with the barriers to the provision of tobacco intervention services specific to incoming fourth year dental students at the University of Iowa. Most of the previous dental student studies have done a descriptive assessment of the barriers related to tobacco intervention behaviors. However, there is a lack of dental studies that examine factors associated with barriers related to tobacco intervention services. This study included a thorough descriptive assessment of various tobacco intervention barriers reported by the fourth year dental students and also examined the associations of knowledge, attitudes, behaviors and curriculum domains with barriers to provision of tobacco intervention services. The study findings may help in reducing or eliminating barriers associated with tobacco intervention and could facilitate in provision of effective intervention services at clinics and in future private practice clinical settings. The bivariate and multivariable results were reported first using the traditional p-value of $p < 0.05$, followed by inclusion of additional variables reaching significance at $p < 0.20$ due to the exploratory nature of the study and small sample size.

Findings from the Univariate Analysis

The current study findings are mostly compared to the Yip et al²² study, since it was the only U.S. dental study that assessed fourth year students regarding tobacco

intervention services. Comparison of findings with other student- and private practitioner-studies are done wherever there was similarity in the questions asked.

Comparisons of results were not done with the non-U.S studies, as attitudes, practices and barriers of health professionals related to tobacco cessation vary by country.

Additionally, tobacco use, attitudes of general public and tobacco cessation laws also differ by country.

The Yip et al²² study was done almost 10 years ago, with the purpose of starting a formal tobacco intervention curriculum in the New York University College of Dentistry. Thus, there could have been changes in the attitudes and practices related to tobacco cessation, smoking habits of the dental students and awareness of quitlines or tobacco cessation methods and medications in these ten years.

The response rate of this study was high (97%) compared to the Yip et al²² study (81%). This could have been due to differences in the data collection methods. The current study administered and collected surveys during the fourth year student orientation, while Yip et al²² distributed surveys during didactic classes and collected them within one week. There were also differences in the demographic characteristics between the studies. The current study had more male participants (66% vs. 50%) and less current smokers (6% vs. 20%). Most of the students in the current study reported spending *two* minutes in providing tobacco intervention services per patient per visit compared to *seven* minutes as reported by the Yip et al²² study.

The findings concerning the knowledge domain are not compared to those from any other study, since no previous U.S. dental studies have assessed students' knowledge regarding the oral and systemic health effects of smoking. More favorable response was

expected from the current study students for “smoking is associated with implant failure” statement. However, students might have seen implant treatment being done on smokers in the clinics. Thus, the students would have thought that it is not associated with implant failure. Slightly more than half of the current study students reported disagreement with the statement “smokers have greater bleeding on probing than non-smokers” (52%). The correct answer to this statement is that smoking is not associated with greater bleeding on probing compared to non-smokers. Vasoconstriction associated with smoking may suppress chronic inflammation, clinical expression of gingivitis, and host inflammatory response and may impair healing.⁹¹ The mechanism of action of smoking on oral tissues, differentiation of oral conditions with exacerbated clinical expression and conditions that are suppressed due to tobacco use could be highlighted in future didactic lectures with appropriate pictures of the oral conditions. Additionally, very few current study students were aware of the association between smoking and necrotizing ulcerative gingivitis (NUG). It is well known that altered ability to cope with psychological stress, immunosuppression and tobacco use are strongly associated with NUG.⁹²

A higher proportion of current study students agreed with the two attitudinal statements compared to the Yip et al²² study. Those were “dental professionals should set a good example by not using tobacco” (84% vs. 74%) and “dentists should actively support and promote community programs related to tobacco intervention services” (82% vs. 71%). A higher proportion of the current study students agreed to the attitudinal statement “tobacco intervention counseling offered in the dental office can have an impact on patients’ quitting” compared to Victoroff et al²³ study (81% vs. 69%). However, the latter study surveyed incoming U.S. dental students’ attitudes toward

tobacco cessation and the low response could have been due to no prior didactic and clinical experience in cessation.

Attitudes play an important role in determining students' receptivity to cessation curriculum and can impact the extent to which students incorporate what they learn into their clinical practice²³. The current study students reported favorable attitudes overall toward tobacco intervention services. This could have been due to the presence of tobacco intervention curriculum and changing attitudes in general of both dentists and society toward preventive and tobacco intervention services compared to previous studies.

A higher percentage of the current study students reported asking the patients verbally regarding tobacco use status compared to Yip et al²² study (81% vs. 69%). Yip et al²² stated that their study did not differentiate between reviewing patient records for tobacco use status and verbally asking the patients about tobacco use. They also specified that their students routinely reviewed this information with patients since it was part of the evaluation forms. However, they must have interpreted it as exclusively verbally asking and reported a low response to that question. The statement asked in the current study could have been modified to "did you verbally ask every patient at every visit about his/her tobacco use." This would have allowed us to know how many current students reported asking all the patients at each visit. A higher percentage of the current study students reported advising their tobacco using patients to quit compared to the Yip et al²² study (70% vs. 58%). However, Advise behavior had a lower response from the current study compared to the Ask behavior. It is important to know whether students are comfortable advising patients and whether students know what to advise patients. The

tobacco intervention behavior “assessing patients regarding readiness to quit” was not assessed by the Yip et al²² study. The reported ‘Assess behavior’ was higher compared to reported ‘Advise behavior’ in the current study (84% vs. 70%). The ‘Assess’ step is crucial in intervention, since unless the students verify the patients for quitting, they won’t know whether the patients are interested in quitting tobacco use.

Very few students from the current study reported assisting patients in setting a specific quit date compared to the Yip et al²² study (5% vs. 25%). This could have been due to the fact that students usually refer patients to a quitline or refer them to the tobacco cessation instructor in Periodontics if the patient is interested in quitting. Thus, they do not consistently counsel the patients after advising them. This is what they are usually encouraged to do by the instructor. A higher proportion of the current study students reported providing tobacco intervention educational materials to patients compared to the Yip et al²² study (25% vs. 14%). Tobacco cessation materials are provided only when the patient reports interest in quitting within few a months at the University of Iowa College of Dentistry.

None of the current study students reported prescribing nicotine replacement therapies (NRTs), Zyban or Chnatix to patients compared to Yip et al²² study (19% prescribed patches and 14% prescribed nicotine gum). This response from the current study could have been due in part to the wording of the question. The current study dental students can ‘recommend’ nicotine replacement drugs to patients but they must be ‘prescribed’ by the faculty due to legal restrictions as students. Additionally, some medications are available over the counter and some of them need to be prescribed. Thus, the question probably should have been altered to “I *recommended* nicotine replacement

therapy to patients.” If the patients are referred to the quitlines, then the quitlines are responsible for supplying NRTs to the patients. Additionally, if the patients are referred to the tobacco cessation instructor in Periodontics, then the instructor prescribes NRTs to the patients.

Very few current study students reported arranging follow-up visits for patients in the college compared to Yip et al²² study (4% vs. 22%). As mentioned previously, if the patients are referred to the quitlines or to the tobacco cessation instructor in Periodontics, then the students do not get opportunity to arrange follow-up visits with the patients. Thus, a clinical requirement to do follow-up visits with one or two patients can be done in future.

A higher percentage of current study participants reported referring to quitlines compared to the Yip et al²² study (30% vs. 23%). The current study students receive didactic instructions about asking, advising and referring patients to quitlines. This method is convenient, as the patients can easily get assistance on the telephone without having to go anywhere. The quitlines proactively call the people seeking assistance to quit after they make the first call or else if this facility of proactively calling is not available then the person calls the quitlines.

The reported tobacco intervention-related activities reduced from ‘Review’ to ‘Refer’ steps for the current study. However, this is consistent with the previous studies. Geller et al⁵³ have explained that this observation could have been due to the fact that fewer patients are willing to quit. If the students get more tobacco using patients that are not willing to quit, then this would lead to low responses for ‘Assist’ and ‘Refer’ areas of cessation process compared to ‘Ask’, ‘Advise’ and ‘Assess’, and students would have

less clinical experience in these areas, as they would have fewer opportunities to counsel and assist patients that are willing to quit. Hence, 'Assist', 'Refer' and 'Arranging' follow-ups could be called as 'patient-driven procedures', while 'Ask', 'Advise' and 'Assess' could be called as 'practitioner-driven procedures'. Thus, willingness of patients to participate in the quitting process plays an important role for providing intervention services to the patients. Provision of consistent intervention services in general also depends on the departments in which the students rotate. For example, in the current study, students reported more support for providing tobacco intervention from the 'Periodontics' and 'Oral Pathology' departments compared to the others. Additionally, provision of consistent tobacco intervention services also depends on the knowledge of the students regarding preventive services related to tobacco intervention. For example, the many current study students reported that these services were not applicable to Pediatric Dentistry and Orthodontic departments. Students in the current study have to check the clinical activities performed for that day in the 'Periodontics' and the 'Family Dentistry' Departments and if the checklist does not contain a reminder about performing tobacco cessation activities, the students are likely to forget about or ignore tobacco intervention. The UI curriculum has started focusing on the three-step approach of tobacco cessation recently. This approach includes asking, advising and referring the patients to quitlines. Hence, students would have had fewer or no opportunities to assist, prescribe, set quit dates and arrange follow-up visits with the patients. Moreover, students are expected to provide cessation services but not evaluated on their clinical experiences. Thus, all the above factors could be associated with reduced reported intervention practices.

Yip et al²² reported more barriers concerning lack of referral knowledge compared to the current study. However, a greater proportion of the current study students reported patient resistance as a barrier compared to Yip et al²² study. There is a need to explore patient-related barriers more in the future so as to better determine whether this category was an actual barrier or just a perceived barrier by the current study students. This could be confirmed by performing chart audits as done by Gelskey et al⁷⁶ to confirm whether students are providing cessation services, to what extent, whether patients refused cessation services and their reasons for refusal. However, even this has limitations, because cessation services could be conducted, but not documented. This is more likely to occur for non-reimbursable procedures.

Results for the other barrier-related statements are compared to different studies, since Yip et al²² did not include them in their study. Inadequate time available for providing intervention services was reported as a barrier by a greater proportion of the current study students compared to Boyd et al²⁴ study. The latter study was conducted with the graduating class of 30 female dental hygiene students at the Oregon Health and Science University. Their students had a two-hour tobacco intervention curriculum. The current study students have to perform dental procedures in a limited time allotted to them. Three and a half to four hours is the maximum clinical time per half day, and the students provide comprehensive treatment to one patient and they usually do a recall visit with a second patient. Since students are slow and have many check steps along the way, lack of time could have been a barrier to providing consistent cessation services. However, the clinical practice guidelines suggest that brief intervention services, even when provided for at least three minutes, could meaningfully impact quit rates. Most of

the current study students reported providing cessation services for up to two minutes and about a quarter reported providing them for three minutes.

A greater proportion of the current study participants reported having inadequate knowledge about NRTs as a barrier compared to the Springer et al³⁹ study that assessed fourth year New York medical students (75% vs. 39%). Perhaps, an NRT training approach similar to that used by Seidman et al⁷⁵ can be used with UI students by allowing the pharmacists at the University of Iowa College of Dentistry to provide instructions to the students regarding various generic and individual drugs and doses. This will familiarize the students more regarding the advantages, adverse effects and contraindications of NRT use.

The barrier-related findings of the current study in terms of “lack of training to counsel patients who used smoked (64%) and smokeless tobacco (65%) ” are comparable to those of Fried et al⁵¹ study who found that less than 40% dental students were prepared to counsel smokers and less than 34% were prepared to counsel smokeless tobacco users based on their tobacco cessation training. The latter study surveyed senior health professional students at the University of Maryland, Baltimore campus, regarding tobacco intervention services. Spangler et al⁹³ developed a web-based smokeless tobacco (ST) cessation curriculum for the medical students that included eight modules in basic and clinical sciences regarding smoking and ST use. They included a didactic lecture on ST use and cessation in the form of a PowerPoint presentation and the students also practiced their ST counseling skills on a standardized patient. The authors found that this curriculum was well received and was effective in training the students.

The current study students reported “inadequate skills in providing tobacco intervention services” (75%) as a barrier. This barrier could be reduced by providing students with more opportunities to practice and apply the knowledge gained through their didactic lectures (i.e. provide more clinical experiences). Wagner et al⁹⁴ conducted and evaluated a patient-instructor program that was developed to teach and assess dental students’ communication skills, with an emphasis on cross-cultural patient encounters. Students worked with simulated patients that evaluated them according to the case-specific checklist. This program improved students’ communication skills and cross-cultural communication skills and also helped in indentifying areas for curricular enhancement.

As mentioned previously, the current study students have to check the clinical activities performed for that day in the specific dental departments, and procedures vary by the department. If all the dental departments do not use this checklist or if the checklist does not contain a reminder regarding conducting cessation activities, then the students are likely to forget or ignore them. Thus, the checklist should contain tobacco intervention-related requirements. Additionally, the software used for entering patients’ health history information should also consist of alerts or reminders so that students are less likely to report “forgetting to give tobacco intervention counseling” as a barrier.

About half of the students reported that “lack of curricular requirements/minimal impact on grades for providing tobacco intervention services” was a barrier. About the same proportion of senior dental hygiene students reported emphasis placed on completing graduation requirements as a strong barrier.²⁴ Having a requirement to

complete a tobacco cessation competency probably would motivate the students to conduct cessation services.

“Inadequate availability of patient education materials related to tobacco intervention” also was reported as a barrier by the current study students (65%). The University of Iowa College of Dentistry has brochures concerning the Iowa Quitline and NRTs information in Spanish and English. It also has Title XIX forms that provide free NRTs for two weeks to Medicaid patients. The current study did not ask the students whether they knew about the type of cessation materials available at the College.

“Inadequate space to hold confidential conversations related to tobacco intervention with the patients” was reported as a barrier by the current study students (60%). This question was thought to be appropriate for the current study, since the students provide dental services in small cubicle spaces that are close to each other, so students could feel uncomfortable asking or discussing tobacco related-information.

“Lack of formal tracking system for tobacco-using patients in the college” was reported as a barrier by the current study students (59%). Currently, the Axium software (that saves patients’ chart- and radiograph-related information) consists of two tobacco-related questions in the health history form: “Do you smoke or use tobacco products?” and “Are you a past user of tobacco products?”, and a tobacco intervention form used by the NCI guidelines. These two questions and the NCI document was also available on the old system. There has been a switch from paper to computer patient records since last year (i.e., 2008). There is no tracking system for identifying tobacco-using patients or tracing how many patients were or are referred to quitlines through either of these records i.e., paper and electronic.

A greater proportion of the current study students reported “inadequate faculty support for providing tobacco intervention services at the individual patient level” as a barrier compared to Boyd et al²⁴ study (62% vs. 45%). In order to increase the faculty support the tobacco cessation instructor could provide a tobacco cessation training session exclusively for all the faculty and people that provide direct patient care. This session will also help in understanding the faculty concerns and various barriers-related to provision of consistent cessation services. This question was explored further in the current study, as to which dental departments’ faculty supported them at what level to provide intervention services.

A higher percentage of the current study students reported “some patients feel that dentists should not be involved with tobacco intervention services” as a barrier compared to Rikard-Bell et al³⁷ (68% vs. 60%). The latter study was conducted on first- through fifth-year dental students at the University of Sydney. However, the response to the above question was not differentiated by the study year and the dental school did not have any formal tobacco intervention curriculum.

All the above barrier-related responses rejected the first null hypothesis that “There are no barriers reported by fourth year dental students concerning provision of tobacco intervention services.” Each of the barrier-related statements was reported as a strong barrier (at least 50% reported), except for the statement “inadequate knowledge related to quitlines.” Besides lack of time and patient resistance as reported by the previous studies, lack of skills, lack of NRTs knowledge and forgetting to give tobacco intervention counseling were reported also reported or identified as strong barriers by the current study.

The curricular questions used for the current study were taken from Davis et al⁹⁵ study that assessed dental hygiene faculties' attitudes toward teaching tobacco intervention. Thus, findings from the current study cannot be compared directly to the later study. The current study students reported that the intervention curriculum included relevant (93%) and current (96%) information. However, a low percentage of the current study students agreed that based on the tobacco intervention curriculum they felt prepared to provide tobacco intervention services as compared to the Yip et al²² study (55% vs. 60%). The authors of the latter study claimed that the students did not have a tobacco intervention curriculum and so the students reported socially desirable responses regarding preparedness to provide tobacco intervention services.

The questions concerning level of guidance received from the different dental departments' faculty at the individual patient level were asked in order to know whether students felt that they received adequate faculty support to practice the tobacco intervention that they had learned through didactic lectures. This was not asked in any of the previous studies. However, the students could have interpreted and answered this question concerning aspects, including encouragement provided by the faculty to conduct cessation services, answering specific cessation-related queries of the students or helping the students at each step of the cessation process. Many current study students reported 'not applicable' for the Orthodontics (28%) and Pediatric Dentistry (36%) departments. However, anticipating tobacco use risk and preventing it early in the life, especially in Pediatric and Orthodontic Departments may curb additional risk behaviors besides tobacco use.⁹⁶

The current study students reported didactic lectures as the most valuable teaching method for learning tobacco intervention, followed by web-based learning, problem-based learning, CD-ROM instruction and objective structured clinical examination (OSCE) methods. Boyd et al²⁴ found that a two-hour tobacco intervention training program composed of a one-hour didactic lecture and a second hour of group discussions and role-playing in order to improve clinical skills was not sufficient to prepare students to provide intervention services. Pederson et al⁸² evaluated a web-based tobacco curriculum program for medical students at both the Mercer and Morehouse schools of medicine in Georgia and did not find any difference between the web-based and traditional teaching method. Gordon et al⁷⁸ assessed changes in the knowledge and attitudes of dental and dental hygiene students from Oregon, New York and Washington universities using a CD-ROM program. The program use was significantly enhancements of knowledge, attitudes and behaviors related to tobacco cessation. Brown et al⁸¹ evaluated first-year Wisconsin medical students regarding Tobacco Intervention Basic Skills curriculum (TIBS), where OSCE was used for evaluation of the students, along with pre- and post-tests and clinical skill application assessment. There were statistically significant differences between the pre- and post-tests. The first-year students found the curriculum appropriate for their level of training and accepted it favorably. Ramseier et al⁸⁵, have underscored the importance of didactic learning achieved through lectures, problem-based learning, and/or e-learning and clinical skills achieved through clinical instruction and practice. The current study did not obtain responses for using a patient centered approach to learn tobacco intervention, which is considered to be more effective than traditional didactic materials alone⁹³.

Findings from the Bivariate Analyses

The attitude and behavior composites did not show any significant associations with the barrier composite, probably because the student population was homogenous, i.e., they had the same dental background, were from the same institution and were of the same age range. Alternatively, these domains may not have covered all the relevant questions in the survey.

The current study findings could not be compared to previous studies, as no previous study had assessed factors associated with dental students' barriers to tobacco intervention services. One dental private practitioner study found that females and participants from dental hygiene profession were more likely to report 'patient resistance' and 'fear of alienating patients' as a barrier compared to males and dentists.⁵⁸ Males and dentists were more likely to report 'lack of reimbursement' as a barrier. However, when the barrier composite scores were created and compared, there were no significant differences by gender or provider type.

Findings from the Multivariable Analyses

The reported coverage of tobacco intervention curriculum topics over the previous three years and perceived importance by the students of incorporating objective-structured clinical examination (OSCE) for learning tobacco intervention were associated with barriers to tobacco intervention services at $p < 0.05$. However, using $p < 0.20$ 'overall tobacco intervention curriculum assessment' was also associated with barriers to tobacco intervention services. Thus, barriers decreased as students' reported adequacy of the tobacco intervention curriculum topics covered over the previous three years increased,

as students' reported overall tobacco intervention curriculum assessment increased and as students reported objective-structured clinical examination a less favorable teaching method for learning tobacco intervention. Hence, tobacco intervention curriculum and overall tobacco intervention assessment in terms of 'relevancy', 'currency' and 'preparedness of students to provide intervention services based upon the curriculum' are important for cessation services. The two approaches of building models using $p < 0.05$ and $p < 0.20$ allowed us to appreciate differences in the variables, p-values and percentage of variance showed by these variables in the two final models. The p-value of the variables using $p < 0.05$ for the final model showed high significance compared to the p-values of the variables using $p < 0.20$ for the final model. Additionally, more variables were significant using $p < 0.20$ (two variables were significant using $p < 0.05$ vs. three using $p < 0.20$) and the variance explained by the model was high using $p < 0.20$ compared to $p < 0.05$ ($R^2 = 28.7\%$ vs. 32.6%).

The importance of having tobacco cessation training in dental schools has been emphasized by many researchers.^{14,15,16} Thus, significance showed by the variable "adequacy of coverage of tobacco intervention curriculum topics over the previous three years" in the final model is not a surprising finding. However, students reporting OSCE as a less favorable method of learning tobacco intervention and the decrease in barriers with students reporting OSCE as a less favorable method is a surprising finding. Web-based or didactic or use of CD-ROM include learning tobacco intervention without patient interaction or clinical experience. Problem-based learning uses group efforts to solve cases or problems associated with tobacco cessation without any patient interaction. However, OSCE technique usually has stations with lab materials, casts, radiographs or

patients (simulated or standardized). The students rotate in different stations and are graded either by their instructors or standardized patients. So, possibly students were not prepared to be graded clinically, were thinking that patients' readiness to quit would be used as a final outcome for grading their counseling skills or students did not want to be graded by their instructors. This technique has been successful in training medical students regarding improving their communication skills.⁹⁷ However, OSCE was not successful when used in training dental students regarding improving their tobacco cessation communication skills.⁹⁸ Training students in counseling the patients regarding tobacco cessation and using a patient-centered approach (standardized patients grading the students) would be another useful method to learn tobacco intervention.

Strengths

The strengths of the study included a thorough assessment of the barrier component and the factors associated with barriers to tobacco intervention services. This was one of the few dental studies that assessed students who had a tobacco intervention curriculum spread out over three of the four years of undergraduate education. The cross-sectional study design allowed data collection that was relatively easy, inexpensive and less time-consuming. The response rate of the study was high, so it prevented major non-response bias.

Limitations

The case definitions used for each of knowledge, attitudes, behaviors and barriers in the study were mostly created by the authors and were based on the existing literature. There is a possibility that important information was not part of the composite score.

Additionally, these composite scores were not validated. The knowledge composite lacked internal consistency, so it was not used as a composite score. Information regarding race and ethnicity and about tobacco intervention training received besides as part of the University of Iowa tobacco intervention curriculum was not sought in the current study.

Due to time constraints and the length of the survey, questions on oral cancer, nicotine addiction, and other oral and systemic diseases associated with tobacco were not asked to the fourth year students in the knowledge composite, but have been included on a similar survey for first year students with expanded focus on their knowledge and attitudes toward tobacco intervention. All the responses were self-reported by the students. Hence, it is not known whether the students knew what each clinical condition is and whether they could be able to apply their knowledge and identify these oral conditions correctly in a tobacco-using patient. The student should be knowledgeable about oral and systemic clinical conditions associated with tobacco use, as informing the patients regarding ill-effects of tobacco use is one of the crucial steps in intervention.

The current study did not collect detailed information regarding attitudes of dental students toward tobacco intervention services. There is a need to explore further whether dental students or dentists prefer to advise their patients and refer to quitlines, take an active role in administering specific cessation strategies, or advise the patients and allow the dental hygienists to provide cessation services. Moreover, it is also important to know which health professionals (physicians, dental hygienists, dentists) do dentists think should have active roles in cessation services, as studied by Stacey et al.⁴⁵ In the future, dentists'/dental students' attitudes related to patients and tobacco intervention services

can be examined, as explored by Rikard et al.³⁷ As dentists might not have a problem providing cessation services, but consider patient-related factors as a threat to the success of cessation services.

The current study did not seek information regarding specific Assess behaviors such as assessing the level of readiness to quit, history of quit attempts, level of nicotine addiction or contraindications for pharmacologic smoking cessation aids. The current study did not seek information about the type of educational materials provided to the patients such as, pamphlets specific to quitting, information about tobacco use and oral diseases, list of websites providing quitting information or information regarding NRTs.

The current study did not assess the students regarding different methods used for follow-up, such as telephone, postcard, or e-mail.

The study did not differentiate between tobacco prevention and tobacco intervention services. Tobacco prevention-related behaviors include the 5As for providing cessation services to adolescents, (i.e., Ask, Advise, Assist, Arrange follow-up visits and Anticipatory guidance i.e., discuss peer and family use).⁹⁹ Additionally, the 5Rs (Relevance, Risks, Rewards, Roadblocks, and Repetition) of tobacco intervention also were not assessed in the current study. Separate data on smoking and smokeless tobacco associated behaviors were not sought by the current study.

The responses related to faculty guidance received from the Pediatric Dentistry department regarding tobacco cessation had many missing values. Hence, it was not included in the final model.

Lastly, the regression models explained only 28.7% of variability using $p < 0.05$ and 32.6% variability using $p < 0.20$ in the barrier result, which means that the survey did not

include some important factors that explained the variation in reported barriers to tobacco intervention. For example, the study did not assess the students regarding the adequacy of their clinical experiences related to tobacco intervention, detailed assessment of students' knowledge regarding nicotine addiction and oral health effects of tobacco use, detailed assessment of students' attitudes toward patients and tobacco intervention services, or detailed assessment regarding specific behaviors such as, assessing level of readiness to quit, history of quit attempts, level of nicotine addiction or contraindications to pharmacologic smoking cessation aids.

This study relied on self-reported data collection and results could be affected by intentional deception, poor memory and misunderstanding questions. The sample size was small, limiting power to detect small differences in the data. The study results cannot establish causation for barriers since it is a cross-sectional study.

Validity and Generalizability

As mentioned previously, the findings of this study are specific to incoming fourth-year dental students at the University of Iowa and cannot be generalized to other dental student or other populations, hence, the study lacks external validity (generalizability). However, the study may be generalizable to dental schools that have similar tobacco cessation curriculums. The current study used a cross-sectional study design, so causality could not be established, thus the study has a weak study design. The study depended on self-reported data collection and thus, unknown internal validity.

Future Directions

There is need to do a similar study with a larger sample size and assess factors associated with barriers to tobacco intervention services. Performing chart audits and documenting tobacco cessation steps will confirm whether students are providing cessation services and the extent to which cessation services are being provided. Another study that could be done would be to survey the University of Iowa College of Dentistry faculty in order to understand whether faculty members feel comfortable guiding students in cessation services and providing them themselves and whether it is feasible to incorporate into and provide these services in the various dental departments. Furthermore, standardized patients (SPs) could be used to improve tobacco cessation counseling of the UI undergraduate dental students. A pre- and post-survey would be useful to know whether students are implementing the above mentioned approach and are comfortable in providing cessation services. Additionally, study group trained by SPs could be compared to the previous year study groups that did not have this training. Furthermore, it is equally important to know whether these students would apply the tobacco intervention knowledge gained in the dental school to their private practice settings. Thus, a study assessing students regarding factors associated with providing tobacco intervention in private practice settings could be done. Based on the results of this study, the UI College of Dentistry has already started making and implementing changes in the tobacco intervention curriculum. The current trend of using a three-step tobacco cessation approach (Ask, Advise and Refer to quitlines or counseling services) was adapted recently by the UI College of Dentistry compared to the traditional five step

(Ask, Advise, Assess, Assist, and Arrange follow-up) approach. Thus, a comparative study on these two approaches can be done.

Recommendations and Policy Implications

Previous studies have indicated the importance of tobacco intervention curricula at the undergraduate dental level, as private practitioners who were trained in tobacco cessation either through schools or continuing education programs reported being more prepared and comfortable in providing cessation services. This study also has shown that the reported adequacy of the tobacco intervention curriculum covered over the previous three years was associated with a decrease in perceived barriers to tobacco intervention services. Thus, this finding should help in promoting a dental school policy to implement a standardized tobacco intervention curriculum that covers key topics didactically and clinically at the national and international level and to also include a competency exam. Additionally, the dental schools would be more active in providing cessation services if accreditation of the dental school depended upon having a tobacco intervention curriculum implementation and competency exam for the same.

CHAPTER VI CONCLUSION

The current study involved assessment of incoming University of Iowa fourth-year dental students regarding factors associated with barriers to provision of tobacco intervention services. The results (using $p < 0.05$) suggest that the first null hypothesis i.e., there are no barriers related to tobacco intervention services was rejected, as barriers were found related to tobacco intervention services. The study results did not identify significant associations of the barrier composite outcomes with knowledge using individual questions (Hypothesis 2), attitude composite (Hypothesis 3) and behavior composite (Hypothesis 4). However, the study results showed significant associations of the barrier composite outcomes with the tobacco intervention curriculum topics composite covered over the past three years (Hypothesis 5). The study results did not identify significant associations of the barrier composite outcomes with the overall curriculum assessment composite (Hypothesis 6). The study results did not identify significant associations of the barrier composite outcomes with levels of guidance received by the fourth year dental students at the individual patient level from each of the eight dental departments (Hypothesis 7). The study results showed significant associations of the barrier composite outcomes with one (OSCE) of the five teaching methods preferred for learning tobacco intervention (Hypothesis 8). The study results did not identify significant associations of the barrier composite outcomes with time spent per patient per visit (Hypothesis 9), gender (Hypothesis 10), age (Hypothesis 11), tobacco use status (Hypothesis 12) and social desirability variables (Hypothesis 13).

This study has shown that the students' greater reported adequacy of tobacco intervention curriculum coverage over the previous three years was associated with a decrease in perceived barriers to tobacco intervention services.

Although the majority of students reported that the tobacco curriculum included relevant and current information, there were gaps in the reported coverage of specific topics most relevant to clinical application i.e., strategies for how to become involved in community-based programs, addressing dental students' own tobacco use and how to develop a comprehensive tobacco intervention program in a clinical settings. In addition, the students reported being much less prepared to actually provide intervention services. Thus, enhanced clinical experiences are required in order to facilitate effective intervention services in the dental school.

The fact that many students reported that tobacco intervention services were not applicable for the Pediatric Dentistry and Orthodontic departments' clinics warrants further attention, as preventive services could be provided to adolescents after anticipating risk of future tobacco use and these departments could take more active roles in the future.

APPENDIX A

COPY OF SURVEY BEFORE PILOT TESTING

Note: In this survey, when it says tobacco “intervention” services or curriculum, you should think of it meaning both tobacco prevention and cessation components.

1. Please use the scale listed below to indicate your level of agreement with each of the following statements. Please **circle the number** that represents your agreement with each item.

	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
A	Dentists have an important role to play in tobacco intervention services.	1	2	3	4	5
B	Tobacco use cessation counseling offered in the dental office can have an impact on patients' quitting.	1	2	3	4	5
C	Dental professionals should set a good example by not using tobacco.	1	2	3	4	5
D	Dentists should more actively support and promote community programs related to tobacco intervention services.	1	2	3	4	5

2. Please use the scale listed below to indicate your level of agreement with each of the following statements. Please **circle the number** that represents your agreement with each item.

	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
A	Smoking is associated with implant failure.	1	2	3	4	5
B	Smoking is associated with chronic heart disease.	1	2	3	4	5
C	Smoking is associated with delayed wound healing.	1	2	3	4	5
D	Smokers have greater bleeding on probing than non-smokers.	1	2	3	4	5
E	Smoking is associated with Necrotizing Ulcerative Gingivitis (NUG).	1	2	3	4	5

3. For what percentage of your patients, did you conduct each of the activities listed below? Please **circle the number** that best represents the percentage for each item.

	Statement	0%	1-24%	25-50%	51-74%	75-90%	91-100%
For statement 1, choose the best percentage concerning all your patients.							
A	I have asked patients whether they use tobacco.	1	2	3	4	5	6
For statements 2-8, answer only about your tobacco-using patients.							
B	I have advised patients who use tobacco to quit.	1	2	3	4	5	6
C	I have assessed patients' willingness to quit.	1	2	3	4	5	6
D	I have assisted patients in quitting by setting a specific quit date.	1	2	3	4	5	6
E	I have assisted patients by providing educational materials	1	2	3	4	5	6
F	I have assisted patients by prescribing nicotine replacement therapy, Zyban®, Chantix®, etc.	1	2	3	4	5	6
G	I have arranged follow-up visits for the patients in the College of Dentistry.	1	2	3	4	5	6
H	I have assisted patients by referring them to quitlines.	1	2	3	4	5	6

4. Please use the scale listed below to indicate how often each of these were **barriers** you faced during provision of tobacco intervention services. Please **circle the number** that represents your agreement with each item.

	Statement	Never	Sometimes	About half the time	Often	Almost always
A	Identifying patients who use tobacco.	1	2	3	4	5
B	Inadequate knowledge about nicotine replacement drugs.	1	2	3	4	5
C	Inadequate knowledge about quitlines.	1	2	3	4	5
D	My lack of training to counsel patients who use smoked tobacco.	1	2	3	4	5
E	My lack of training to counsel patients who use smokeless tobacco.	1	2	3	4	5
F	Levels of skills in providing tobacco intervention services.	1	2	3	4	5
G	Forgetting to give tobacco intervention counseling.	1	2	3	4	5
H	Lack of incentive (no curricular requirements/minimal impact on grades) for providing tobacco intervention services.	1	2	3	4	5
I	Patients' resistance to tobacco intervention services.	1	2	3	4	5

	Statement	Never	Sometimes	About half the time	Often	Almost always
J	Inadequate time available for providing intervention services.	1	2	3	4	5
K	Inadequate availability of patient education materials related to tobacco intervention.	1	2	3	4	5
L	Inadequate space to hold confidential conversations related to tobacco intervention with the patients.	1	2	3	4	5
M	Lack of a formal tracking system for tobacco-using patients in the College.	1	2	3	4	5
N	Inadequate faculty support for providing tobacco intervention services at the individual patient level.	1	2	3	4	5
O	Inadequate opportunities to provide tobacco intervention services to my patients (who mostly do not use tobacco).	1	2	3	4	5
P	Some patients feel that dentists should not be involved with tobacco intervention services.	1	2	3	4	5

5. Please use the scale listed below to indicate the best answer concerning the adequacy of the coverage concerning each of the following topics in the College of Dentistry didactic tobacco intervention curriculum over the past three years. **(This refers to the College of Dentistry curriculum led by Ms.Nancy Slach in Periodontics but also includes content presented by Drs. Rhys Jones, Georgia Johnson, etc.)** Please **circle the number** that represents your response for each item.

	Statement	Not covered at all	Covered minimally	Covered moderately well	Covered very well
A	Historical, social and economic factors associated with tobacco use and the tobacco industry.	1	2	3	4
B	A review of general tobacco-related diseases.	1	2	3	4
C	A review of oral tobacco-related diseases.	1	2	3	4
D	The nature of nicotine dependency and addiction.	1	2	3	4
E	Public Health Service's 5As and 5Rs for conducting tobacco cessation counseling.	1	2	3	4
F	Brief motivational interviewing.	1	2	3	4
G	How to develop a comprehensive tobacco intervention program in a clinical setting.	1	2	3	4
H	FDA-approved pharmacotherapies to assist cessation attempts.	1	2	3	4
I	Strategies for how to become involved in community-based tobacco control.	1	2	3	4
J	Addressing dental students' own tobacco use.	1	2	3	4

6. Please use the scale listed below to indicate your agreement with each of the following statements. Please **circle the number** that represents your agreement with each item.

	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
A	The tobacco intervention curriculum included relevant information.	1	2	3	4	5
B	The tobacco intervention curriculum included current information.	1	2	3	4	5
C	Based on the tobacco intervention curriculum and experience I have had, I feel prepared to provide tobacco intervention services.	1	2	3	4	5

7. Approximately what percentage of the time has each of these departments guided you at the individual patient level in providing tobacco intervention services?

Please **circle the number** that best represents the percentage for each department

	Departments	0%	1-24%	25-50%	51-74%	75-90%	91-100%
A	Admissions	1	2	3	4	5	6
B	Endodontics	1	2	3	4	5	6
C	Family Dentistry	1	2	3	4	5	6
D	Operative Dentistry	1	2	3	4	5	6
E	Oral and Maxillofacial Surgery	1	2	3	4	5	6
F	Oral Pathology, Radiology, and Medicine	1	2	3	4	5	6
G	Orthodontics	1	2	3	4	5	6
H	Pediatric Dentistry	1	2	3	4	5	6
I	Periodontics	1	2	3	4	5	6
J	Prosthodontics	1	2	3	4	5	6
K	Preventive and Community Dentistry	1	2	3	4	5	6

8. What is your age? _____ Years old

Please circle the correct answer:

9. Gender -

Male 1

Female 2

10. Which of the following best describes your **tobacco use status**?

Current user 1

(use of tobacco in the last 30 days)

Former user 2

(use of tobacco in the past, but not in the last 30 days)

Never use 3

(not used tobacco at all)

11. For those patients who use tobacco and for whom you provided **tobacco intervention services**, how much time did you usually spend **per patient per visit in counseling**?

Less than or equal to one minute 1

Two minutes 2

Three minutes 3

Four or more minutes 4

12. Please use the scale listed below to indicate how valuable it would be to incorporate each of these possible forms of learning about tobacco intervention at the University of Iowa, College of Dentistry. Please **circle the number** that best represents your agreement with each item.

	Statement	Not valuable at all	Somewhat valuable	Moderately valuable	Very valuable
1	Web-based learning.	1	2	3	4
2	Problem-based learning.	1	2	3	4
3	Computer- based training and learning.	1	2	3	4
4	Objective- structured clinical examination (OSCE).	1	2	3	4
5	Didactic lectures.	1	2	3	4

13. Are you planning to provide tobacco intervention services in your future dental office?

Yes 1
 No 2
 Not yet decided 3

14. Related to tobacco intervention services, do you think that dental students should be graded on didactic work only or clinical work only or both? Explain briefly.

Didactic only
 (Explanation)_____ 1

Clinical only
 (Explanation)_____ 2

Both
 (Explanation)_____ 3

15. Please use “true” or “false” listed below to indicate your agreement with each of the following statements. Please **circle** the **number** that represents your agreement with each of the items.

	Statement	True	False
A	I never hesitate to go out of my way to help someone in trouble.	1	2
B	I have never intensely disliked anyone.	1	2
C	There have been times when I was quite jealous of the good fortune of others.	1	2
D	I would never think of letting someone else be punished for my wrong doings.	1	2
E	I sometimes feel resentful when I don't get my way.	1	2
F	There have been times when I felt like rebelling against people in authority even though I knew they were right.	1	2
G	I am always courteous, even to people who are disagreeable.	1	2
H	When I don't know something, I don't at all mind admitting it.	1	2
I	I can remember “playing sick” to get out of something.	1	2
J	I am sometimes irritated by people who ask favors of me.	1	2

16. Do you have any specific suggestions or other comments about the tobacco intervention curriculum, tobacco intervention services, etc. at the College of Dentistry?

17. What barriers to providing tobacco intervention services do you think you might encounter in future private practice clinical settings?

Thank you for participating in the survey!

APPENDIX B
SOURCES FOR THE QUESTIONNAIRE

1. Please use the scale listed below to indicate your level of agreement with each of the following statements. Please **circle the number** that represents your agreement with each item.

	Statement	Sources
A	Dentists have an important role to play in tobacco intervention services.	Modified from Yip et al (Yip, 2000) Polychonopoulou (Polychonopoulou, 2004)
B	Tobacco intervention counseling offered in the dental office can have an impact on patients' quitting.	Victoroff et al (Victoroff, 2004)
C	Dental professionals should set a good example by not using tobacco.	Yip et al (Yip, 2000) Polychonopoulou et al (Polychonopoulou, 2004)
D	Dentists should actively support and promote community programs related to tobacco intervention services.	Modified from Yip et al (Yip, 2000)

2. Please use the scale listed below to indicate your level of agreement with each of the following statements. Please **circle the number** that represents your agreement with each item.

	Statement	Sources
A	Smoking is associated with implant failure.	U.S. Department of Health and Human Services. A National Cancer Institute and National Institute of Dental Research Guide for Health Professionals: Tobacco effects in the mouth, 1992.
B	Smoking is associated with chronic heart disease.	Polychonopoulou et al (Polychonopoulou, 2004)
C	Smoking is associated with delayed wound healing.	U.S. Department of Health and Human Services. A National Cancer Institute and National Institute of Dental Research Guide for Health Professionals: Tobacco effects in the mouth, 1992.
D	Smokers have greater bleeding on probing than non-smokers.	George Taylor (via Dr. Levy)
E	Smoking is associated with Necrotizing Ulcerative Gingivitis (NUG).	U.S. Department of Health and Human Services. A National Cancer Institute and National Institute of Dental Research Guide for Health Professionals: Tobacco effects in the mouth, 1992.

3. Approximately what percentage of your patients used tobacco in the past year?
(Dr. Levy and Dr. McQuistan)

- a. 1 – 10 %
- b. 11 – 20%
- c. 21 – 30%
- d. 30% or more

4. For what percentage of your patients in the **past year** did you conduct each of the following activities listed below related to the **tobacco intervention services**? Please **circle the number** that best represents the percentage for each item.

	Statement	Sources
For statements A and B, choose the best percentage concerning <i>all</i> your patients.		
A	I reviewed the patient's chart information related to tobacco use	(Dr. Levy and Dr. McQuistan)
B	I asked patients verbally whether they use tobacco.	(Dr. Levy and Dr. McQuistan)
<i>Almost all studies have assessed students, and health professionals on 5As</i>		
For statements C to I, answer only about your <i>tobacco-using</i> patients.		
	Statement	
C	I advised patients who use tobacco to quit.	Yip et al (Yip, 2000), Aquilino et al (Aquilino, 2003) Boyd et al (Boyd, 2006)
D	I assessed patients' willingness to quit.	Aquilino et al (Aquilino, 2003) Boyd et al (Boyd, 2006)
E	I assisted patients in quitting by setting a specific quit date.	Yip et al (Yip, 2000), Aquilino et al (Aquilino, 2003)
F	I provided tobacco intervention educational materials to patients.	Yip et al (Yip, 2000), Aquilino et al (Aquilino, 2003)
G	I assisted patients by prescribing nicotine replacement therapy	Yip et al (Yip, 2000), Aquilino et al (Aquilino, 2003)
H	I arranged follow-up visits for the patients concerning tobacco intervention services in the College of Dentistry.	Yip et al (Yip, 2000), Aquilino et al (Aquilino, 2003) Boyd et al (Boyd, 2006)
I	I referred patients to quitlines.	Yip et al (Yip, 2000), Aquilino et al (Aquilino, 2003)

5. Please use the scale listed below to indicate how often each of these aspects **interfered** with your providing tobacco intervention services in the past year. Please **circle the number** that represents your agreement with each item.

	Statement	Sources
A	Inadequate knowledge about nicotine replacement drugs.	Aquilino et al (Aquilino, 2003)
B	Inadequate knowledge about quitlines.	Aquilino et al (Aquilino, 2003) Yip et al (Yip, 2000)
C	Lack of training to counsel patients who use smoked tobacco (cigarettes, cigars, pipes, etc).	Fried et al (Fried, 2004) Polychonopoulou et al (Polychonopoulou, 2004)
D	Lack of training to counsel patients who use smokeless tobacco.	Fried et al (2004)
E	Inadequate skills in providing tobacco intervention services.	Aquilino et al (Aquilino, 2003) Rikard-Bell et al (Rikard-Bell, 2003)
F	Forgetting to give tobacco intervention counseling.	Young et al, (Young, 2001)
G	Lack of incentive (no curricular requirements/minimal impact on grades) for providing tobacco intervention services.	Dr. Levy
H	Patients' resistance to tobacco intervention services.	Yip (Yip, 2000) Polychonopoulou et al (Polychonopoulou, 2004) Boyd et al (Boyd, 2006)
I	Inadequate time available for providing intervention services.	Boyd et al (Boyd, 2006)
J	Inadequate availability of patient education materials related to tobacco intervention.	Aquilino et al (Aquilino, 2003) Polychonopoulou et al (Polychonopoulou, 2004)
K	Inadequate space to hold confidential conversations related to tobacco intervention with the patients.	Watt et al (Watt, 2004)
L	Lack of a formal tracking system for tobacco-using patients in the College	Gottlieb et al (Gottlieb, 2001)
M	Inadequate faculty support for providing tobacco intervention services at the individual patient level.	Boyd et al (Boyd, 2006)
N	Some patients feel that dentists should not be involved with tobacco intervention services.	Rikard-Bell et al (Rikard-Bell, 2003)

6. Please use the scale listed below to indicate the best answer concerning the adequacy of the coverage concerning each of the following topics in the College of Dentistry didactic (lecture) tobacco intervention curriculum over the **past three years. (This refers to the College of Dentistry curriculum (lectures) led by Ms. Nancy Slach in Periodontics ,but also includes content presented by Drs. Rhys Jones, Georgia Johnson, etc.)** Please **circle the number** that represents your response for each item.

	Statement
A	Historical, social and economic factors associated with tobacco use and the tobacco industry.
B	A review of general tobacco-related diseases.
C	A review of oral tobacco-related diseases.
D	The nature of nicotine dependency and addiction.
E	Public Health Service's 5As and 5Rs for conducting tobacco cessation counseling.
F	Brief motivational interviewing.
G	How to develop a comprehensive tobacco intervention program in a clinical setting.
H	FDA-approved pharmacotherapies to assist cessation attempts.
I	Strategies for how to become involved in community-based tobacco control.
J	Addressing dental students' own tobacco use.
The above statements were incorporated from the Davis et al (Davis, 2005) study	

7. Please use the scale listed below to indicate your agreement with each of the following statements. Please **circle the number** that represents your agreement with each item.

	Statement	Sources
A	The tobacco intervention curriculum included relevant information.	Dr. Levy
B	The tobacco intervention curriculum included current information.	
C	Based on the tobacco intervention curriculum, I feel prepared to provide tobacco intervention services.	Yip et al , (Yip, 2000) Fried et al (Fried, 2004) (Polychonopoulou, 2004)

8. For the tobacco-using patients you saw in each of the different clinics during **third year**, what percentages of the time did the faculty work with and/or encourage you to provide tobacco intervention services? Please **circle the number** that best represents the percentage for each department.

	Departments	Sources
A	Endodontics	Nancy and Bhagyashree
B	Operative Dentistry	
C	Oral and Maxillofacial Surgery	
D	Oral Diagnosis, Oral Pathology, Oral Radiology and Medicine	
E	Orthodontics	
F	Pediatric Dentistry	
G	Periodontics	
H	Prosthodontics	

9. What is your age? _____ Years old

Please circle the number to the right that matches your answer:

10. Gender -

Male

1

Female

2

11. Which of the following best describes your **tobacco use status**? (Dr. Squier)

Current use 1

(use of tobacco in the last 30 days)

Former user 2

(use of tobacco in the past, but not in the last 30 days)

Never user 3

(not used tobacco at all)

12. For those patients who use tobacco and for whom you provided **tobacco intervention services**, how much time did you usually spend **per patient per visit in counseling**?

Source: Yip et al, (Yip, 2000)

- | | |
|-------------------------------------|---|
| a. Less than or equal to one minute | 1 |
| b. Two minutes | 2 |
| c. Three minutes | 3 |
| d. Four or more minutes | 4 |

13. Please use the scale listed below to indicate how valuable it would be to incorporate the following teaching methods into the tobacco intervention curriculum at the University of Iowa, College of Dentistry. Please **circle the number** that best represents your agreement with each item.

	Statement	Sources
A	Web-based learning.	Bhagyashree
B	Problem-based learning.	Bhagyashree
C	Computer-based training and learning.(CD-ROM instruction)	Polychonopoulou et al, (Polychonopoulou, 2004)
D	Objective- structured clinical examination (OSCE).	Bhagyashree
E	Didactic lectures.	Polychonopoulou et al, (Polychonopoulou, 2004)

14. Are you planning to provide tobacco intervention services in your future dental office? (Bhagyashree)

- | | |
|-----------------|---|
| Yes | 1 |
| No | 2 |
| Not yet decided | 3 |

15. Related to tobacco intervention services, do you think that dental students should be graded on didactic work only, clinical work only or both? Explain briefly. (Bhagyashree)

Didactic only (Explanation)

_____ 1

Clinical only (Explanation)

_____ 2

Both (Explanation) _____ 3

16. Listed below are a number of statements concerning personal attitudes and traits. Read each item and decide whether the statement is **true** or **false** as it pertains to you personally. Please **circle the number** that represents your agreement with each of the items.

Sources: Rebecca Mandell, Strahan et al (Strahan, 1972)

	Statement	True	False
A	I never hesitate to go out of my way to help someone in trouble.	1	2
B	I have never intensely disliked anyone.	1	2
C	There have been times when I was quite jealous of the good fortune of others.	1	2
D	I would never think of letting someone else be punished for my wrong doings.	1	2
E	I sometimes feel resentful when I don't get my way.	1	2
F	There have been times when I felt like rebelling against people in authority even though I knew they were right.	1	2
G	I am always courteous, even to people who are disagreeable.	1	2
H	When I don't know something, I don't at all mind admitting it.	1	2
I	I can remember "playing sick" to get out of something.	1	2
J	I am sometimes irritated by people who ask favors of me.	1	2

17. Do you have any specific suggestions or other comments about the tobacco intervention curriculum, tobacco intervention services, etc. at the College of Dentistry? (Bhagyashree)

18. What barriers to providing tobacco intervention services do you anticipate encountering in your future private practice clinical settings? (Bhagyashree)

Thank you for participating in the survey!

APPENDIX C

COPY OF FINAL SURVEY

Note: In this survey, when it says tobacco “intervention” services or curriculum, you should think of it meaning both tobacco prevention and cessation components. Please think about all dental school experiences you had over the past three years while answering questions about didactic content and think about third year only concerning clinical experiences.

1. Please use the scale listed below to indicate your level of agreement with each of the following statements. Please **circle the number** that represents your agreement with each item.

	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
A	Dentists have an important role to play in tobacco intervention services.	1	2	3	4	5
B	Tobacco intervention counseling offered in the dental office can have an impact on patients' quitting.	1	2	3	4	5
C	Dental professionals should set a good example by not using tobacco.	1	2	3	4	5
D	Dentists should actively support and promote community programs related to tobacco intervention services.	1	2	3	4	5

2. Please use the scale listed below to indicate your level of agreement with each of the following statements. Please **circle the number** that represents your agreement with each item.

	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
A	Smoking is associated with implant failure.	1	2	3	4	5
B	Smoking is associated with chronic heart disease.	1	2	3	4	5
C	Smoking is associated with delayed wound healing.	1	2	3	4	5
D	Smokers have greater bleeding on probing than non-smokers.	1	2	3	4	5
E	Smoking is associated with Necrotizing Ulcerative Gingivitis (NUG).	1	2	3	4	5

3. Approximately what percentage of your patients used tobacco in the past year?
- e. 1 – 10 %
 - f. 11 – 20%
 - g. 21 – 30%
 - h. 30% or more

4. For what percentage of your patients in the **past year** did you conduct each of the following activities listed below related to the **tobacco intervention services**? Please **circle the number** that best represents the percentage for each item.

	Statement	0%	1-24%	25-50%	51-74%	75-90%	91-100%
For statements A and B, choose the best percentage concerning <i>all</i> your patients.							
A	I reviewed the patient's chart information related to tobacco use.	1	2	3	4	5	6
B	I asked patients verbally whether they use tobacco.	1	2	3	4	5	6
For statements C to I, answer only about your <i>tobacco-using</i> patients.							
	Statement	0%	1-24%	25-50%	51-74%	75-90%	91-100%
C	I advised patients who use tobacco to quit.	1	2	3	4	5	6
D	I assessed patients' willingness to quit.	1	2	3	4	5	6
E	I assisted patients in quitting by setting a specific quit date.	1	2	3	4	5	6
F	I provided tobacco intervention educational materials to patients.	1	2	3	4	5	6
G	I assisted patients by prescribing nicotine replacement therapy , Zyban®, Chantix®, etc.	1	2	3	4	5	6
H	I arranged follow-up visits for the patients concerning tobacco intervention services in the College of Dentistry.	1	2	3	4	5	6
I	I referred patients to quitlines.	1	2	3	4	5	6

5. Please use the scale listed below to indicate how often each of these aspects **interfered** with your providing tobacco intervention services in the past year. Please **circle the number** that represents your agreement with each item.

	Statement	Never	Sometimes	About half the time	Often	Almost always
A	Inadequate knowledge about nicotine replacement drugs.	1	2	3	4	5
B	Inadequate knowledge about quitlines.	1	2	3	4	5
C	Lack of training to counsel patients who use smoked tobacco (cigarettes, cigars, pipes, etc).	1	2	3	4	5
D	Lack of training to counsel patients who use smokeless tobacco.	1	2	3	4	5
E	Inadequate skills in providing tobacco intervention services.	1	2	3	4	5
F	Forgetting to give tobacco intervention counseling.	1	2	3	4	5
G	Lack of incentive (no curricular requirements/minimal impact on grades) for providing tobacco intervention services.	1	2	3	4	5
H	Patients' resistance to tobacco intervention services.	1	2	3	4	5

Table 5 continued..

	Statement	Never	Sometimes	About half the time	Often	Almost always
I	Inadequate time available for providing intervention services.	1	2	3	4	5
J	Inadequate availability of patient education materials related to tobacco intervention.	1	2	3	4	5
K	Inadequate space to hold confidential conversations related to tobacco intervention with the patients.	1	2	3	4	5
L	Lack of a formal tracking system for tobacco-using patients in the College.	1	2	3	4	5
M	Inadequate faculty support for providing tobacco intervention services at the individual patient level.	1	2	3	4	5
N	Some patients feel that dentists should not be involved with tobacco intervention services.	1	2	3	4	5

6. Please use the scale listed below to indicate the best answer concerning the adequacy of the coverage concerning each of the following topics in the College of Dentistry didactic (lecture) tobacco intervention curriculum over the **past three years**. (This refers to the **College of Dentistry curriculum (lectures) led by Ms. Nancy Slach in Periodontics ,but also includes content presented by Drs. Rhys Jones, Georgia Johnson, etc.)** Please **circle the number** that represents your response for each item.

	Statement	Not covered at all	Covered minimally	Covered moderately well	Covered very well
A	Historical, social and economic factors associated with tobacco use and the tobacco industry.	1	2	3	4
B	A review of general tobacco-related diseases.	1	2	3	4
C	A review of oral tobacco-related diseases.	1	2	3	4
D	The nature of nicotine dependency and addiction.	1	2	3	4
E	Public Health Service's 5As and 5Rs for conducting tobacco cessation counseling.	1	2	3	4
F	Brief motivational interviewing.	1	2	3	4
G	How to develop a comprehensive tobacco intervention program in a clinical setting.	1	2	3	4
H	FDA-approved pharmacotherapies to assist cessation attempts.	1	2	3	4
I	Strategies for how to become involved in community-based tobacco control.	1	2	3	4
J	Addressing dental students' own tobacco use.	1	2	3	4

7. Please use the scale listed below to indicate your agreement with each of the following statements. Please **circle the number** that represents your agreement with each item.

	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
A	The tobacco intervention curriculum included relevant information.	1	2	3	4	5
B	The tobacco intervention curriculum included current information.	1	2	3	4	5
C	Based on the tobacco intervention curriculum, I feel prepared to provide tobacco intervention services.	1	2	3	4	5

8. For the tobacco-using patients you saw in each of the different clinics during **third year**, what percentages of the time did the faculty work with and/or encourage you to provide tobacco intervention services? Please **circle the number** that best represents the percentage for each department.

	Departments	0%	1-24%	25-50%	51-74%	75-100%	Not applicable (meaning no tobacco use among any patients in the clinic)
A	Endodontics	1	2	3	4	5	6
B	Operative Dentistry	1	2	3	4	5	6
C	Oral and Maxillofacial Surgery	1	2	3	4	5	6
D	Oral Diagnosis, Oral Pathology, Oral Radiology and Medicine	1	2	3	4	5	6
E	Orthodontics	1	2	3	4	5	6
F	Pediatric Dentistry	1	2	3	4	5	6
G	Periodontics	1	2	3	4	5	6
H	Prosthodontics	1	2	3	4	5	6

9. What is your age? _____ Years old

Please circle the number to the right that matches your answer:

10. Gender -

Male 1

Female 2

11. Which of the following best describes your **tobacco use status**?

Current user 1
(use of tobacco in the last 30 days)

Former user 2
(use of tobacco in the past, but not in the last 30 days)

Never user 3
(not used tobacco at all)

12. For those patients who use tobacco and for whom you provided **tobacco intervention services**, how much time did you usually spend **per patient per visit in counseling**?

Less than or equal to one minute 1

Two minutes 2

Three minutes 3

Four or more minutes 4

13. Please use the scale listed below to indicate how valuable it would be to incorporate the following teaching methods into the tobacco intervention curriculum at the University of Iowa, College of Dentistry. Please **circle the number** that best represents your agreement with each item.

	Statement	Not valuable at all	Somewhat valuable	Moderately valuable	Very valuable
A	Web-based learning.	1	2	3	4
B	Problem-based learning.	1	2	3	4
C	Computer-based training and learning.(CD-ROM instruction)	1	2	3	4
D	Objective- structured clinical examination (OSCE).	1	2	3	4
E	Didactic lectures.	1	2	3	4

14. Are you planning to provide tobacco intervention services in your future dental office?

- Yes 1
- No 2
- Not yet decided 3

15. Related to tobacco intervention services, do you think that dental students should be graded on didactic work only, clinical work only or both? Explain briefly.

Didactic only (Explanation)

_____ 1

Clinical only (Explanation)

_____ 2

Both (Explanation)

_____ 3

16. Listed below are a number of statements concerning personal attitudes and traits. Read each item and decide whether the statement is **true** or **false** as it pertains to you personally. Please **circle the number** that represents your agreement with each of the items.

	Statement	True	False
A	I never hesitate to go out of my way to help someone in trouble.	1	2
B	I have never intensely disliked anyone.	1	2
C	There have been times when I was quite jealous of the good fortune of others.	1	2
D	I would never think of letting someone else be punished for my wrong doings.	1	2
E	I sometimes feel resentful when I don't get my way.	1	2
F	There have been times when I felt like rebelling against people in authority even though I knew they were right.	1	2
G	I am always courteous, even to people who are disagreeable.	1	2
H	When I don't know something, I don't at all mind admitting it.	1	2
I	I can remember "playing sick" to get out of something.	1	2
J	I am sometimes irritated by people who ask favors of me.	1	2

17. Do you have any specific suggestions or other comments about the tobacco intervention curriculum, tobacco intervention services, etc. at the College of Dentistry?

18. What barriers to providing tobacco intervention services do you anticipate encountering in your future private practice clinical settings?

Thank you for participating in the survey!

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