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- Mass Fatality Incidents and the Role of the Dental Hygienist: Are We Prepared?
- Practicum Experiences: Effects on Clinical Self-Confidence of Senior Dental Hygiene Students
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The *Journal of Dental Hygiene* is the refereed, scientific publication of the American Dental Hygienists' Association. It promotes the publication of original research related to the profession, the education, and the practice of dental hygiene. The Journal supports the development and dissemination of a dental hygiene body of knowledge through scientific inquiry in basic, applied and clinical research.

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Collaboration Facilitates Growth of the Profession

Rebecca S. Wilder, RDH, BS, MS



The 92nd Annual Session of the American Dental Hygienists' Association (ADHA) is in a few weeks. Among the exciting events happening during those few days is a pre-meeting with the ADHA Council on Research (COR), members of the Canadian Dental Hygienists' Association (CDHA), representatives from the International Federation of Dental Hygienists (IFDH) and members of the Advisory Board for the National Center for Dental Hygiene Research and Practice (NCDHRP). A similar collaborative meeting occurred in October at the 3rd North American/Global Dental Hygiene Research Conference in Bethesda, Md. The meeting was very productive and verified the fact that we have more similarities than differences in our approaches to oral health care. Another highlight of the October meeting was the announcement of the availability of two excellent resources for dental hygiene educators and current and future investigators. The Dental Hygiene Toolkit and "Best Practices for Incorporating Dental Hygiene Research & Evidence Based Decision Making (EBDM) into Dental Hygiene Curriculum" were both created by the NCDHRP and edited by Professor Denise Bowen. JoAnn Gurenlian provided an excellent overview of the two resources in a recent editorial.¹

The Toolkit is designed to facilitate dental hygiene researchers' understanding of the process of conducting investigations in a more efficient and precise manner. The Toolkit covers a wide spectrum of topics including the research process, research dissemination, specifics about survey research, meta-analyses, oral presentations, data analysis and more. New investigators might find the information

on protocol design and requirements, reviewing the literature, scientific writing and conducting scholarship particularly useful.

One of the goals of every institution that educates dental hygiene students should be to provide introductory knowledge about the research process and evidence based decision making. The second resource, "Best Practices for Incorporating Research & EBDM into Dental Hygiene Curriculum" intends to provide valuable materials to assist dental hygiene faculty in curriculum development in this area. Both of the resources mentioned above can be obtained at the NCDHRP and IFDH website.

At the 2015 joint meeting in June, the ADHA COR will unveil a draft document of the revised National Dental Hygiene Research Agenda, which guides our research priorities. The COR has been working diligently to revise the document to reflect current and future research needs for the profession. Members are welcome and encouraged to provide input regarding the agenda. I hope to see you there!

Sincerely,

Rebecca Wilder, RDH, BS, MS
Editor-in-Chief, Journal of Dental Hygiene

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CRITICAL ISSUES IN DENTAL HYGIENE

Mass Fatality Incidents and the Role of the Dental Hygienist: Are We Prepared?

Tara L. Newcomb, BSDH, MS; Ann M. Bruhn, BSDH, MS; Bridget Giles, PhD

Abstract

Purpose: Dental hygienists can fill critical roles during mass fatality incidents in the area of disaster victim identification, providing much needed support to forensic odontologists. The purpose of this paper is to bring awareness that research is needed to assess current dental hygiene programs, continuing education opportunities and the type of approach being used to develop and implement pedagogy in the forensic specialty area, specifically mass fatality preparedness and response for the dental hygienist. Because of the threat of terrorism in the U.S. and natural disasters like hurricanes, the need to prepare dental professionals in disaster response and fatality management is real. The authors' recommendations are to incorporate training in the areas of risk management and infection control in the mortuary setting, antemortem and postmortem records comparison, safe usage of portable radiographic equipment, and proper radiographic technique for the deceased victim. Disaster victim identification training in these areas is necessary for the accurate, efficient and dignified identification of disaster victims while minimizing errors and increasing responder safety. The dental hygiene professional can assist disaster mortuary response efforts in a way that leverages multidisciplinary teams, if effective training programs are implemented.

Keywords: dental hygiene education, mass fatality incidents, forensic odontology, emergency preparedness and response, victim identification, radiology

This study supports the NDHRA priority area, **Professional Education and Development:** Investigate curriculum models for training and certification of competency in specialty areas.

INTRODUCTION

A mass fatality incident is an emergency management term used to categorize an event that causes loss of life which overwhelms a community's ability to locate, identify and process dead bodies for identification.¹ Mass fatality incidents may be either man-made (hazardous material incidents, transportation accidents or terrorist attacks), or caused by acts of nature (hurricane, tornado or tsunami). There have been many defining moments in history where challenges of responding to mass fatality incidents have been clearly realized. The terrorist attacks on the World Trade Center in New York City and on the Pentagon on September 11, 2001, resulted in nearly 3,000 deaths.² On August 29, 2005, Hurricane Katrina moved across the Gulf Coast, killing almost 1,800 people.³ In October 2012, Hurricane Sandy was responsible for the deaths of at least 117 people.⁴ These and other similar moments demonstrate the impact that mass fatality incidents have nationally and globally. Since dental forensic expertise played an important role in victim identification during these incidents, effective preparedness and response training programs related to disasters and victim identification must be created.

Forensic odontology is the proper handling, examination and evaluation of dental evidence, which

will be presented in the interest of justice, and has been a major contributor to victim identification in mass fatality incidents.⁵ This includes collecting and recording both antemortem records and postmortem records. Antemortem records are victim's records created before their time of death to include dated, written notes, dental and social histories, radiographs, clinical photographs, study models, referral letters, and documentation of oral modifications (i.e. oral tattoos or piercings), which are very helpful when all other common identification methods (driver's license, photo id, etc.) are missing or unavailable.^{6,7} Postmortem records are collected after death through a medical examination of a dead body. Under the severe circumstances of mass fatality incidents, dental identification is vital as the victim may be burned, disfigured, crushed or decayed, in such a way that identification by family members is not possible, not recommended or unreliable. Because of their preservability, the best means of biometric identification are the dental structures; teeth can provide evidence of identification even when victims are exposed to severe extremes of heat, trauma or decomposition.^{6,8-10} Even in fires from aviation fuel after a plane crash, a victim's teeth can remain intact when other body parts are destroyed.¹⁰ Dental structures are often preserved because they are well

insulated by bone and swelling of the tongue that occurs during intense heat. During the 2001 World Trade Center attack, at least 501 victims were identified by dental comparison,¹¹ and forensic dental efforts alone enlisted approximately 350 dentists.¹² Following the tsunami in Thailand in 2004, for the first 1,474 victims identified, 79% of the bodies were identified by dental comparison.^{13,14}

During a mass fatality incident, dental teams are formed to collect and systematically record both antemortem and postmortem data, as well as compare data and report evidence. The American Board of Forensic Odontology (ABFO) recommends the use of dental hygienists on mass fatality victim identification teams while under the direct supervision of the forensic odontologist, since dental hygienists hold licensure in competencies that directly benefit the forensic dental team, including administrative skills, dental radiography and clinical oral examination of both hard and soft tissues.^{4,7,14,15} Other expertise include knowledge in the areas of dental anatomy, tooth anomalies and dental charting, which are critical to successful identification of victims during mass fatality incidents. Table I defines possible roles that the dental hygienist could fill during a mass fatality incident.

Victim identification during mass fatality incidents is an essential process to maintain law and order in a civilized society. During a mass fatality incident, the lack of trained incident responders could prolong the process of victim identification, adding to the survivors' psychological trauma.¹⁶ Not knowing whether a loved one is dead or alive can cause frustration, anger and even violence.¹⁷ Furthermore, the mourning processes may not start until deceased victims are identified. The absence of appropriately trained professionals may also result in a lack of sensitivity to cultural and religious practices, an increase in identification errors, and delays in legal processes.¹⁸ Identification is needed for the timely execution of insurance policies, wills, child guardianship and remarriage for the victim's family. Finally, as was seen in Japan and the South Asian Tsunami disaster, having unrecovered and unidentified bodies for a long period of time can undermine public trust and confidence in authorities.¹⁷

Research also shows mass fatality incident responders are at an increased risk of acute stress disorder, post-traumatic stress disorder and depression.¹⁹ Increased distress was significantly related to the hours of exposure to the remains, prior experience handling remains, age, and the support received from spouses and co-workers during the identification process.¹⁶ Since volunteers will be working in a highly stressful and emotionally challenging environment, they should have the requisite skills to operate effectively.^{18,20} This includes the ability to

Table I: Duties of the Dental Hygienist During a Mass Fatality Incident^{4,11}

Administrative Role	<ul style="list-style-type: none"> • Serving as a the dental registrar • Management of dental support personnel • Providing standardized and quality documentation of antemortem and postmortem records • Provision of chain of custody for evidence • Conducting follow-up evaluations and research for future preparedness • Updating and maintaining a master list of identifications (Brannon and Connick 2000)
Postmortem Team Role	<ul style="list-style-type: none"> • Providing surgical assistance to the dentist in resecting procedures • Participating as a member of a multi-verification dental identification team • Exposure of postmortem dental radiographs
Antemortem Team Role	<ul style="list-style-type: none"> • Reconciliation of dental records to identify victim
Records Comparison Role	<ul style="list-style-type: none"> • Arrangement of data for comparison by the forensic odontologist • Serve as a multi-verification team member

cope with exposure to traumatic events, to work under intense pressure, and to function in a variety of roles. It has been shown that psychological debriefing is effective in the preventive treatment of post-traumatic stress disorder.¹⁶ Psychological impacts of a mass fatality incident must be considered by dental hygienists willing to volunteer.

Major differences exist when working in mortuary or temporary morgue settings often used during a mass fatality incident. Dental hygienists are viewed as an asset to mass fatality incidents and identification efforts; however, there are very few training programs that focus on preparing the dental hygienist for disaster response.^{12,14,21} Specifically, more education is needed to prepare the dental hygienist to participate as a mass fatality incident responder and include the following:

1. Knowledge and recognition of associated risks and hazards in a morgue or temporary morgue site
2. Postmortem dental coding

3. Working on a multi-verification team
4. Safety and radiation technique when working with portable radiation equipment and victim remains

Risks and Hazards in the Mortuary Setting

Infection Control: A mortuary setting may subject dental hygienists to a wide variety of infectious agents, including bloodborne and aerosolized pathogens such as human immunodeficiency virus, hepatitis B and C viruses, and Mycobacterium tuberculosis because of the unique characteristics of forensic practice. Studies have confirmed with the cessation of life certain pathogenic bacteria are released.^{22,23} Also after death, there is a lack of the blood-brain barrier and endothelial cells to restrict the movement of pathogens to the brain.²⁴ In particular during a mass fatality incident, the deceased may be stored for prolonged periods of time, increasing the risk of infectious disease transmission.

The exposure of the mucous membranes (eyes, nose and mouth) of dental hygienists to blood and body fluids of the deceased can be associated with the transmission of bloodborne viruses and other infectious. Therefore, dental hygienists must protect themselves from mucous membrane exposures with use of universal precautions, which are based on the principle that all blood, body fluids, secretions, non-intact skin, mucous membranes and body excretions may contain transmissible infectious agents (Table II). Hand hygiene is a major component of standard precautions and one of the most effective methods to prevent transmission of pathogens. Proper hand hygiene includes hand washing for 15 to 20 seconds with warm clean water and soap or use of alcohol-based hand rub, both before and after personal contact with the deceased. Universal precautions for mortuary settings include, but are not limited to, wearing 2 pairs of rubber gloves (i.e., "double gloving") for handling tissues or blood, as well as wearing eye protection, cap, disposable gown, mask, plastic apron, sleeve covers, shoe covers and mortuary issue scrubs. Frequent changing of the outer gloves is highly recommended. When assisting a forensic odontologist who is using sharp instruments, (scalpels, knives and saws) cut resistant gloves should be worn.^{23,25} The appropriate personal protective equipment (PPE) should be worn by anyone participating in the autopsy dissection. Immunosuppressed staff or those with fresh or open wounds should not be involved with handling victims or victim remains.²² Also, equipment or items contaminated with infectious body fluids must be handled in a manner to prevent transmission of infectious agents (e.g. wear gloves for direct contact, properly clean, disinfect or sterilize reusable equipment before use on another corpse). Following examination, protective clothing must be removed prior to leaving the morgue

Table II: Recommendations for Application of Universal Precautions for Mortuary Settings¹⁸

Component	Recommendations
Hand Hygiene	<ul style="list-style-type: none"> • After touching blood, body fluids, secretions, excretions, contaminated items • Immediately after removing gloves
Personal Protective Equipment (PPE)	
Two Pairs of Rubber Gloves	<ul style="list-style-type: none"> • For touching blood, body fluids, secretions, excretions, contaminated items • For touching mucous membranes and non-intact skin
Gown	<ul style="list-style-type: none"> • During procedures when contact of clothing/exposed skin with blood/body fluids, secretions and excretions is anticipated
Sleeve Covers and Shoe Covers	<ul style="list-style-type: none"> • During procedures when contact of clothing/exposed skin with blood/body fluids, secretions and excretions is anticipated
Mask, Eye Protection (Goggles), Face Shield	<ul style="list-style-type: none"> • During procedures and activities likely to generate splashes or sprays of blood, body fluids and secretions
Soiled Equipment	<ul style="list-style-type: none"> • Handle in a manner that prevents transfer of microorganisms to other deceased and to the mortuary environment • Wear gloves • Perform hand hygiene
Environmental Control	<ul style="list-style-type: none"> • Develop procedures for routine cleaning, and disinfection of environmental surfaces, especially mortuary areas
Textiles and Laundry	<ul style="list-style-type: none"> • Handle in a manner that prevents transfer of microorganisms to the environment

environment, and all protective clothing should be placed in plastic bags for proper disposal or decontamination.

Education and training on the principles and rationale for universal precautions facilitate appropriate decision-making and are critical for an enhanced safety climate in the mortuary setting. These precautions are intended to protect all persons by reducing cross-contamination and ensuring infectious agents are not transferred among members of the victim identification team or other responders via hands,

clothing or equipment.²³ Another safety concern in the mortuary setting is airborne disease transmission. Some procedures, such as dissection procedures, can generate small particle aerosols (aerosol-generating procedures) associated with transmission of infectious agents to dental hygienists and to forensic odontologists. The high-risk infections transmitted by aerosols include tuberculosis, rabies, viral hemorrhagic fever, anthrax and influenza. Airborne precautions prevent transmission of infectious aerosols that can remain infectious over long distances and time periods when suspended in the air. Use of a particulate respirator (high-efficiency particulate air mask) is recommended during aerosol-generating procedures when the aerosol is likely to contain high-risk pathogens like *M. tuberculosis* and influenza viruses.²² Other safe work practices include keeping gloved hands that are potentially contaminated from touching the mouth, nose, eyes, or face, and positioning the deceased such that direct sprays and splatter occurs away from the dental hygienist. Careful placement of PPE before decedent contact will help avoid the need to make PPE adjustments and consequently risk face or mucous membrane contamination during use. Additional precautions include: minimizing aerosols containing bone dust (i.e. with vacuum attachments to the vibrating saw) when assisting a forensic odontologist. In addition, it is prudent to maintain all vaccinations required for health care providers.

Hazards: As always, awareness and care to avoid cuts and punctures are paramount for prevention of both injury and infection. Other objects such as broken glass, needle fragments, bone pieces and fragmented projectiles often found in victims of mass fatality incidents can injure the dental hygienist.²⁴ The presence of these objects may or may not be known at the start of the examination and if suspected, dental hygienists should use cut resistant gloves. Staff involved in postmortem examination should also be aware that bodies may be contaminated with either chemical or radioactive sources; this type of contamination by radioactive materials could be deliberate, as a consequence of medical treatment, or as a consequence of the explosion of atomic devices.²⁷ To ensure the safety of mortuary staff, efforts must be made to maintain a safe working environment, and chemical and radiological monitoring protocol must be in place before postmortem examinations.²³

Antemortem and Postmortem Records

Dental Coding: Dental teams are assembled to start the difficult task of creating postmortem records. This process can be long and involved due to the nature of the incident and the need to quickly and correctly identify hundreds or thousands of victims. Victim identification software exists to facilitate efficiency in recording dental data by charting

dental considerations, physical intra-oral and tooth descriptors, pathological lesions and anthropologic findings of an unidentified human remain; they also have the capability to store and display graphics features such as digital radiographic images and intra oral photos.

It is important to know that there are several identification software applications used for electronic management of antemortem and postmortem dental records and comparisons. Some of the most commonly used include CAPMI® (U.S. Army Institute of Dental Research),²⁸ WinID®,^{5,29} "DAVID web"³⁰ and the PLASS Data DVI® (PLASS DATA Software, Holdbaek, Denmark).

Dental records that are transcribed into victim identification software use various coding systems; therefore, several differences in antemortem dental charting and postmortem victim identification software coding exist. A graphic representation of dental conditions is observed, recorded and the exact location and condition of all teeth and restorations are documented in antemortem dental charting. Tooth coding involves use of nomenclature that is different or may not be recognized by a dental hygienist when working with victim identification software. A well-known victim identification software used by the ABFO, WinID®, uses primary and secondary codes to describe a tooth within a single dentition (Figure 1). For example, when documenting restored surfaces of a tooth, the restoration itself is not coded; more specifically, a disto-occlusal (DO) restoration and a mesio-occlusal (MO) restoration in victim identification software would be coded as a MOD, respectively. Codes include capital letters and/or symbols that are representative of a category. The letter V, in WinID® stands for a non-restored tooth-virgin, and (/) indicates no information about the tooth is available and may indicate portions of the skull are not present.^{5,28} The letter Z can represent temporary filling material or can indicate gross caries.⁵ Codes must be ordered correctly and may be autocorrected by the system, which is important as the main function is to rank records for a best match, and help find, sort or filter records.⁵ Comparisons are made on a tooth by tooth basis within these systems. Coding using victim identification software is not the same as clinical dental charting; dental hygienists should have experience working in a victim identification system prior to a mass fatality incident.

Records Comparison: When dealing with a large number of fatalities, it is recommended that a single victim identification software type be used to link antemortem and postmortem records to a particular disaster. The victim identification software used should be established prior to and be in place at the mass fatality incident site; this is necessary for uploading any antemortem records collected for records

Figure 1: WinID® Code Nomenclature^{2,21}

WinID® Primary Codes	WinID® Secondary Codes
M - Mesial surface is restored	A - Annotation: An unusual finding is associated with this tooth. Specifics of the finding are detailed in the comment section.
O - Occusal surface of posterior tooth is restored	B - Tooth is deciduous
D - Distal surface of tooth is restored	C - Tooth is fitted with a crown. Shorthand for MODFL-C.
F - Facial surface of tooth is restored	E - Resin filling material
L - Lingual surface of tooth is restored	G - Gold restoration
I - Incisal edge of anterior tooth is restored	H - Porcelain
U - Tooth is unerupted	N - Non-precious filling or crown material. Includes stainless steel.
V - Non-restored tooth, virgin	P - Pontic: Used only when tooth has been marked as miss with code "X".
X - Tooth is missing, extracted	R - Root canal filled
J - The tooth is present but no other info is known. Missing postmortem, fractured crown, avulsed tooth/no information about tooth is available.	S - Silver amalgam
	T - Denture tooth: Used only when tooth has been marked as missing with "X".
	Z - Temporary filling materials. Also indicates grows caries (used sparingly).

comparisons.^{28,31} Records comparison in a mass fatality incident uses victim identification software to order possible matches, and includes matching unique identifying factors such as individual tooth crown and root anatomy (wear, fractures, anomalies of size, shape and color), pulp morphology, size of restorations, base materials and trabeculation patterns.^{6,32} Comparisons of antemortem and postmortem dental records can indicate 3 possible results for each tooth. A match result means a tooth is the same in the antemortem and postmortem records, a possible result is the condition of the tooth in the postmortem record may have developed or progressed from the antemortem record, and a mismatch result means the postmortem record is not the same or the possibility for similarities does not exist in the antemortem record.²⁸ Comparisons of dental features are limited to the dental codes used within each victim identification software system.

Using multiple verification teams for records comparison helps to reduce fatigue induced error, which can occur during mass fatality incidents.⁶ Multiple verification teams can include several combinations of dental professions: a dentist can perform the dental examination while another dentist records, or a dentist and dental hygienist can work together; the dentist would perform the dental examination while the dental hygienist would record the findings. These persons would then reverse roles to ensure the examination and dental coding was done accurately.³³ Once the multiple verification teams agree that all information was discovered and entered correctly in

the victim identification software, a comparison of antemortem and postmortem records can begin.

Radiographic Imaging

Radiographic Equipment and Safety: One of the most accurate methods for victim identification is the exposure of dental radiographic images.^{34,35} Radiographs are significant during records comparison, postmortem profiling and age estimations; they provide critical information in detection and preservation of forensic evidence.^{35,36} Dental hygienists are an asset on mass fatality incident teams because they can expose radiographic images and provide interpretation of antemortem and postmortem radiographs.¹⁴ Portable, hand-held dental x-ray devices are recommended in forensic dentistry, since they can be carried to mortuary or temporary morgue settings and have ease of use with pre-set exposure factors.³⁷ The device also utilizes direct current and can be interchanged for use with film, photostimulable phosphor plates and direct digital sensors.³⁸ Portable x-ray devices have an external backscatter shield around the position-indicating device and internal radiation shielding to protect the operator from scatter radiation exposure during typical patient and operator positions, where the occlusal plane of the patient is parallel to the floor and the mid-sagittal plane of the patient is perpendicular to the floor. This shield does not offer optimal operator protection when used atypically, which is the case of fatality victim remains during a mass fatality incident.³⁸ For example, when the radiographer is imag-

ing a bisected mandible, the x-ray device may have to be positioned with the device at a 90-degree angle to the floor. Due to this atypical use, the operator should adorn a lead shield, lead gloves and personal dosimeter to maintain proper radiation safety principles while taking postmortem radiographs. Personal dosimeter badges should be worn to determine occupational radiation exposures. This badge does not protect the operator — it measures how much exposure (if any) that the radiographer had obtained during the procedure. Handheld x-ray devices should never be touched with clinician (treatment) gloves when working with victim remains. Dental hygienists must use infection control standards to include use of protective barriers for radiology equipment that cannot be sterilized, and adhere to universal precautions for mortuary settings during postmortem exposures.

Radiographic Technique: Unique challenges exist when exposing x-rays on victim remains such as difficulty duplicating antemortem angulations with postmortem exposures.³⁶ Dental hygiene education and expertise in oral radiology is limited to living persons, with images taken in a supine position. Also, challenges exist in placing film or digital sensors in the absence of occlusion. Postmortem radiographic imaging is significantly different and can include bone fragments, decomposed tissue and sheared pieces of the dentition. Studies show that equipment necessary to expose quality radiographic images during mass fatality incident is often limited, and postmortem images tend to be of poor diagnostic quality and difficult to compare with antemortem dental records.³⁶ Therefore, the radiographer should make an attempt to obtain and view antemortem records before exposing postmortem images to determine which technique was utilized antemortem — the bisecting technique or the paralleling technique, and follow that technique postmortem. Every attempt should be made to view antemortem radiographic images before exposing postmortem images, however, this may not be possible in mass fatalities. If antemortem radiographs are not available, the paralleling technique should be implemented since intraoral radiographs exposed with the paralleling technique offer minimal image distortion and superimposition of adjacent oral structures. Postmortem exposure adjustments can be made as needed to include decreases in voltage (kVp), amperage (mA) or time (seconds) for adequate comparisons and identification.

The radiographer exposing postmortem images must be skilled in use of the bisecting technique because image receptor holders may not be available or it may be difficult to place image receptors parallel to the long axis of the teeth. Fractured victim remains or low palatal vault, tori present, primary dentition, edentulous areas, or missing/broken remains

increase the need for the bisecting technique. Images taken with the bisecting technique may produce increased magnification and distortion and greater chance for error; however, the bisecting technique provides acceptable results for victim identification. The image receptor should be placed close to the teeth, and vertical angulation directed perpendicular to an imaginary bisector that is estimated between the long axis of the teeth being imaged and long axis of the image receptor. The bisecting technique also requires the use of a short position-indicating device since the image receptor is placed close to the teeth of interest, which is found on most portable, handheld x-ray devices.

Although it is critical to expose quality postmortem radiographs, having quality antemortem images is just as important for comparisons and adequate identifications. For example, antemortem images must have open contacts, clear distinction of the cemento-enamel junction, pulpal outline, root apex, differentiation of restorative materials, and pathology and disease to make acceptable identifications.^{20,37} Analysis after the South Asian tsunami of 2004 indicated 64% of 106 antemortem records received had either no radiographs or images were of poor quality.³⁹ To minimize errors, radiographers should follow the 4 steps for the exposure of diagnostic radiographic images: horizontal angulation, vertical angulation, centering the position-indicating device and proper placement of the image receptor.

DISCUSSION

Addressing mass fatality incident preparedness didactically is a challenge because the literature is void of curriculum models for dental hygiene training in the area of mass fatality incident and victim identification.²⁰ Additionally, there is a lack of advancement in forensic education, specifically catastrophe preparedness in dental curriculum — competencies and objectives for course content and delivery have been recommended by More et al,⁴⁰ Glotzer et al,⁴¹ Stoeckel et al²⁰ and Hermsen et al,⁴² but have not been fully evaluated or standardized. More et al⁴⁰ and Glotzer et al⁴¹ recommend sequencing instruction throughout all 4 years of predoctoral dental school curriculum, given in units of progressively more challenging instruction in modular form. More et al recommends using lectures, case studies, drills and dramatizations using multimedia to simulate catastrophic events.⁴⁰ Proposed dental school curriculum have been based on More et al's proposed competencies and objectives; general competencies include the role of dentists in disaster events, emergency preparedness, and hazards and pathogens used in bioterrorism.⁴⁰ Hermsen et al's proposed forensic dental education in predoctoral dental school curriculum also recommends disaster preparedness,

including using WinID3 (computer-assisted identification program), Nomad (Aribex, Inc., Orem, Utah) and Dexis (Dexis Digital Diagnostic Imaging, Hatfield, Penn).⁴² Stoeckel et al recommends forensic dental training in dental school curriculum, however, to third or fourth year students only.²⁰ This author also recommends victim identification exercises for mass disaster preparedness given through both lecture and hands-on simulated scenarios.²⁰ The specific number of lectures hours dedicated to mass fatality incident training varies significantly among each proposed curriculum. Programs addressing dental hygiene mass fatality incident preparedness and training are needed; specifically, research assessing current dental hygiene programs, continuing education opportunities and approaches used to develop and implement pedagogy in the forensic specialty area, specifically mass fatality preparedness and response for the dental hygienist. A combination of educational approaches using the suggested training topics listed in this paper and existing recommendations for dental curriculum (applicable to dental hygiene) may provide awareness toward addressing specific dental hygiene courses for supplementing mass fatality incident lectures, identifying the number of courses needed for training, and/or determining if a continuing education certificate would be beneficial.

Based on the defined roles of the dental hygienist during mass fatality incident and approaches utilized in dental curriculum, the authors make the following recommendations of objectives and assessment for future curriculum development:

1. Risk Management in the Mortuary Setting for the Dental Hygienist: Identify ways to reduce the risk and increase knowledge of hazards in the mortuary setting.
 - Provide gaming and simulation based training and lectures on situational awareness, risk and hazard identification and management, infection control in the morgue, toxicity, autopsy precautions and protocols, special equipment, surface and waste decontamination, and applying teamwork skills.²⁴
 - Assessment: Virtual, game-based simulation as well as live simulation exercises to determine skill levels obtained by dental hygienists.
2. Victim Identification Software and Dental Coding: Apply knowledge of victim identification software and records comparison teams.
 - Develop hands-on case study practice entering antemortem records with postmortem

remains, working on multidisciplinary victim identification teams, dental coding, legality of obtaining patient records, chain of evidence for antemortem records, documenting dental evidence and best practices for evidence collection.

- Assessment: Use of case-study with mock missing persons records to correctly chart in victim identification software systems.²⁰
3. Dental Radiation Safety and Technique on Human Remains: Demonstrate safety protocol and appropriate radiographic imaging technique skills on simulated victim remains.
 - Develop live simulations (radiology lab) on imaging dental fragments and intact skulls with portable radiographic equipment, how to reduce technique errors for records comparisons, common errors when exposing dental radiographs in an atypical position, knowledge about safe use of equipment and infection control.
 - Assessment: Repetitive practice and evaluation of technique errors and safety violations using standard retake criteria from existing radiology curriculum.³⁷

CONCLUSION

Currently, there is an underutilization of dental hygienists on mass fatality victim identification teams.¹⁴ Dental hygienists have applicable competencies in infection control, dental charting, and radiation safety and technique; however, disaster preparedness and response training is needed to fill the gap in a way that leverages multidisciplinary teams, provides frequent and consistent training in a safe environment, and that is sustainable.^{20,43} It is recommended that dental hygiene advocates petition change on collecting notice of willingness to volunteer for mass fatality incident through licensure and licensure renewal periods. The goal of the dental profession should be to increase the number of skilled and deployable oral health professionals able to participate in emergency relief efforts.

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RESEARCH

Practicum Experiences: Effects on Clinical Self-Confidence of Senior Dental Hygiene Students

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Abstract

Purpose: The purpose of this study was to determine the effects of a 3-week practicum experience on the clinical self-confidence of University of North Carolina (UNC) senior dental hygiene students.

Methods: A mixed methods approach was utilized. Before and after a 3-week practicum experience, UNC senior dental hygiene students (n=32) were asked to complete a 20-statement clinical self-confidence survey based on the dental hygiene process of care. Statements were Likert-scaled, ranging from "not at all confident" to "totally confident." The stratified Mantel Haenszel row mean score test with the subject as strata as a repeated approach was used to assess whether on average across subjects, the pre- and post-surveys had the same mean score. Students were also asked to submit reflective journal entries discussing critical incidents during their practicum experience. Representative comments from students' journal entries were selected as qualitative data to support survey results.

Results: Pre- and post-practicum surveys (31 and 32, respectively) were completed, and all 32 students submitted journal entries. The differences in the row mean scores from pre- to post-practicum survey were statistically significant ($p < 0.05$), indicating an overall positive gain in clinical self-confidence from the practicum experience. Students' journal entries provided comments that supported the quantitative results.

Conclusion: The results suggest that a 3-week practicum experience in dental hygiene students' final semester increased UNC dental hygiene students' clinical self-confidence in the dental hygiene process of care. Dental hygiene administrators may want to consider the benefits of requiring students to participate in a practicum experience if they do not already do so.

Keywords: curriculum, dental hygienists, education dental, service learning, self concept, clinical competence

This study supports the NDHRA priority area, **Professional Education and Development:** Evaluate the extent to which current dental hygiene curricula prepare dental hygienists to meet the increasingly complex oral health needs of the public.

INTRODUCTION

Curricula in a dental hygiene program should support the development of a confident and well-rounded dental hygienist, prepared to treat a variety of patients in traditional and nontraditional settings. The challenges of educators to prepare dental hygiene students to succeed in an evolving profession are ever present. The American Dental Education Association (ADEA) has recommended that dental institutions "develop the knowledge and skills necessary to serve a diverse population, provide experiences of oral health care delivery in community-based and nontraditional settings, and encourage externships in underserved areas."¹ Moreover, the American Dental Association's (ADA) Commission on Dental Accreditation (CODA) standards require students to have a sufficient number of hours in clinical practice to develop appropriate clinical judgment, as well as experience in providing care to children, adolescents, adults, geriatric patients and special needs patients.² Practicum experiences pro-

vide a method to follow ADEA's recommendations and fulfill ADA's CODA standards because they have been shown to provide many experiences with diverse patients with a variety of needs.³⁻⁸

The practicum experience is a type of experiential learning that includes hands on practice, reflection, abstraction and application of the new experience.⁹ Experiential learning helps students connect theory to practice.¹⁰ Students may encounter experiential learning in a school's clinic or lab setting, but the situation may not be practical due to the academic environment.

Practicum experiences in dental education are also referred to as service learning, outreach placements, community-based experiences, external placements, extramural rotations, service learning or community-externships.^{3-8,11-18} A benefit of the practicum experience is that it provides stu-

dents with an opportunity to apply what they have learned in school to practical situations in a variety of community-based settings. Often occurring near the end of an educational program, practicum experiences typically last several weeks, allowing students to gain insight into their future career. The efficacy and value of practicum experiences in dental education has been studied using various quantitative and qualitative methodologies. Smith et al found that dental, dental therapy and dental hygiene students were overall positive about their experiences.⁵ The students felt that they gained experience with diverse patients in various settings, and increased awareness of the different possible careers in dental hygiene.⁵ Likewise, an Australian study using a cross-sectional survey of dental hygiene students' practicum experiences also reported positive feelings towards the community-based placements and described exposure to a variety of clinical skills.¹⁸ Ledford et al found that 46% of dental hygiene graduates that participated in a practicum experience felt that it made them more likely to seek a career in an alternative practice setting.¹⁷ Sixty percent of the students also felt that their practicum experience enhanced their knowledge of the specialty, while 88% thought it was an important part of their education.¹⁷

Practicum experiences have also shown to produce an increase in perceived overall clinical self-confidence in dental and dental hygiene students.^{4,5,11-14,19} Dental therapy and dental hygiene students in a dental school in the United Kingdom reported gaining confidence in patient care delivery after their practicum experiences.⁵ Another study by Butters et al evaluated dental hygiene students' self-perceptions of clinical competence in 19 different areas of clinical dental hygiene care after a practicum experience based on pre- and post-surveys.⁸ They found that students perceived an increase in clinical competence in 6 areas: radiographic technique, scaling periodontally involved teeth, child patient management, clinical speed, clinical accuracy and clinical judgment.⁸

Several studies have drawn similar conclusions regarding practicum experiences for dental and dental hygiene students, such as enhancing their clinical knowledge and skills,^{4-6,8,12,13,15,19} increasing speed and efficiency,^{5,8,13} and facilitating professional growth.^{6,12,15} Advantages also include awareness of ethical dilemmas,^{6,12} benefits to the community, and comfort and awareness of vulnerable, underserved populations.^{3,6,7,19} Enhancing communication and teamwork among dental professionals are also noted advantages from participation in an externship.^{4,5} Moreover, dental and dental hygiene students have shown an interest in different career opportunities after their practicum experiences.⁵⁻⁷

The experiences students have during their practicum rotations may not fully develop knowledge and desired skills without reflection.^{15,16} Reflective journaling has been widely used in nursing education as a means of self-assessment and critical thinking, and is accepted as an essential part of the learning process.¹⁸ In dental education, studies in which students have practiced reflection regarding clinical experiences, awareness of clinical and professional development increased.^{15,20,21} Several studies assessing dental and dental hygiene students' practicum experiences have utilized reflections as qualitative data.^{3,6,12,15,20,22} Strauss et al recommend reflecting on practicum experiences in order for students to recognize the value of their experiences and to ultimately encourage lifelong self-assessment practices.¹⁵ Therefore, reflective journaling may aid in fulfilling ADA's CODA standards for dental hygiene programs requiring graduates to "be competent in the application of self-assessment skills to prepare them for life-long learning."¹ Furthermore, Mofidi et al conceded that reflective practice during practicum experiences was necessary to develop a well-rounded practitioner in order to be successful in an evolving health care environment.¹²

The Critical Incident Technique (CIT) was first described by Flanagan in 1954, who defined it as "a set of procedures for collecting direct observations of human behavior in such a way as to facilitate their potential usefulness in solving practical problems."²³ The CIT was used in Mofidi et al's study to guide dental students' reflections after a practicum rotation, in which dental students acknowledged the value in their incidents, describing them as "awakening, unforgettable, memorable, and transformative."¹² Similarly, Fitzgerald et al concluded that the CIT is an appropriate research method in dental education, and could provide many benefits to dental education.²⁴

Limited studies have been conducted on dental hygiene students' practicum experiences and particularly in how the experience may have affected their clinical self-confidence. For example, the Ledford et al study found that most dental hygiene graduates who participated in a practicum found it to be beneficial and a significant part of their dental hygiene education; however, the study did not look at the effect it had on their clinical self-confidence in the dental hygiene process of care.¹⁷ A study conducted by Butters et al evaluated the effect of a 4-week practicum experience on a Midwestern university's dental hygiene students' perceived clinical competence.⁸ This was the only study to evaluate specific dental hygiene clinical aspects and found that 6 of 19 dimensions assessed significantly improved.⁸

Educational methodologies should continuously

be assessed in order to ensure the goals are being met. Therefore, the outcomes of practicum experiences should be assessed to determine the success of the program. CODA requires dental hygiene programs to support the development of students that are competent in the dental hygiene process of care.² A successful practicum experience would show that students are gaining clinical self-confidence in all areas of the dental hygiene process of care.

University of North Carolina School of Dentistry's Dental Hygiene Program Practicum Experience

The curriculum in the University of North Carolina-Chapel Hill School of Dentistry's (UNC SoD) Dental Hygiene Program includes a 3-week practicum experience in students' senior year, last semester of the program. The goal for the practicum experience is for the dental hygiene students to gain strong and diverse clinical experiences, and to participate in a practical application of their education. Students choose from a list of practicum sites, including health departments, hospitals, prisons, veterans' dental clinics and UNC SoD's Graduate Periodontology Clinic. Students participate 35 hours per week at their site in clinical patient care, for a total of 105 hours at the completion of 3 weeks. The dentist and/or dental hygienist at the site mentor the student throughout the practicum experience. Students are typically scheduled the same number of patients the practicum site's licensed dental hygienist treats in a normal day. Although the practicum experience has been in place for many years, no study has been conducted to determine the outcomes of the students' experience on clinical self-confidence. Therefore, the primary purpose of this study was to determine the effect of practicum experiences on UNC SoD's senior dental hygiene students' clinical self-confidence in the dental hygiene process of care.

METHODS AND MATERIALS

The UNC Biomedical Institutional Review Board rendered this study no more than minimal risk to human subjects and exempted this study.

Scheduling of the Practicum Experience

Thirty-two students were separated into 2 groups for the practicum experience so that sites could be utilized twice. While one group was participating in the practicum for 3 weeks (group 1, n=16), the other group remained in UNC SoD's clinic. When the first group returned, the second group of students (group 2, n=16) participated in the practicum. Practicum sites for the study period included the following: health departments, a prison, UNC SoD

Graduate Periodontology Clinic, hospitals, veteran's dental clinics and community health centers.

Clinical Self-Confidence Survey

In order to quantitatively measure the change in dental hygiene students' clinical self-confidence in the dental hygiene process of care following the practicum experience, the investigators created a clinical self-confidence survey. The survey consisted of 20 statements based on the American Dental Hygienists' Association's (ADHA) Standards for Clinical Dental Hygiene Practice which include: assessment, dental hygiene diagnosis, planning, implementation and documentation.²⁵ Self-confidence levels were reported on a 5-point Likert scale from "not at all confident" to "totally confident." The survey was pilot tested with 6 UNC dental hygiene graduates from the previous year (2012), and revisions were incorporated based on respondents' suggestions. Senior dental hygiene students (n=32) were asked to complete the pre-practicum clinical self-confidence survey 1 week before their practicum experience. The post-practicum survey was completed upon return from the practicum after 1 week of patient care in UNC SoD's clinics. The survey was confidentially coded in order to encourage honest responses, protect the identity of the respondent, and to match pre- and post-surveys to assess for change. Students were aware that participation was voluntary and they could choose not to participate at any given time without penalty.

The stratified Mantel Haenszel row mean score test with the subject as strata as a repeated measures was used to assess whether there was change in the respondents' pre- to post-practicum scores on average across subjects. The Mantel Haenszel row mean score test of the change in score from pre- to post-practicum was used to compare the 2 groups. Level of significance was set at $\alpha < 0.05$.

Reflective Journaling

As an assignment for the practicum course, the students submitted 1 reflective journal entry per week regarding their practicum experience. The assignment was to write about a critical incident by reflecting on events that occurred while on practicum that were either positive or negative and had a lasting effect on them.²³ They were asked to discuss how the event made them feel, the professional implications and what could have been done differently. The students were asked not to use any names of patients or dental personnel in their reflective journal entries. The content of the entries were not graded, but credit was given for the completed assignment. To encourage honesty in students' reflections, the reflective journal entries were coded for the purpose of the study in order to protect the

identity of the students. Representative comments were selected by the primary investigator from students' reflective journal entries to support survey results.

RESULTS

Completed pre- and post practicum clinical self-confidence surveys were obtained from 31 out of the 32 senior dental hygiene students for a 97% response rate. One student was absent on the day the pre-practicum survey was administered. All 32 students submitted their reflective journal entries to the study.

The average change in clinical self-confidence from pre- to post-practicum was statistically significant for all of the 20 statements, indicating an overall positive gain in clinical self-confidence from the practicum experience (Table I). Greater than 50% of the students reported an increase in confidence for 14 out of the 20 statements. Several students reported no change in confidence from pre- to post-practicum, while a small number of students reported a decrease in confidence for many of the statements (Table I)

Groups 1 and 2 were significantly different in the average change scores for statement 9 ($p=0.001$) and 19 ($p=0.001$). For both statements, the proportion of students that participated in the first practicum who reported positive changes was substantially higher than the proportion of students in the second practicum (Statement 9: 75% vs 40%; Statement 19: 56% vs 20%) (Table I).

Although the findings from the pre- and post-practicum surveys indicated a significant increase in confidence following the practicum experience, the students' reflections provided a more in-depth understanding of what experiences were related to the increased confidence: treating diverse patients, speed of treatment, practicing in a practical setting and overall clinical self-confidence. Table II reports a representation of comments from students' reflective journal entries that support the survey results. Figure 1 reports a representation of comments from students' reflective journal entries in which students discussed their overall self-confidence.

Eighty-seven percent of the students reported an increase in confidence in treating multiple patients per day in a timely and thorough manner. In the reflective journal entries, many students commented on treating patients at a quicker pace during their practicum experiences (Table II). One student wrote, "This second week of practicum rotation, I was able to finish patients much quicker than I did on the first few days of the first week of my rotation."

The reflective journal entries also revealed that many students treated a variety of patients. Fifty-eight percent of students reported an increase in confidence in treating all patient types. In their reflective journal entries, students reported treating children, geriatric patients and pregnant patients, as well as patients with mental or physical disabilities (Table II).

Seventy-seven percent of students reported an increase in confidence in practicing as a registered dental hygienist in a private practice setting after the practicum experience. One student reflected, "I am so grateful I got to experience a more 'real-life' setting for three weeks to better prepare me when I graduate from dental hygiene school" (Table II). Furthermore, many students' reflections included statements about their overall confidence in their clinical abilities. One student stated, "I have learned greater independence and greater confidence in my ability as a clinician" (Figure 1).

DISCUSSION

As dental hygiene students approach graduation and the beginning of their careers as licensed professionals, it is necessary to ensure that they are confident in implementing all parts of the dental hygiene process of care. CODA requires dental hygiene programs to support the development of dental hygienists who are competent in providing the dental hygiene process of care.² The results of this study indicate a significant increase in the clinical self-confidence of 31 dental hygiene students at UNC SoD for each of the surveyed aspects of the dental hygiene process of care after a 3-week practicum experience. Comments from students' journal entries also reflected an increase in clinical self-confidence in particular aspects.

During the practicum experience, students face practical situations where they get to practice being a part of the dental team. Unlike the UNC SoD's clinic where students have long appointment times, a homogenous patient pool and little experience with a dental team, it is quite different during the practicum experience. At the practicum sites, students treat multiple patients per day, often in settings where the patients are diverse and have a variety of needs. The repetitive practice over a 3-week period may explain the students' increase in clinical self-confidence. Furthermore, the practicum experience reinforces what the students have been learning throughout their dental hygiene education. Keselyak et al also suggested that service learning with special needs patients might increase an understanding of applying theory to practice.²⁶

Butters et al found dental hygiene students to have an increased perception of clinical competence in clinical speed after an extramural education pro-

Table I: Dental Hygiene Students' Clinical Self-Confidence After a Practicum Experience (n=31)

Clinical Self-Confidence Survey Statement	Change from pre-to post-practicum	n	Positive Change in Confidence (Percent)	p-value
1. Evaluate a patient's medical history and vitals and incorporate findings into a dental hygiene treatment plan.	Negative	3	45	0.007
	None	14		
	Positive	14		
2. Accurately perform an extraoral/intraoral assessment and use findings to create and implement a dental hygiene treatment plan.	Negative	2	39	0.008
	None	17		
	Positive	12		
3. Determine a patient's level of risk to develop periodontal disease by using medical history and assessment findings.	Negative	1	55	<0.001
	None	13		
	Positive	17		
4. Determine a patient's level of risk to develop caries by using medical history and assessment findings.	Negative	2	42	0.005
	None	16		
	Positive	13		
5. Utilize assessment data to formulate a dental hygiene diagnosis and incorporate into patient's overall treatment plan.	Negative	3	39	0.016
	None	16		
	Positive	12		
6. Determine the necessity for a patient to be referred to a periodontist.	Negative	3	54	0.002
	None	11		
	Positive	17		
7. Determine which of the following procedures are needed: a prophylaxis, periodontal maintenance, or periodontal debridement.	Negative	1	61	<0.001
	None	11		
	Positive	19		
8. Expose diagnostic radiographs and interpret them to assist in making a dental hygiene diagnosis and treatment plan.	Negative	0	61	<0.001
	None	12		
	Positive	19		
9. Create a dental hygiene diagnosis and treatment plan with the priorities arranged according to the patient's clinical assessment, needs, and values.	Negative	3	58	0.001
	None	10		
	Positive	18		
10. Utilize all possible resources to facilitate patient care including communication with dental specialists and medical providers.	Negative	1	65	<0.001
	None	10		
	Positive	20		

gram.⁸ Similarly, the students in this study were more confident in treating multiple patients per day in a timely and through manner, with 87% of the students reporting a positive change from pre- to post-practicum. This can likely be attributed to repetitive practice and is an indicator that students may benefit more from a multiple-week practicum experience. Studies conducted on dental students have also shown that the students did more procedures in less time as a result of practicum experiences.^{13,27} Mascarenhas et al found that as each week of the dental students' externship progressed, more

procedures were performed.²⁷ Likewise, Mashabi et al found that revenue increased as a result of increased productivity after dental students' returned from a 10-week externship.¹³

Lynch et al found that dental students reported an increase in confidence in taking radiographs and treatment planning after participating in a community-based teaching program.¹¹ This is similar to this study's findings with 61% of dental hygiene students reporting an increased confidence in exposing and interpreting radiographs and 58% reporting an

Table I: Dental Hygiene Students' Clinical Self-Confidence After a Practicum Experience (n=31) (continued)

Clinical Self-Confidence Survey Statement	Change from pre- to post-practicum	n	Positive Change in Confidence (Percent)	p-value
11. Communicate with the dentist about a patient's overall care.	Negative	2	58	<0.001
	None	11		
	Positive	18		
12. Detect suspicious restorations and/or areas of possible decay and relay these findings to the dentist.	Negative	0	68	<0.001
	None	10		
	Positive	21		
13. Discuss dental hygiene treatment plan with a patient (and/or their legal guardian/caregiver) including rationale, risks, benefits, possible outcomes, alternatives, and prognosis.	Negative	3	58	0.004
	None	10		
	Positive	18		
14. Treat all patient types, including all ages of patients, medical conditions, physical or mental disability, economic status, or culture.	Negative	2	58	<0.001
	None	11		
	Positive	18		
15. Use hand instruments and determine where and when an unfamiliar instrument is to be used based on its design.	Negative	1	74	<0.001
	None	7		
	Positive	23		
16. Treat multiple patients per day in a timely and thorough manner.	Negative	1	87	<0.001
	None	3		
	Positive	27		
17. Evaluate outcomes of dental hygiene care and determine the need for further treatment, oral hygiene instruction, or referral.	Negative	1	65	<0.001
	None	10		
	Positive	17		
18. Document all parts of the dental hygiene process care: assessment, dental hygiene diagnosis, dental hygiene treatment plan, implementation, and evaluation.	Negative	2	26	0.046
	None	21		
	Positive	8		
19. Document discussions and interactions between the patient and all dental personnel that are relevant to the patient's dental care.	Negative	0	39	0.001
	None	19		
	Positive	12		
20. Practice as a Registered Dental Hygienist in a private practice setting.	Negative	1	77	<0.001
	None	6		
	Positive	24		

increased confidence in creating a dental hygiene diagnosis and treatment plan. Furthermore, Butters et al found that dental hygiene students perceived an increase in clinical competence in radiographic technique after a 4-week extramural rotation.⁸

Comments from the reflective journal entries also revealed that many students treated a variety of patients. Students reported treating children, geriatric patients, pregnant patients as well as patients with mental or physical disabilities. Fifty-eight per-

cent of students reported an increase in confidence in treating all patient types. This is consistent with literature that has found that students were more aware and comfortable in treating underserved and vulnerable populations after practicum experiences.^{3-5,7,28,29} As for students who did not increase in self-confidence in this aspect, perhaps their practicum site did not provide them with a variety of patients or perhaps they already felt confident prior to their practicum in treating all patient types.

Table II: Representative Comments Supporting Survey Results

Statement from clinical self-confidence survey	Representative sample of comments from students' journal entries	Percent Positive change in self-confidence from pre- to post-practicum (n=31)
Utilize assessment data to formulate a dental hygiene diagnosis and incorporate into patient's overall treatment plan.	<ul style="list-style-type: none"> • "I am learning how to adapt treatment plans for immunocompromised and severely disabled patients." • "...through creativity and patience, I was able to adapt his treatment plan to his needs." 	39
Treat all patient types including all ages of patients, medical conditions, physical or mental disability, economic status, or culture.	<ul style="list-style-type: none"> • "I am being challenged with a plethora of special needs patients." • "The patients at my facility are compromised in their health—mental and physical disabilities and disease..." • Throughout their reflective journal entries, many students wrote about treating a variety of patients: children, patients on Medicaid, wheelchair bound patients, mentally handicapped patients, geriatric patients, pregnant patients, ADHD patients... 	58
Treat multiple patients per day in a timely and thorough manner.	<ul style="list-style-type: none"> • "I learned to increase my pace this week." • "This second week of practicum rotation, I was able to finish patients much quicker than I did on the first few days of the first week of my rotation." • "I feel so much more confident with time management." 	87
Practice as a RDH in a private practice setting.	<ul style="list-style-type: none"> • "I am so grateful I got to experience a more "real-life" setting for three weeks to better prepare me when I graduate from dental hygiene school." • "It has honestly felt as if I was actually starting a first job as an actual hygienist!" • "It has helped me to see what the "real world" of dental hygiene is like beyond school." 	77

Student reflections supplied several comments that relate to an overall increase in clinical self-confidence. One student stated, "I have learned greater independence and greater confidence in my ability as a clinician." Likewise, other studies have found practicum experiences to produce an increase in overall clinical self-confidence in dental and dental hygiene students.^{4,8,11-14,19} Similarly, 77% of the students in this study felt more confident to practice as a registered dental hygienist in a private practice setting after the practicum experience. A few students referred to their experiences in their reflections as giving them a sample of the "real world."

Although a significant increase in self-confidence was found for each statement in the survey, a notable amount of students reported no change in self-confidence for the statements. This indicates that some students were already confident in the surveyed aspects before their practicum. Furthermore,

a small number of students reported a decrease in confidence for many of the statements. Perhaps after the practicum experience, some of the students realized their initial confidence was misplaced. In both cases of no change or decreased change in self-confidence, perhaps students' practicum sites did not provide them with experiences needed to increase confidence. The various practicum sites should be individually evaluated for effectiveness and similarity of patient experiences.

An unexpected finding of this study was that Group 1 had a significantly higher change in row mean score than Group 2 for statements 9 and 19 on the clinical self-confidence survey. These results indicate that in regards to these 2 statements, Group 2 appeared to be more self-confident than Group 1 before participating in the practicum experience. Although these results cannot be explained, Group 2 participated in their practicum experiences 3 weeks

after Group 1, therefore Group 2 was treating patients in UNC SoD's clinic throughout that time. By having more time in UNC SoD's clinic before practicum, with the dental hygiene instructors for guidance, Group 2 may have had more experience in creating a dental hygiene diagnosis and treatment plan and documenting discussions and interactions, resulting in being confident prior to beginning the practicum experience.

It can be argued that just because a student reports being confident, it does not necessarily mean that student is competent. Each individual is different and some students may evaluate themselves harder than others. Hopefully, if a student is confident in implementing the dental hygiene process of care, it means that they feel they have enough knowledge and experiences to feel comfortable in caring for their patients without very much supervision. If anything, a pre- and post-practicum survey may be useful in making the student more aware of their strengths and weaknesses. The reflective journal entries may also contribute to making the student more aware of their clinical self-confidence. Both a pre- and post-practicum survey and reflective journals may also be useful as an outcomes assessment for practicums and could also be used as a self-assessment measure for students. Burch has also recommended reflections and self-assessment measures to be utilized as strategies for assessing service learning in dental hygiene education.³⁰

As this study was conducted at only one university with a limited number of subjects, the results cannot be generalized. A response-shift bias may affect the validity of the pre- and post-survey design. Due to the practicum experience being a requirement for students in UNC SoD's dental hygiene program, a control group was not feasible for this study; however, students' comments from their journal entries supplied evidence that practicum experiences provided valuable, practical experiences that they would not otherwise have obtained. Further studies including more dental hygiene programs and subjects should be done to confirm results, using a control group if possible. Future studies could also compare faculty members' opinions of students' abilities in the dental hygiene process of care after a practicum experience. Another study could assess how many dental hygiene programs are currently requiring students to participate in a multiple week practicum.

The outcomes of this study may encourage dental hygiene programs to require students to par-

Figure 1: Representative Comments on Overall Clinical Self-Confidence

- "Moments like these help build confidence and help form special revision skills for appointments..."
- "(My supervising RDH) told me that she has seen many hygiene students rotate through the site and that she thinks I am prepared for the "real world." I was so happy to have this confidence boost."
- "This week really helped my confidence level with patient care."
- "I have learned greater independence and greater confidence in my ability as a clinician."

ticipate in a multiple-week practicum if they do not already do so. This study's results may also encourage reflecting on clinical experiences to increase awareness of students' strengths and weaknesses. These results add to the limited existing knowledge about the learning outcomes of dental hygiene students' practicum experiences.

CONCLUSION

Educational methodologies, such as practicum experiences, should be regularly assessed to determine the success of the program. The results suggest that a 3-week practicum experience in dental hygiene students' final semester will increase students' clinical self-confidence in providing the dental hygiene process of care. Dental hygiene programs may want to consider the benefits of requiring students to participate in a practicum experience if they do not already do so.

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RESEARCH

Comfort Levels Among Predoctoral Dental and Dental Hygiene Students in Treating Patients at High-Risk for HIV/AIDS

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Abstract

Purpose: The purpose of this article is to discuss the impact of the training program for predoctoral dental and hygiene students at Loma Linda University School of Dentistry (LLUSD) with regard to issues related to treating patients with a high risk of having HIV/AIDS.

Methods: LLUSD offers a training program for fourth-year dental hygiene and predoctoral dental students that addresses the oral health care needs of persons with HIV disease. The training occurs in small groups 2 days per week at a community clinic serving HIV-positive individuals. Three academic quarters are required to train all fourth-year students each year. Evaluation of program effectiveness is conducted by means of pre- and post-session surveys. Dental hygiene and dental students completed the pre-survey during the spring quarter of their third year in public health dentistry courses. The same students completed the post-session survey at the end of their weekly training sessions during the fourth year.

Results: The overall change in all areas related to the students' comfort level in treating patients in the 3 defined categories is in a positive direction (p -value <0.0001). The change was much higher among dental hygiene students compared with predoctoral dental students.

Conclusion: A comparison of pre- and post-session surveys reveals a significant improvement in students' perception of and comfort level with treating patients who are homosexual/bisexual or intravenous drug users, or who have a history of blood transfusion in both student groups upon completion of the HIV and the Dentist training program at LLUSD.

Keywords: homosexuality, drug users, blood transfusion, education, dental, dental hygiene, student

This study supports the NDHRA priority area, **Occupational Health and Safety:** Investigate the impact of exposure to environmental stressors on the health of the dental hygienist.

INTRODUCTION

Dentists and dental hygienists see many medically compromised patients in need of care with conditions and personal histories that pose management challenges and that could potentially expose health care professionals, office staff and other patients to risks associated with infectious diseases. Such patients must be given oral health care that addresses their needs and personal conditions, while simultaneously minimizing risk in the office environment. Such management was greatly simplified with the adoption of the approach of treating all patients as potentially infectious. The Center for Disease Control and Prevention (CDC) first issued guidelines for isolation precautions (termed Universal Precautions) to be used with patients known to have or suspected of having an infectious disease in 1983.¹ In 1987, the guidelines for preventing HIV transmission in health-care settings were expanded, requiring blood and body fluid precautions to be used with all patients, regardless of their bloodborne infection status.² These guidelines were updated and

expanded in 1996 and 2007, and are now referred to as Standard Precautions.³

Due to the surgical nature of most dental treatment, the potential for exposure to bloodborne pathogens due to percutaneous injuries and mucosal splash is considerable. Of particular concern in the dental clinic are patients with HIV/AIDS. A higher risk of HIV transmission is associated with homosexual/bisexual individuals, intravenous drug users and persons with a history of blood transfusion; however, there are no patients who can be identified to have no risk of transmission. The Standard Precautions addresses this issue with the mandate that everyone be treated as a potential source of infection.^{4,5}

The CDC reports that from 2005 to 2008, HIV incidence in the U.S. has grown slowly and steadily from 37,000 to 42,000.⁶ The annual number of deaths attributable to HIV/AIDS amounts to ap-

proximately 15,500.⁷ Effective antiretroviral medications and disease management are allowing more people with HIV disease to live longer with what can now be managed by many as a chronic condition.⁸

The issue of health care professionals' comfort with and willingness to treat HIV patients is not confined to the U.S. alone - it is a global concern. According to Marcus et al, 20% of HIV patients in the U.S. were unable to obtain dental treatment in the past 6 months due to socio-economic status in addition to their medical condition.⁹ In a more recent study, Myers et al report of a survey indicating that nearly 9% of students were unwilling to perform dental procedures on patients with HIV.¹⁰ A survey study conducted in Canada reports that 16% of dentists would refuse to treat HIV patients because they lack a belief in ethical responsibility and fear cross-infection.¹¹ A report was published in Thailand on a survey distributed to patients with HIV who needed dental treatment; 40.9% of patients reported that they failed to disclose that they had HIV in order to obtain the requisite dental care.¹² Meanwhile, in a study conducted by Giuliani et al, general dentists in Italy stated that dentists discriminate against patients with HIV.¹³ Moreover, the literature indicates that many dentists tend to avoid treating patients with HIV.^{14,15}

Several studies found that students lacked knowledge regarding infection control when treating HIV patients; this lack of knowledge was clearly needed to be addressed by means of educational programs.¹⁶⁻¹⁸ The Loma Linda University School of Dentistry (LLUSD) recognized the need for providing dental hygiene and predoctoral dental students with additional training related to treating patients with HIV disease. The HIV and the Dentist program was instituted in 2003 to provide all fourth-year students with training in a community dental clinic with a large HIV-positive clientele. This training includes the epidemiology and pathology of the disease, as well as dental treatment considerations and sociological and behavioral aspects. A considerable effort is made to present technical health care management information along with an appreciation of the basic humanity of HIV-positive individuals. The intent of the program is to teach students how to manage patients with this disease, reduce the risk of transmission of the infection to others in the dental office and decrease the stigma associated with treating such individuals among health care providers.

The aim of the present study is to evaluate the effectiveness of the LLUSD program in reducing students' concerns related to treating patients identified with a high risk of having HIV/AIDS.

METHODS AND MATERIALS

LLUSD developed the HIV and the dentist program to help students manage the oral health care needs of persons with HIV disease. The program components have been published elsewhere.^{19,20} The training occurs in small groups of 5 to 7 over a 2 half-day sessions. The student in each group spends a total of 8 hours during 1-week periods in the HIV training program at the community clinic. Three academic quarters are needed to train all fourth-year students each year. Evaluation of program effectiveness is conducted by means of pre- and post-session surveys, which were identical for the dental hygiene and the dental students. The survey questions were developed with the assistance of staff of the Behavioral Health Program at the Social Action Community Health System (SACHS). Dental hygiene and dental students completed the pre-survey at the beginning of the training program during the spring quarter of their third year in public health dentistry courses. The same students completed the post-session survey at the end of their weekly training sessions during the fourth year. Both surveys were collected by the secretary of the Department of Dental Education Services. The surveys contained 5 statements regarding:

1. HIV general knowledge
2. Attitudes towards the HIV-positive clientele
3. Comfort with treating this group
4. Confidence in the effectiveness of universal precautions and post-exposure prophylaxis following bloodborne exposures
5. A self-assessment of an understanding of the issues involved

Students' comfort level with treating the HIV group is addressed by the following 3 questions:

1. How do you feel about treating homosexual/bisexual individuals
2. How do you feel about treating intravenous drug users
3. How do you feel about treating patients with a history of blood transfusion

Participants scored questions on a 5-point Likert scale as follows: 1=very uncomfortable, 2=uncomfortable, 3=Neutral, 4=comfortable and 5=very comfortable.

Six years of pre- and post-session survey results (composed of 5 overlapping 2-year cycles) are reported in this article. The surveys were distributed to 414 dental students and 197 dental hygiene students from 2003 to 2009. All the students completed the pre-test survey. However, 337 dental students and 172 dental hygiene students (a total of 549 stu-

Table I: Percentages of the Comfort Levels of Predoctoral Dental Students Regarding Treatment of Different Categories of High-Risk Patients

Statement	Session	Percentage of answers*					p-value
		1	2	3	4	5	
Homosexual/bisexual individual	Pre n=377	4.51	12.47	30.50	31.30	21.22	<0.0001
	Post n=377	2.84	3.35	24.74	39.18	29.90	
IV drug user	Pre n=377	3.98	18.57	36.34	27.32	13.79	<0.0001
	Post n=377	1.80	5.41	28.87	42.27	21.65	
Patient with a history of blood transfusion	Pre n=377	2.92	1.59	36.34	37.67	21.49	<0.0001
	Post n=377	1.55	1.03	19.33	43.04	35.05	

*The answers were given on 5-point answer scales ranging from 1="Very uncomfortable" to 5="Very Comfortable"

Table II: Percentages of the Comfort Levels of Dental Hygiene Students Regarding Treatment of Different Categories of High-Risk Patients

Statement	Session	Percentage of answers*					p-value
		1	2	3	4	5	
Homosexual/bisexual individual	Pre n=172	1.31	3.06	32.75	34.93	27.95	<0.0001
	Post n=172	2.60	1.56	10.94	45.83	39.06	
IV drug user	Pre n=172	1.70	15.74	45.11	23.40	14.04	<0.0001
	Post n=172	1.09	4.35	21.20	47.83	25.54	
Patient with a history of blood transfusion	Pre n=172	0.00	1.72	31.33	46.35	20.60	<0.0001
	Post n=172	1.53	1.02	14.80	48.98	33.67	

*The answers were given on 5-point answer scales ranging from 1="Very uncomfortable" to 5="Very Comfortable"

dents, or 89.85% of students) completed the post-session survey. A statistical analysis was conducted on the completed pre-post questionnaire for the same participants. Slight modifications were made to the surveys, but the general content remained the same. We did not include questions related to demographics in the early cycles, but we did include these later on. Those dental/hygiene students who did not complete post-training questionnaires were excluded from the analysis. Descriptive statistics were generated, including means. The normality distributions were depicted in histograms and assessed by means of Kolmogorov-Smirnov normality tests. Given the nature of the data, the non-parametric Wilcoxon signed-rank test analyzed was performed on data recorded in pre-session and post session surveys. A p-value<0.05 was considered statistically significant.

The data were analyzed with a proportional odds model. This model is used for cases in which an ordered categorical dependent variable is present; in this particular case, students' comfort level with each high-risk group at the end of the program can be identified as the ordered categorical dependent

variable. The explanatory variables were baseline comfort level, student level (DDS, dental hygiene), and cohort (2003 to 2005, 2004 to 2006, 2005 to 2007, 2006 to 2008, 2007 to 2009). We collapsed categories of combined "very uncomfortable" and "uncomfortable" into one due to low count in "very uncomfortable." In addition, a 5-point scale did not show a difference when compared with a 4-point scale; hence, the 5-point scale was changed to a 4-point scale for the analysis purpose. The interaction term between student level and cohort was statistically significant. The evidence suggests that student level (DDS and dental hygiene combined) affects the comfort level differently in the cohort (5 cycles). A separate proportional odds model for each student level was conducted (one for the DDS and the other for dental hygiene). The model's goodness of fit was also examined. All statistical analysis was conducted using SAS 9.3.

RESULTS

In reviewing the post-session survey data after participation in the HIV and the dentist training program, the Wilcoxon signed-rank test showed chang-

Table III: Association between Baseline Comfort Level with Regards to Treating Homosexual/Bisexual Individuals and Comfort Level at the End of the Program as an Outcome

Variable	All		Predoctoral study only		Dental Hygienist Only	
	OR (95% CI)	p-value*	OR (95% CI)	p-value*	OR (95% CI)	p-value*
Baseline comfort	37.17 (22.82-60.55)	<0.001	76.17 (38.96-148.90)	<0.001	239.51 (55.83-999.99)	<0.001
Student Dental Hygienist vs. Predoc	2.50 (1.61-3.89)	-	-	-	-	-
Year	-	<0.001	-	0.001	-	0.001
04 to 06 vs 03 to 05	0.37 (0.20-0.69)	-	0.15 (0.06-0.33)	-	1.08 (0.31-3.71)	-
05 to 07 vs 03 to 05	0.38 (0.21-0.69)	-	0.15 (0.06-0.33)	-	1.16 (0.34-3.96)	-
06 to 08 vs 03 to 05	0.58 (0.31-1.06)	-	0.24 (0.11-0.54)	-	2.09 (0.57-7.69)	-
07 to 09 vs 03 to 05	1.30 (0.70-2.42)	-	4.51 (1.93-10.50)	-	0.06 (0.02-0.25)	-

*p-value of trend; OR (odds ratio); CI (confidence interval)
 Bold number means p-value of a proportional odds model is 0<0.05

Table IV: Association between Baseline Comfort Level with Regards to Treating IV Drug Users and Comfort Level at the End of the Program as an Outcome

Variable	All		Predoctoral study only		Dental Hygienist Only	
	OR (95% CI)	p-value*	OR (95% CI)	p-value*	OR (95% CI)	p-value*
Baseline comfort	20.48 (14.04-29.90)	<0.001	71.21 (35.91-141.24)	<0.001	55.15 (18.50-164.42)	<0.001
Student Dental Hygienist vs. Predoc	3.58 (2.31-5.56)	-	-	-	-	-
Year	-	<0.001	-	0.002	-	0.130
04 to 06 vs 03 to 05	0.77 (0.42-1.40)	-	0.23 (0.11-0.51)	-	36.59 (8.25-162.28)	-
05 to 07 vs 03 to 05	0.79 (0.43-1.44)	-	0.25 (0.12-0.53)	-	37.21 (8.31-164.54)	-
06 to 08 vs 03 to 05	0.47 (0.26-0.84)	-	0.32 (0.15-0.70)	-	0.80 (0.29-2.17)	-
07 to 09 vs 03 to 05	2.13 (1.17-3.89)	-	4.86 (2.03-11.66)	-	1.45 (0.53-3.96)	-

*p-value of trend; OR (odds ratio); CI (confidence interval)
 Bold number means p-value of a proportional odds model is 0<0.05

es in all categories that were highly statistically significant at a p-value<0.0001 (Tables I and II).

In a proportional odds model with comfort level with treating HIV patients as the outcome variable, baseline comfort was found to have a significant positive association with the outcome (odd ratio

(OR) 37.17, 95% confidence interval (CI) 22.82 to 60.55), and dental hygienists were more likely to be comfortable with treating HIV patients compared with pre-doctoral students (OR 2.50, 95% CI 1.61 to 3.89) (Table III). The results did not differ when each student level was examined separately. For both student groups, the baseline had a significant

Table V: Association between Baseline Comfort Level with Regards to Treating Patient with Histories of Blood Transfusion and Comfort Level at the End of the Program as an Outcome

Variable	All		Predoctoral study only		Dental Hygienist Only	
	OR (95% CI)	p-value*	OR (95% CI)	p-value*	OR (95% CI)	p-value*
Baseline comfort	239.91 (83.23-691.53)	<0.001	411.49 (136.73-999.99)	<0.001	166.12 (37.68-732.31)	<0.001
Student Dental Hygienist vs. Predoc	1.99 (1.31-3.02)	-	-	-	-	-
Year	-	0.028	-	0.001	-	0.634
04 to 06 vs 03 to 05	0.46 (0.25-0.87)	-	0.13 (0.05-0.32)	-	3.91 (1.24-12.34)	-
05 to 07 vs 03 to 05	0.47 (0.26-0.89)	-	0.14 (0.06-0.34)	-	3.97 (1.31-12.46)	-
06 to 08 vs 03 to 05	0.90 (0.49-1.63)	-	0.27 (0.12-0.60)	-	12.96 (3.44-48.77)	-
07 to 09 vs 03 to 05	1.55 (0.85-2.85)	-	2.61 (1.16-5.84)	-	1.09 (0.36-3.30)	-

*p-value of trend; OR (odds ratio); CI (confidence interval)

Bold number means p-value of a proportional odds model is $0 < 0.05$

positive association with the students' comfort level at the end of the program. In other words, students who felt comfortable with treating HIV patients initially were more likely to feel more comfortable with and more confident about treating the same group of patients after completing the program.

The results were similar for IV drug users and patients with a history of blood transfusion (Tables IV and V). In both, a significant positive association with the comfort level was found (OR 20.48, 95% CI 14.04 to 29.90 for IV drug users, and OR 239.91, 95% CI 83.23 to 691.53 for patients with a history of blood transfusion). Dental hygienists were also more likely to be comfortable with treating these patients.

A graphic presentation of a comparison with quartiles (P25, median, P75) of the pre-session and post-session responses indicating students' level of comfort with treating certain patients is presented in Figure 1.

DISCUSSION

The findings of this study indicate that as a result of the HIV and the dentist training program, there was a significant increase in the comfort level of students with regards to treating patients in the three categories of homosexual/bisexual individuals, intravenous drug users, and people who had blood transfusions. This indicates that the program was beneficial to both dental and dental hygienist students. Education and training can positively

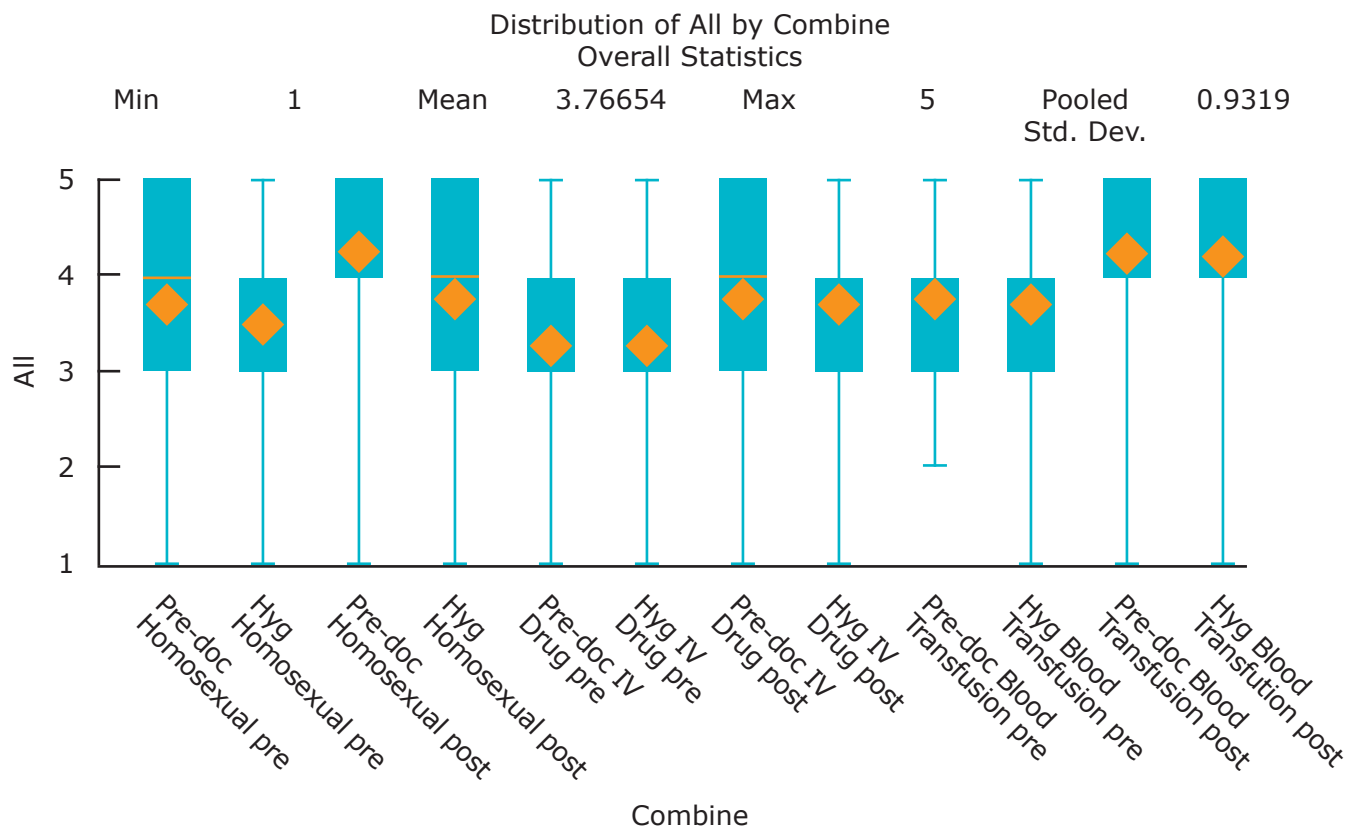
influence attitudes toward the provision of care to groups of individuals who have been, and often continue to be, stigmatized for their sexual orientation, lifestyle and/or medical condition.

To the best of the authors' knowledge, there has been no paper or publication thus far that has discussed the same variables examined in this paper with regards to pre-doctoral and dental hygiene students' comfort levels in treating high-risk patients. Some reports have discussed existing knowledge of bloodborne pathogens among dental students¹⁰ and have concluded that the need exists to improve education for dental students in U.S. dental schools in terms of enhancing their knowledge and willingness to perform procedures on patients with HIV.

The current study demonstrated that in general, dental hygiene students had stronger shifts towards enhanced comfort in treating patients with HIV in comparison with dental students. While this program altered the perception of both groups toward intravenous drug users, the dental hygiene students developed a more positive attitude towards treating such patients than the dental students. Dental hygiene students exhibited the same attitude pattern regarding patients with histories of blood transfusion. After attending the program, there was a positive statistical increase for both dental and dental hygiene students in terms of the intent to treat patients with histories of blood transfusion.

Studies in India concluded that providing awareness campaigns and re-orientation training for the

Figure 1: The Box Plot of Pre- and Post-Session Responses to the Intent to Treat Certain High-Risk Patients



medical intern students is essential in making them more comfortable in treating HIV patients.²⁰⁻²³ Other studies that found positive results through educational programs for dental hygiene and dental students similar to this study were conducted at Maulana Azad Medical College, New Delhi, where it showed a positive relation between the education given and a willingness to treat patients at risk.²⁰

However, a study from India that reported on the intent of students to treat patients with HIV and HBV found that even after attending an advanced education program, students still had negative attitudes towards treating patients with HIV/HBV, which could have been due to the need for a more sophisticated program, one that would facilitate a proper understanding of how to adapt to the practice experience of the students.²¹

There were a few limitations in our study; the variables homo/bisexual, IV user and history of blood transfusion are not commonly reported variables for the intent to treat by dental students and hygienists. These variables can carry a large array of infectious diseases in addition to HIV; hence a direct comparison between our study and previous publications cannot be obtained. The study consisted of a convenience sample of predoctoral and dental hygiene students that were not representa-

tive to the US population. An additional limitation would be changing the survey (even if only demographic data). The literature addresses the impact of reporting demographic data on respondents and it can be negative.²³

Clinical Relevance

Dentists may be lacking in terms of willingness to treat and manage patients who are at risk of transmissible disease. For this reason, before they graduate, students need to be educated on how to handle such cases, so that they can serve as dental providers for all types of patients they might encounter in their careers. In addition, they need to learn about proper protection and how to reduce the risk of acquiring a disease during the course of treatment.

A focus on educating dental hygiene students is of equal importance in this regard, due to their higher chance of seeing more patients periodically compared to dentists. Hence, it is important to integrate additional training programs for both hygiene and dental students.

Details of the program contents in LLUSD were previously published in other articles, this program can aid any school in applying its own methodology to its own curriculum and target population. We

hope in the future to see more programs addressing this issue.

CONCLUSION

This study showed a significant improvement for both dental and dental hygiene students as a result of completing the LLUSD training program in terms of their perception and comfort level in treating patients who are homosexual/bisexual, intravenous drug users, or patients with histories of blood transfusion. Academic institutions need to ensure that dental and dental hygiene students are receiving the proper training to prepare them to provide optimal oral care to this patient population.

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DISCLOSURE

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RESEARCH

Oral Health Knowledge, Attitudes and Behaviors of Parents of Children with Diabetes Compared to Those of Parents of Children without Diabetes

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Abstract

Purpose: To compare the oral health knowledge, attitudes, and behaviors of parents of children, aged 6 to 13, who have type 1 (insulin-dependent) diabetes to those of parents of similarly aged children without diabetes.

Methods: The study population consisted of 46 parents of children with diabetes and 46 parents of children without diabetes from outpatient clinics, providing medical care to children with and without diabetes, respectively. After gaining permission of clinic directors, the investigator approached parents, who were waiting in the clinics' reception areas, to complete the 33-item survey. The survey included questions on socio-demographic characteristics, their child's oral hygiene practices, dental visits, dietary habits, their own oral health knowledge and attitudes, and their child's diabetic condition, when relevant. A Chi-square test was used to determine significant differences between responses of the two groups of parents.

Results: All parents approached completed the survey. Children with diabetes had significantly less frequent sugary drink consumption and less untreated dental caries than children without diabetes. The majority of parents of children with diabetes selected "don't know" for statements related to diabetes and oral health, whereas most parents of children without diabetes agreed with the statements, resulting in significant differences between groups. Most parents of children with diabetes considered these same statements important to them, while the importance to parents of children without diabetes was variable.

Conclusion: To maintain their children's oral health, parents of children with diabetes must receive more education regarding the prevention and control of the oral complications of diabetes.

Keywords: diabetes mellitus type 1, diabetes complications, periodontal diseases, oral health, oral hygiene

This study supports the NDHRA priority area, **Clinical Dental Hygiene Care:** Investigate how dental hygienists identify patients who are at-risk for oral/systemic disease.

INTRODUCTION

Diabetes mellitus is one of the most common chronic diseases in children and adolescents.¹ Type 1 diabetes represents only 5 to 10% of all diagnosed diabetes cases; however, it is the leading form of diabetes in children of all ages and accounts for almost all diabetes in children younger than 10 years old.² From a population of 3,458,974 youth less than 20 years of age, 6,668 were diagnosed with type 1 diabetes in 2009, for a prevalence of 1.93 per 1,000.³ Applying this prevalence to U.S. census data, it was estimated that 166,984 youth less than 20 years of age have type 1 diabetes.³ These statistics emphasize the importance of studying type 1 diabetes in childhood.

Diabetes is associated with many pathological complications including periodontal disease.^{1,4} Numerous studies have shown that children with diabe-

tes are at increased risk for developing periodontal disease at an early age.⁴⁻¹¹ Furthermore, periodontal disease is more prevalent among children with diabetes compared to children without diabetes, as evidenced by higher plaque index scores, significantly more gingival inflammation and greater clinical attachment loss.^{4,6-11}

Due to the increased risk of periodontal disease, prevention of plaque-induced gingival inflammation through proper oral hygiene self-care and regular professional care are crucial in children with diabetes.^{4,5,9} Because parents are children's primary caregivers during childhood, their knowledge, attitudes and behaviors toward oral health can significantly influence their child's oral health and behavior.¹²⁻¹⁵ These studies have shown a positive relationship between children's oral health status, as deter-

mined by either self-report or clinical examination, and their parents' oral health knowledge, attitudes and behaviors.¹²⁻¹⁵

Although much is known about the association between childhood diabetes and periodontal disease, no studies of the oral health knowledge, attitudes and behaviors of parents of children with diabetes related to their child's oral health have been identified. Therefore, this study specifically asks the following research questions:

- What are the knowledge, attitudes and behaviors of parents of children with diabetes towards oral health?
- Do the knowledge, attitudes, and behaviors of parents of children with diabetes differ from those of parents with children without diabetes?

The purpose of this study was to compare the oral health knowledge, attitudes and behaviors of parents of children, aged 6 to 13 years, who have type 1 (insulin-dependent) diabetes with those same factors of parents of similarly aged children without diabetes.

METHODS AND MATERIALS

This analytic cross-sectional study was approved by the Institutional Review Board of the University of California, San Francisco (UCSF).

The target study population consisted of 46 parents of children with type 1 diabetes, 6 to 13 years of age, who were outpatients of the Madison Pediatric Diabetes Clinic in UCSF Benioff Children's Hospital, San Francisco, California, and 46 parents of children without diabetes, in the same age range, from the Pediatric Primary Care Clinic at the same hospital.

Parents who were not English speakers were excluded from the study. The sample size of 46 per group was determined from a power analysis formula, taking into consideration of the level of statistical significance ($\alpha=0.05$), amount of power (0.80) and the effect size (0.95). The effect size was the expected difference in the means between the control and experimental groups, based on past research.

The 33-item questionnaire, developed by the investigators, included questions in the following domains: demographic characteristics (6 multiple-choice questions), oral health behaviors (13 multiple-choice questions), parental attitudes toward oral health (7 Likert-scale statements), and parental knowledge of oral health and the relationship between diabetes and oral health (7 Likert-scale

statements). The 4-point Likert scale consisted of strongly agree, agree, disagree and don't know or very important, important, neutral, and not important.

A pilot study was conducted with a convenience sample of 5 parents of children between the ages of 6 to 13 to test the survey questions for clarity. Based on the feedback, questions were modified accordingly.

Potential participants were recruited by the investigator in the reception area of the clinics, while they were waiting to be seen by their child's physician. The investigator obtained verbal consent prior to administering the survey and was available to answer any questions. Reviewing appointment schedules, prior to visiting the clinics, to determine the ages of scheduled patients, allowed the investigator to maximize her efforts in recruiting eligible subjects.

The investigator entered the participants' responses to the survey into Qualtrics™ Survey Software, a web-based survey tool supported by UCSF. Results were expressed as frequencies of responses for each item on the survey. A Chi-square test was conducted to compare the responses of the two groups of parents. A p-value of 0.05 or less was used to determine statistical significant differences between the 2 groups.

RESULTS

Ninety-two parents participated in this study; 46 parents of children with diabetes and 46 parents of children without diabetes. The children with diabetes were significantly ($p=0.02$) older than the children without diabetes (Table I). Males and females were equally represented in the diabetic population, while there were more males in the non-diabetic group, creating a significantly ($p=0.03$) different gender distribution between the groups. The children with diabetes were predominantly non-Hispanic white, whereas the non-diabetic group's ethnic background distribution was significantly ($p=0.00$) different, being evenly distributed among Asians, Hispanics/Latinos and Non-Hispanic whites. All 46 children with diabetes had type 1 diabetes, and the mean duration of having diabetes was 3.1 years (Table I).

A statistically significant ($p=0.02$) difference was found between the household income level of the 2 groups (Table II). Forty-three percent of the participating parents of children with diabetes had incomes over \$125,000, and 22% of parents of children without diabetes reported being below poverty income levels. The educational level of the parents was not statistically different between the 2 groups,

Table I: Demographic Characteristics of the Children with and without Diabetes Mellitus

Variable	Children with Diabetes Mellitus n (%)	Children without Diabetes Mellitus n (%)	p-value
Age	10.1±2.35	8.4±2.17	0.02*
Gender			
Male	23 (50)	33 (72)	0.03*
Female	23 (50)	13 (28)	
Ethnicity			
African American	2 (4)	4 (9)	0.00*
Asian	3 (7)	14 (30)	
Hispanic/Latino	6 (13)	11 (24)	
Native American	0 (0)	7 (15)	
Non-Hispanic White	31 (67)	10 (22)	
Other	4 (9)	7 (15)	
Duration of Diabetes Mellitus, years	3.1	-	-

Age is shown as mean ± standard deviation
 *Significant differences between groups (p <0.05)

although it appeared that more parents of children with diabetes had graduate education (Table II).

A statistically significant difference was found between the 2 groups in terms of the child brushing independently; a greater number of parents of children with diabetes reported that their child brushed independently than parents of children without diabetes (Table III). The majority of parents from both groups reported a twice daily frequency of brushing and similar frequencies of flossing. Eighty-three percent of the parents of the children with diabetes and 67% of the parents of the children without diabetes reported that their child had acquired the skill of flossing.

Seventy-four percent of the parents of children with diabetes reported that the frequency of their child's dental visits was "every 6 months," while this value was 59% for parents of children without diabetes (Table IV). Likewise, no parents of children with diabetes reported any dental visits at more than 2 year intervals and "only when experiencing pain," while 11% of parents with children without

Table II: Demographic Characteristics of Parents

Variable	Children with Diabetes Mellitus n (%)	Children without Diabetes Mellitus n (%)	p-value
Highest Education of the Mother			
Less than high school	1 (2)	4 (9)	0.22
High school	4 (9)	9 (20)	
Some college	13 (28)	8 (17)	
College graduate	15 (33)	16 (35)	
Graduate education	13 (28)	9 (20)	
Highest Education of the Father			
Less than high school	1 (2)	3 (7)	0.47
High school	9 (18)	14 (30)	
Some college	8 (18)	9 (20)	
College graduate	15 (33)	10 (22)	
Graduate education	13 (29)	10 (22)	
Annual Household Income			
Less than \$23,550	4 (9)	10 (22)	0.02*
\$23,551 to \$39,999	5 (11)	6 (13)	
\$40,000 to \$49,999	0 (0)	5 (11)	
\$50,000 to \$74,999	5 (11)	2 (4)	
\$75,000 to \$99,999	2 (4)	1 (2)	
\$100,000 to \$124,999	2 (4)	7 (15)	
Over \$125,000	20 (43)	8 (17)	
Decline to answer	8 (17)	7 (15)	

*Significant differences between groups (p<0.05)

diabetes selected these responses. Cleaning/check-up was the main reason for the last visit for both groups, although extractions were reported to be a more common reason for children without diabetes (13% versus 4%) (Table IV). Having untreated cavities was reported by significantly (p=0.01) more parents in the non-diabetic group than in the diabetic group (Table IV).

Approximately one-third of both groups of parents reported that their child consumed sugary food

once a week (Table V). Significantly ($p=0.01$) more frequent sugary drink consumption was reported for the non-diabetic group than the diabetic group (Table V).

The majority of parents of children with diabetes selected "don't know" for the statements regarding the relationship between diabetes and oral health (Table VI). To these same statements, most of the parents of children without diabetes selected "agree," resulting in statistically significant differences between the 2 groups for 3 of the 4 statements. The vast majority of both groups strongly agreed or agreed with the statements related to sugary snacks and drinks and their effects on oral health.

Most parents of the children with diabetes considered these same statements very important or important to them (Table VII). The importance to parents of children without diabetes was variable; statements directly related to diabetes were less important to them. One statement, "Bacteria in the mouth can worsen systemic disease, such as diabetes," was significantly ($p=0.05$) more important to parents of children with diabetes (Table VII).

DISCUSSION

Periodontal disease has been reported to be more frequent in children with diabetes than in children without diabetes, but it is not known whether these risks are recognized by parents.^{4,6-11} Thus, the purpose of this study was to compare the oral health knowledge, attitudes and behaviors of parents of children with type 1 diabetes with those of parents of children without diabetes. The results indicate that the diabetic group had significantly less frequent sugary drink consumption and less untreated dental caries. The majority of parents of children with diabetes selected "don't know" for statements related to diabetes and periodontal disease, whereas most parents of children without diabetes agreed with the statements, resulting in significant differences between the 2 groups. On the other hand, most parents of the children with diabetes considered these same statements important to them while the importance to parents of children without diabetes was variable.

Of the 92 children in the study, 46 were from the Madison Pediatric Diabetes Clinic and 46 were from the Pediatric Primary Care Clinic at the same hospital. The Madison Pediatric Diabetes Clinic is a specialty clinic where patients come from a broad geographic area whereas the majority of patients seen at the Pediatric Primary Care Clinic are local patients from the city of San Francisco. The race/ethnicity difference between the 2 groups reflects this difference in the patient population of the clin-

Table III: Parents' Reports on Oral Hygiene Behaviors of the Children with and without Diabetes Mellitus

Variable	Children with Diabetes Mellitus n (%)	Children without Diabetes Mellitus n (%)	p-value
Independent brushing			
Yes	45 (98)	38 (83)	0.01*
No	1 (2)	8 (17)	
Frequency of brushing			
More than 3 times	1 (2)	0 (0)	0.56
3 times	2 (4)	3 (7)	
Twice	36 (78)	39 (85)	
Once	7 (15)	3 (7)	
Less than once a day	0 (0)	1 (2)	
Ability to floss			
Yes	38 (83)	31 (67)	0.09
No	8 (17)	15 (33)	
Frequency of flossing			
More than once a day	2 (4)	2 (4)	0.61
Once a day	6 (13)	9 (20)	
2 to 3 times a week	16 (35)	8 (17)	
Once a week	10 (22)	11 (24)	
Less than once a week	8 (17)	9 (20)	
Never	3 (7)	4 (9)	
Don't know	1 (2)	3 (7)	

*Significant differences between groups ($p<0.05$)

ics as the population in San Francisco is more diverse than other cities in northern California.¹⁶

One component of the survey examined parental reports of their child's oral health behaviors. One of the findings was that more children with diabetes than children without diabetes brushed their teeth independently. This difference is probably related to the age of the children. The mean age of the diabetic group was approximately 2 years older than the non-diabetic group; additionally, the age of the highest percentage of children with diabetes was 13 years old, as compared to 6 years old for the children without diabetes. Most parents who reported helping their child with tooth brushing were parents of the 6-year-old subgroup. The 2 groups did not report any differences in frequency of tooth

Table IV: Parents' Reports on Dental History of the Children with and without Diabetes Mellitus

Variable	Children with Diabetes Mellitus n (%)	Children without Diabetes Mellitus n (%)	p-value
Frequency of dental visit			
Every 6 months	34 (74)	27 (59)	0.3
Yearly	9 (20)	11 (24)	
Between 1 to 2 years	3 (7)	2 (4)	
More than 2 years	0 (0)	4 (9)	
Only when Experiencing Pain	0 (0)	1 (2)	
Never	0 (0)	0 (0)	
Don't Know	0 (0)	1 (2)	
Reason for the Last Visit			
Checkup/Cleaning	39 (85)	38 (83)	0.17
Fillings	4 (9)	0 (0)	
Extraction	2 (4)	6 (13)	
Gum Problem	1 (2)	2 (4)	
Presence of Untreated Cavities			
Yes	2 (4)	6 (13)	0.01*
No	43 (94)	34 (74)	
Don't Know	1 (2)	6 (13)	

*Significant differences between groups (p<0.05)

brushing or flossing. This similarity may relate to the data in which parents of children with diabetes did not know that children without diabetes are more likely to experience gum disease than children without diabetes. Children with diabetes have been reported to exhibit significantly greater gingival inflammation and clinical attachment loss, compared with non-diabetic children, when the sub-gingival bacterial challenge did not differ.^{4,6,7,11} This may be due to the fact that individuals with type 1 diabetes exhibit more exacerbated inflammatory response to a bacterial challenge than individuals without diabetes.^{17,18} Thus, more frequent tooth brushing and flossing, to reduce the accumulation of the bacterial biofilm, is recommended for children with diabetes.⁴

Higher numbers of untreated cavities were reported by the parents of the children without diabetes. This finding may be related to the demographic characteristics, such as race and ethnicity, and parents' education and household income level. The non-diabetic group had higher proportions of racial/ethnic minorities and a higher percentage of parents with only a high school education. Furthermore,

Table V: Parents' Reports on Frequency of Sugary Food and Drink Consumed by Children with and without Diabetes Mellitus

Variable	Children with Diabetes Mellitus n (%)	Children without Diabetes Mellitus n (%)	p-value
Sugary food consumption			
Never	1 (2)	0 (0)	0.47
Less than once a week	4 (9)	5 (11)	
Once a week	17 (37)	17 (37)	
Once a day	15 (33)	19 (41)	
Twice a day	7 (15)	2 (4)	
More than twice a day	2 (4)	3 (7)	
Sugary drink consumption			
Never	11 (24)	4 (9)	0.01*
Less than once a week	13 (28)	8 (17)	
Once a week	11 (24)	13 (28)	
Once a day	7 (15)	14 (30)	
Twice a day	0 (0)	6 (13)	
More than twice a day	4 (9)	1 (2)	

*Significant differences between groups (p<0.05)

more parents of children without diabetes reported household income below the poverty level. According to a 2000 Surgeon General's report, disparities in oral health in children are impacted by family income, race/ethnicity and caregiver's education level.¹⁹ Untreated dental caries is more prevalent in poor and low-income children and racial/ethnic minority groups, with low-income children being twice as likely to have untreated dental caries than higher income children.¹⁷ Children whose parents were not college educated were reported to be less than half as likely to receive dental care compared to children of college-educated parents.^{19,20} In the current study, 6 month dental visits were less frequent in children without diabetes, whose parents tended to be less college educated.

Another explanation for the higher number of untreated cavities in the children without diabetes is the greater frequency of sugary drink consumption in this group. The relationship between sugar and dental caries is well known.²¹ The data showing that sugary drink consumption was more frequent in children without diabetes than in chil-

dren with diabetes are consistent with a previous study by Siudikiene et al.²² They found that children with diabetes consumed more main meals and less snacks per day whereas children without diabetes consumed more frequent sugary snacks.²² This may be because children with diabetes usually have a recommended number of meals per day, based on the dosage of insulin being administered.²² Additionally, even distribution of complex carbohydrates throughout the day and avoiding refined sugar are frequent dietary recommendations for children with diabetes.²³ These dietary practices more likely explain why parents of children with diabetes reported their children consuming less frequent sugary drinks but no greater knowledge of the effect of sugar on oral health than the parents of the children without diabetes. The data showed no difference between the 2 groups in agreement with the statement that sugary snacks and drinks can hurt children's teeth.

The findings from the survey questions regarding parents' oral health knowledge suggest that parents of children with diabetes lacked knowledge of the association between diabetes and periodontal disease. These findings are in accordance with those of previous studies on oral health perceptions of individuals with diabetes.^{24,25} Moore et al reported that patients with diabetes lacked important knowledge regarding the effects of diabetes on their oral health.²⁴ In another study it was found that individuals with diabetes seek dental care less frequently than those without diabetes, with the main reason for not seeing a dentist being lack of a perceived need.²⁵ Moreover, the time commitment for glucose monitoring, drug administration and frequent visits to the physician causes oral health care to be less of a priority for this population.²⁵ Even though these studies were mainly focused on adult populations with diabetes, it would be reasonable to assume that the same is true for parents of children with diabetes. These parents may have focused on the medical aspects of the disease, studying the medical literature, often supplied by the physicians. They may have been overwhelmed by the vast amount of information, especially that related to medical management of the condition, which may be requiring multiple life style modifications.

In the current study, oral health may also not have been a priority for these parents of children with diabetes who may not even be considering the possibility of oral complication of the disease. Perhaps these parents did receive the information about diabetes and oral health, but have not been able to internalize it due to all the other lifestyle changes necessitated by the diagnosis. This may explain our result that the majority of parents of children with diabetes selected "don't know" for statements related to diabetes and oral health. The findings that parents of children with diabetes appeared to know

Table VI: Parents' Levels of Agreement with Oral Health Statements

Statement	Parents of Children with Diabetes Mellitus n (%)	Parents of Children without Diabetes Mellitus n (%)	p-value
Gum disease can cause poor glycemic control in diabetics.			
Strongly agree	7 (15)	14 (30)	0.00*
Agree	8 (17)	17 (37)	
Disagree	0 (0)	2 (4)	
Don't know	31 (68)	13 (28)	
Bacteria in the mouth can worsen systemic disease such as diabetes.			
Strongly agree	4 (9)	10 (22)	0.03*
Agree	13(28)	21 (46)	
Disagree	12 (2)	1 (2)	
Don't know	28 (61)	14 (30)	
Sugary snacks and drinks can hurt children's teeth.			
Strongly agree	34 (74)	29 (63)	0.23
Agree	9 (20)	16 (35)	
Disagree	2 (4)	0 (0)	
Don't know	1 (2)	1 (2)	
Bleeding gums may indicate gum disease.			
Strongly agree	20 (43)	20 (43)	0.8
Agree	20 (43)	19 (41)	
Disagree	0 (0)	1 (2)	
Don't know	6 (14)	6 (13)	
Gum problems can occur in children.			
Strongly agree	20 (43)	19 (41)	0.61
Agree	23 (50)	20 (43)	
Disagree	0 (0)	0 (0)	
Don't know	6 (7)	7 (15)	
Diabetes can cause gum disease.			
Strongly agree	6 (13)	10 (22)	0.03*
Agree	7 (15)	15 (33)	
Disagree	1 (2)	3 (7)	
Don't know	32 (70)	18 (39)	
Diabetic children are more likely to experience gum disease than non-diabetic children.			
Strongly agree	6 (13)	12 (26)	0.26
Agree	10 (22)	13 (28)	
Disagree	1 (2)	1 (2)	
Don't know	29 (63)	20 (43)	

*Significant differences between groups (p<0.05)

less than parents of children without diabetes may also relate to our observation that more parents of children with diabetes had graduate education. Perhaps more educated parents were more comfortable admitting their lack of knowledge on certain issues or they may have had higher expectations as to the meaning of “agree” in reference to these questions.

Another possible reason why less parents of children with diabetes agreed than parents of children without diabetes with the statements relating diabetes and periodontal disease may be cognitive dissonance.²⁶ Perhaps parents of children with diabetes, despite their advantageous educational background, do not want to believe that their children are susceptible to detrimental health conditions that are not typically associated with the disease process. Similarly, parents of children without diabetes, despite similar levels of knowledge about the relation of periodontal disease and diabetes, may find it easier to agree with the statements because it is not their child who has diabetes and thus the issue is less important to them. Interestingly, parents of children with diabetes indicated that they feel that the information regarding the association between periodontal disease and diabetes is important to them, even though they did not know that the statements were true. This could indicate that the parents of children with diabetes consider their child’s oral health to be important, but they lack sufficient knowledge to recognize that their child’s oral health may be more compromised than children without diabetes and require better oral hygiene practices. This lack of knowledge would also explain some of the similarity of oral health behaviors between the two groups.

The current study findings in general suggest that there is a need for oral health education for parents of children with diabetes in order to provide them with the appropriate knowledge to properly care for their child’s oral health. Periodontal disease is largely preventable and the amount of periodontal destruction can be reduced when recognized during early stages.^{27,28} Therefore, it is critical for children with diabetes to build good oral hygiene habits at an early age so that severe periodontal disease, which can lead to tooth loss later in their lives, can be prevented. Type 1 diabetes can be diagnosed at any age, as early as infancy,²⁹ and the duration of diabetes has been shown to be associated with the amount of periodontal destruction.⁸ These factors make it even more important that parents are educated early in the course of their child’s diagnosis of diabetes.

The link between diabetes and periodontal disease demands greater medical-dental professional collaboration: the inflammatory response to oral

Table VII: Parents’ Perceptions of Personal Importance of Oral Health Statements

Statement	Parents of Children with Diabetes Mellitus n (%)	Parents of Children without Diabetes Mellitus n (%)	p-value
Gum disease can cause poor glycemic control in diabetics			
Very important	23 (50)	15 (33)	0.1
Important	15 (33)	17 (37)	
Neutral	7 (15)	7 (15)	
Not important	1 (2)	7 (15)	
Bacteria in the mouth can worsen systemic disease such as diabetes			
Very important	24 (52)	12 (26)	0.05*
Important	15 (33)	26 (57)	
Neutral	6 (13)	5 (11)	
Not important	1 (2)	3 (7)	
Sugary snacks and drinks can hurt children’s teeth			
Very important	29 (63)	26 (57)	0.61
Important	13 (28)	15 (33)	
Neutral	3 (7)	4 (11)	
Not important	1 (2)	2 (9)	
Bleeding gums may indicate gum disease			
Very important	24 (52)	22 (48)	0.89
Important	16 (35)	18 (39)	
Neutral	5 (11)	4 (9)	
Not important	1 (2)	2 (4)	
Gum problem can occur in children			
Very important	25 (54)	22 (48)	0.19
Important	18 (39)	18 (39)	
Neutral	3 (7)	4 (9)	
Not important	0 (0)	2 (4)	
Diabetes can cause gum disease			
Very important	25 (54)	16 (35)	0.51
Important	15 (33)	17 (37)	
Neutral	5 (11)	10 (22)	
Not important	1 (2)	3 (7)	
Diabetic children are more likely to experience gum disease than non-diabetic children			
Very important	25 (54)	17 (37)	0.27
Important	15 (33)	18 (39)	
Neutral	5 (11)	7 (15)	
Not important	1 (2)	4 (9)	

*Significant differences between groups (p<0.05)

pathogens may be exacerbated with patients with diabetes, and proinflammatory cytokines produced by periodontal tissues during chronic infection may lead to poor glycemic control and insulin resistance.^{27,30} However, some health care professionals may not be aware of the importance of controlling periodontal disease among patients with diabetes. It is critical that this topic be included in curricula of all professional schools, especially dentistry, medicine, nursing and pharmacy. In-service training programs at wellness centers, medical clinics and health care institutions are another opportunity in which health care providers can be educated. Dental hygienists would be the ideal professional to develop and provide these programs. The goal for both these approaches would be for all health care providers, who come in contact with patients with diabetes, to be knowledgeable about the link between diabetes and periodontal disease.

Dental hygienists need to assume greater roles in providing effective education regarding the oral complications of diabetes to families with children with diabetes. Dental hygienists could be valuable at diabetes centers to provide educational services directly to these families, ideally at the time of the child's diagnosis. Moreover, when caring for patients in dental practices, dental hygienists are in a great position to provide this education. Dental hygiene curricula prepare dental hygienists with the breadth and depth of knowledge of diabetes and oral health. Dental hygienists need to take advantage of all opportunities to promote the prevention and control of the oral complications of diabetes. It is an interesting dichotomy that these children with diabetes appear to have regular dental care and yet the parents have limited knowledge of this association.

The fact that some of the findings of the current study may have been due to the difference of the mean age of the 2 groups, rather than the presence or absence of diabetes, is a limitation of the

study. Additionally, the differing socio-economic profile of the 2 groups may have had some impact on the results of the study. Because the data are self-reported, another limitation would be the ability of parents to accurately report the dental history and frequencies of oral hygiene behaviors and sugary food and drink consumption. The survey instrument, while pilot-tested, may have limited validity and reliability as it was self-generated. Lastly, the small sample size of 46 subjects per group may limit the generalizability of the data.

CONCLUSION

Because children with diabetes are at increased risk for periodontal disease, it is important that extensive preventive measures are instituted at an early age. Parents play a significant role in their child's oral health during childhood.^{12,13} Thus, this study investigated the oral health knowledge, attitudes and behaviors of parents with children with diabetes. The results indicated that parents of children with diabetes are not sufficiently aware of their child's increased oral health risks. Thus, dental hygienists should assume more responsibility to educate these parents of children with diabetes regarding the prevention and control of the oral complications of diabetes.

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RESEARCH

Does the Structure of Dental Hygiene Instruction Impact Plaque Control in Primary School Students?

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Abstract

Purpose: A 6-month pilot study was conducted to test the assumption that an interactive, contextualized tooth brushing education program would impact the oral hygiene of low income students.

Methods: The intervention consisted of an educational program focused on tooth brushing that included interactive sessions with dental professionals and teachers. School 1 students received instruction, toothbrushes, and encouragement to brush their teeth daily after lunch. School 2 students received instruction only. School 3 students only received toothbrushes to remove plaque. Children in all 3 schools were examined by trained dental hygiene students who used plaque disclosing liquid to score the amount of plaque. A predictive correlational design was used to determine the extent that different intervention types and/or demographic/hygiene practices predicted differences in post intervention plaque level, once baseline plaque level was taken into account.

Results: A total of 254 first and second grade students in 3 public elementary schools in Miami participated in the study. Overall, mean plaque scores were significantly lower at the 6 month follow-up. Between-group comparisons of the mean follow-up scores, adjusted for the effect of the baseline scores, revealed greater but non-significant plaque reduction at School 1 compared to the other schools, and the presence of significant age and ethnic effects.

Conclusion: The most intensive intervention instruction accompanied by repeated practice may lead to improved oral hygiene when compared to instruction alone, when oral hygiene practices and demographic characteristics are taken into account. Design changes intended to increase statistical power may help to explicate these effects.

Keywords: contextualized learning, daily toothbrushes in school, dental hygiene instruction, interactive hygiene program, plaque control

This study supports the NDHRA priority area, **Health Services Research:** Investigate how alternative models of dental hygiene care delivery can reduce health care inequities.

INTRODUCTION

Dental caries (tooth decay) are among the most common chronic childhood diseases, ahead of asthma and hay fever.¹ Additionally, oral health care is the most prevalent unmet health need among U.S. children.² Dental caries are also characterized by profound disparities, in that children from families living below the federal poverty line (FPL) have twice the prevalence of dental caries than higher income children, with greater extent and severity of decay and a greater likelihood their disease will remain untreated.³

While oral health faces challenges throughout the U.S., the problem is perhaps most challenging in Florida. Florida was 1 of 3 states that received a grade of 'F' in 2 consecutive Oral Health Report Cards issued by the Pew Center on the States.⁴ That grade was largely due to extremely low Medicaid reimbursement rates, the nation's lowest dental care utilization by Medicaid recipients, the lack of an oral

health surveillance system and one of the nation's most restrictive state practice acts on dental hygienists' ability to independently provide preventive services. In addition, more than 20% of Florida's population lives in designated dental health profession shortage areas.⁵ The number of dentists needed to remove the shortage designations (869) is higher than for any other state and accounts for 13.6% of the total number of dentists estimated for the entire country (6,374).

Hospitals in the state of Florida experienced more than 115,000 emergency department visits in 2010 for dental-related problems that were largely preventable and resulted in total charges exceeding \$88 million. Visits charged to child-specific payors such as KidCare, Healthy Kids, MediKids and Children's Medical Services more than doubled from 2008 to 2010, and fees for services almost tripled. That pattern is particularly evident in Miami-Dade

County, where charges for dental emergency department visits rose from \$4.6 million in 2008 to \$7 million in 2010; two-thirds of those charges were incurred by Medicaid or uninsured patients. The number of children seen in hospital emergency departments for dental problems rose for all age groups during that time.⁶

Children in Miami face unique sociocultural challenges to oral health. From 2006 to 2010, 22% of the population of Miami-Dade County under age 18 lived below the FPL, and more than 35% of the population aged 5 years or older do not speak English very well.⁷

There is compelling evidence that access to oral health services is a major problem among Miami's children from low-income families, including those insured by Medicaid. Evaluations of Miami-Dade's Medicaid managed care program, which began in 2004, found that that use of dental services by continuously enrolled children declined from 2003 to 2005 from 37 to 22%, the number of dentists who provided care for Medicaid-enrolled children declined by 59%, the proportion of children receiving preventive dental services fell by 60%, but total costs remained fairly constant.^{8,9}

Widespread and effective prevention of oral disease is essential to improving the oral health of Miami's children and reducing the levels of unmet needs. Children receiving oral hygiene instruction are told to brush their teeth 3 times daily for optimal oral health, but it may not be practical for them to accomplish that goal while they are in school. Moreover, if they are not regularly brushing at home, young children might not have sufficient opportunities to learn important oral hygiene skills through repeated practice in daily routines.^{10,11} This situation is especially true for younger children. Without requiring additional time out of the school day and without placing additional responsibility on the teachers, can schools teach oral health as well as provide contextualized opportunities for children to practice oral health skills as part of the educational curriculum and realize meaningful benefits?

The purpose of this pilot study was to test the effectiveness of The Toothbrush Project, a tooth brushing education program provided to children from low-income families in grades 1 and 2 in Miami-Dade County Public Schools (M-DCPS), delivered by dental professionals and elementary school teachers and staff. The primary research question posed by this study was whether there were significant differences in plaque control among participants who received an educational program and then have had an opportunity every day to practice the learned oral health skills, an educational program alone, and no oral health education.

Using a predictive correlational design, the authors sought to determine the extent to which different intervention types and selected demographic/hygiene practice indicators (alone and in combination) predict differences in post-intervention plaque level once baseline plaque level was taken into account. The study was conducted during the 2010 to 2011 school year.

METHODS AND MATERIALS

The Toothbrush Project was spearheaded by EDU-DENTAL, a 501(c)(3) corporation formed in 2009 by Lynda Colaizzi, a general and cosmetic dentist in the Miami area and a children's health care advocate. EDU-DENTAL formed an alliance among Miami-Dade College Dental Hygiene Program, University of Florida College of Dentistry, Howard and Sharon Socol Family Foundation, and The Early Childhood Initiative Foundation, Benco Dental Supply Company, Henry Schein Inc., and GlaxoSmithKline to address oral health needs of children in Miami.

Participants

A convenience sample of 3 elementary schools participated in the study. All participating schools were funded by the Title I program and therefore contained a large proportion of students with family incomes low enough to qualify them for participation in the federal Free/Reduced Price Lunch program. All first and second grade classes at the 3 schools were invited to participate in the study. Therefore, the sample used in the study was a cluster sample. Table I lists the demographic characteristics of the schools and students who participated in the study. A power analysis of a regression model that included predictors for treatment, age and hygiene was conducted on an a priori basis to ascertain the sensitivity of the study given the most basic design. The results of the analysis indicated that conventional levels of power ($1-\beta > 0.80$) and significance ($p < 0.05$) could be achieved if a moderate or larger treatment effect was found.

The table shows that the schools differ in terms of socioeconomic status and minority composition, with School 1 being the least disadvantaged and School 3 being the most disadvantaged. The ethnic breakdown of the participating students shows similar disparities.

Design of the Study

The primary research question posed by this study was whether there were significant differences in plaque control among participants who received an educational program and then had an opportunity every day to practice the learned oral health skills, an educational program alone, and no oral health education.

ucation. A predictive correlational design was used to determine the extent to which the levels of the intervention, oral hygiene practices and demographic characteristics predict differences in post intervention plaque level, once baseline plaque level is taken into account.¹³ The interventions were implemented at the school level with all child participants in each school assigned to the same condition.

Measures

The first measure was the presence of colored plaque revealed through disclosing solution as indicated by the standardized O’Leary Plaque Score Index computed for each student, which expresses the amount of the tooth surface covered with visible plaque after the use of disclosing solution as a percentage of the total tooth surface.¹⁴ Each tooth was divided into 4 or 6 surfaces and the number surfaces containing plaque were divided by the total number of surfaces and expressed as a percentage.

The second measure was a 35 item data collection instrument comprised of an 11 item identification section (i.e. student last name/first name/number, school name/number, teacher, age, gender, ethnicity, siblings and parent/guardian), 1 item to record dental insurance status, a 6 item hygiene information section (i.e. brushing/flossing patterns, toothbrush ownership and prior dental visits), a 16 item section to record oral hygiene indicators at baseline and follow-up (i.e. caries, bleeding, lesions, debris and plaque), and a space to record notes. The hygiene habits of the parents were not measured. The third measure was the Quality of Life (QoL) Survey designed to measure the extent to which each family’s physical, emotional and socioeconomic well-being was impacted by students’ dental problems/treatment. The survey consisted of 15 items: 1 for identification, 13 that adhered to a 5-point Likert-type format with response options that ranged from 1 (never) to 5 (very often) and included space for a 0 (don’t know) response, and 1 item to indicate students’ Medicaid eligibility. A QoL score was determined by computing the mean of the Likert-type items, with higher scores indicative of a QoL that was more negatively impacted by dental problems. The items in the survey were developed by one of the authors and examined for face and content validity by fellow colleagues. The construct validity and reliability of the instrument have not been established.

Procedures

Permission to recruit participants was obtained from the M-DCPS Office of Program Evaluation, the principals of the participating schools and the students’ parents/legal guardians. Permission forms sent to the parent/legal guardians were in English, Spanish and Creole.

Table I: Percentage of Each School’s Student Sample and School Population within Selected Demographic Categories

Student			
	School 1 (n=141)	School 2 (n=80)	School 3 (n=63)
Age			
6	58.87	58.75	63.49
7	39.72	38.75	33.33
8	1.42	2.5	3.17
Gender			
Female	51.06	54.22	44.44
Male	47.52	42.5	53.97
Not Specified	1.42	1.25	1.59
Race/Ethnicity			
Black	31.91	76.25	91.94
Hispanic	51.06	20	6.45
Other	17.02	3.75	1.61
School			
Free/Reduced Price Lunch*	71	96	97
Minority Students*	84	88	99

Note: Student level percentages were computed from primary sources. School level percentages were computed from secondary sources.²¹

*Percentages are reported by the state as whole numbers.

The QoL survey with versions in English, Spanish and Haitian Creole was provided to those students with completed consent forms at the beginning of the study. Students were instructed to bring the survey home to their parents and to return completed survey forms to their teacher.

School 1 received the baseline and 6 month plaque assessment as well as an educational program focused on oral health. The educational component included interactive sessions with dental hygiene students, using puppets and oversized toothbrushes focused on tooth brushing on the day the baseline data was collected. DVDs from the American Dental Association with cartoons about brushing and dental health were shown every week, by the teachers without dental professionals present.¹² These students also received classroom visits every 2 weeks from a dentist, dental hygienist and dental assistants to reinforce learned behavior for the duration of the study, except during holiday intermission. The same team of professionals participated in each session. Before the program started, the team was instructed on the goals and methods of instruction. During these visits take-home booklets, puzzles and stick-

ers were widely distributed to the students. Each intervention session lasted approximately 15 to 20 minutes. These sessions were presented each time in the same manner and style, although the times were not the same as they needed to adjust to the teachers/curriculum schedule. In addition, a mini-toothbrush was provided for each child in participating classrooms for the duration of the study with encouragement to brush their teeth after lunch each school day. The mini pre-pasted toothbrushes were placed on the cafeteria trays of the participating students each day throughout the study. The teacher covering lunch duty each day prompted/reminded the students to brush. The brushes did not contain fluoride, were disposable, recyclable and also low foaming to avoid the need for rinsing and spitting. All the toothbrushes were collected from every student and placed in the recyclable bin by the teachers overseeing the cafeteria that day.

School 2 received baseline and 6 month plaque assessment and an educational program focused on oral health only. Neither a mini-toothbrush nor repeated instruction in brushing of any kind was provided. The educational component included interactive sessions with dental hygiene students, using puppets and oversized toothbrushes focused on tooth brushing on the day the baseline data was collected. DVDs from the American Dental Association with cartoons about brushing and dental health were shown every week by the teachers without dental professionals present.¹² These students also received classroom visits every 2 weeks from a dentist, dental hygienist and dental assistants to reinforce learned behavior for the duration of the study, except during holiday intermission. During these visits take-home booklets, puzzles and stickers were widely distributed to the students. Each intervention session lasted approximately 15 to 20 minutes. These sessions were presented each time in the same manner and style, although the times were not the same as they needed to adjust to the teachers/curriculum schedule.

School 3 received baseline and 6 month plaque assessment. All children in this school were given toothbrushes to remove the disclosing solution only. The toothbrushes were then collected and placed in the recyclable bin at the school. This school serves as the reference group. The baseline exams were done in the early morning to accommodate the school schedule and availability of the dental hygiene students. The participants had already been at school long enough to have had an opportunity to eat their subsidized breakfast. The next exams were performed approximately 6 months after the interventions began. Second-year dental hygiene students worked in pairs, with 1 student clinically disclosing and assessing the amount of plaque and the other student recording answers to questions and plaque

scores. The students were assessed weekly by college faculty on their proficiency at conducting these measurements throughout their clinical program to assure the procedure was standardized. Standardization for the faculty was conducted at the beginning of each semester. The students received different examiners for each plaque assessment.

Data Analyses

A QoL score was computed for each participant who completed 10 or more items by taking the mean of the responses to the items in the QoL Survey. Analysis of variance was used to compare mean QoL scores of the respondents in the 3 schools. Further examination of the results of the QoL Survey was limited to descriptive statistics.

Descriptive statistics and paired sample t-tests were used to examine the plaque level, and to gauge the statistical significance of changes from baseline to follow-up. The analyses were conducted overall, and by school, age, gender, race, brushing level and flossing status. The primary data analysis involved a 3-stage process. First, ordinary least squares regression analysis was used to apply the predictive correlational design and to determine the relative influence of treatment level (i.e. school), baseline plaque level; hygiene practices (i.e. brushing and flossing); demographic characteristics (i.e. age (6, 7, 8)), gender (i.e. male, female); and race (i.e. Black, Hispanic, Other) on post intervention plaque level. Interactive effects were also examined to ascertain whether the influence of any of the predictors was affected by the baseline plaque level. Continuous predictors were grand-mean centered. Second, adjusted scores were computed by fitting the baseline plaque score to the follow-up plaque score, then adding the mean predicted score to the residual score of each participant, creating, in effect, the follow-up plaque level that would have resulted had all the participants begun with the same baseline plaque scores. Finally, between-group comparisons of the mean adjusted plaque scores among the various levels of the study subgroups were conducted. Analyses of remaining indicators were limited to descriptive statistics. All data analyses were conducted by using the SPSS version 22.0 computer package.

RESULTS

Of the total of 339 students targeted to participate in the project, completed consent forms were returned by 298, resulting in an 87.9% return rate, which did not differ significantly by school.

Of the 298 students with completed consent forms, the QoL Survey was only completed by 90 of their caregivers, resulting in a return rate of 30.2% for that instrument. QoL scores, determined

Table II: Results of the Quality of Life Survey

Item	Number		Percent				
	Total	Don't Know	Never	Hardly Ever	Occasionally	Often	Very Often
In the past 6 months, has your child:							
Had pain in the teeth, mouth, or jaw*	90	2	55.68	27.27	13.64	2.27	1.14
Had difficulty drinking hot or cold beverages*	89	1	73.86	15.91	9.09	1.14	0
Had difficulty eating some foods*	90	0	73.33	14.44	11.11	0	1.11
Had difficulty pronouncing any words*	90	2	84.09	11.36	3.41	1.14	0
Missed preschool, daycare, or school*	89	0	83.15	13.48	1.12	1.12	1.12
Had trouble sleeping*	90	0	82.22	10	6.67	0	1.11
Been irritable or frustrated*	88	1	78.16	12.64	6.9	1.15	1.15
Avoided smiling or laughing when around other children*	90	0	80	11.11	5.56	2.22	1.11
Avoided talking with other children*	90	1	83.15	12.36	2.25	1.12	1.12
In the past six month how often have you or another family member:							
Been upset because of your child's dental problems**	90	1	71.91	16.85	5.62	2.25	3.37
Felt guilty because of your child's dental problems**	90	0	77.78	11.11	6.67	2.22	2.22
Taken time off from work because of your child's dental problems**	90	1	80.9	12.36	5.62	0	1.12
In the past six months how often has your child had dental problems that had a financial impact on your family**	90	2	78.41	13.64	2.27	1.14	3.41

Note: Question marks are missing in the original instrument.

*Because of dental problems or dental treatments.

**Or dental treatments.

by computing the mean of the items responses for each participant who completed 10 or more items, did not significantly differ by school, $F(2, 86)=2.18$, $p=0.12$. An analysis of inter-item response variation showed that nearly 45% ($n=40$) of the respondents selected the same choice for all the items. Across the 90 respondents, the inter-item standard deviation of the QoL score averaged 0.39, suggesting the possibility of acquiescent response bias. As such, caution should be exercised when interpreting the results. Table II lists for each survey item the number of respondents (total and those who chose "Don't know") followed by the percentage of respondents who selected each of the 5 valid response options. The results were mostly positive with the bulk of respondents reported never or hardly ever experiencing any of the listed factors.

Of the 298 students with completed consent forms, 254 had valid pre- and post-measures, and met the criteria for inclusion in the efficacy analysis, representing 74.93% of the target group. Students who were less than 6 years old were excluded from the analysis. Table III lists the number of partici-

pants followed by the mean and standard deviation at baseline and follow-up and the result of paired sample t-tests measuring change from baseline to follow-up, by subgroup.

At baseline, the mean plaque score was 35.47, which did not differ significantly by sex, race/ethnicity or school. Overall, across all 3 schools, the mean plaque scores of 31.17 were significantly ($p<0.05$) lower at follow-up. The largest reductions in mean plaque scores were observed among students classified as Other ($\Delta=19.16$, $p<0.01$) and students who were 7 years old ($\Delta=16.53$, $p<0.01$). Although students at all 3 elementary schools tended to have reductions in plaque scores, that difference was not statistically significant. Least squares regression was conducted to provide a more detailed explication of the differences. An initial regression conducted with backward elimination included all group by baseline interactions. The results give the influence of each predictor with the other predictors taken into account. The final model that resulted from numerous manual stepwise addition and deletion of predictors is presented in Table IV.

Table III: Descriptive Statistics and Paired Sample t-tests

	School 1					School 2				
	Baseline			Follow up		Baseline			Follow up	
	n	M	SD	M	SD	n	M	SD	M	SD
Age										
6	73	31.29	19.3	30.22	23.91	44	38.39	23.74	36.66	27.8
7	48	35.38	23.8	24.25	19.1*	28	42.39	25.79	35.48	27.19
8	2	57.5	60.1	47.5	37.48	2	41	15.56	26	19.8
Gender										
Female	64	31.75	18.59	28.04	21.13	43	39	25.41	37.93	29.5
Male	58	35.17	25.32	28.62	24.09	30	40.07	21.99	32.15	23.44
Race										
Black	39	31.82	23.45	31.3	24.75	56	40.63	23.29	36.35	27.12
Hispanic	62	31.6	17.35	28.02	22.95	15	31.07	24.03	35.6	30.76
Other	22	40.77	29.25	23.05	15.64*	3	72.33	14.64	29.67	1.53*
Brush										
Both	87	33.8	21.94	26.66	21.8*	52	40.38	24.68	38.22	28.82
Evening	5	39.4	30.07	19.8	7.16	1	89	--	100	--
Morning	31	30.94	21.06	33.77	25.12	21	36.62	21.2	27.19	16.53
Floss										
No	88	33.74	22.07	27.92	21.41	60	39.68	24.05	33.13	24.34
Yes	35	32.23	21.89	28.82	25.23	14	41.21	25.65	47.93	35.51
Across Subgroups	123	33.31	21.94	28.17	22.46	74	39.97	24.19	35.93	27.15

Note: The significance levels of paired sample t-tests comparing the change in plaque level from baseline to follow up displayed to the right of the means for each school.

*p<0.05

**p<0.01

The follow-up plaque score for a student whose baseline plaque score is equal to the sample average of 35.47 and who is 6 years old is predicted to be 33.628. A 7-year-old student is predicted to have plaque score at follow-up that is a significant 6.269 points lower than a 6-year-old student does, regardless of his or her baseline plaque level, a weak effect size. An 8-year-old student whose baseline plaque score is equal to the sample mean is predicted to have a plaque score at follow-up that is a non-significant 2.769 points higher than a 6-year-old student does. However, a significant weak interaction effect was found indicating that the difference seen for an 8-year-old changes with his or her baseline plaque level. Each 1 point increase in baseline plaque level predicts a 0.692 point reduction in difference seen between 8-year-old and 6-year-old students. As such, an 8-year-old student would only experience a significant reduction in plaque relative to a 6-year-old-student if his or her baseline plaque scores were outside the limits of the sample. No significant effects for the intervention, hygiene practice or other demographic factors were found.

In sum, no significant effects for the intervention or for hygiene practice were found. However, 7-year-old students were predicted to have significant but weak lower plaque scores at follow-up than 6-year-old students, regardless of their baseline plaque levels. Although a significant weak interaction between 8-year-old status and baseline plaque levels was found, significant differences between the follow-up plaque levels of 8-year-old and 6-year-old students were not found within the sample limits. No other significant demographic effects were found. Finally, adjusted scores were computed by fitting the baseline plaque score to the follow-up plaque score, then adding the mean predicted score to the residual score of each participant. Because of the complexity resulting from the interaction and the small number of students affected, 8-year-olds were excluded from this phase of the analysis. Table V lists for each subgroup the descriptive statistics of each level followed by the results of independent sample t-tests and the effect sizes resulting from each comparison.

Table III: Descriptive Statistics and Paired Sample t-tests (continued)

	School 3					Total				
	Baseline			Follow up		Baseline			Follow up	
	n	M	SD	M	SD	n	M	SD	M	SD
Age										
6	36	31	19.37	34.72	27.39	153	33.26	20.81	33.13	25.9
7	17	40.24	25.51	26	16.75	93	38.38	24.66	27.95	21.85**
8	2	42	26.87	19.5	12.02	6	46.83	31.37	31	23.66
Gender										
Female	23	35.04	23.54	23.7	10.73*	130	34.73	22	30.54	23.47
Male	31	34.32	20.62	37.48	29.98	119	36.18	23.28	31.82	25.64
Race										
Black	49	34.24	21.81	29.55	22.9	144	36.07	22.99	32.67	25.11
Hispanic	4	45	19.3	55.5	37.83	81	32.16	18.8	30.78	25.73
Other	1	18	--	38	--	26	43.54	29.46	24.38	14.77**
Brush										
Both	34	35.71	21.91	33.35	27.56	173	36.16	22.84	31.45	25.61
Evening	1	18	--	48	--	7	43.43	32.72	35.29	30.97
Morning	20	32.6	21.93	27.45	18.18	72	33.06	21.18	30.1	21.04
Floss										
No	42	34.33	22.14	32.95	24.82	190	35.75	22.77	30.67	23.15*
Yes	13	34	20.97	26.69	23.12	62	34.63	22.52	32.69	28.25
Across Subgroups	55	34.25	21.68	31.47	24.37	252	35.47	22.67	31.17	24.46*

Note: The significance levels of paired sample t-tests comparing the change in plaque level from baseline to follow up displayed to the right of the means for each school.

*p<0.05

**p<0.01

The comparisons of the adjusted means generally mirror the results found in the predictive analysis in that a significant weak effect for age is seen. In addition, a significant moderate ethnic effect is also seen, that may have been previously been obscured due to multi-colinearity within the sample. Moreover, adjusted plaque reduction at School 1 was found to be greater than that seen at the other schools and approach but not breach the threshold for significance in at least 1 comparison, potentially due to numerous power and design considerations as revealed through a post-hoc power analysis.

DISCUSSION

Dental plaque biofilm is a major etiologic factor for dental caries, and effective plaque control may reduce children's risk for dental caries and gingival inflammation.¹⁵⁻¹⁸ Findings from this study suggest that a tooth brushing educational program augmented with contextualized cues (i.e. pre-pasted toothbrush on cafeteria trays suggesting brushing

after eating) and opportunities to practice oral hygiene skills following a meal shows promise for reducing dental plaque levels. The largest improvement in plaque scores occurred in the school that received the educational intervention and distributed mini-toothbrushes to the children, although there was not a statistically significant difference between schools in the mean reduction in plaque scores. There have been other intervention studies that incorporated oral hygiene instruction and periodic follow-up to improve plaque control among school-aged children. These interventions were primarily intended to educate families and promote oral hygiene practiced in the home.^{10,11} A unique feature of the present study was the addition of the pre-pasted toothbrushes included on the cafeteria trays. The toothbrushes were intended to provide contextualized cues about when to brush (i.e. following a meal) and opportunities to practice brushing embedded as part of a logical and appropriate lunchtime routine. Embedded learning approaches offered children opportunities to prac-

Table IV: Regression Analysis of the Follow up Plaque Scores

Predictor	Coefficient	f2
Constant	33.628**	
	-1.945	
School 2	6.22	0.012
	-3.556	
School 3	2.495	0.002
	-3.897	
Baseline Plaque Level	0.212**	0.038
	-0.069	
Seven Year Old	-6.269	0.015
	-3.173	
Eight Year Old	2.769	0
	-10.696	
Baseline Plaque x Eight Year Old Interaction	-0.692	0.015
	-0.349	
R2=0.039		

Note: The school exposed to the oral hygiene intervention (School 1) serves as the reference group in this analysis. Each coefficient gives the influence of a one unit change in each predictor on the outcome variable when all the other predictors are taken into account. Standard errors are shown in parenthesis. Continuous variables are referenced to their sample mean (grand-mean centered). Coefficients of dichotomous predictors yield mean differences between the labeled group and a reference group comprised of participants classified as six-year-old students. Non-significant predictors are excluded. f2 is the effect size of the predictor obtained when adding it to a model containing the remaining terms: 0.02 (weak), 0.15 (moderate) and 0.35 (strong).

*p<0.05
**p<0.001

tice existing and develop new skills in everyday activities, particularly in those activities where use of the skills are logical and appropriate. Rather than only instruct children in how to brush and to model brushing skills as part of the educational program, children in School 1 were provided opportunities to practice brushing as part of a meaningful and functional routine (i.e. lunchtime). These types of embedded and contextualized learning opportunities have been shown to promote skill generalization and maintenance.^{11,19} Other findings included significantly greater plaque reduction among older children. This may be due in part to better listening and reading comprehension skills and/or better dexterity when handling toothbrushes and/or dental floss due to more developed fine-motor skills.^{22,23} Plaque reduction was also found to be significantly greater among Hispanic children when compared

Table V: Between-Group Comparisons of the Adjusted Means

	n	M	SD	t	d
Age					
6	153	33.51	25.62	2.059*	0.271
7	93	27.32	21.02		
Gender					
Female	127	30.73	23.54	-0.295	-0.037
Male	116	31.65	25.01		
Race#					
Black	139	32.49	25.55	0.317	0.044##
Hispanic	81	31.38	23.89	2.521*	0.548**
Other	25	23.32	14.59	2.042	0.467+
Brush#					
Both	169	31.69	25.49	-0.201	-0.078##
Evening	7	33.67	28.22	0.583	0.083**
Morning	70	29.69	20.31	0.477	0.189+
Floss					
No	185	30.88	22.86	-0.329	-0.048
Yes	61	32.06	27.81		
Intervention#					
School 1	121	28.3	21.9	-1.951	0.29##
School 2	72	35.27	27.16	-1.037	0.171**
School 3	53	32.17	24.19	0.661	0.119+

Note: Statistics are based on adjusted means with d effect sizes used to gauge practical significance
#Bonferroni correction used to adjust significance levels for the effect of multiple comparisons
##First-second line
**First-third line
+Second to third line
*p<0.05

to their African American counterparts. Cultural factors, customs and educational differences have been found to produce such disparities in other studies.^{24,25}

There are a number of inherent limitations to this study. First, it did not use a randomized allocation design or masking of the examiners, so measurement bias cannot be ruled out. Because this study was designed to only measure an intermediate outcome in the dental caries disease process (visible plaque level), the degree to which the intervention truly reduced disease risk remains unknown. Age and ethnic differences manifesting as maturational differences in coordination/fine motor skills and disparities in oral hygiene, respectively, may also have served to obscure the treatment effects in this study. Statistical power, though not sufficient to de-

tect relatively modest declines in plaque scores in this study, can be substantially improved through design changes. Given findings related to the age and grade of the students, these include blocking (i.e. randomly assigning classrooms to each treatment within a grade), measuring students 3 or more times a year, and using precisely recorded age as a covariate, then analyzing the resulting data using a k-between, one-within subjects analysis of variance.^{13,20}

CONCLUSION

Findings from this study suggest that intensive toothbrushing instruction, particularly when accompanied by daily distribution of free pre-pasted toothbrushes, may lead to improved oral hygiene among our most vulnerable children, those living below the federal poverty level.

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DISCLOSURE

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Increasing Tobacco Intervention Strategies by Oral Health Practitioners in Indiana

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Abstract

Purpose: To implement and assess an evidence-based 7-hour continuing education program for Indiana oral health care practitioners on tobacco use, dependence and treatment using a team-based approach. Program effectiveness was assessed by participants' reported increase in knowledge and the extent to which they implemented course concepts and strategies into dental practice.

Methods: Course attendees' study participation was based on agreeing to provide their contact information and to complete two surveys (an 18 item post-session and 14 item 3-month follow-up) which captured their self-reported knowledge and application of course concepts. Surveys included open-ended and multiple choice (dichotomous or 5-point Likert scale) items. Follow-up surveys were mailed / delivered electronically to participants; non-responders were sent two reminders. De-identified data were analyzed in an aggregate using descriptive statistics, percentages and counts.

Results: Eleven programs were attended by 626 practitioners. Initial survey response rate was 91% (565); hygienists (70%), dentists (25%); unidentified (5%). Most indicated the program enhanced their knowledge of most course concepts; 98% (522) planned to use learned communication strategies. Of dentists, 90% (113) planned to refer to the Indiana quitline and 60% (71) planned to provide patient cessation materials. Follow-up response rate was 40% (250); 79% (184) reported implementing cessation communication strategies. One-third of respondents reported referring patients to the quitline for counseling.

Conclusion: Continuing education for oral health providers in understanding tobacco use, dependence and treatment may be beneficial to enhance their capacity and willingness to integrate tobacco cessation interventions into oral healthcare settings. However, this does not necessarily assure that they will change their practice behaviors by utilizing the learned concepts and skills with patients.

Keywords: tobacco cessation, tobacco dependence education, continuing education

This study supports the NDHRA priority area, **Health Promotion/Disease Prevention:** Validate and test assessment instruments/strategies/mechanisms that increase health promotion and disease prevention among diverse populations.

INTRODUCTION

Oral Health Practitioners and Tobacco Interventions: A Perfect Match

Approximately 20% of the U.S. population uses tobacco.¹ Each day, nearly 4,000 U.S. youth smoke their first cigarette.^{2,3} From 2000 to 2004 cigarette smoking was estimated to be responsible for \$193 billion in annual health-related economic losses including nearly \$96 billion in medical costs and \$97 billion in lost productivity.⁴ Approximately 70% of all smokers desire to quit.⁵

Health care providers have a vital role to play in helping users of both smoking and smokeless (spit) tobacco quit; tobacco interventions delivered by clinicians, including dental professionals, can increase abstinence rates.⁶⁻⁸ As such, the U.S. Public Health Service (USPHS) Clinical Practice Guideline, *Treating Tobacco Use and Dependence*, recommends

that all clinicians provide tobacco interventions.⁷ As a primary health care provider, dental professionals are often able to establish and maintain trusting patient relationships which helps create a safe environment for discussing the topic of tobacco use. Nevertheless, although dental office tobacco prevention and treatment efforts can increase tobacco abstinence, they are underutilized.^{9,10} Both students and practicing dental hygienists have cited both a lack of confidence and intervention skills training as reasons for not providing tobacco interventions.^{11,12}

Tobacco dependence education should be integral to health care professionals' education and clinical training. However, a survey of dental hygiene educators found faculty were only moderately confident in teaching tobacco dependence education, and their curricula lacked instruction on brief motivational interviewing, pharmacotherapy or es-

establishing a tobacco control program in the dental practice.¹³ Likewise, barriers to integrating tobacco dependence education in predoctoral curricula included a lack of integration between didactic content and clinical practice, and a failure to provide supportive intervention skills.¹⁴ Other studies found that the reported lack of faculty time, student interest, current materials and a perceived lack of faculty expertise were reasons for not fully integrating tobacco cessation strategies into patient care.^{15,16}

The American Dental Association (ADA) recognizes the dental hygienist as an appropriate team member to provide tobacco cessation interventions. The ADA lists tobacco cessation counseling under Section II 3.3.2, Provision of Clinical Dental Hygiene Services and is also in the American Dental Hygienists Association (ADHA) Standards of Clinical Practice documents.^{17,18} The ADHA has also contributed to the promotion of dental hygienists as tobacco cessation experts. Following a Robert Wood Johnson Foundation sponsored summit and a grant award in November 2003, the ADHA has continued its dedication to oral and systemic health by the concerted efforts of registered dental hygienists focusing on tobacco dependence treatment. The ADHA explains that it is "proud to make such a positive impact on the oral and overall health of the public by encouraging dental hygienists to help smokers quit."¹⁹ The grant assisted the ADHA to offer a nationwide campaign designed to promote a smoking cessation intervention and additional educational materials to Association members. Its goal was to increase the percentage of dental hygienists that screen clients for tobacco use.¹⁹ Further, the grant allowed for the development of an educational program (Ask. Advise. Refer), designation of points of contact in each state for technical assistance and expertise who would also serve as the Smoking Cessation Initiative Liaison and creation of a dedicated Website (www.askadviserefer.org). The ADHA reports that the objectives are to "further establish dental hygienists as advocates of cessation intervention and to place dental hygiene on the frontline of smoking cessation intervention."¹⁹

National Tobacco Control Program

In 1999, the Center for Disease Control (CDC) and Prevention Office on Smoking and Health created the National Tobacco Control Program to encourage a coordinated, national effort to reduce tobacco-related morbidity and mortality. The program provides funding and technical support to state and territorial health departments. National Tobacco Control Program program funding aims to achieve the objectives outlined in the CDC's Best Practices for Comprehensive Tobacco Control Programs 2007, an evidence-based guide to help states plan and establish effective tobacco control programs.²⁰

Indiana Tobacco Prevention and Cessation Commission

The vision of the Indiana Executive Board of the Tobacco Use Prevention and Cessation Commission Trust Fund was to significantly improve the health of all Indiana residents by reducing the negative health and economic impact of tobacco use. The Tobacco Use Prevention and Cessation mission is "to prevent and reduce the use of all tobacco products in Indiana and to protect citizens from exposure to tobacco smoke."²¹ On July 1, 2011 the Tobacco Use Prevention and Cessation became part of the Indiana State Department of Health. While its mission is unchanged, one overarching goal is to mobilize stronger partner coalitions that reflect the Tobacco Use Prevention and Cessation targeted population groups and support its program objectives. The Board allocates resources from the Trust Fund to accomplish this goal.²¹

Indiana University School of Dentistry Tobacco Cessation & Biobehavioral Group

Established in 2006 from a university-sponsored grant, the Tobacco Cessation & Biobehavioral Group's mission has 3 components: research, education and cessation. The research component involves biomedical, behavioral and educational research. The education and cessation components focus on graduating students and researchers with extensive education about smoking and spit tobacco and the health effects, training health professionals to provide tobacco-using patients with evidence-based information and treatment, and offering tobacco cessation counseling.²²

However, dental practitioners with limited time and resources can assist tobacco-using patients who are interested in quitting by referring them to a tobacco quitline.²³ Quitline referrals and subsequent in-depth counseling from quitline personnel is an effective strategy for increasing cessation rates.²⁴ Quitline referral by dental practitioners is a feasible strategy for assisting patients to quit tobacco in all its forms if efficient links between the dental practice and the quitline can be established.²³ Patients receiving telephone counseling quit tobacco use at higher rates, but only a small percentage of those proactively referred actually receive counseling.²³ Nonetheless, training practitioners to provide brief tobacco interventions may result in a behavior change among practitioners enabling them to be more effective in helping their patients quit tobacco.²⁵

With this in mind, Tobacco Cessation & Biobehavioral Group members of the Indiana University School of Dentistry (IUSD) developed and delivered a 7-hour continuing education program for Indiana

oral health practitioners to improve their knowledge, confidence and skills in providing tobacco cessation interventions to their patients. The program was funded by multiple grants (2008 to 2010) from the Tobacco Prevention and Cessation Commission of the Indiana State Department of Health and was implemented in collaboration with the Indiana Dental Hygiene Association and Tobacco Prevention and Cessation community partners.

It was anticipated that after participating in the continuing education program, attendees would increase their knowledge on tobacco dependence and treatment and would actively apply their learning to clinical practice. This project aimed to assess the effectiveness of the tobacco education program at enhancing attendees' knowledge of tobacco's addictive nature and associated health effects, pharmacotherapeutic and behavioral tobacco interventions, local and statewide tobacco cessation referral resources, and the components and protocols for establishing a team-based approach for tobacco interventions in the dental office, as well as obtain information on the extent to which program participants' integrated course concepts and strategies into practice.

METHODS AND MATERIALS

Program Development

The Indiana Dental Hygiene Association representatives and Tobacco Cessation & Biobehavioral Group study investigators selected 11 Indiana sites for the continuing education program based on the highest tobacco use rates by county as reported by Indiana Tobacco Prevention and Cessation. Continuing education program brochures that included registration information were mailed to all licensed dental and dental hygiene professionals in zip codes within a 50 mile radius of each selected continuing education site. The program provided 7 hours of continuing education credit towards Indiana licensure and was offered free of charge.

Program content was based on the Mayo Clinic's Nicotine Dependence Treatment Program and the USPHS Clinical Practice Guideline, Treating Tobacco Use and Dependence.⁷ Program topics included: Nicotine Dependence 101, Oral Health and Tobacco (from molecular to clinically evident effects of tobacco on oral tissues), Pharmacotherapy and Cessation Aids, Behavioral Interventions, A Team-Based Office Model for Implementing a Tobacco Cessation Program, and Indiana Tobacco Prevention and Cessation Community Partners and Resources. Interventional strategies emphasized the 5 A's protocol (Ask patients about tobacco use, Advise them to quit, Assess willingness to quit, Assist in the quit attempt and Arrange for follow-up), and the Ask-

Advise-Refer protocol. The program's learning objectives included:

- Describe and recognize the oral and systemic effects of tobacco use
- Evaluate available efficacy and safety data on new and emerging tobacco cessation therapies
- Apply an individualized tobacco cessation quit-plan that maximizes the likelihood of treatment success
- Identify planning, maintenance, therapy, resources and referral sources, and follow-up to prevent relapse and promote long-term cessation success
- Identify tobacco cessation referral resources, and meet with county Tobacco Prevention and Cessation representatives of the Indiana State Department of Health

Measures

An initial post-continuing education survey and 3-month follow-up survey were developed to capture the attendees' self-reported knowledge and tobacco intervention activities at 2 points in time. To establish content validity, each survey was piloted with a small group of IUSD faculty, and surveys were modified based on their feedback. The 18-item initial post-continuing education survey contained items regarding demographics, content knowledge acquisition and respondents' intention to apply concepts to patient care. The survey contained multiple choice items with dichotomous (yes/no) or scaled response choices (strongly agree, agree, undecided, disagree, strongly disagree). There was also 1 open-ended item (If you do NOT plan to refer patients to the Indiana quitline, please tell us why). Five of the survey items were directed solely to dentist attendees. These were:

1. Do you plan to provide, or continue to provide, patients with tobacco cessation literature in your dental practice?
2. If you plan to provide (or plan to continue to provide) tobacco cessation resources, how will you provide those resources?
3. For what reasons might you NOT plan to provide tobacco cessation resources in your practice or be UNSURE about providing such literature?
4. Do you plan for your practice to refer patients who are interested in community cessation resources and/or the Indiana Quitline?
5. If you do NOT plan to refer patients, please tell us why.

The 3-month follow-up survey contained 14 items concerning demographics, participants' self-reported implementation of intervention strategies discussed during the continuing education program and perceived barriers to implementation. The

follow-up survey gathered information about attendees' progress in implementing a team-based tobacco cessation program into the dental setting. Item formats were similar to the initial survey, however, there were 4 open-ended items and 1 question directed solely to dentists (I am prescribing pharmacological agents for tobacco cessation to my patients who want to quit using tobacco). Approval for this research project was obtained by the Indiana University Purdue University Indianapolis Institutional Review Board.

Procedures

During the continuing education program, the study was explained to attendees and they were offered the opportunity to participate by agreeing to provide their contact information, and complete the initial and 3 month follow-up surveys. At the conclusion of each program, participants were asked to complete the initial post-continuing education survey. At 3 months following each program, the follow-up survey was mailed or delivered electronically to those who had previously consented to participate and had completed the initial survey. A contact information form, attached to the initial survey, was used to mail 3-month follow-up surveys and survey completion reminders to non-responders. A maximum of 3 contact attempts were made to complete the 3-month surveys (the initial contact and 2 subsequent mailings were sent to non-responders). The survey was confidential; however, to track completion, both the contact information form and the surveys were coded with the same numerical identifier. Survey data were reviewed, coded, entered into an electronic database and analyzed as de-identified aggregate data using descriptive statistics including frequencies and percentages. Open-ended responses were categorized into themes for analysis.

RESULTS

A total of 626 individuals attended the 11 continuing education programs. Of the attendees who completed the initial survey (n=565), approximately 70% were dental hygienists, 25% were dentists and other allied health professionals, and the remainder did not identify their profession (Table I). Mean response rate for all individuals in the initial survey was 91%.

The results of the scaled items from the initial survey are shown in Table II. The majority of the attendees' responded "Strongly Agree" or "Agree" to the statements concerning their understanding of course concepts and intention to integrate course content in their practice. Knowledge gained and/or confidence in applying that knowledge was highest in the following topics: tobacco's oral effects, nico-

tine addiction, effects of pharmacotherapy, communication strategies and tobacco cessation resources. Some survey items generated less certainty among respondents, principally, confidence in their knowledge about dosing and adverse effects of cessation pharmacotherapy, and intention to take an active role in the implementation of a team-based tobacco intervention plan in their practice.

Dentists were asked to complete the final 5 items. Of 119 dentist respondents, 28% (33) indicated that they currently provide tobacco cessation literature in their practice and planned to continue doing so, while 60% (71) stated that they planned to provide such literature and 13% (15) stated they were unsure if they would provide tobacco cessation literature in their office. Of those dentists who currently provide or planned to provide literature in their office (n=104), tobacco cessation resources are/would be presented as: reception area literature display (86), treatment area literature display (86), reception area video (7), treatment area video (18) and office website with links (17). Of materials to be distributed directly to patients, dentists indicated that they are/would be distributed by multiple individuals, including the dental hygienist (87), dentist (69), assistant (59) and other personnel (17).

When asked why they might not plan to provide or are unsure about providing tobacco cessation resources/literature in their practice, dentists (n=126) indicated the following reasons: lack of time to discuss resources (23), lack of time to distribute resources (20), patient acceptance of resources (15), concerns about cost of resources (13), space for resources (10), locating/obtaining appropriate resources (8) and lack of referral agencies in my area (8). Other reasons indicated for not planning to provide tobacco cessation resources included: retired/unemployed/not practicing status, working in a research environment and my (employer's) permission is required.

Of the 126 respondents who answered the survey item "Do you plan for your practice to refer patients who are interested in community cessation resources and /or the Indiana Quitline," 90% (113) indicated that they currently were or planning to refer patients, 8% (10) were unsure if they would make such referrals and 3% (4) indicated that did not intend to refer patients to the Quitline and local Tobacco Prevention and Cessation resources.

Three Month Post-Continuing Education Follow-up Survey

Although response rate varied by location, completed follow-up surveys were returned by 250 individuals resulting in a mean response rate of 40% (Table I). The professions of the 3-month survey

Table I: Participant Demographics by CE Location and Completion Rates of Initial and 3-Month Follow-up Surveys

CE Program Location	Number of Attendees	Initial surveys distributed	Initial surveys completed	DDS	DH	DA	Other	Not Reported	Follow-up Survey Collected
Terre Haute	55	55	41	5	34	4	0	12	16
Muncie	69	69	58	9	47	1	0	11	38
Columbus	48	48	45	7	36	0	0	5	25
S. Bend	112	112	95	12	77	4	2	17	41
Evansville	47	47	43	2	39	1	5	0	20
Fort Wayne	89	89	89	6	62	10	11	0	27
Valparaiso	34	34	32	6	22	5	1	0	15
Indianapolis	85	85	84	16	48	4	2	15	31
Gary	16	16	15	3	13	0	0	0	5
Lawrenceburg	21	20	20	7	14	0	0	0	12
Carmel	50	46	43	21	29	0	0	0	20
Total	626	621	565	94	421	29	21	60	250
Mean Response Rate			91%						40%

respondents were proportionally similar to those completing the initial survey (Table III).

In response to the statement, "I am personally using the communication strategies learned in the course when talking to patients about tobacco use," participants (n=233) responded as follows: strongly agree (12.4%, 29), agree (66.5%, 155), undecided (15%, 35), disagree (4.7%, 11) and strongly disagree (1.2%, 3).

Table IV details the respondents' referral of patients to the local Tobacco Prevention and Cessation community partners and the Indiana tobacco quitline for counseling as well as their reasons for not making such referrals. Practitioners appeared to favor referrals to the Indiana quitline over local Tobacco Prevention and Cessation counselors.

Participants' responses to items regarding the extent to which they had implemented the tobacco interventional strategies discussed in the course are described in Table V. Additionally, participants were asked to provide examples of how they accomplished implementation of the tobacco intervention with patients in their office. Seventy-five write-in responses were provided; the following are a sample of these comments:

- "Inquire about patient's previous cessation times. Inform patients of dental & medical health problems associated with smoking. Give patient info and contact options."
- "Ask patient if they desired to not smoke. If yes, then describe the quit line and other options

available. Depending on their response, gave the patient the appropriate materials."

- "For every patient I ask about tobacco use (what kind, how long they have used, if they have considered quitting), I advise them to quit and refer to the quit line or physician."

Participants were also asked to provide an example of 1 challenge they have encountered in integrating a tobacco cessation intervention into their office routine. Of the 89 responses received, the most common themes were: lack of patient interest/compliance, time and difficulty getting staff involved. Thirty-three responses were received for the final item, "If you have not implemented a tobacco cessation intervention plan or do not intend to, why not?" The most common reasons given were: lack of interest/approval from the dentist in the practice, lack of time to discuss or implement a plan, and that the respondent was not currently in active practice/employed.

DISCUSSION

As tobacco use is a well-known risk factor for a myriad of oral and maxillofacial conditions, addressing patient tobacco use is a part of preventive dental practice and advising patients to quit is a professional responsibility of the dental team. In general, tobacco users expect and are comfortable receiving such advice.^{24,25} Campbell et al found that most patients believed that dental offices should provide tobacco interventions, and support for such was equal between tobacco users and non-users.²⁶ Further, a recent systematic review concluded that brief to-

Table II: Results of Tobacco Dependence Education Program Initial Post-CE Survey

Responses: Number (Percent)					
Survey Items	SA	A	U	D	SD
I have increased my knowledge about tobacco's oral effects. (n=545)	347 (63.6)	190 (34.8)	7 (1.2)	1 (0.2)	0
I have a clear understanding of nicotine's addictive process (psychological, physical, and social). (n=545)	334 (61.3)	207 (38)	4 (0.73)	0	0
I feel confident in my knowledge of the pharmacological effects of the 3 pharmacological therapies (bupropion, nicotine replacement therapy, varenicline) discussed in this program. (n=545)	196 (36)	310 (57)	37 (7)	0	0
I feel confident in my knowledge of the dosing requirements of the 3 pharmacological therapies (bupropion, nicotine replacement therapy, varenicline) discussed in this program. (n=544)	144 (26.4)	310 (57)	83 (15.3)	6 (1.1)	1 (0.2)
I feel confident in my knowledge of the adverse effects of the 3 pharmacological therapies (bupropion, nicotine replacement therapy, varenicline) discussed in this program. (n=543)	157 (29)	330 (60.7)	54 (10)	2 (0.3)	0
I plan to take an active role in the implementation of the team-based tobacco cessation plan into the healthcare setting where I work. (n=511)	128 (25)	257 (50.3)	116 (22.7)	8 (1.6)	2 (0.4)
I have learned valuable communication strategies for talking with patients about quitting tobacco use. (n=542)	300 (55.4)	239 (44)	3 (0.55)	0	0
I plan to use the communication strategies learned in this course when talking to patients about tobacco use. (n=534)	247 (46.2)	275 (51.5)	12 (2.2)	0	0
I understand how to select tobacco cessation resources that fit the needs of the patient population in our practice (e.g., pregnant women, minorities, and youth). (n=539)	203 (37.7)	313 (58)	22 (4)	1 (0.2)	0
I have a clear understanding of the services provided by local Indiana Tobacco Prevention and Cessation Agency (ITPC) resources in my community. (n=542)	199 (36.7)	304 (56)	33 (6)	6 (1.1)	0
I have a clear understanding of the services provided by the Indiana Quitline. (n=535)	249 (46.5)	274 (51.2)	9 (1.7)	3 (0.6)	0

SA=Strongly Agree; A=Agree; U=Undecided; D=Disagree; SD=Strongly Disagree

bacco use cessation counseling conducted by oral health professionals was found to be effective at 12 months or longer.²⁷ However, dental professionals have been largely inactive in direct counseling of patients to quit tobacco.²⁸ Major constraints cited against the implementation of tobacco counseling in oral health care settings include suboptimal attitudes, insufficient training and lack of reimbursement.²⁹⁻³²

The continuing education program described here sought to enhance Indiana oral health care providers' understanding of tobacco dependence and treatment and encourage them to provide tobacco cessation interventions. The program reached over 600 practitioners, primarily dental hygienists whose role focuses on patient education and disease pre-

Table III: Comparison of Demographic Category of Respondents completing the Initial Post-CE Course Survey and 3-Month Follow-Up Survey

Respondent Category	Initial Survey Percent	3 Month Survey Percent
Dentists	15	15
Dental hygienists	67	70.4
Dental assistants	5	4
Other	3.3	1.2
Unreported	9.6	10

Table IV: Results of Tobacco Dependence Education Course 3- Month Follow-up Survey

Survey Item	1 to 5	6 to 10	11 to 15	16+	I have not referred any patients
Since the CE course, approximately how many patients have you referred to local ITPC counselors?	67	16	4	5	144
Since the CE course, approximately how many patients have you referred to the IN quitline?	98	31	10	8	90
Reasons for Not Referring to Indiana TPC Counselors	Responses				
Patients not interested	22				
Referring to the Indiana Quitline instead	20				
Not currently seeing patients / retired / unemployed	15				
Forgot / lost my resource information	11				
Few smokers in the practice	7				
Live / practice in another state	5				
Lack of time	3				
Not comfortable referring	3				
Pts wanted Rx only / not interested in referral	2				
Refer to our own tobacco counselors	2				
Reasons for Not Referring to Indiana Tobacco Quitline					
Referred patients to local tobacco cessation resources instead	6				
Patients interested in cessation medications only, not counseling	3				
Live / practice in another state	3				
Not currently in practice / unemployed / retired	2				
Counseling patients myself	1				
Patients not interested	1				

vention. In the short-term, the program appeared to be effective at increasing attendees' knowledge, especially on tobacco's oral health effects, nicotine addiction, and how tobacco cessation medications work.

Participants indicated that the program was effective in teaching communication strategies to employ with tobacco users; this should have improved attendees' confidence in approaching patients about quitting tobacco. Immediately after the program, nearly 98% of participants planned to use these communication techniques in practice. However, 3 months later, enthusiasm for applying these communication strategies seemed to decrease: 78% reported applying these skills, 15% were undecided and 6% were not employing them in patient interactions.

Immediately post-program, nearly 90% of dentists indicated that they provided or planned to provide patient tobacco cessation resource materials, primarily in treatment or reception rooms. Although

materials were distributed by multiple personnel, the dental hygienist and dentist were primary. Findings were similar at follow-up. The principal barriers to providing patient resources were a lack of time to discuss and distribute materials to patients, lack of patient acceptance, the cost of materials, and difficulty locating and obtaining resources. This finding was problematic because the continuing education program provided numerous free resources (educational posters, pamphlets, quitline information, etc.) to attendees and links to the Indiana State Department of Health Tobacco Prevention and Cessation Commission website where a plethora of patient referral and education materials could be obtained at no charge.

Immediately post-program, participants reported enhanced awareness of tobacco cessation referral resources, and the majority (90%) planned to refer patients to county Tobacco Prevention and Cessation counselors or the Indiana quitline. At follow-up, only 60 and 40% reported making referrals to the quitline and Tobacco Prevention and Cessation

Table V: Responses on 3-Month Follow-up Survey Regarding Participants' Implementation of Tobacco Intervention Strategies

Survey Item	Percent (number)
I am personally referring patients interested in tobacco cessation to:	
Indiana Quitline (n=175)	31.4% (55)
Patient's family MD (n=190)	71.5% (136)
Have not referred patients (n=174)	53.4% (93)
Other : oral surgeon, local hospital, acupuncturist, myself as counselor; gave Rx instead of counseling; not practicing/retired; live/work out of state (n=150)	34.0% (51)
In which of the following ways does your office provide patients with tobacco cessation materials?	
Literature display in reception area (n=191)	47.6% (91)
Literature display in treatment area (n=204)	67.1% (137)
Video - reception area (n=177)	3.3% (6)
Video - treatment area (n=179)	7.2% (13)
Distributed directly to patient by:	
Dentist (n=184)	50% (92)
Dental Hygienist (n=207)	88.4% (183)
Other office personnel (n=172)	32.5% (56)
Office website with links (n=164)	5.4% (9)
Other: posters, quit cards, staff nurses, quarterly newsletter (n=144)	4.1% (6)
If the office where you work is NOT providing patient tobacco cessation resources, what concerns do you think may have affected that decision?	
Cost of tobacco cessation resources (n=77)	28.5% (22)
Space for tobacco cessation resources (n=78)	23% (18)
Locating and obtaining appropriate resources (n=79)	20% (16)
Patient acceptance of tobacco cessation resources (n=84)	48.8% (41)
Lack of time to distribute resources (n=79)	46.8% (37)
Lack of time to discuss tobacco cessation (n=83)	50% (42)
Lack of referral agencies in my area (n=77)	16.8% (13)
Other: (n=53)	13% (7)

counselors, respectively. The Ask-Advise-Refer approach with quitline referral was the most popular interventional strategy, probably due to its efficiency. Unfortunately, the more proactive "FAX to Quit" strategy (faxing patient information to the quitline and allowing a quitline counselor to begin patient counseling within 48 hours) was reportedly used by very few practitioners. The reasons for not referring to Tobacco Prevention and Cessation counselors included use of the quitline instead, patient lack of interest in counseling, and misplacing Tobacco Prevention and Cessation counselor contact information. Although the continuing education program provided clinicians the opportunity to meet their county Tobacco Prevention and Cessation partner and obtain their contact and service information, some clinicians may have found that patients preferred the quitline's convenience or anonymity over in-person counseling.

Although the CE program appeared to increase participants' knowledge of cessation pharmacotherapy, immediately after the program at least 10% of the participants did not feel confident in their knowledge of the dosing or adverse effects of the medications discussed. This suggests the program did not adequately address this issue, and may explain, in part, why at 3 months very few dentists reported recommending/prescribing tobacco cessation medications to their patients.

Despite emphasis during the course, even immediately after the continuing education program, nearly 25% of attendees did not plan to take an active role in implementing a tobacco cessation program in their office. At 3 months, relatively few participants reported adopting specific formal office protocols and practices for providing tobacco interventions with patients.

Table V: Responses on 3-Month Follow-up Survey Regarding Participants' Implementation of Tobacco Intervention Strategies (continued)

Survey Item	Percent (number)
Aspects of the Brief Intervention approach used by respondents:	
Ask Advise, Refer (n=128)	84.3% (108)
Ask, Advise, Refer to Quitline (n=138)	80% (110)
Ask, Advise, Refer to Quitline + Fax to Quitline (n=117)	12.8% (15)
Ask, Advise, Refer to physician or local cessation program (n=125)	52% (65)
Ask, Advise, Refer to local ITPC partner (n=114)	22% (25)
Actively provide patients with tobacco cessation materials (n=126)	69% (87)
Document brief intervention in patient record (n=127)	76.3% (97)
Other (n=72)	11% (8)
Aspects of the Policy and Procedure approach used by respondents:	
Assigned roles in office for cessation intervention responsibilities (n=26)	15.3% (4)
Developed protocol for identifying patient tobacco users (n=26)	42% (11)
Actively provide patients with tobacco cessation materials (n=29)	75.8% (22)
Actively encourage patients to set quit dates (n=26)	57.6% (15)
Recommend specific OTC NRT therapy (n=30)	76.6% (23)
Prescribe specific NRT to patients (n=26)	23% (6)
Prescribe other pharm support to patients (n=23)	13% (3)
Developed protocol for post-intervention follow-up (n=25)	12% (3)
Consistently document interventions in patient record (n=27)	66.6% (18)
For Dentists Only: (n=35)	
I am prescribing pharmacological agents for tobacco cessation to my patients who want to quit using tobacco	
NRT Patch	22.8% (8)
NRT gum	25.7% (9)
NRT Lozenge	11.4% (4)
NRT Inhaler	5.7% (2)
Bupropion	11.4% (4)
Varenicline	25.7% (9)

Teaching oral health care professionals about tobacco use and dependence, and how to implement tobacco cessation interventions, does not necessarily assure that they will change their practice behaviors and begin to utilize the learned concepts and skills with their patients. This continuing education program emphasized the "team approach" to tobacco cessation interventions which outlined suggested roles and responsibilities for each member of the dental team, including the dentist, dental hygienist, assistant and non-clinical staff. First suggested in Christen's how-to model, most cessation programs conducted in dental offices stress the pivotal role of the team care approach that involves all dental practice members.³³ Among the keys to success, working as team where all staff are involved and invested in the program, and identifying an office champion (coordinator) who has overall

responsibility for the program can make a positive impact in enhancing patients' quit attempts.^{26,34} As the dental hygienist typically has more patient contact time than the dentist, and has the most training and expertise as an oral health educator, it is recommended that the dental hygienist serve as the coordinator of the office tobacco cessation program. Given that health care is moving toward an inter-professional model of care delivery, dental hygienists may have more opportunities to work in a variety of settings as part of a health care team. Their expertise in educating patients and their families on the connection between oral and systemic health and the impact of tobacco use on oral health, and motivating patients in adopting healthy behaviors allows them to provide a unique and vital contribution to the health care team.

This study had several limitations, most notably the self-report nature of the survey and a decrease in response rate from the initial survey to the 3-month follow-up survey. However, demographically, initial and follow-up participants had similar characteristics. Another limitation was an inability to systematically track participant referrals to the quitline or Tobacco Prevention and Cessation counselors and, ultimately, obtain information on patient quit rates other than anecdotal, self-report information. Further, survey results revealed some potential areas for improvement in the continuing education program itself. The pharmacotherapy section of the course may need to be revised for better participant comprehension, and include an open discussion of perceived barriers to the use of pharmacotherapy strategies. Although the continuing education program contained interactive components and question and answer periods, more role-playing and active learning techniques could be employed to further enhance skill development.

As Berwick noted, it is helpful to understand not only whether interventions work but in what context.³⁵ Amemori compared the effect of an educational intervention on increases in provision of patient tobacco interventions by Finnish dentists and dental hygienists' across 3 study groups: control group, those who received tobacco dependence education and cessation training, and a group that received tobacco dependence education/cessation training with monetary compensation for cessation counseling that was provided.³⁶ Findings revealed that the educational session was effective in increasing providers' self-efficacy and skills in counseling.³⁶ Compared to dentists, dental hygienists were more active in counseling and their counseling performance showed greater increases in cessation numbers in both intervention groups. However, similar to the present study, the educational intervention's positive effects on clinician tobacco cessation activities faded rapidly 2 months post-continuing education course. Remarkably, compared to tobacco dependence education/cessation training alone, the incentive of receiving payment for counseling did not result in increased practitioner tobacco intervention activities. Future studies should focus on identifying what factors, beyond knowledge acqui-

sition, enhance oral health care providers' motivations and willingness to engage in tobacco cessation interventions.

CONCLUSION

Providing oral health professionals with education in tobacco use and cessation strategies, as well as patient education materials and tobacco cessation referral information and resources (e.g. state-funded tobacco quitline) may encourage them to provide brief tobacco interventions as a routine part of practice. Providing this service to their patients illustrates how oral health professionals can function as an interdisciplinary team. Dentistry should function as part of an interprofessional health care team with the goals of integrated health promotion and holistic care for every individual. Continuing education opportunities regarding tobacco dependence and treatment, including the ability to connect with local tobacco cessation resources, should be made available. Oral health care practitioners with appropriate training can contribute to finding a solution to the problem of tobacco use and dependence.

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