

Learning to Write

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When I was in high school, if you had asked me if I would love writing as an adult I would have given you that look teenagers do so often. English was not my favorite subject, and I certainly did not have the best grammar skills. In undergraduate dental hygiene school I had to write occasionally, but not much. All of this is to say that we all have to start someplace. Most of us are not natural writers.

I learned to write when I had to. It all started with my graduate program, when I was expected to conduct research and write a research paper. Then, I was under pressure to actually publish the work! When I completed my graduate work, I was so tired of it that I put it aside for an entire year before I submitted it for publication (my graduate students are not provided with that option). Then, I acquired a position in an academic institution with high expectations for scholarly activity, so I had to learn to write.

One of the most humbling experiences is being a beginning author and getting feedback on your writing. While it is meant to be constructive, it is typically perceived as critical. I will always remember the first time I had a journal editor (who was a faculty colleague at my institution) review one of the articles I planned to submit for publication. At that time, reviewers used red pen and not “track changes.” My paper came back soaked in red ink! After a couple of days I got over the shock and proceeded to revise the



paper according to the suggestions of the reviewer. Again, I asked the editor to look at the paper and again it came back with more red marks. I must say that this was one of the best experiences of my career as far as developing me as a scholar and writer. Was it painful? Yes! But one has to put themselves in a position of vulnerability in order to learn how to get better at something. One has to risk being criticized in order to improve. Did I get the paper published? Yes – with flying colors!

Now, after many years of writing, I welcome opportunities to help others learn how to write and contribute to the dental hygiene literature. Being a journal editor is a tremendous privilege and a huge responsibility. For one, it has made me appreciate all the help I received

along the way. It has also helped me appreciate the high bar that was set for me. The challenge is helping others reach their goals of publishing when they may not have the mentoring they need.

At ADHA we have set the bar high for our publications in the *Journal of Dental Hygiene*. We have a responsibility to all members of our profession to publish works that are of high quality and that will contribute to the dental hygiene body of knowledge.

Many times we receive papers from first time authors. I love receiving these papers. We need dental hygiene professions in the pipeline to carry on the research and scholarship for the profession. I commend these authors for taking the leap and making themselves vulnerable so that they can grow and learn. This issue of the *JDH* contains several papers from first time authors. They have climbed one hurdle. My challenge to them and those of you who are contemplating becoming a writer is best said in a quote by Pablo Picasso: “I am always doing that which I cannot do, in order that I may learn how to do it.”

Most writers have had the thought that they cannot do it. Most persevere and learn otherwise. Try it – you might like it!

Sincerely,
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Evaluating the Effects of Coaching to Improve Motivational Interviewing Skills of Dental Hygiene Students

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Introduction

Education of individuals or groups is a primary role of dental hygienists. This role is further defined as developing someone to adopt efficient behaviors to attain better oral health.¹ A typical dental hygiene patient education strategy is one in which the dental hygienist or dental hygiene student communicates information and the patient changes their habits based upon the information given.¹⁻³ Knowledge, however, does not consistently impart an interest in developing the skills for daily inter-dental hygiene,^{4,5} or sustaining behavioral change in oral hygiene habits.⁶ As such, alternative approaches to elicit a patient's behavioral change are warranted.

A number of well-established health psychology models have been adapted to oral hygiene education providing alternative approaches to eliciting behavior change.⁷⁻¹² While these models may be included in a prerequisite psychology course taken by dental hygiene students, their use may not be well-integrated into the professional dental hygiene curriculum, nor applied in patient care. Students may be instructed in the components of patient education,¹³ however, they may not be instructed on how to elicit behavioral change in an oral health setting.

When discussing behavioral

Abstract

Purpose: Motivational Interviewing (MI) is a style of encouraging and supporting patients in making their own choices in matters concerning their health. MI is emerging in health care as a viable strategy for enhancing a patient's intrinsic motivation to change self care. The purpose of this pilot study was to determine the effects and level of incorporation of coaching to improve MI adherence of dental hygiene students' patient education presentations as measured by parts of the Motivational Interviewing Integrity Coding System (MITI) and Motivational Interviewing Skills Code (MISC).

Methods: A convenience sample of second year dental hygiene students from a Midwestern community college were invited to participate in the study. This pilot study utilized a pre- and post-test design to evaluate the effect of coaching to improve MI scores of students. Students were audio taped during 2 brief patient education sessions. Upon completion of the first tape, students received feedback and coaching in MI and then made a second tape of a brief patient education encounter.

Results: Student subjects changed behavior scores in the direction appropriate to MI following coaching on most measures. Summary scores indicate an improvement in the use of open questions, complex reflections and MI adherence, but not in change talk or reflections-to-questions ratio.

Conclusions: The use of coaching sessions improved the skills of dental hygiene students learning MI-adherent behaviors.

Key Words: brief motivational interviewing, patient education, change talk, open questions

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change in relationship to general and oral health self care, patients are the key decision makers. Sustainable change is not successful when

dictated to the patient – change must come from within the individual. This forms the basis for Motivational Interviewing (MI). Accord-

ing to Miller and Rollnick, “MI is a client-centered, directive method for enhancing intrinsic motivation to change by exploring and resolving ambivalence.”¹⁴ The counselor invites the client to verbalize what change they are willing to make in their behavior, called eliciting “change talk.” Change talk is defined as speech that indicates a particular movement toward change, and is a valuable indicator as to whether or not the patient will change their behavior.¹⁴

MI techniques have been investigated for treatment of diseases such as asthma, eating disorders, exercising, obesity and early childhood caries, and it has also been used for increasing exercise, all with some success in treatment.^{15–19} There is early evidence to suggest that this technique can be successfully integrated in dental education.²⁰ The purpose of this pilot study was to determine the effects and level of incorporation of brief MI feedback/coaching on dental hygiene students’ patient education presentations as measured by parts of Motivational Interviewing Integrity Coding System (MITI) and Motivational Interviewing Skill Code (MISC).

Review of the Literature

To begin to understand how people change behaviors, it is important to think first about why people change their behaviors.¹⁴ A common held and often reproduced belief asserts that educating patients about the negative consequences involved in a behavior is enough to elicit change. If that were true, there would be more dental hygiene patients using preventive dental aids on a daily basis and fewer patients using tobacco. In contrast, MI is predicated on a different conceptual model. It is based upon the works of Carl Rogers, which emphasizes a patient-centered philosophy.¹⁴ Miller and Rollnick believe that MI is more “a fundamental spirit” than a technique.¹⁴ It is a style of communication, encouraging and supporting patients in making their own choices in

matters concerning their health. The decision comes from within the patient, not the counselor, allowing the patient to have complete autonomy in the decision-making process.²¹

Four Guiding Principles and Methods of Motivational Interviewing

Principles in health psychology may be based upon research and provide the basis to form the process to achieve desired goals.²² There are 4 guiding principles that define MI technique: resisting the righting reflex, understanding and exploring the patient’s own motivations to overcome ambivalence, to listen with empathy and to empower the patient by encouraging hope and optimism.²¹

The means by which these principles are attained are represented by the open questions, affirmations, reflective listening and summaries methods (OARS). When initiating a discussion of behavioral change in an oral hygiene session, the 4 OARS are important methods to use throughout the entire process of MI.¹⁴

Open ended questions

Open questions elicit more than brief responses in order to build understanding and create trust between dental hygienist and patient. It is recommended to start with an open question to stimulate discussion and then follow with reflective listening.²¹ There are certainly acceptable times to use closed questions, but they should be kept to a minimum. Examples of different types of open questions can be generated through the desire, ability, reasons and need method (DARN). DARN consists of questions that require more than one word answers and can encourage change talk. Questions such as “What do you want to have happen?” or “What are you able to do?” begin to address the patient’s reasons for making a change.²¹

Asking these forms of open questions allows patients to say what change they would like to make in their behavior, thus encourag-

ing change talk. Again, it is not the advice of the dental hygienist, but the desire of the patient to decide what change can be accomplished. “I think I can,” “I will” and “I can do this” are all examples of change talk. Change talk is a valuable indicator as to whether the patient will change their behavior or not.¹⁴ In the example of flossing, a patient may state “I can floss at night.” This indicates a change in habit or change talk. A study by Amrhein et al indicates there is a definite pattern to a commitment to change and patient language. Change talk was found to be the strongest indicator of behavior change.²³ Once the change has been stated, it may be tempting to move on in the discussion, but it can be an opportunity for the patient to elaborate and reinforce the idea of change within their own mind.

Once a desire for making a change has been brought forward by the patient through an open dialogue, the dental hygienist can then offer suggestions only after asking if the patient is interested in receiving such information. After receiving permission to give information, the dental hygienist can then offer advice in a manner more receptive to the patient in a more MI-adherent manner.²¹ An example would be to ask if the patient would like to know what others have done in the same situation.

Affirmations

Affirmations encourage when someone is doing something right and will also build rapport.¹⁴ Most patients do attempt some type of home care. Whatever they are doing correctly should be affirmed, especially if they are trying to incorporate a new skill, such as flossing. This will allow a sense of hope that they can improve their oral health and are showing signs of achieving that goal. If a patient shows a change in a plaque score, acknowledge the change and congratulate the patient on doing a great job. Do not always focus on what is incorrect – a simple affirmation would be to acknowledge an area where the patient’s mouth is

healthy due to proper home care.

Reflective listening

Reflective listening is a method used in MI to show a means of understanding someone without passing judgment.²⁴ It produces a sense of acceptance and empathy between dental hygienist and patient. It allows patients to feel as though they have been heard. When this occurs, Miller and Rollnick suggest that it allows the patient to begin the process of at least considering change.¹⁴ While reflective listening is the most important and most challenging skill to develop, it is a critical element in using MI. If a patient has trouble with flossing because of not having enough time due to a busy schedule, a response could be, “You do have a lot on your plate when getting ready in the morning.”

Summations

After the patient has decided what to do differently by initiating change talk, sum up their ideas and hold the patient accountable.¹⁴ If the patient has decided to floss at night, write it down in the treatment notes and say, “That sounds like a good plan, and let me know at the next appointment how that works for you.”

Using MI during patient education requires learning new approaches and then practicing to acquire the true spirit of MI by using all of these methods. Use of MI in patient education in dental hygiene has not been explored. To date, there are a few studies showing positive trends in the use of MI in dentistry.

Application of Motivational Interviewing in Dentistry

The effect of teaching Brief Motivational Interviewing to dental students for tobacco cessation counseling was evaluated in a pre- and post-test research design.²⁰ Although long term patient behavioral change was not assessed, coaching did result in patients talking more and asking more questions in sessions of students with Brief Motivational Interviewing training. This style of en-

couraging behavioral change could be applied to dental hygiene patient education techniques.²⁰

Weinstein et al compared MI intervention to standard health education practices with parents of children susceptible to early childhood caries (ECC).²⁵ An assessment of caries at the end of 1 year indicated those in the MI group had fewer caries than those in the control group. A follow-up 2 year study conducted by Weinstein et al indicated that MI counseling yielded an increase in parent compliance with their children receiving fluoride varnish treatments as compared to the control group not exposed to MI counseling. It had a positive effect upon seeking preventive health measures as compared to traditionally educated groups.²⁶

The Importance of Training

Training is important to instill the 4 guiding principles and OARS into the educational toolbox of health care educators. Many studies audiotape sessions and provide feedback for the counselor or therapist.²⁷⁻²⁹ Study and practice are requisites to clinician counselors’ development of effective patient education techniques while using the principles of MI. Emmons and Rollnick stated that behavioral change by the counselor as a result of training is as important as the behavioral change for the patient.³⁰

In a clinical trial study by Miller et al, feedback and coaching of MI skills were compared to standard training and self-trained groups.³¹ Audiotapes of sessions were used to compute scores by using global MI spirit scores and behavioral counts by comparing base line 4 and 8 month tapes. Feedback/coaching groups attained a more consistent score of incorporating MI skills during patient education than the other groups.

Methodology

Sample

A convenience sample of second year dental hygiene students from a Midwestern community college were invited to participate in the

study. Students were given a description of the study, including their right to refuse participation and to withdraw from the study at any time for any reason. No personal identifiable information was collected as part of study procedures. This study was approved by the University of Missouri, Kansas City Social Science Institutional Review Board for expedited review.

Design

The effect of teaching Brief Motivational Interviewing to dental hygiene students for patient education behavioral counseling was evaluated in pre- and post-test research design. Students were audio taped during 2 patient education sessions. Students selected patients for the sessions, and if a patient was not available, they role-played with one another. Research indicates that students learn to develop MI skills whether they use standardized patients or role-play with one another and receive feedback from peers.³² In the first taping, clinic patients were available for 9 students, and 6 students role-played with other students acting as patients. In the second taping, clinic patients were available for 8 students and 7 students role-played with other students. The first audiotape session recorded the student subjects providing patient education using previously learned MI techniques. Upon completion of the first tape, students received feedback and coaching in MI from a registered dental hygienist that had previous training in MI. Following feedback/coaching sessions, all student subjects made a second tape of a patient education encounter with a patient of their choice.

Procedures

All dental hygiene subjects were given literature to read, which explains that patients do not always change their oral health habits strictly when given advice about how to develop a healthy behavior. The literature discussed how people change their behavior and how to facilitate the change and introduced

the principles and uses of MI in oral health settings.³³ In addition, the training was based on Motivational Interviewing in Health Care by Rollnick, Miller and Butler.²¹ There were 2 consecutive sessions: one lasting 4 hours and the other 3 hours in duration. Sessions consisted of a Power Point lecture with handouts and discussion explaining the guiding principles of MI and use of OARS. Student subjects also practiced exercises of various forms of communication styles, including guiding, directing and listening styles, open questions and complex reflections. Student subjects were trained by a registered dental hygienist who received training in a moderate level of MI by attending a 2 day training session.

Students completed their first tape following the training sessions. The tapes were coded by a trained and blinded coder using the MITI. Each student was assigned a unique subject number randomly. The coder provided feedback and trained the registered dental hygienist on how to provide feedback/coaching to student subjects. Feedback/coaching sessions were done individually by phone and averaged 30 to 40 minutes each. They consisted of providing students with subject areas for warranting improvement, emphasizing the posing of more open-ended questions, expressing more empathy, providing affirmations and listening for change talk. Upon completion of the feedback/coaching sessions, student subjects made their second tape. After all of the tapes were recorded, the tapes were evaluated by a second MITI coder, blind to whether the taping occurred before or after coaching. This final coding was done by a co-author of the MITI.³⁴

Instrument

The MITI was used to measure students use of MI techniques during a patient education session.³⁴ The MITI includes global rater scales designed to be used on longer coding sessions than were available in this study. Therefore, the global rater scales were omitted from the coding

and only the behavior counts of the student subjects were obtained. A second instrument, the MISC, which is a parent instrument to the MITI,³⁴ was added as a method to code behavior counts of patients. The MISC is useful to measure patient change talk and counter change talk.³⁷

The coding calculated behavior counts of both students and patients. Behavior counts require the coder to count the number of student behaviors throughout the session such as giving information, MI adherent, MI non-adherent, open and closed questions and simple and complex reflections. These are all components of MI. The coder is required only to count, not to judge the quality or overall adequacy of the session.

Reliability of the Instrument

Tests of the MITI coding system attain acceptable rates of intra-class correlation coefficients (ICC). In one study, the coefficients ranged from 0.5 to 0.9,³⁴ and in the second, the items showed a coherent pattern of inter-item correlations.³⁵ Inter-rater reliability for the MISC was confirmed through a clinical trial yielding an intra-class correlation of raters in the good to excellent range.³⁶

Data Analysis

Summary scores were tallied as follows: percent of complex reflections divided by total reflections, percent of open questions divided by the sum of open and closed questions, reflection-to-question ratio and the percent MI adherent statements divided by the sum of MI adherent and non-adherent statements. Variations in the behavior counts from pre- to post-test were used to identify dental hygiene student competency in MI.³⁴

The Wilcoxon signed ranks and paired t-tests were used to compare pre-coaching scores with post-coaching scores.

Results

Fifteen second year dental hygiene students participated in this study. Students were female and

ranged in age from 20 to 35. No student subjects dropped out or refused to participate in the study.

Student and patient statements were coded into domains according to behavior skills measured by MITI and MISC requirements. Domains consistent with MI-supportive behaviors are: MI adherence, open questions, complex reflections, simple reflections and change talk. The remaining domains (gives information, non-adherent statements, closed questions and counter change talk) are associated with behaviors contrary to MI. To assist the reader in tracking the direction of observed behaviors, each table includes a column indicating the desired direction for each set of data.

With a few exceptions, the students changed behavior frequencies in the direction appropriate to MI (Figure 1, Table I). Students made more MI adherent interventions, they made fewer interventions that were MI non-adherent, they asked fewer closed questions and they elicited more change talk following coaching. In addition, counter change talk remained at zero, which was the desired rate. However, the only significant change was the reduction in closed questions. Increases in open-ended questions, complex reflections and simple reflections would have supported the hypotheses, but were not demonstrated.

The behavior domains of gives information, MI adherence and MI non-adherence were related to length of session. To control for length of session, these frequencies were divided by the session length, producing rates that are presented in Table II, along with the observed behaviors per minute.

All the rates changed in the desired MI behavior direction. Student subjects showed an improvement by decreasing rates of giving information, increasing rates of MI adherent interventions and decreasing rates of MI non-adherent interventions. However, the only significant change was the decrease rate of MI non-adherence.

Figure I: Median Motivational Interviewing behavioral frequencies for before and after feedback/coaching of dental hygiene students (n=15)

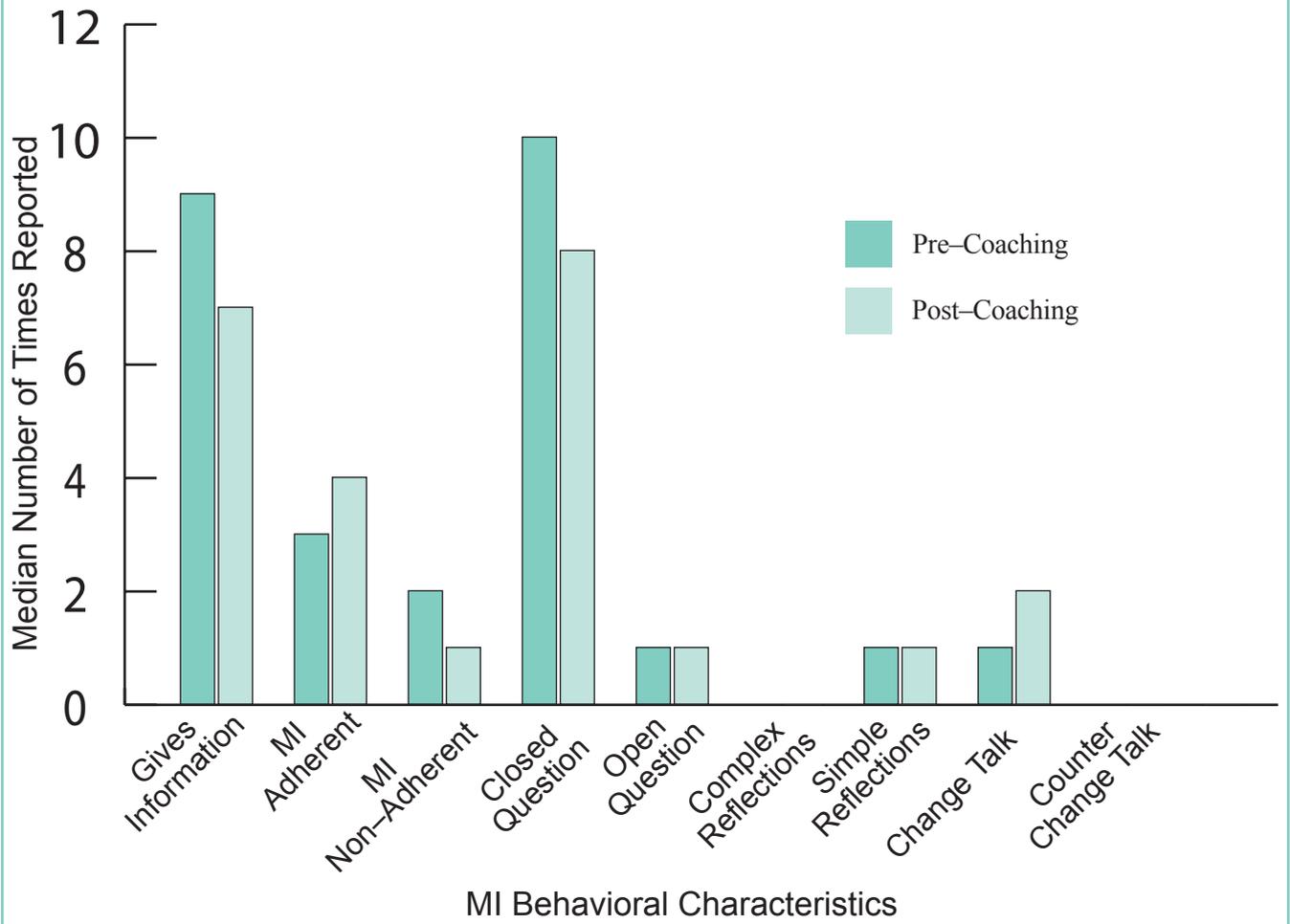


Table III presents tallied mean and standard deviation summary scores according to MITI and MISC procedures. Percent of open questions is calculated by the number of open questions divided by the sum of open and closed questions, percent of complex reflections is complex reflections divided by total reflections, reflection-to-question ratio is the total number of reflections divided by the total number of questions, percent MI adherence is the number of MI adherent statements divided by the sum of MI adherent and non-adherent statements and the percent change talk is the number of change talk statements divided by the number of change talk statements plus the number of counter change talk statements by the patient. In all cases, an increase in the proportion indicates that students demonstrated MI sup-

portive behaviors.

In summary, Table III shows that the student subjects' change was in the desired direction for percent open questions, percent complex reflections and percent MI adherence, although only the percent MI adherence showed a significant change. The reflection-to-questions ratio and percent change talk scores went in an undesirable direction, although none of the changes were significant.

Discussion

It has already been demonstrated that health professionals, including dental students, can learn Brief Motivational Interviewing.^{15-19,38} This pilot study demonstrates that certain MI skills were improved as a result of coaching.

Competence in MI is a complex process of learning and integrating

various skills. After learning skills, the clinician must learn how and when to implement the various skills to become successful in providing a climate for change in the patient.¹⁴ Miller and Mount indicate that MI training needs to focus on improving selected behaviors and reducing other behaviors over time.³⁹ In this study, areas of MI adherence were measured by behavior counts from 2 testing instruments: the MITI and the MISC.

Coaching provided in this study emphasized the need for dental hygiene students to provide more affirmations, to ask more open questions and to ask fewer closed questions. The coaching sessions did not emphasize reflections. The improvements observed in this pilot study reflected the priorities emphasized in the coaching sessions. Students

Table I: Median MI and patient behavioral frequencies for before and after feedback/coaching of dental hygiene students from data in Figure I (p-value<.05)

	Pre-Coaching	Post-Coaching	Desired direction of behavioral change	Difference	Significance (Wilcoxon Signed Ranks test)
Gives Information	9	7	-	-2	ns
MI Adherent	3	4	+	+1	ns
MI Non-adherent	2	1	-	-1	ns
Closed Questions	10	8	-	-2	.01
Open Questions	1	1	+	0	ns
Complex Reflections	0	0	+	0	ns
Simple Reflections	1	1	+	0	ns
Change Talk	1	2	+	+1	ns
Counter Change Talk	0	0	-	0	ns

demonstrated a positive change (but not significant) in asking more open-ended questions following coaching, and showed a significant change in percentage of MI-adherent behaviors.

Study Limitations

One of the limitations of this study was lack of access to an equivalent control group. A control group would have determined whether students improved spontaneously without coaching. Considering the complexity of practicing MI, it is unlikely that students would spontaneously start practicing all aspects of MI. However, there may be certain features that students would improve on simply as a matter of experience (rather than from coaching), and this study design would not be able to detect that.

Additionally, students did not receive reinforcement from instructors of MI behavior skills while in clinic when providing patient education. A future study should include teaching MI methods to instructors in order to reinforce skills, or as a way to provide an ongoing intervention as students acquire new MI skills. Between the 2 taping sessions was a period of several months without

Table II: Mean rates and standard deviations of those MI behaviors that correlate with length of session frequency of behaviors per minute before and after feedback/coaching (n=15)

Behaviors of student subjects	Rate before coaching	Rate after coaching	Desired direction of behavioral change	Significance paired t-test
Give Information	1.43(.57)	1.36 (.54)	-	ns
MI Adherent	.56 (.28)	.83 (.68)	+	ns
MI Non-adherent	.35 (.28)	.17 (.15)	-	.03
Length of session in minutes	6.5 (4.8)	6.3 (4.0)		ns

Table III: Mean MITI and MISC summary scores of before and after feedback/coaching dental hygiene students (n=15)

Percent of behavior scores of student subjects	Before coaching	After coaching	Desired direction of change	Significance paired t test
Open questions	9 (9)	13 (10)	+	ns
Complex Reflections	2 (18)	6 (18)	+	ns
Reflections to questions	14 (13)	9 (11)	+	ns
Change Talk	82 (21)	79 (28)	+	ns
Percent MI adherence	64 (25)	77 (23)	+	.048

any reinforcement for students to develop skills after their initial didactic course. Instead, there was a tendency to implement patient education as they were previously taught by giving advice and demonstrating effective tooth brushing and flossing.

As stated earlier, training is vital to learning MI.^{30,31} In a study by White et al, medical school students received a basic course of MI during their first year of school. Mentors were used in small group discussions and role-play. Their training continued during their third year with more structured training and feedback.⁴⁰ In contrast, the students in this study received less feedback. If students were to receive more training and feedback over a longer period of time, with reinforcements and learning new skills from instructors, it could impact how students would use MI in their patient education. Future long-term studies need to be done to determine what the impact would be. More audio taped sessions with feedback/coaching could produce more of a statistical difference in dental hygiene students' skills.

The study design could have been improved by a larger sample size and a control group. However, it is likely that one session of coaching is not effective in producing MI-proficient students, especially in a setting where faculty are not trained in MI and are not reinforcing it clinically. Future studies should address the questions of how intense or long term the coaching should be, and which environments are needed to produce proficiency.

Conclusion

Dental hygiene students in this study showed improvements in acquiring MI skills following a feedback/coaching session. MI is a useful tool in developing change in patient behaviors. Developing the use of MI skills through implementing educational curriculum changes would have a positive impact upon patient education. The goal of patient education is to have an effect upon behavior. MI provides an important health education strategy when implementing change in patient behavior and would have

a positive effect upon the overall health of individuals.

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Halitosis: A Review of Current Literature

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Introduction

Bad breath, halitosis and oral malodor are labels placed on an unpleasant smell or odor that may emanate from the oral cavity. With up to 50% of people worldwide assessing themselves as having frequent or constant incidents of malodor, it is a common complaint of many adults.¹ Advertisements in today's media focus on the American culture and its obsession with fresh smelling breath. The American public spends between \$1 billion and \$3 billion annually on gum, mints and breath fresheners.² Along with public concern, the American Dental Association Council on Scientific Affairs concludes that oral malodor is an identifiable condition that should be treated by the dental professional.³

The etiology of halitosis can be of systemic (extra-oral) or intra-oral origins. Halitosis is often caused by food debris and biofilm buildup on the teeth and tongue. The odor emanating from the oral cavity is produced by microbial putrefaction of the debris left in the mouth, resulting in the production of malodorous volatile sulfur compounds (VSCs). Systemic or extra-oral conditions may also produce volatile compounds that are eliminated through exhaled air, contributing to halitosis.¹

A literature search was conducted to assess the scientific community's recent (2000 to 2009) recommendations on classification, assessment, diagnosis, contributing factors, associated bacteria and treatment of halitosis. In this review, classification, assessment, diagnosis, treatment and management and contributing factors, both intra-oral and

Abstract

Purpose: Halitosis is defined as an unpleasant odor that emanates from the oral cavity with intra-oral and/or extra-oral origins. Fifty percent of people worldwide view themselves as having halitosis, with 90% of the etiology being intra-oral. Dental hygiene practitioners should be knowledgeable about the current classifications, diagnosis and treatment modalities to best meet the needs of patients either self-reporting or diagnosed with this problem. Classification of halitosis, assessment, diagnosis, intra-oral and systemic contributing factors, treatment, management and clinical application are discussed in this review.

Key Words: halitosis, oral malodor, bad breath, assessment, classification, diagnosis, treatment

This study supports the NDHRA priority area, Clinical Dental Hygiene Care: Assess the use of evidence-based treatment recommendations in dental hygiene practice.

systemic, will be discussed. Based on current literature and research, this review will help the reader bridge information into clinical application by suggesting protocols developed to assist patients in overcoming halitosis.

The term halitosis, also referred to as oral malodor, fetor ex ore, bromopnea and bad breath, is generally used to describe breath odor regardless of its origin. The term oral malodor describes odor from the oral cavity. In this review, the term halitosis will be used to describe odor originating from the oral cavity and other origins as well.

Classification of Halitosis

The International Society for Breath Odor Research established a method of classifying halitosis through scientific analyses.^{4,5} The classification system allows the dental team to identify causative factors and establish potential treatment protocols (Tables I and II). The significance of these categories

and recommended path of treatment will assist the dental hygienist with treatment planning and prioritization of care.

Assessment

There are 3 primary assessment measurements for genuine halitosis:^{5,6}

1. Organoleptic: a sensory test that is scored by a trained judge or clinician based on the perception of the judge or clinician
2. Gas chromatography: considered the method of choice for researchers, it makes a distinction between VSCs that contribute to halitosis and helps the clinician determine intra- or extra-oral origin
3. Sulfide monitoring: a portable device for monitoring VSCs. These monitors are better at measuring total VSCs instead of determining individual compounds

Organoleptic

There are several ways to perform this subjective measurement. One method is to insert a tube into the patient's mouth and while the patient exhales slowly, the examiner smells from the other end of the tube. Often, confidentiality is maintained through use of a screen. The assessment can also be performed by scraping the posterior dorsum of the tongue with a spoon and smelling the contents. Various scoring systems have been designed, however, most are based on a numerical scale of 1 to 5, with 1 being barely noticeable odor and 5 being extremely foul odor.^{4,6} Morning appointments for assessment are preferred. Participants are encouraged to arrive without having had anything to eat or drink, performed oral hygiene or used perfume or tobacco products. Examiners are also encouraged to refrain from drinking coffee, tea or juice and abstain from using tobacco or perfume.⁵

Gas Chromatography

With this device, the measurement of VSCs can be obtained and differentiated with samples from saliva, tongue coating and breath. This assists in determining the origin of halitosis.⁶ Tangerman and Winkel state that without this device, extra-oral blood-borne halitosis may never have been identified.⁷ While it is a highly objective measurement device, it is expensive and not financially feasible for most dental practitioners. New, more affordable portable devices are being developed.⁶

Sulfide Monitoring

This portable monitor measures VSCs by an electrochemical reaction with sulfur compounds found within the breath, which is generated from a tube in the patient's mouth. Electrical current that is generated is directly proportional to the levels of VSCs.⁶ The Halimeter® (Inter-scan Corporation, Chatsworth, Calif.) is the most recognized device for sulfide monitoring. Limitations

Table I: Classification of halitosis with corresponding treatment needs (TN)

Classification	Treatment Needs	Description
1. Genuine halitosis		Obvious malodor, with intensity beyond socially acceptable level is perceived.
a. Physiologic halitosis	TN-1	Malodor arises through putrefactive processes within the oral cavity. Neither a specific disease nor a pathologic condition that could cause halitosis is found. Origin is mainly the dorsoposterior region of the tongue. Temporary halitosis due to dietary factors should be excluded.
b. Pathologic halitosis		
i. Oral	TN-2	Halitosis caused by disease, pathologic condition or malfunction of oral tissues. Halitosis derived from tongue coating, modified by pathologic condition (e.g., periodontal disease, xerostomia), is included in this subdivision.
ii. Extra-oral	TN-3	Malodor originates from nasal, paranasal and/or laryngeal regions. Malodor originates from pulmonary tract or upper digestive tract. Malodor originates from disorders anywhere in the body whereby the odor is blood-borne and emitted via the lungs (e.g. diabetes mellitus, hepatic cirrhosis, uremia, internal bleeding).
2. Pseudo-halitosis	TN-4	Obvious malodor is not perceived by others, although the patient stubbornly complains of its existence. Condition is improved by counseling (using literature support, education and explanation of examination results) and simple oral hygiene measures.
3. Halitophobia	TN-5	After treatment for genuine halitosis or pseudo-halitosis, the patient persists in believing that he/she has halitosis. No physical or social evidence exists to suggest that halitosis is present.

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include an inability to accurately estimate levels of dimethyl sulfide, the compound shown to be most evident in extra-oral halitosis.⁷ It is most sensitive for hydrogen sulfide and less sensitive for methyl mercaptan. Also, if VSCs are shown to be low by the monitor, it may not accurately determine halitosis when other factors are involved such as

alcohols, phenyl compounds and polyamines.⁶

Other methods

1. BANA test: an operator-friendly test that detects gram-negative anaerobes and short-chain fatty acids on the dorsum of the tongue. However, the specific role of different bacteria in the

production of VSCs cannot be fully determined by this method⁶

2. Chemical Sensors: this gives the clinician the ability to measure VSCs from the periodontal pocket and on the tongue. A sulfide sensing element on the probe recognizes sulfide ions and measures their concentration⁶

Another option for assessing halitosis is to have the patient report what they are experiencing. In a study to determine a patient's ability to self-assess, researchers had patients self-evaluate using questionnaires and organoleptic scores and then compared them to more objective methods with a portable sulfide monitor. A significant correlation ($p < 0.001$) was established between patient self-assessments and the Halimeter[®] results of VSC levels.⁸

Diagnosis

In order for the proper treatment and management of halitosis to occur, an accurate diagnosis must be obtained. Steps towards an accurate diagnosis include a thorough medical history complete with dietary analysis and identification of personal habits. The patient's chief complaint should be understood and the dental and halitosis history, if any, recorded. Clinical observations of the tongue, teeth (including large carious lesions and faulty restorations),³ periodontal tissues and upper respiratory tract, along with a complete extra-oral exam, must be included as part of patient assessment.⁹ Once a thorough assessment has been completed, the dental hygienist can then classify the halitosis as genuine (extra-oral or intra-oral origins), pseudo or, in rare cases, as halitophobia. Understanding extra-oral and intra-oral origins is important for determining the appropriate course of treatment.

A study by Tangerman and Winkel⁷ was conducted to differentiate extra- and intra-oral halitosis. Analytical techniques were employed

Table II: Treatment needs (TN) for breath malodor

Category	Description
TN-1*	Explanation of halitosis and instructions for oral hygiene (support and reinforcement of a patient's own self-care for further improvement of their oral hygiene)
TN-2	Oral prophylaxis, professional cleaning and treatment for oral diseases, especially periodontal diseases
TN-3	Referral to a physician or a medical specialist
TN-4	Explanation of examination data, further professional instruction, education and reassurance
TN-5	Referral to a clinical psychologist, a psychiatrist or other psychology specialist

*TN-1 is applicable to all cases requiring TN-2 through TN-5

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to identify the volatile compounds associated with odor and their emanating origin. The diagnostic tools used were full-mouth and nose organoleptic odor assessments using a 0 to 5 scale of VSCs by means of the Halimeter[®] and the Winkel Tongue Coating Index (WTCI). Results showed clear distinctions in concentrations and location of VSCs between extra- and intra-oral halitosis. Subjects with intra-oral halitosis had odor stemming from the oral cavity but not the nose, whereas subjects with extra-oral halitosis had blood-borne odor that was measurable from both the mouth and nose. Dimethyl sulfide was the only malodorous compound found in significant levels for extra-oral halitosis, whereas methyl mercaptan and hydrogen sulfide were compounds most associated with intra-oral halitosis.

Intra-oral Contributing Factors and Bacteria Associated with Halitosis

Intra-oral contributing factors account for 90% of cases of halitosis in dental patients³ and are most often evident upon arousing from sleep.¹⁰ This malodor is usually caused by low salivary flow, lack

of oral hygiene and/or breathing through the mouth. However, for most individuals, the odor has no special significance, as it is resolved with brushing, flossing, eating and/or drinking water.¹⁰ Patients who experience halitosis of intra-oral etiology, not resolved by simple personal hygiene habits, usually have an infection in the mouth (caries or periodontal disease)¹⁰ or other factors such as gross dental neglect, smoking or xerostomia.²

As previously discussed, VSCs are produced in the mouth by bacterial putrefaction, which is the breakdown of substances such as food debris, cells, saliva and blood by enzymes produced from the bacteria. Amino acids are metabolized through this process, creating malodorous gases. Most common compounds are hydrogen sulfide, methyl mercaptan and dimethyl sulfide.^{1,3,10} The most common bacteria to produce these compounds are gram-negative anaerobic bacteria, such as *Porphyromonas gingivalis*, *Prevotella intermedia*, *Fusobacterium nucleatum*, *Bacteroides forsythus* and *Treponema denticola*.^{1,10} Many sites harbor these bacteria, such as teeth, buccal mucosa, periodontal pockets, faulty restorations and re-

movable partial dentures. However, the posterior dorsal surface of the tongue is considered the primary site in cases of halitosis.^{1,3,10}

To determine the relationship of VSC concentrations to tongue coating and periodontal health, Lee et al¹¹ used gas chromatography to sample mouth air prior to tongue scraping and after prophylaxis and tongue scraping. With a population of 40 subjects, mouth air was sampled for a baseline, and then tongue scraping was performed with another mouth air testing. This was followed by a prophylaxis with mouth air testing performed again, totaling 3 different times that mouth air was tested. Each tongue scraping was also evaluated by weight. The subjects were divided by levels of methyl mercaptan into high and low halitosis groups. VSC concentrations were higher in those with high methyl mercaptan levels prior to tongue scraping. However, both groups had decreased levels of methyl mercaptan after tongue scraping. Evaluation of periodontal health showed that 73% of the high methyl mercaptan group had 1 or more periodontal pockets greater than 4 mm as compared to 38.1% of the low methyl mercaptan group. Each group showed significant differences in all measurements except for tongue coating weight. It was concluded that the tongue is a strong contributor to halitosis by harboring bacteria that produce VSCs and that periodontal disease can also contribute to VSC production. This study supported earlier findings of Morita and Wang that intra-oral malodor and VSC levels significantly correlated with tongue coating and periodontal disease condition.¹²

Under magnification, the tongue is compared to the "surface of the moon after a rain shower."² Craters, fissures and peaks are covered with a fine sticky substance that harbors the malodorous bacteria. Researchers reported that a single epithelial cell in the oral cavity can harbor up to 25 bacteria, whereas 1 epithelial

cell on the dorsum of the tongue can harbor up to 100 bacteria.¹³ Crevices of the tongue create an ideal environment for the bacteria to proliferate and produce VSCs. The dorsum of the tongue and its bacteria has been the subject of several studies.¹³⁻¹⁵

A microbiological analysis of the tongue was conducted on patients with and without halitosis by Donaldson et al.¹⁴ The experimental group (halitosis patients) and control group (patients without halitosis) had samples taken from the posterior dorsum of the tongue. The subjects with halitosis were classified using an organoleptic assessment and a Halimeter[®]. After incubation under anaerobic conditions, the samples were analyzed. Both groups had a predominant level of Veillonella, Prevotella and Fusobacterium species. The halitosis group, however, presented with more diverse species. Many of these species were unidentifiable gram-negative and gram-positive rods, along with gram-negative coccobacilli. The researchers concluded that halitosis is a result of multifaceted interactions between diverse species of bacteria.

The correlation between diverse, unidentifiable bacteria and halitosis was supported in a study designed to identify bacterial species on the tongue associated with halitosis.¹³ Researchers took samples from 8 adult subjects with halitosis and 5 control subjects who did not have halitosis. The samples were taken from the dorsum of the tongue by scraping an area of about 2 square cm. Halitosis assessments occurred by organoleptic means and a portable sulfide detector. Bacterial species were identified, and the thickness and extent of tongue coating was determined. The results of the study indicated that both common and uncommon species were present in the experimental and control groups. Most prevalent bacterial species in both groups were Streptococcus salivarius, Prevotella melaninogenica, Streptococcus

parasanguinis, Campylobacter concisus and Streptococcus mitis. However, bacteria were present in greater number and with greater diversity in the halitosis or experimental group. Among the bacteria identified, 32 were present solely in the halitosis group (84 bacterial species in the halitosis group, with 16 to 23 per subject, 69 in the control group, with 11 to 19 species per subject). Thirteen of these species were unidentifiable or uncultured. Solobacterium moorei was the key species unique to all halitosis subjects. S. moorei is a gram-positive bacteria first noted in human feces and has been linked to bacteremia, septicemia and refractory endodontic infections. The findings of this study confirmed the importance of the presence of specific bacterial species associated with halitosis and the differences between patients.

Riggio et al¹⁵ confirmed earlier findings of Donaldson et al.¹⁴ A diversity of bacteria, unidentifiable species and a greater abundance of bacteria were again identified in the halitosis subjects. The bacterial species Veillonella, Prevotella and Fusobacterium were identified in both test groups. However, no significant periodontal pathogens were observed. It was recommended that further studies investigate the process and amount of VSC production by individual bacterial species.

As the understanding of the role played by bacteria grows, researchers are examining other areas of the oral cavity as potential sources of VSCs. It has long been accepted that there is a link between periodontal disease and oral malodor.^{16,17} Hydrogen sulfide and methyl mercaptan, both associated with intra-oral halitosis, have been found to potentially facilitate the penetration of lipo-polysaccharide into the gingival epithelium, thus inducing inflammation.¹⁶ Hydrogen sulfide and methyl mercaptan are also thought to aid in bacterial invasion of the connective tissue by their toxic effects on epithelial cells.¹⁶ Methyl mercaptan was shown to hinder ep-

ithelial cell growth and production in a study conducted by Setoguchi et al.¹⁸ Researchers were surprised to find that gingival fibroblasts were left unaffected.

Recently, levels of VSCs were evaluated in 72 patients with chronic periodontitis to assess outcomes after tongue scraping, non-surgical periodontal therapy and oral hygiene instruction.¹⁹ Pre-treatment measurements were taken by organoleptic test scores and VSCs measured with the OralChroma™ device (Abilit Corp., Osaka City, Japan), a portable gas chromatograph. Periodontal examinations, along with full-mouth radiographs, were completed. Tongue scraping, non-surgical periodontal therapy and oral hygiene instructions, including the use of chlorhexidine rinse (CHX), were each followed with a VSC measurement. For each treatment, a progressive reduction of VSCs occurred during the course of the study. Hydrogen sulfide levels showed the most significant decrease after each treatment, whereas methyl mercaptan decreased only following tongue scraping and oral hygiene instructions that included rinsing with CHX. There was no correlation between pocket depth and concentrations of VSCs. The researchers concluded this contradiction with past research occurred because they measured VSCs indirectly versus measuring levels directly from the pocket. While tongue scraping alone produced the largest decrease of VSCs, the researchers concluded that tongue scraping in conjunction with periodontal therapy significantly reduced oral malodor.

A study was conducted by Awano et al²⁰ to determine the relationship between periodontal disease-associated bacteria and oral malodor production. One hundred and one adults were classified into 3 groups: patients with halitosis and pocket depths greater than 4 mm, patients with halitosis without pocket depths greater than 4 mm and non-halitosis patients without pocket depths greater than 4 mm. Gas chromatog-

raphy was used to evaluate hydrogen sulfide and methyl mercaptan concentration levels. Saliva was then collected from each subject to determine levels of periodontal pathogenic bacteria. Subjects with *B. forsythus* in saliva were shown to have higher levels of VSCs and more severe periodontal conditions compared to those without. Subjects with higher levels of *P. gingivalis* had higher levels of methyl mercaptan production. *Actinobacillus actinomycetemcomitans* and *P. intermedia* presence in saliva did not correlate with VSC production in subjects.

Extra-oral Factors Contributing to Halitosis

Approximately 10% of halitosis cases originate from systemic conditions or a location other than the oral cavity. Such cases are referred to as extra-oral halitosis.^{3,7} Therefore, the dental hygienist must be diligent in completing a thorough medical history to understand all possible origins.³ Possible systemic contributors associated with extra-oral halitosis are identified in Table III.

Extra-oral halitosis can be further categorized by origin, either respiratory tract or blood-borne. Tangerman reported that upper and lower respiratory tract origins usually result from anaerobic infections, ulcerations and/or cancer. Confirmation of upper and lower respiratory tract halitosis is largely based on medical assessments of these systems.²¹ Infections of the respiratory tract create discharge from the nasal and sinus cavities, which in turn can contribute to halitosis and tonsillitis.¹

Table IV presents the causes of extra-oral halitosis with blood-borne origins and the associated odorants.²¹ Odorants are produced in the blood and transported to the lungs. Pulmonary emissions of these odorants and their associated toxins are exhaled through the nose and mouth.^{2,21}

Extra-oral halitosis from blood-

borne sources may originate from any compound. However, the most identifiable odorant is dimethyl sulfide.² For example, trimethylamine has been described as the substance contributing to Fish-odor Syndrome or Trimethylaminuria. This disorder is differentiated by greater than normal levels of trimethylamine in the body and is distinguished by the smell of rotting fish emanating from breath, sweat and urine.²² Gene mutations and the body's inability to produce enzymes to break down the compound account for most cases. However, it has also been noted in individuals with kidney or liver disease, a small number of premature babies and, in a few cases, women at the start of menstruation. This condition should no longer be considered rare as more cases are being recognized.²²

Moshkowitz et al studied the relationship of halitosis and upper gastrointestinal diseases.²³ One hundred and thirty-two patients complaining of upper gastrointestinal symptoms were included in the study. Each patient completed a questionnaire that included questions about bad breath. The study was designed to measure the severity and presence of reflux and other gastrointestinal diseases. Subjects were then given an upper gastrointestinal endoscopy. The final diagnoses of these patients revealed no significant relationship or correlation between patient-perceived (self-assessed) halitosis and gastrointestinal diseases such as functional dyspepsia, peptic ulcer or *Helicobacter pylori* infection. However, there was a significant association between patient-perceived (self-assessed) halitosis and gastroesophageal reflux disease (GERD) ($p=0.002$). Researchers suggested that halitosis caused by GERD resulted from direct damage to the oropharyngeal mucosa, causing inflammation. While the study was limited to patient-perceived halitosis, the findings concluded that it is important to recognize halitosis as a symptom of GERD, and physicians and den-

Table III: Systemic Causes of Halitosis¹

<ul style="list-style-type: none"> • Acute febrile illness • Respiratory tract infection (usually upper) • Helicobacter pylori infection • Pharyngo–esophageal diverticulum • Gastroesophageal reflux disease (GERD) • Pyloric stenosis or duodenal obstruction • Hepatic failure • Renal failure • Diabetic ketoacidosis • Leukemia • Trimethylaminuria • Hypermethioninaemia • Menstruation (menstrual breath)

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tal practitioners should consider it a manifestation of the disease.

In a case study by Murata et al,²⁴ a 33-year-old Japanese woman's chief complaint was bad breath of about 1 month duration. She had a previous diagnosis of asthma and had received periodic examinations. Medications for the treatment of asthma included suplatast tosilate administered after each meal for treatment of asthma. Her VSC levels were measured with a gas chromatograph. An attempt to remove intra-oral odor was completed with tooth brushing, flossing, inter-dental brushing and tongue cleaning. Prophylaxis by a dentist was completed twice a week for the first 2 weeks and then periodic check-ups were executed every 3 months. No disinfectants were used before measurements of VSC levels were obtained. The results showed levels of methyl mercaptan and hydrogen sulfide were significantly lower following treatment, but levels of dimethyl sulfide remained stable. The examiners suspected that dimethyl sulfide was a side effect of the asthma medications. Upon discontinuation of the medication, dimethyl

Table IV

Causes of blood-borne halitosis	Odorant
Systemic diseases <ul style="list-style-type: none"> • Hepatic failure/liver cirrhosis • Uremia/kidney failure • Diabetic ketoacidosis/diabetes mellitus 	<ul style="list-style-type: none"> • Dimethyl sulfide • Dimethylamine, trimethylamine • Acetone
Metabolic disorders <ul style="list-style-type: none"> • Isolated persistent hypermethioninemia • Fish odor syndrome, trimethylaminuria 	<ul style="list-style-type: none"> • Dimethyl sulfide • Trimethylamine
Medication <ul style="list-style-type: none"> • Disulfiram • Dimethyl sulphoxide • Cysteamine 	<ul style="list-style-type: none"> • Carbon disulfide • Dimethyl sulfide • Dimethyl sulfide
Food <ul style="list-style-type: none"> • Garlic • Onion 	<ul style="list-style-type: none"> • Allyl methyl sulfide • Methyl propyl sulfide

Tangerman A. Halitosis in medicine: A review. *Int Dent J*. 2002;52(Suppl 3):201–206.¹⁹

sulfide was not detected. This case study emphasizes the need for the dental hygienist to recognize the extra-oral manifestations of halitosis, such as patient medications, so that referral to an appropriate physician occurs.

Treatment and Management

Mechanical Reduction

As in most oral diseases, mechanical removal of biofilm and microorganisms is the first step in control of halitosis.⁹ Brushing and flossing of teeth are important, but tongue cleansing is paramount for halitosis reduction. It is estimated that approximately 60% of VSCs originate on the surface of the tongue.^{9,25} In a study conducted to compare the effects of polystyrene tongue scrapers and toothbrush bristles on the surface of the tongue against measurable VSCs, the tongue scraper performed at 75% reduction while the toothbrush bristles reduced levels of VSCs by 45%. Patients reported they preferred the tongue scraper over the toothbrush.²⁶

In a Cochrane systematic review of tongue scrapers, researchers conducted a database search for randomized clinical trials.²⁷ Research-

ers concluded that, although tongue scrapers produced a reduction in VSCs when compared to tooth brushing, they did not have a long-term effect and were only slightly more effective than tooth brushing alone. Limited evidence of tongue trauma with aggressive use was also reported.

Recently, manufacturers have included a tongue cleansing device on the back of toothbrush heads. Researchers wanted to determine if these devices were as effective as conventional tongue scrapers.²⁸ Using a Halimeter® to score breath air and non-stimulated saliva for microbial analysis, it was determined both methods of cleansing the tongue were equally effective in reducing the number of bacteria on the tongue and VSCs.

To understand how different methods of oral hygiene reduced halitosis and VSC concentrations in morning breath, Faveri et al conducted a cross-over study of 19 volunteers who were divided into 4 groups.²⁹ Baseline and end-of-study VSC concentrations were determined with a Halimeter® and organoleptic scores were obtained. Assigned groups were given different oral hygiene regimens: Group

I tooth brushing, Group II tooth brushing and inter-dental flossing, Group III tooth brushing and tongue scraping and Group IV tooth brushing, inter-dental flossing and tongue scraping. Subjects performed procedures 3 times a day for 7 days. Morning breath was evaluated again at the end of the study. The highest mean score for both measurements was found in the 2 groups that excluded tongue scraping. The 2 groups that included tongue scraping revealed a statistically significant difference from groups that did not use the tongue scraper ($p < 0.05$). This confirmed prior research that the tongue is the recognized site for most VSC production and tongue scraping results in an improvement in breath quality.^{14,15}

Chemotherapeutic Reduction

Toothpastes and mouth rinses have long been used to help reduce halitosis through chemotherapeutic reduction. The most common active ingredients included in these products are triclosan, essential oils, cetylpyridinium chloride (CPC) and CHX.⁹ Zinc, another active ingredient in mouthwash, has been shown to be effective by inhibiting bacterial breakdown of proteins, thus inhibiting VSC production.²⁵ Chlorine dioxide solution (0.1% solution) has also been shown to maintain VSCs at lower levels when compared to a placebo mouth rinse.³⁰

Roldan et al³¹ researched 5 different commercial mouth rinses, all containing CHX. Each product differed in concentration and additives including alcohol, sodium fluoride, zinc lactate and CPC. The researchers wanted to determine their efficacy in reducing salivary bacterial count and VSCs in expelled air. Methods included a randomized, double-blind, cross-over design and included un-stimulated saliva samples from subjects to determine bacterial count. Halitosis was measured by calibrated examiners with an organoleptic assessment of ratings on a 0 to 5 numerical scale. Bacterial count and VSC levels were

recorded for each sampling of time and product used. Results showed that formulations of CHX combined with CPC attained the best results for reduction in both VSCs in expelled air and salivary bacterial count. CHX combined with sodium fluoride was the least effective of the formulations for both bacterial count and VSCs. CHX and zinc lactate had the best effect after 1 hour, but did not sustain this effect at the 5 hour mark. Inability to correlate the results with tongue coating indices was identified as a study limitation.

Thrane et al³² also tested a formula of zinc acetate and CHX in low concentrations against other existing formulations. Researchers hypothesized that the low concentrations would be more effective in reducing hydrogen sulfide in mouth air. The population sample included 10 healthy volunteers in a double-blind clinical study. Baseline hydrogen sulfide levels were standardized by first rinsing with a solution of L-cysteine. A mouth air sample was then obtained and analyzed by a gas chromatograph. The subjects were tested using different mouth rinses containing the following active ingredients: essential oils, CHX combined with CPC, triclosan, CPC alone, zinc gluconate and zinc acetate at 0.3% combined with CHX at 0.05%. Statistically significant results occurred in all 10 volunteers after using low levels of zinc acetate and CHX mouth rinse ($p < 0.05$). The formula not only inhibited hydrogen sulfide, but continued to show reductions at the 3 hour mark. It was speculated that low concentrations of zinc acetate and CHX molecules provide sites for the sulfur ion to bind to. Subjects also reported fewer side effects such as discoloration, metallic taste and mucosal desquamation at the lower concentration level than when stronger concentrations were used.

A study was conducted by Fine et al³³ to investigate the efficacy of either essential oil mouth rinse con-

taining 0.09% zinc chloride as an anti-calculus agent (Tartar Control Listerine® Antiseptic) and a rinse containing 5% hydro-alcohol in controlling pathogens associated with halitosis. Baseline bacteria samples were obtained from subgingival buccal surfaces of posterior teeth and the dorsum of the tongue from all participants. All subjects were given an ADA approved dentifrice and soft toothbrush to use during the trial. Subjects were examined 12 hours after the first rinse and again after 2 weeks of rinsing twice daily, with measurements taken 12 hours after the last rinse. The study was a randomized, double-blind, controlled crossover design. Bacterial samples were taken at the designated 12 hour marks for each time period. Results showed a statistically significant reduction in bacteria both on subgingival buccal surfaces and the dorsum of the tongue after the 12 hour mark of the first rinse containing essential oils and 0.09% zinc chloride ($p < 0.001$). Reductions were even higher after 14 days of use.

A systematic review, published by Cochrane, compared the effectiveness of mouth rinses in controlling halitosis. Baseline characteristics, diversity of subjects and measurement methods prevented the possibility of a meta-analysis between chosen studies. However, the researchers concluded that mouth rinses containing CHX and CPC can inhibit production of VSCs, while mouth rinses containing chlorine dioxide and zinc may neutralize the sulfur compounds producing halitosis.³⁴

A widely used ingredient in many oral health products is triclosan. It is lipid-soluble and recognized for its antibacterial and anti-plaque effects. It has also been acknowledged as having broad-spectrum effects on gram-negative microbes.⁶ When combined with copolymer, it adheres to soft and hard tissues for up to 12 hours.³⁵

In a study to determine the effectiveness of a triclosan/copolymer/

sodium fluoride dentifrice (0.243%), Hu et al tested the dentifrice against an over-the-counter product containing 0.243% sodium fluoride.³⁶ A 3 week, randomized, double-blind, longitudinal clinical trial was conducted. Organoleptic judges were calibrated to examine the subjects at 1.5, 4 and 12 hours after subjects used their assigned toothpaste. This evaluation was followed each week for 3 weeks to assess odor scores. There was no difference in baseline scores for the 2 groups. Breath odor scores showed a statistically significant reduction for the triclosan dentifrice of 87.8 to 97.6% at each examination. Percentage ranges for the dentifrice containing only sodium fluoride were 0 to 10%. Researchers concluded that the triclosan/copolymer/sodium fluoride dentifrice reduced oral malodor for up to 12 hours.

A Combined Therapeutic Approach

In an effort to explore combined therapeutic approaches, Roldan et al aimed to treat halitosis by evaluating a mechanical and chemotherapeutic protocol.³⁷ Nineteen patients were followed for 3 months and evaluated with organoleptic and VSC level assessments, tongue coating indices, periodontal variables, bacterial ratios in oral niches and subgingivally and bacterial flora of the saliva and tongue. Treatment for each patient included a prophylaxis, oral hygiene instructions that included tongue scraping and use of a mouth rinse that contained CHX, CPC and zinc lactate. Variables were measured at 1 month and 3 months after the baseline. Results showed that periodontal and halitosis pathogens were reduced at both the 1 and 3 month measurements. Of the microflora evaluated, *P. gingivalis* was most affected. Mean probing depths and plaque levels decreased significantly after 3 months. Tongue coating indices were reduced significantly along with organoleptic scores ($p < 0.001$) and VSC levels ($p < 0.05$). Researchers concluded

and results demonstrated that oral halitosis can be managed.

Clinical Application

The scenario is familiar. A patient enters the dental clinic, hoping for answers to a question that may be difficult to ask: “Do I have bad breath?” and “What can I do about it?” The clinician, in a confident and professional manner, needs to then follow established evidence-based protocols to help the patient.

Ideally, the first step is to establish the origin of the malodor. A thorough medical history along with diet and medications needs to be confirmed.¹ Intra-oral and extra-oral halitosis have different treatment protocols with distinguishable VSCs.^{4,5} However, not all clinicians have access to instruments that document VSCs or exact levels. The organoleptic assessment is the most common method to evaluate halitosis,³ and the research shows that patients are even capable of scoring their own malodor.⁸ An assessment taken in the morning before eating and oral hygiene procedures is best.⁴⁻⁶

When the clinician follows treatment protocols established by the International Society for Breath Odor Research (Table II), all patients are instructed in correct oral hygiene habits, including the important step of tongue cleansing.²⁹ Beyond the patient’s ability to cleanse the teeth and tongue, researchers recommend an oral prophylaxis as an important step in mechanical removal of causative volatiles and bacteria and control of halitosis.^{1-3,9,38} If either hard tissue or periodontal diseases are present, they must be treated as contributors of halitosis. In addition, faulty restorations should be replaced.^{3,5,38} Chemotherapeutics have demonstrated effectiveness as an adjunct to therapy. Based on current research, a dentifrice with triclosan³⁶ can be recommended along with a mouth rinse that would contain either CHX or CPC to inhibit production of VSCs or chlorine di-

oxide and zinc to neutralize the sulfur compounds.³⁴

If the halitosis is not resolved with the above-mentioned measures, additional assessment needs to be conducted to determine if it is extra-oral and/or blood-borne halitosis. The best method for this is to use gas chromatography as it distinguishes between hydrogen sulfide, methyl mercaptan and dimethyl sulfide.⁶ Dimethyl sulfide is the VSC most associated with extra-oral halitosis.^{2,7,21} If measured in high levels, with the reviewed health history considered, the patient would be referred to a physician for further evaluation.⁷ In rare cases, pseudo-halitosis can be resolved with education, and those patients exhibiting halitophobia will need to be referred to a therapist.^{4,5,38,39}

Conclusion

Fifty percent of the public worldwide suffers from some form of oral halitosis and is looking to the oral health care professional for guidance. Upon satisfactory completion of treatment for halitosis, research has shown that patients recognize an improvement in social life and satisfaction of care.⁴⁰ Since halitosis is a recognizable condition, and a common chief complaint among patients,³ the clinician should be prepared to diagnose, classify, treat and manage patients that suffer from this uncomfortable and sometimes socially debilitating condition.

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An Analysis of Student Performance Benchmarks in Dental Hygiene via Distance Education

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Introduction

Educational opportunities continue to grow exponentially in colleges and universities across the United States because of the implementation of technologically based delivery systems.¹ Distance learning (DL) or distance education (DE), defined as the learner and facilitator separated by physical space, is facilitated by rapid advances in today's technology.² Technological changes, including computer use and fiber-optic cabling, synchronous interactive television systems (ITV) and other hybrid configurations, allow learning in other than the traditional face-to-face classrooms.³

In 2002, 1.6 million students took courses on-line across the United States. By 2003, the number of online course enrollees climbed to 1.97 million, succeeded by 2.33 million in 2004.^{4,5} Delivery of online courses requires a technological platform and computer.⁶ Continued growth and expansion of online coursework is now an integral element of mainstream higher education – 63% of schools offering undergraduate face-to-face programs also offer undergraduate programs online.⁷ Three graduate programs, 35 undergraduate and 12 dental hygiene degree completion programs in the United States now use varying forms of DL.^{8,9} Even though a significant body of literature exists documenting participant satisfaction using alternative mediums for delivering dental hygiene courses,¹⁰⁻¹² only one published quantitative

Abstract

Purpose: Three graduate programs, 35 undergraduate programs and 12 dental hygiene degree completion programs in the United States use varying forms of Distance Learning (DL). Relying heavily on DL leaves an unanswered question: Is learner performance on standard benchmark assessments impacted when using technology as a delivery system? A 10 year, longitudinal examination looked for student performance differences in a Distance Education (DE) dental hygiene program. The purpose of this research was to determine if there was a difference in performance between learners taught in a traditional classroom as compared to their counterparts taking classes through an alternative delivery system.

Methods: A longitudinal, ex post facto design was used. Two hundred and sixty-six subject records were examined. Seventy-seven individuals (29%) were lost through attrition over 10 years. One hundred and eighty-nine records were used as the study sample, 117 individuals were located face-to-face and 72 were at a distance. Independent variables included time and location, while the dependent variables included course grades, grade point average (GPA) and the National Board of Dental Hygiene Examination (NBDHE). Three research questions were asked: Were there statistically significant differences in learner performance on the National Board of Dental Hygiene Examination (NBDHE)? Were there statistically significant differences in learner performance when considering GPAs? Did statistically significant differences in performance exist relating to individual course grades? T-tests were used for data analysis in answering the research questions.

Results: From a cumulative perspective, no statistically significant differences were apparent for the NBDHE and GPAs or for individual courses.

Conclusions: Interactive Television (ITV), the synchronous DL system examined, was considered effective for delivering education to learners if similar performance outcomes were the evaluation criteria.

Key Words: Distance Education, Distance Learning, Outcomes, Benchmarks, Dental Hygiene, Assessment, Student Performance, Allied Health

This study supports the NDHRA priority area, Professional Education and Development: Validate and test measures that evaluate student critical thinking and decision making skills.

research study existed verifying actual performance while receiving dental and dental hygiene education using various alternative delivery

systems.¹³ Quantitative analyses of performance benchmarks from a programmatic perspective, such as grade point average (GPA), course

grades and scores on national examinations provide research evidence of individual's educational experiences in alternative delivery programs.

The purpose of this study was determining whether face-to-face learners performed differently on established benchmark assessments than their classmates located at a distance. The defined benchmarks include course grades, GPAs and the National Board of Dental Hygiene Examination (NBDHE). A longitudinal examination of benchmark scores during a 10 year period looked for statistically significant differences in performance. Evaluation of entire educational programs, rather than single courses, addressed issues concerning data reliability, validity and the American Dental Association Commission of Dental Accreditation (ADA CODA) Standard 1, relating to Institutional Effectiveness.

Review of the Literature

The ADA CODA Standard 1 requires that "benchmarks or measures of learning are used to demonstrate effectiveness"¹⁴ and are documented in the areas of planning and assessment. Addressing the quality of educational programs is the intent of this Standard. Educational programs have a responsibility to assure the ongoing cycle of educational assessment, planning and implementation. Evaluation assures learners receive current, relevant and cost efficient educational programming. Programs are accountable to stakeholders in assuring educational programs meets the ADA CODA Quality Standards. A key consideration of the Standards is broad-based, systematic, continuous data collection and analysis, which is designed to evaluate and promote achievement of program goals while maximizing academic success of enrolled students. The CODA Standard allows programs to identify their own goals, assuring competence within the discipline. Ongoing program assessment

uses the NBDHE, GPAs and course grades to provide direct benchmark measures that are indicators of Institutional Effectiveness. Indirect measures, including retention, attrition, program transfer and employer satisfaction data also identify and document areas for continuing process and program improvements.

Educational technology continues transforming dental hygiene education at a rapid pace. A review of the current dental hygiene literature indicates various program delivery models are being used by educational institutions and program administrators to implement alternative delivery methods for teaching and learning, as well as ongoing assessment.¹⁵⁻¹⁷ As institutions consider expanding learning using DL as a delivery modality, theoretical constructs need to be considered, such as those offered by Gussy et al¹⁸ and Magnussen,¹⁹ or theorized by this researcher. Additionally, as institutions consider advancing the profession at large by expanding educational opportunities for degree completion as suggested by Monson and Engeswick,²⁰ it is crucial the concrete, statistical measures of predictive performance be examined.²¹⁻²² A focus on statistical performance measures for authentication instead of learner satisfaction data can provide a solid, evidence-based groundwork for continued use of DL for dental hygiene education. As dental hygienists seek to pursue degree completion and additional certification, it is important that both institutional and programmatic decisions are made based on solid predictors of academic performance over time rather than only student satisfaction surveys or outlier data from 1 or 2 courses.¹⁰⁻¹²

Methodology

This research was designed to address the question: To what extent was learner performance on standard benchmark assessments impacted when using technology as a delivery system? The evaluation of NBDHE scores, course grades and

GPAs may ascertain program effectiveness in the delivery of dental hygiene education. Learners were self-selected for statistical analysis based on location. The first group consisted of face-to-face (host site) learners while the second group consisted of learners located at a distance from the instructor via ITV. The study design evaluated if face-to-face and distance participants had statistically significant differences in performance.²² Independent variables included location and time. Location determined group assignment while time included examining graduate populations from 1997 through 2006. Dependent variables included course GPAs, cumulative GPAs and NBDHE scores.

Research Questions

Three questions were asked regarding documentation of performance between face-to-face and distance college learners:

1. Were there significant statistical differences in performance on the NBDHE?
2. Were there significant statistical differences in GPAs?
3. Were there significant statistical differences in individual course grades?

Population

This study's research population began with 266 students from the graduating classes of 1997 through 2006. One hundred and eighty-nine students graduated from the program in 10 years. There were 117 (44%) face-to-face instructor-lead learners, while 72 (27%) used the ITV system. All data files for the learners who graduated (n=189) were used for the study.

Over the 10 year period, 77 students (29%) did not complete all educational coursework and graduate. Learners were required to complete exit interviews with a neutral party upon deciding to leave the program and institution. The data collected from individuals who did not complete the program (n=77) was used as part of the program effectiveness

process. Thirty–six persons (13.5%) not completing were located face–to–face and 41 persons (15.5%) received didactic education through ITV. Academic performance, while one reason for attrition, was not considered a major factor. Attrition was equally distributed between both groups and was attributed to several categories beyond academic performance, including personal, health, ethical conduct considerations, military commitments, the profession not being “right” for the individual and death of 1 participant. It should also be noted the majority of attrition occurred during the first year of the program. The state where the research data was gathered has a statewide curriculum in place for dental hygiene education. This permits students to change academic location, if space is available, within the state. As individual personal situations change and people move, they can still complete educational programs elsewhere. While considering the data, it should be noted a substantial number of individuals (n=14) transferred to different programs within the state, taking advantage of the statewide curriculum if personal situations warranted its necessity. Ten persons withdrew, citing they did not like instructor. This information is also important from a programmatic perspective as we consider CODA Standard 1. Seventy–five percent of participants completed the program and graduated. Colleges and universities have the latitude under the auspices of CODA Standard 1 to determine acceptable levels of attrition. While 29% of individuals not completing the program over a 10 year period might seem high, when considering Institutional Effectiveness, the program used the data to make continual revisions to the admissions process, faculty teaching assignments and tenure decisions. Positive impacts on increasing the state’s health care provider numbers and cost/benefit to the state’s economy were also factors documented to meet CODA Standard 1. Upon closer review, the

Table I: Ten year Cumulative Analysis of National Board Dental Hygiene Examination Scores by Host and Distance Learners

Year	Location	N	Mean	df	t–value	2–Tailed Prob.
1997–2006	Host	114	89.19	183	–.109	.914
	Distance	71	89.79			
*p < .05						

Table II: Ten year Analysis of Cumulative GPAs by Host and Distance Learners

Year	Location	N	Mean	df	t–value	2–Tailed Prob.
1997–2006	Host	117	3.37	186	–1.079	.282
	Distance	71	3.43			
*p < .05						

data demonstrates, despite this attrition, the program was effective in providing and graduating dental hygienists using DL as an educational delivery mechanism.

Data Analysis

For each research question, independent group t–tests determined if any statistically significant differences existed. Data was analyzed year–by–year, course by course and through cumulative comparisons. Furthermore, a t–test was applied to the aggregated group’s data. Only a portion of the data findings are reported here. Data analysis was conducted for documenting program effectiveness of DL. The results of this study, in documenting learner performance for an entire program, addresses one of 2 “gaps” noted in the scientific literature by Phipps and Merisotis²³ – research learner outcomes for entire academic programs and not just for individual courses. Phipps and Merisotis also recommended proposing and using a conceptual framework for consideration and potential testing for further DL research, which is posited separately by this author.

Statistical Significance

Statistical level of significance (p–value) was set at p<0.05. This value level is a routine alpha–level for probability testing of null hypotheses.

Results

Each of the study’s research questions are addressed based upon the statistical analyses while looking at each individual supposition. Discussion highlights findings from a program perspective, examining program effectiveness over time that may be of concern to allied health administrators and educators.

Research Question 1

The first research question asked: Did significant statistical differences in performance on the NBDHE exist between face–to–face and distance college learners? Cumulative data demonstrated no statistically significant difference existed between host and distance learners’ performance over a 10 year period (Table I).

Research Question 2

The second research question asked: Did significant statistical differences in GPAs exist between face–to–face versus DE college–level learners? No statistically significant differences existed between host and distance learners’ performance related to cumulative GPAs for the 10 cohorts (Table II).

Research Question 3

The third research question asked: Did significant statistical differences in individual course grades

exist between face-to-face and distance college learners? Data was analyzed answering this question in 3 different ways: cumulatively, year by year and course by course, to identify any existing statistically significant trends. Only the results of the cumulative analysis are addressed here. Comparing cumulative learner performance for the core dental hygiene courses revealed no statistically significant differences (Table III). It was determined no statistically significant differences existed in learner performance for the program's entire didactic academic curriculum over a 10 year period. It is important to note that year by year and course by course, statistically significant results were identified.

The results were evaluated from a programmatic perspective while examining trends that might be of concern when considering CODA Standard 1. The results of the study, reflecting a 10 year period of comparative data, identified no statistically significant performance differences between face-to-face and distance learners on the various benchmark measures evaluated.

Analysis of NBDHE scores, GPAs and cumulative core course grades were used to determine if CODA Standard 1 was met. Program completion rates, graduate success on the analyzed benchmarks, program improvement and change based on assessment data, plans, timelines and programs effectiveness in meeting the stated missions, goals and strategic plans are all used as evidence documenting Institutional Effectiveness. The data analyzed here as a component of effectiveness assessment suggests DE was as effective as traditional methods for delivering educational programming.

Question 1

As a trend over time, no major differences were observed in performance on the NBDHE between host and distance learning cohorts. The research presented in Table I

Table III: Ten year Analysis of Core Dental Hygiene Courses

Oral Anatomy (508–101) Course Averages by Host and Distance Learners						
Student Year	Location	n	Mean	df	t-value	2-Tailed Prob.
1997–2006	Host	107	2.96	134	1.223	.223
1997–2006	Distance	69	2.84			
Dental Hygiene Theory I (508–113) Course Averages by Host and Distance Learners						
Student Year	Location	n	Mean	df	t-value	2-Tailed Prob.
1997–2006	Host	114	3.73	184	1.445	.150
1997–2006	Distance	72	3.64			
Nutrition (508–114) Course Averages by Host and Distance Learners						
Student Year	Location	n	Mean	df	t-value	2-Tailed Prob.
1997–2006	Host	107	3.36	177	.001	.999
1997–2006	Distance	72	3.36			
Periodontology (508–115) Course Averages by Host and Distance Learners						
Student Year	Location	n	Mean	df	t-value	2-Tailed Prob.
1997–2006	Host	111	3.05	179	.853	.395
1997–2006	Distance	70	2.97			
Oral Pathology (508–122) Course Averages by Host and Distance Learners						
Student Year	Location	n	Mean	df	t-value	2-Tailed Prob.
1997–2006	Host	109	3.41	129	1.19	.233
1997–2006	Distance	72	3.30			
Dental Pharmacology (508–123) Course Averages by Host and Distance Learners						
Student Year	Location	n	Mean	df	t-value	2-Tailed Prob.
1997–2006	Host	116	3.35	185	.322	.748
1997–2006	Distance	71	3.32			
Dental Hygiene Theory II (508–124) Course Averages by Host and Distance Learners						
Student Year	Location	n	Mean	df	t-value	2-Tailed Prob.
1997–2006	Host	117	3.65	187	1.199	.232
1997–2006	Distance	72	3.57			
Community Dental Health (508–131) Course Averages by Host and Distance Learners						
Student Year	Location	n	Mean	df	t-value	2-Tailed Prob.
1997–2006	Host	116	3.70	186	-1.09	.913
1997–2006	Distance	72	3.71			
*p < .05						

provides exploratory, longitudinal DL data for this national benchmark, providing documentation of learner success as an example of evidence meeting CODA Standard 1.

Question 2

Based on the GPA evidence presented in Table II, the data suggests DE can be effective for dental hygiene education. This data may also

provide preliminary evidence for this national performance benchmark for DL programs. Furthermore, from a program perspective, this data also documents learner success as another example of evidence meeting CODA Standard 1. Even though some learners might not prefer DL for educational delivery, their individual performance, as evidenced by GPAs, was not impacted by its use.

Question 3

Cumulative analysis of core didactic course grades also provides a pattern of evidence documenting meeting the intent of Standard 1. An examination of the data for significant trends indicates these courses' cumulative averages have remained consistent and stable over time. The 8 core dental hygiene courses did not show statistically significant differences in performance between face-to-face and distance students. This study documents one program's successful delivery of a dental hygiene educational program while using DL.

Discussion

The statistical analyses of performance outcomes suggest CODA Standard 1 was met as evidenced by the 10 year cumulative NBDHE and GPA data, and the cumulative course by course data. The results documented learner performance for an entire academic program rather than only analyzing individual courses, addressing one of the research gaps noted by Phipps and Merisotis.²³ The data also helps answer the question: Is it prudent for colleges' and universities' dental and dental hygiene programs to continue expansion of the use of DE as a means of course and program delivery? Based on these preliminary research findings, the answer appears to be yes. It is important to note the study design limits findings to dentistry and might not be applicable to other

educational programming.

Another question posed is: Can a perspective body of knowledge be generated regarding learner performance on given standard outcome measures? Performance measured by GPAs and course grades as national benchmarks provide generalized, external validity to other programs because this study data lays the foundation for DL research related to academic programs. The findings of this research also provide insights into the use of DL as a viable delivery mechanism for education. In addition, it provides a foundational basis for benchmark comparison for future DL research for programs considering using this method for program delivery. If similar performance outcomes are the decision-making factor, the study findings suggest the use of DE is a viable mechanism for educational delivery. Finally, this research provides an analysis of performance over time, rather than 1 or 2 years, for an entire educational program using DL technologies. This data might assist administrators at various colleges or universities in decision-making processes regarding the implementation of DL programming for general education, allied health or, specifically, dental and dental hygiene programs.

Conclusion

Allied health and dental hygiene programs should continue offering education using DL as an alternative delivery mechanism. This research identified learners at various locations who performed equally well on standard benchmark assessments documenting program effectiveness. DL was considered an effective medium for delivering educational programming, and the use of DL should be continued. Additionally, DL could be used for delivering not only other allied health programs, but could also deliver other educational programs in the

same manner.

A path analysis should be undertaken as we consider inferring data back to larger populations for both GPAs and course grades. It must be stated that DL is not for everyone. Further research may include analyzing this national benchmark data and determining what factors promote student success in dental hygiene DL programs.

Once research is conducted identifying persons for whom the DL option is not a preferred delivery mechanism, strong recommendations could be made to that individual or individuals to provide guidance into taking program courses with face-to-face cohorts for improving performance results, retention, learner satisfaction, perseverance and, ultimately, program completion and graduation.

There is a need to replicate this study using data from asynchronous DL programs, which have replaced the synchronous model studied in the current paper. .

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Application of a Conceptual Framework for Distance Learning in Dental Hygiene Education and Allied Health Disciplines

Jodi L. Olmsted, RDH, BS, MS, EdS, PhD

Introduction

In response to more flexible learning options, Distance Education (DE) use continues expanding rapidly in post-secondary education, especially over the previous decade.¹ Almost 3.5 million students, or nearly 20%, are taking at least 1 online class, with the largest growth noted within 2 year associate degree granting institutions.² In the Sloan Consortium's 2008 report, results indicate that while DE growth continues, it is slower than in previous years.³ With an estimated 3 million students, DE enrollments are expected to increase another 19% by 2013.³ Of the institutions currently using DL, 90% employed the Internet for asynchronous computer-based instruction.³

Currently, 3 graduate programs, 35 undergraduate and 12 dental hygiene degree completion programs in the United States employ various forms of DL. Relying heavily on DL for offering educational programs leaves an unanswered question: Is learner performance on dental hygiene standard benchmark assessments impacted when technology is used as a delivery system? Some standard benchmark assessments in dental hygiene education include the National Board of Dental Hygiene Examination (NBDHE) scores, dental hygiene course grades and course grade point averages (GPAs). Allied health disciplines also rely on course grades, GPA and national registry examinations, including the NCLEX (National Council Licensure Examination—Registered Nurse) for nurs-

Abstract

Purpose: Distance education (DE) and distance learning (DL) technologies use continues to experience exponential, global growth. Various DE delivery platforms are being used for dental hygiene and allied health programs offered in post-secondary education. However, a need exists to analyze factors of program and student success using DL modalities. Administrators and educators should consider building educational programs on sound pedagogical principles when using DL for their delivery mechanism. This paper offers an applied conceptual framework as a model when developing DE/DL programs for preparing professionals in dental hygiene and allied health careers.

Key Words: Distance Education; Distance Learning; Outcomes; Benchmarks; Dental Hygiene; Assessment; Student Performance; Allied Health; Conceptual Framework; Developmental Model

This study supports the NDHRA priority area, Professional Education and Development: Validate and test measures that evaluate student critical thinking and decision making skills.

ing, PTCB (Pharmacy Technician Certification Board) for pharmacy and the NPTE (National Physical Therapy Examination) for physical therapy as benchmark indicator data documenting performance outcomes and program effectiveness.

Seven research gaps were identified by Phipps and Merisotis⁴ while reviewing the research on DL in higher education. They also questioned the overall quality of previous DL research, rendering previous study results inconclusive. They based their conclusions on the following: the research reviewed did not attempt to control extraneous variables, thus not showing "cause and effect," most studies did not use actual subjects, validity and reliability of the test instruments used were questionable and many studies did

not adequately measure attitudes of learners and faculty. The 7 research gaps Phipps and Merisotis⁴ identified included:

1. Research focused on learner outcomes for individual courses rather than entire academic programs
2. Research did not take into account personal differences among learners
3. Drop-out rates for distance education were higher and not explained
4. Research did not account or measure different learning styles
5. Research did not look at the impact of using individual technologies versus the interaction of multiple technologies
6. Research did not include a theoretical or conceptual framework

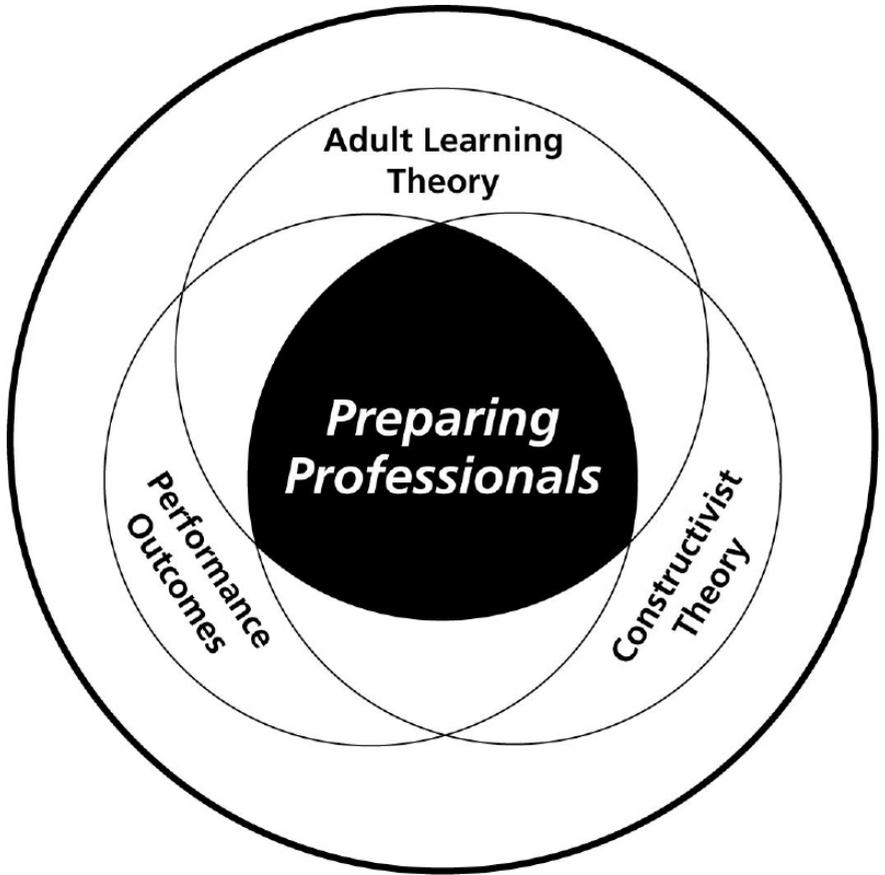
7. Research did not adequately address the effectiveness of the use of digital libraries and their potential limitations

The first of those concerns was addressed through Olmsted's research,⁵ which documented learner performance for an entire dental hygiene academic program, rather than individual courses over a 7 year period.⁵ In addition, the current paper offers a theoretical or conceptual framework for using DL which was a gap identified by Phipps and Merisotis⁴ (Figure 1).

Offering a practical, applied conceptual model based on sound, pedagogical learning principles for dental hygiene and allied health education provides groundwork for administrators and educators to continue implementing future DL programs. Administrators and educators developing and implementing DE/DL programs should base their decision making on informed, educational research. Programs are often developed and implemented based on outside pressures, and are not developed based on sound pedagogical principles of educational practice. The model/framework proposed here was developed based on 20 years of informed, educational research. If administrators in occupational areas, including dental hygiene, allied health or general and post secondary education, are considering developing a new DE program, or evaluating an existing one, this platform provides a theoretical framework for use. It is a basis for developing, implementing, evaluating and modifying DL programs informed by the pedagogical principles of Adult Learning Theory, Constructivism and Performance Outcomes.

Educational technology continues transforming dental hygiene and allied health education at a rapid pace. Traditional, undergraduate dental hygiene programs focusing on developing entry-level clinical skills might not use distance or advanced technology for educational purposes. However, with the ongoing improvement of clinical simulation

Figure 1: Preparing Professionals



programs, undergraduate dental hygiene preparation might have unique opportunities for incorporating clinical skill development differently. As dental hygiene graduate and degree completion programs typically do not have clinical components in the curricula, it is easier to incorporate a variety of technological advancements into program and course delivery. As educational fees continue rising, cost containment continues to be an issue, whether in the need and use of maintaining and upgrading undergraduate education clinical facilities or graduate programs use of advanced technological options for DE/DL program delivery. Educational institutions and program administrators taking into consideration implementation of alternative delivery methods for teaching and learning can consider using various program delivery system models.⁶⁻¹² Refocusing on DE and DL, Grimes'⁹⁻¹¹ body of research in asynchronous dental hygiene environments also

raises several crucial concerns for consideration. Amongst those issues are faculty and student satisfaction with learning and using the various technologies, sample sizes of data currently being gathered and analyzed and course hybridization. Two other significant concerns Grimes' work identifies includes learner self-directedness and concern for the perceived lack of relationship development using asynchronous learning networks. As the use of DL as a delivery modality increases, there is a need for sound pedagogical theoretical constructs to serve as the underlying framework for the development, implementation, evaluation and modification of educational experiences. Conceptual models offered by Gussy et al¹³ and Magnusen¹⁴ for e-learning were primarily one-dimensional, based solely on the principles of Constructivism. Their work spoke at length about re-focusing direction from educators as subject matter experts to fa-

cilitators of learning in DL environments. Their work did not consider multiple pedagogical principles or a multi-faceted approach in offering a DL model forwarding sound educational principles of teaching and learning. Rather, the model posited here for administrators and educators' consideration suggests a more holistic, multi-dimensional, pedagogical approach. In addition, as the dental hygiene profession advances through the expansion of educational opportunities for degree completion as suggested by Monson and Engeswick,¹⁵ it is crucial that assessment of outcomes of DL academic performance continues.⁵ The model under consideration also provides a conceptual framework for future research relating to DL (Figure 1). Not just applicable to dental hygiene or allied health education, the model has broader implications for use by post secondary administrators and educators wherever DL is being considered as a delivery mechanism, and should be tested accordingly.

Preparing Professionals: An Applied Conceptual Framework

Previous research has not offered applied conceptual frameworks justifying the continued use of DE as a learning modality for the preparation of health care professionals. Recent studies¹³⁻¹⁴ have begun providing frameworks for institutional administrators and educators to use in developing DL educational programs. DL is used not only in educational settings, but also in business and industry throughout the world.¹⁶ Conceptual frameworks must be established and used as a structure upon which to build programs. These models must take into account a myriad of differing factors while remaining simple enough to be applied across disciplines. Adult Learning Theory, Constructivist Theory and Program Outcomes in relation to DL inform 3 major areas of overlapping consideration for the conceptual framework posited here by the researcher.

Adult Learning Theory

While preparing professionals for entering the workforce as health care providers, it is important to consider several adult learning theories and their impact on the development of future workers. Adults are often self-motivated, seeking to make sense of their own existence and purpose in life, and will compare their learning experiences against their own intrinsic needs, values and life experiences.¹⁷ Adults tend to learn more effectively from experiential techniques and want to gain skills that can be applied immediately in real-world circumstances.¹⁸ Notable characteristics of adult learners include their willingness to be results-driven problem solvers, self-directed, responsible and reflective about what is being learned in comparison to real life experience.¹⁷ They desire timely, to-the-point training directly related to their needs. Yang¹⁹ proposed a holistic theory of knowledge acquisition for adult learners that is multi-faceted. Yang's model effectively bridges various paradigms of learning proposed in the adult learning literature and incorporates knowledge as a social construct.

Constructivist Theory-Building Community & Shared Meaning

Another component to be considered in the development of a conceptual framework supporting preparing professionals is the recognition of learners' needs. Such recognition can be used to develop a profound sense of community during the learning experience. Constructivist learning is defined as "meaningful action during the development of complex and unfolding knowledge."²⁰ Several grounding assumptions for constructivist learning, as identified by Brooks and Brooks,²¹ include:

1. Knowledge is constructed
2. Multiple perspectives reflect the diversity of individually constructed world views
3. Knowledge is dependent on context
4. Learning is social and based on dialogue

Yet DL is not for everyone. If individuals are not self-directed, motivated and capable of setting personal time and deadline priorities, they may not succeed in DL programs. An inventory and understanding of personal learning styles can aid potential learners in identifying whether a DL program of study is appropriate for them. It is important for adult constructivist learners to understand in advance what is expected of them in the DL community.²² Furthermore, it is important that DL facilitators carefully cultivate a positive environment supporting active participation and learner engagement.²² While advantages and disadvantages for both synchronous and asynchronous learning environments exist, it is a facilitator's obligation to develop and build positive learning communities focused around the educational objectives while meeting each participant's needs. Facilitators must convey primary concepts and "big" ideas while seeking and valuing their learner participants' points of view.²¹ Clear expectations must be established in advance, and learners should have prior knowledge of their personal learning styles in order to succeed in the DL environment.²³⁻²⁷

Individuals constructing courses or programs using DL must appreciate the audience engagement in the learning experience.²² The DL environment must allow socio-cultural opportunities for relationship construction so that learners can build their own contextual meaning. In this form, learning develops from authentic, real-world experiences. Sharing experiences through socio-cultural interactions strengthens the ability of learners to apply meaning in clinical contexts. Content knowledge and advanced skills continue developing based on the framework of the participant's previous knowledge. Breadth and depth of curriculum, especially in programs employing DL delivery mechanisms, must proceed from simple to complex matters in order to maximize learning. Learning is not discovering more – it is re-interpreting concepts

through different schemata.

According to Novotny²⁸ and Doolittle,²⁹ students in DL courses and programs differ from those in traditional brick and mortar classrooms. Although content is similar, differences exist between how students access and transform information into functional knowledge. Initially, differences might appear as barriers, but with appropriate instructional and technical support, these perceived barriers often diminish, if not disappear. Students develop new strengths and new pathways to learning. Nursing students in DL classes believed their cultural perspective experiences, critical analysis, self-assessment, resource development, discussion and self-management were strengthened during their learning experience.^{30,32-33} Both Brooks and Brooks²¹ and Vela²⁷ believed learners construct meaning based on their experiences, and there is a need for facilitators to develop activities that challenge learners' suppositions, while posing problems and questions of emerging relevance.²⁴ Assessment is considered a segment of the learning continuum, rather than a separate and distinct activity. In DL environments, it is imperative these principles are embedded in the context of the program and courses to maximize learner growth and development.³¹

Learner Outcomes

Numerous researchers have examined learners' performance in relation to DL.³⁴⁻⁴² It is important to note that, while many studies have shown no statistically significant differences in performance,³⁴⁻³⁷ there have also been mixed results reported regarding learner performance in DL environments.³⁸⁻⁴⁰ Another key consideration is that the majority of studies reviewed have assessed only 1 or 2 courses, or course section results, rather than entire academic programs before drawing their conclusions.^{34-39,41-42} In addition, other than Olmsted's work,⁵ none of these studies were conducted over significant periods of time, and the re-

sults identified might be spurious in nature. Reported results in studies undertaken within shorter periods might not provide enough data for making recommendations for change or laying the groundwork for further research by testing proposed conceptual frameworks.^{34-39,41,43}

Preparing Professionals for the Future

The paradoxes facing distance educators include learners reporting they do not want to learn at a distance, but would rather engage with a learning group or with an instructor because they value the informal social interactions occurring both in and outside the classroom.^{1,3} Other evidence suggests that learners are increasingly demanding opportunities to learn at a distance, desiring supplementation or replacement of conventional learning experiences via distance education because of the multiple roles placed on them by a complicated global society.^{1-4,33,45} This paradoxical relationship provides the underpinnings of the conceptual framework presented here as a model for the development, implementation, evaluation and modification of DL educational programming. The model (Figure 1) also provides a conceptual framework for future research related to using distance education, and is not just applicable in the areas of dental hygiene and allied health care education, but has broader application for all circumstances when distance education is considered as a delivery mechanism when considering the research gaps in DL noted by Phipps and Merisotis.⁴

Preparing Professionals—Additional Questions for Consideration and Study

Studies by Olmsted⁵ and Grimes¹⁰ concluded that DL as a delivery mechanism was as effective as traditional means, and can be used as a tool for expanding the delivery of dental hygiene and allied health education to areas distant from established educational programs, as evidenced by learner performance

on established national benchmark assessments like course grades and GPA. Dental hygiene and allied health advanced degree and degree completion programs, unlike entry-level preparatory programs, often do not have registry examination performance benchmark data (NB-DHE, NCLEX, PTCB and NPTE) to use for triangulating student and program performance, with course grades and GPA as indicators of educational performance. Entry-level programs using traditional delivery modalities that evaluate the development of affective, laboratory and clinical skills through direct observation differ significantly from DE/DL degree completion and advanced graduate degree, primarily cognitive programs. Administrator's and educator's decisions about continuing expansion of DE/DL programs in dental hygiene and allied health education should be based on various factors, including sound pedagogical principles, applied conceptual frameworks and performance outcome data. Further investigation should be undertaken for DL programs relying on using multiple technologies, and also solely relying on asynchronous, computer aided (i.e. Internet) delivery modalities. Factors affecting learner performance in relationship to the conceptual framework should be investigated. Should we consider what impact technological changes and upgrades have made on learner performance over time? How have characteristics of adult learners and constructivist learning theories impacted learner performance? The question should be raised as to what factors affect these individuals' performance results and their success as students and working professionals. Is people's self-motivation while using DL environments stronger than other groups? Are distance learners more persistent as adults? Do they construct their own meaning as individuals brought together as groups for a single purpose – that of gaining education for a career? Are personal learning styles a factor in academic success? Are there other

intrinsic or extrinsic factors affecting academic performance, including family considerations? Bender²² reported facilitator need to cultivate positive environments supporting active participation and learner engagement. Are certain courses better suited for strictly face-to-face or hybridized delivery systems? Even though studies by Olmsted⁵ and Grimes¹⁰ revealed no real performance differences for didactic coursework between DL and face-to-face education of dental hygiene professionals while using DL as a delivery system, some materials and learning activities are best suited for traditional face-to-face delivery. All these questions relate back to Phipps and Merisotis⁴ gaps as noted in the DL research literature. Consideration of the model offered provides a conceptual framework for future research strictly relating to DL. It is not just applicable to dental hygiene and allied health education, but has broader implications for use, wherever DL is being considered as a delivery mechanism, and should be tested accordingly.

The questions raised here lead to recommendations for future re-

search. Extensive previous research has been conducted on predictors of learner success and satisfaction.²⁻³ If administrators and educators are not using data for making changes or modifications to program admissions policies, performance outcomes will remain the same. It is important to implement changes within programs based on indicator data. If reasons for selecting DL as a delivery medium continue to hold true today, it is necessary for administrators and educators to continue examining the myriad, multi-dimensional and complex factors discussed in association with this conceptual framework. As we consider being informed by and associated with the persistence of the adult learner, constructivist perspectives of learning and actual benchmark performance in outcomes assessments for both DL and face-to-face instruction assuring learner and program success, administrators and educators can use subjective and objective data generated by this conceptual model as a tool for evaluating student and program success. Gathering this data can provide the profession with evidence supporting ongoing use of conceptual frame-

works as an underpinning for development, implementation, evaluation and modification of dental hygiene and allied health DL programs as we continue preparing professionals for the workforce.

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Oral Health Knowledge Attitudes and Behaviors of Migrant Preschooler Parents

Sherri M. Lukes, RDH, MS

Introduction

As dentistry increasingly faces access to care issues for a significant portion of the United States population, all oral health care providers should be informed about the various underserved populations in order to develop a unified plan for addressing oral health disparities. Unless employed in public health settings, dental hygienists likely know little about underserved populations in general, nor their oral health conditions and difficulties accessing oral health services. Migrant and seasonal farm workers (MSFWs) are one such group with multiple issues affecting their oral health status as well as their knowledge, attitudes and behaviors concerning oral health. Increased awareness and knowledge of this underserved population is warranted for the dental hygienist.

Review of the Literature

Nearly all migrant farm workers who provide labor for the beautiful fruits and vegetables we find in our supermarkets are Hispanic, primarily from Mexico. The National Agricultural Workers Survey indicated 79% of all farm workers were born in Mexico, 23% in the United States, 2% in Central America and 1% in other countries.^{1,2} Though migration status is difficult to estimate, only 19% are currently considered truly migratory, actually following the crops. Many simply shuttle between their residence (either inside or outside the United States) and one primary location to work

Abstract

Purpose: The purpose of the study was to establish baseline data about oral health knowledge, attitudes and behaviors of migrant and seasonal farm workers (MSFW). The study focused on MSFWs that are parents of preschool-aged children, and who utilized services at 3 migrant dental clinics.

Methods: An oral health knowledge attitudes and behaviors survey was developed and pilot tested in 2006. The resulting 34 item survey was administered by trained promotores de salud (community health workers) to 45 parents of preschoolers (15 at each clinic site) served by 3 migrant dental clinics. Parents answered questions as they pertained to their oldest preschooler (up to age 5).

Results: Dental visits in the last 12 months were reported for 26 (58%) of the children. Fifteen parents (33%) had a dental visit in the last year. Thirty-five parents (77/8%) reported their child's oral health to be good, and 21 (46.7%) reported their own to be good. Half of the children were enrolled in Head Start (HS). Of those, 18 (79%) had a dental visit in the last year, whereas 8 (36%) of those not enrolled in HS had a visit. Discrepancies existed for the age parents believed children should stop using a bottle and the age they actually did stop using a bottle. There were discrepancies in knowledge about decay causing drinks and consumption of drinks by preschool-aged children.

Conclusions: MSFWs remain an underserved population with poor access to oral health care and multiple factors affecting oral health knowledge, attitudes and behaviors. A better understanding of influences on oral health knowledge, attitudes and behaviors within the population can assist in implementing appropriate interventions for the maintenance of good oral health in MSFW families. HS can have a positive impact on oral health for MSFW children.

Key Words: migrant and seasonal farm workers, oral health, knowledge attitudes and behaviors

This study supports the NDHRA priority area, Health Promotion/ Disease Prevention: Investigates how environmental factors (culture, socioeconomic status, SES, education) influence oral health behaviors.

and are considered "seasonal" farm workers.^{1,3} There are 3 main south-to-north streams that MSFWs usually follow – the western, midwest and eastern streams. Depending on where they originate from, there can be a great deal of ethnic and cultur-

al variation among the 3 streams.^{4,5} Regardless, MSFW families' lives are very difficult. Sixty-one percent of the population lives in poverty, earning an average of only \$7,500 per year.¹ Their low socioeconomic status is compounded by a myriad

of health problems, such as pesticide exposure, malnutrition and loneliness.

The federal Migrant Health Program was instituted in 1962 to address the poor health conditions of migrant farm workers.¹ Migrant health centers evolved into community health centers from which most MSFW families obtain medical and dental care, as most have no health insurance. However, nearly 50 years later, general and oral health status remains poor, as the migrant health care system reaches only 12 to 15% of the population annually.⁴ MSFWs suffer disproportionately more than the general population from a number of diseases and conditions,¹⁻⁸ and oral health problems are often listed among the top health concerns of the population.^{2,4,8} Dr. David Satcher included them as one of the populations affected by the “silent epidemic” of oral disease in his 2000 Surgeon General’s Report on Oral Health in America.⁹ He called for more research about these vulnerable populations to develop strategies for meeting their oral health needs.

Studies stretching over more than 30 years in different areas of the country with differing methodologies and limitations have attempted to describe oral health status of MSFWs, and though few in number, all reveal disproportionate rates of oral disease when compared to the general population.^{2,10,11,12} MSFWs tend to seek episodic or acute medical and dental care as a result of multiple access barriers.^{1-5,7,8,10} A study of migrant clinics across the country showed that more than half of clinics offered no evening hours which means missing work, reduced pay and possibly loss of job as a result of seeking care.^{2,3,5,8,13} Numerous other access to care barriers are documented in the literature including mobility, cost, language, transportation and cultural issues and beliefs about health.¹³⁻²⁵

Though MSFW parents typically report their children’s oral health as being superior to their

own, and seek care for their children more than for themselves,² oral health needs among the children are great as well. Studies conducted in Washington, Michigan, Colorado, Alabama, Illinois and California have revealed that children of MSFWs have higher rates of dental decay than the general population.^{11,12,17,21,24,26,27} A few recent studies have concentrated on early childhood caries (ECC) in MSFW populations, both prevalence of and knowledge and behaviors of parents with children affected by the condition. As with regular dental caries, disparity in the prevalence of ECC is experienced by the children of MSFWs.^{17,21,23,27}

There is little research concerning oral health knowledge, attitudes and behaviors of MSFWs and how findings from such assessments could be used to better serve the population and improve their oral health status. There can be much variation of knowledge, attitudes and behaviors among underserved groups requiring careful design of questionnaires. A study of Latin American immigrants in the Washington, D.C. inner-city area utilized focus groups to assist in the development of an oral health knowledge, attitudes and behaviors survey.²⁸ Surveys of knowledge, attitudes and behaviors of MSFWs have documented a weak knowledge of a sweet diet and caries in this population.^{8,25,27} Ramos-Gomez et al studied ECC and dietary habits in a MSFW population in California and found that 45% of children went to bed with a bottle containing carcinogenic liquids.²⁷ Multiple issues influence oral health-related dietary and weaning behaviors in disadvantaged populations.^{17,29} Cultural norms and the difficult lives of MSFWs play major roles in oral health behaviors and are not always a direct result of a lack of knowledge.^{6,17,23} As changes occur over time in both the field of dentistry and in the MSFW population, relevant studies are merited for assessing their current oral health knowledge attitudes and behaviors

in order to plan appropriate interventions for serving this difficult to reach population.

This article reports findings from a study conducted with a convenience sample of MSFW parents/caregivers of preschoolers served by 3 of an agency’s dental clinics located in the Chicago, Ill area. The purpose of the study was to elucidate oral health knowledge, attitudes and behaviors of the parents/caregivers to better serve the population and ultimately improve oral health status of MSFW children.

Methodology

Focus groups were conducted during the summer of 2006 with members from the target population within the clinics’ service areas. The purpose of the focus groups was to identify oral health issues and concerns of MSFW preschooler parents and caregivers. An evaluator with experience in migrant oral health research outlined basic oral health areas for focus group discussions. Coordinators of the sites’ *promotores de salud* programs were trained to conduct focus groups, and in turn facilitated the sessions and reported results to the evaluator. This process was followed in order to develop an appropriate survey for addressing what the MSFW families perceive as significant issues, as opposed to what oral health professionals’ may perceive as significant. The evaluator then designed a survey instrument that was informed by issues and concerns of the target population identified from the focus group sessions and an examination of the literature’s oral health knowledge, attitudes and behaviors surveys from similar groups. The survey was translated into Spanish and pilot tested in 2006. Following the pilot, the survey was revised to eliminate ambiguous questions. In 2007, a public health graduate student translated the final 34 item survey into Spanish and trained and calibrated the same *promotores* coordinators at the 3 clinics in administration of the surveys. During

the summer of 2007, the survey was administered at the clinics to a convenience sample of 15 preschooler parents from each of the 3 migrant health clinic service areas for a total of 45 surveys. Not all parents surveyed were current patients of the dental clinics. The coordinators read the surveys to the parents/caregivers at the clinics in private, each answering orally from a list of possible responses. Preschooler parents answered questions as they pertained to the oldest preschooler in the home aged 1 to 5 years, assuming comparable practices would be followed for all preschoolers and answering questions for more than 1 preschooler in the home could be confusing and difficult. Verbal consent was secured from each participant before survey administration and the survey was approved by the agency's internal review board. Each interviewee received a gift card in recognition of their time and participation. Results from the first 3 surveys of each site's sample were sent to the graduate student trainer for feedback and quality assurance check before proceeding with the remaining surveys. All surveys were completed during the summer months and results sent to the evaluator for analysis.

Results

The majority of the parents (40, 89%) were born in Mexico, while only 6 of the children were, with the remaining 39 (87%) born in the United States. Most of the children (39, 87%) were born in the United States. Thirty-four of the parents/caregivers (76%) had lived in the United States more than 5 years. The language parents were comfortable speaking was Spanish (40, 89%). Only 3 (7%) were comfortable speaking English and 2 (4%) were comfortable speaking both Spanish and English. The same results were reported for a question about comfort level in reading Spanish and English. Parent's education level ranged from less than sixth grade completed (7, 16%) to having com-

pleted some college or university study (3, 7%).

Most parents (35, 78%) reported their child's teeth were cleaned daily. Twenty-six children (58%) had seen a dentist in the last 12 months (Figure 1). The reasons cited most for not seeing a dentist (n=19) were that the child had no pain or problem (13, 68%), the child did not have a dentist (5, 26%), no transportation (2, 10%) and language problems (2, 10%) (Figure 2). The answer cited most for the reason the child did go to the dentist (n=26) was for an exam (21, 81%). Four (15%) of the children went because of pain.

Only 15 (33%) of the parents surveyed had been to the dentist in the last 12 months (Figure 1). The most common reason for not going (n=30) was no pain or problem (15, 53%), but the second most common reason for the parents not going was cost (12, 40%).

Thirty-five parents (78%) reported believed their child's oral health to be good, 10 (22%) believed it

Figure 1: Percentage of Dental Visits in the Last Year for Child and Parent (N=45)

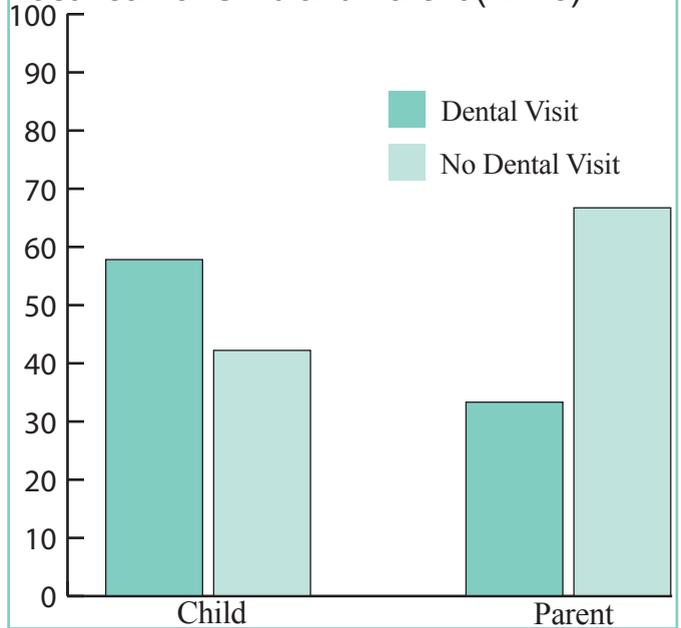
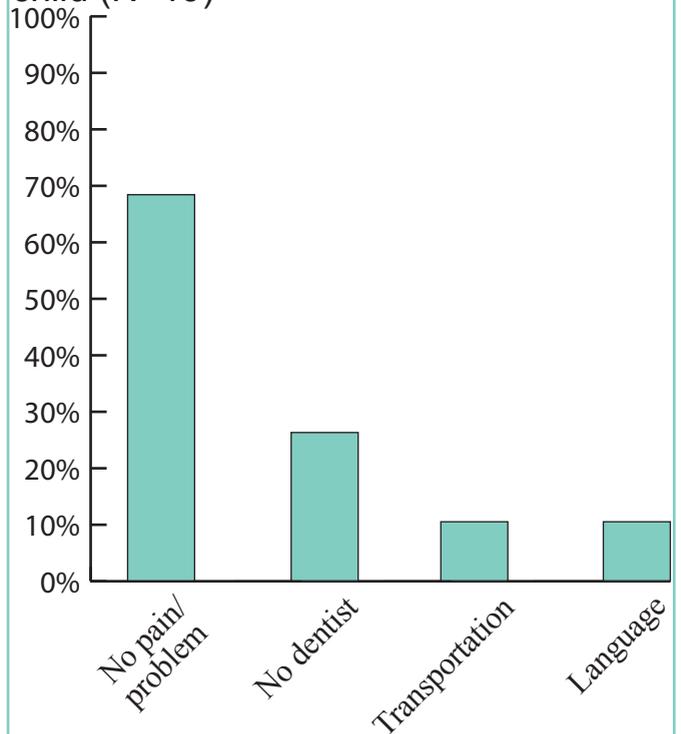


Figure 2: Reasons for no dental visit-child (N=19)



was fair and no one reported believing their child's oral health to be poor. When reporting about their own oral health, 21 (47%) parents believed their own oral health was good, 18 (40%) believed it was fair and 6 (13%) believed their own to be poor.

For the question about when children stopped using a bottle and transferred to a cup, most parents (32, 71%) listed the age a child should stop using a bottle to drink from 1 year of age or 18 months (8, 18%). For the question about when children actually did stop/transfer, 6 children still used a bottle (age range of 13 months to 4 years, 11 months). Nineteen (42%) stopped at 1 year, 8 (18%) at 1.5 years, 7 (16%) at 2 years and 1 stopped at 2.5 and 3 years, respectively (Table I). Eight parents (18%) reported their child takes a bottle to bed, and most commonly in the bottle was cow's milk. Most parents knew that high sugar items (candy, regular soda pop, cookies, etc.) can cause decay, but more than half (25, 56%) also marked diet soda pop as causing decay. And though most parents responded that fruit juice can cause decay (33, 73.3%), it was listed as the drink most commonly given to their children between meals (22, 49%).

When the parents' were asked their general feelings regarding dentists, 31 (69%) believed dentists are good health care providers, 29 (64%) said their fees are too high and 8 (18%) said they try to keep patients coming back for additional appointments so they could get more money from them. Twenty said they prefer seeing a dentist in Mexico and 20 said they prefer seeing one in the United States. Cost was the most commonly cited factor for preferring to go to the dentist in Mexico.

Head Start/Non Head Start

Twenty-three (51%) of the 45 children were enrolled in Head Start (HS). The remaining 22 (49%) were not enrolled. Selected questions were analyzed for HS enrolled and non-HS enrolled children. Daily cleaning of the child's teeth was reported for 19 HS children and 16 non-HS children. Chi-square analysis of these results indicate no statistically significant difference between the HS and non-HS groups

Table I

Bottle weaning/ transfer to cup (n=45)	Age parent believed child should stop bottle use/transfer to cup	Age child did stop bottle use/transfer to cup*
Child still uses bottle		13.3% (6)
1 year	71.1% (32)	42.2% (19)
1.5 years	17.8% (8)	17.8% (8)
2 years	4.4% (2)	15.7% (7)
2.5 years	0	2.2% (1)
3 years	4.4% (2)	2.2% (1)
Other	2.2% (1)	2.2% (1)

*One parent did not answer

($2=0.066$, $p>0.05$) for this variable.

For the question about a dental visit for the child in the last 12 months, 18 (79%) of the 23 HS children had seen a dentist in the last 12 months, but only 8 (36%) of 22 non-HS children had seen a dentist in the last 12 months (Figure 3). Again, the 2 groups were compared using a chi-square analysis. Children in the HS group were more likely than non-HS children to have seen a dentist in the last 12 months ($2=8.09$, $p<0.05$). Of several reasons suggested for not seeing a dentist, no pain or problem and having no dentist were selected most. Four HS parents selected no pain or problem as a reason for their child not seeing a dentist. Nine (39%) non-HS parents selected no pain or problem and 4 marked no dentist as reasons the children did not see a dentist.

Discussion

Consistent with the literature, almost all of the parents surveyed (40, 88.9%) were born in Mexico. However, most of the parents (34, 76%) had lived in the United States more than 5 years. In spite of the parents' longevity in the United States, only 5 were comfortable speaking English and only 2 of the 5 were comfortable speaking both languages. The same results were reported about reading both English and Spanish materials. While a reduced comfort level reading English is understandable, one would be inclined to believe that, after living in the United

States for over 5 years, there would be a higher comfort level with speaking the language, especially since most of their children were born in the United States, thus English proficient. Language is cited in numerous other studies as an access to care barrier and should alert oral care providers that MSFW parents and other Hispanics may have difficulties with English regardless of length of time in this country, and may hinder them in seeking care for themselves or their children.^{1-5,7,8,10}

A higher number of children than parents had seen a dentist within the last year. Only 15 parents had been to the dentist during the same time frame. The reasons for not having a dental visit were different as well. Of the 19 children who did not see a dentist, the primary reason reported by 13 of the parents was no pain or problems and 5 indicated the child had no dentist. Of the 30 parents who had not seen the dentist, half stated it was because they had no pain or problems, but the second most common reason was cost. This is consistent with the literature in that MSFWs primarily seek acute dental care.^{3,14,16} Lukes and Miller reported similar results among 119 farm workers utilizing dental services at a Southern Illinois migrant health center in 2000. Half had sought care in the last year and of those who had not, the absence of pain was the most common reason for not seeking care. Specific barriers to care were reported as lim-

ited clinic hours and fees.¹⁰ A North Carolina/West Virginia study found that children received dental care on a regular basis while the parents usually received no care or emergency care.¹⁶ Cost was a primary barrier for the parents, but not listed as a common reason for no dental visits among the children. Cost becomes a reason for the MSFWs themselves to not seek dental care, but possibly does not enter into the care seeking behavior as greatly when it comes to the oral health of the children. Quandt et al had similar results.² Though dental health services use was greater for children than the parents in this study, dental health services usage among MSFW's children is low overall, as documented in other studies.^{7,18}

The parents believed their children's oral health to be better overall than their own with 78% of parents reporting their child's oral health to be good. This assumption could be based upon knowing that children receive care more often than they themselves receive. In Quandt's study in North Carolina and Virginia, MSFW mothers also ranked the condition of their children's teeth as better than their own.² They ranked their own as fair or poor, but their children's as good or very good. Most of the children in both studies were born in the United States and have likely had more access to oral health care than their parents, who in both studies were born primarily in Mexico. Domoto et al, however, found that 60% of MSFWs who were parents and suffered with dental decay themselves indicated they were unaware of the child's dental problem.¹⁷ Parents' perceptions of their children's oral health as being better than their own should not be mistaken for the children's oral health status as being good. MSFW children's overall oral health status remains poor compared to the general population, which points to a need for interventions to enhance parental awareness and education of dental issues in both themselves and their children.

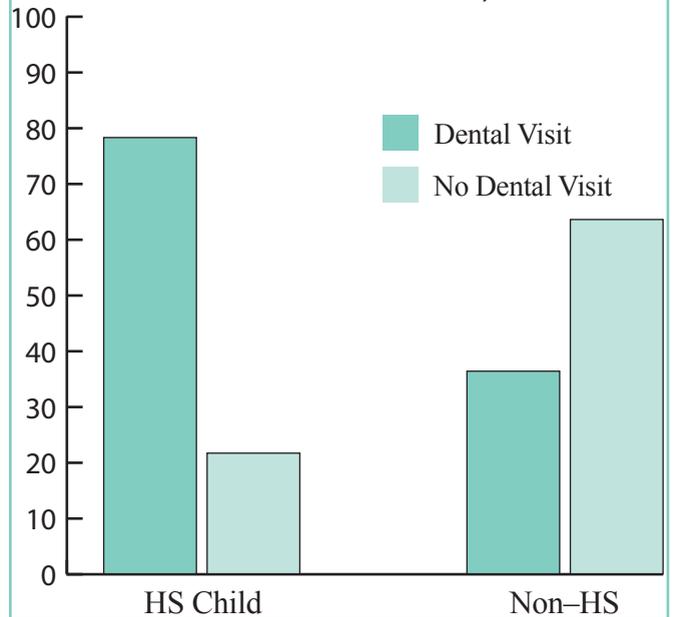
There appears to be a discrepancy between parents' knowledge of appropriate time to wean from bottle to cup and when the weaning process actually occurred among the children.

Eight parents also reported their child takes a bottle to bed with them, though only 6 reported that the child still used a bottle. Perhaps the transfer had occurred but the child was allowed a bottle only at bedtime. Health behaviors of MSFW families are often dictated by their difficult lifestyle rather than knowledge of appropriate practices. They are often unlikely to follow recommendations that cause familial disruptions. In an early childhood caries (ECC) study by Weinstein et al, less help with caring for the child was found to be associated with ECC in the children and ECC parents were less likely to endure the stress of early weaning and sleeping without the bottle.^{17,23} When a husband requires a good night's rest to work long hours in the field the next day, it may not be practical to allow the baby to cry for want of a bottle. This is also an area where cultural patterns may vary among the population as documented by Domoto et al and Bechtel et al.^{6,17}

Consumption of various types of drinks showed inconsistencies between parents' knowledge and behavior as well. Thirty-three (73%) noted fruit juice as carcinogenic; however, fruit juice was the drink most commonly given to their children between meals. Because children tend to enjoy sweet

drinks more than just water, a study of disadvantaged parents in the UK revealed that the parents thought it "cruel" to offer water instead of something sweet to drink and saw it as a sign of poverty.²⁹ The percentage of Illinoisans served by community water systems with optimally fluoridated water is 99%,³⁰ so certainly water is the drink of choice for MSFW's children. However, fluoride use is only one variable in a multi-factorial disease. Studies from all areas of the country show disproportionate rates of decay, regardless of fluoride status in the different areas where MSFWs live. Their mobility also makes it difficult to assess the benefits their children would receive from fluoridated water systems. Educating the parents about positive effects of fluoride in the water could serve to decrease feelings of guilt about only offering water to drink. As stated previously, knowledge alone can be insufficient to produce behavior change and has been demonstrated in other studies among similar populations.^{21,25,29,31} Oral health education for underserved populations may require something other than simply a cognitive approach as

Figure 3: Dental Visit in Last 12 Months (by Head Start Enrollment) (HS enrolled N=23, Non-HS enrolled N=22)



internal and external forces within MSFW's environments are beyond their control and likely affect health behaviors. Employment of a variety of health education models is indicated when designing education for such populations. Services to assist with social and environmental issues as well as the other access to care barriers are also necessary to help this population achieve good oral health.

Negative comments from the focus groups led the evaluator to include questions in the survey about MSFW's feelings concerning dentists. Surprisingly, most thought United States dentists were good health care providers and the same number of parents preferred seeing a dentist in the United States as did those who preferred to see a dentist in Mexico. This could be the result of conscious efforts of the agency's 3 clinics to serve the population, as the agency has been serving migrant and seasonal farm workers for many years. Dental providers should consistently be working on cultural competency skills to serve the growing Hispanic populations as well as other diverse populations.

It appears the most significant finding from the survey concerns utilization of dental services according to HS enrollment. HS is a federal program for underserved populations such as MSFW children, and requires dental exams upon enrollment. When separating the children into groups of HS enrolled and non-HS enrolled, those enrolled were significantly more likely to have seen a dentist in the last year. Programs such as HS can have a significant impact on oral health

status of underserved populations. A study by Lukes, Wadhawan and Lampiris in 2004 conducted basic screening surveys on MSFW children enrolled in summer migrant education programs throughout Illinois.²⁶ This program has provided dental services for enrolled children since 1983. The basic screening services revealed dental sealant prevalence to be 51% for children 8 to 10 years of age, far exceeding the national average of 23% and even exceeding the Healthy People 2010 national goal of 50%.³² These results demonstrate how enrollment in such programs can have a significant effect on oral health of disparate groups and could be used to justify continuation of programs during fiscally challenging times.

Limitations of the study include the small sample size and limited geographic distribution of the participants, as all of the participants lived in the Chicago area. The sample of health center patients could be more dentally aware, with differing knowledge, attitudes and behaviors, than those who do not access services. Midwestern MSFWs may also be very different from those in other parts of the country with different issues affecting oral health knowledge, attitudes and behaviors. Farm workers from the eastern or western streams may be from different areas of Mexico with different cultural beliefs and practices. Another limitation is that all data was self reported, which can have recall issues associated with reporting. Information about all preschoolers under the age of 5 in the home could have yielded different results. Studying MSFWs is especially dif-

ficult due to mobility and multiple issues affecting the population. Therefore, data gathered even in small increments can be significant contributions to the literature.

Conclusion

Migrant and seasonal farm workers remain an underserved population with poor oral health status, poor access to oral health care and multiple factors affecting oral health knowledge, attitudes and behaviors. More research is warranted on this difficult to reach population. A better understanding of influences on oral health knowledge, attitudes and behaviors can assist in implementing appropriate interventions for the maintenance of good oral health in MSFW families. Programs such as HS can have a positive impact on oral health status of MSFW children and other underserved groups eligible for the program. Dental hygienists should be community advocates for programs such as HS that promote oral health for underserved populations.

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Factors Affecting North Carolina Dental Hygienists' Confidence in Providing Obesity Education and Counseling

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This project won 2nd place in the DENTSPLYADHA Graduate Dental Hygiene Research Competition, June, 2009.

Introduction

Obesity is a major public health problem in the United States, and is considered to be the second leading cause of preventable death in adults.¹⁻³ Approximately 112,000 deaths per year are attributed to obesity.⁴ Between 1980 and 2004, the prevalence of obesity increased in adults from 15 to 33%, and 6 to 19% in children.⁵ According to the CDC, in 2007 North Carolina ranked eleventh in obesity among adults, with 28% of the adult population considered obese (body mass index >30).⁶

Obesity is a well-established risk factor for diabetes mellitus.⁷ Diabetes is a well-known risk factor for periodontal disease – accordingly, there is an indirect but plausible link between obesity and oral health. In line with current dental health care trends that seek to include screening for systemic conditions that may impact oral health, there has been a recent interest in including an assessment for obesity risk factors at the dental appointment. Dental practice-based prevention and intervention strategies have been studied by Tavares and colleagues⁸ who reported that employing dental hygienists in a community-based public health clinic to provide obesity screening to children is effective and well-accepted.

Abstract

Purpose: Obesity is a major public health issue in the United States. Dental hygienists influence their patients' oral health by providing dietary and behavioral recommendations that encourage good oral health practices. However, it is not known if they are ready to provide behavioral counseling strategies for weight loss. This study investigates whether dental hygienists in North Carolina are confident to counsel patients who are at-risk for obesity.

Methods: A questionnaire was used to survey 246 dental hygienists attending a continuing education (CE) course. It investigated self-reported confidence in providing obesity counseling, educational preparation, outcome expectations and self-efficacy. The primary outcome was confidence in providing weight loss counseling. Mantel Haenszel statistics were used to compare group of interest.

Results: Of the dental hygienists surveyed, 43% perceived an increase of overweight patients in their practices. Nearly all (95%) felt that dental hygienists have a role in helping patients improve nutrition. Over half (65%) expressed confidence in discussing obesity-related health risks. On average, the confidence in getting patients to follow weight loss advice was significantly different ($p=0.02$) for those with a 2 year degree and those with a 4 year degree.

Conclusions: The findings indicate that many North Carolina dental hygienists are willing to discuss obesity with patients.

Key Words: dental hygienist, obesity, confidence, education and counseling

This study supports the NDHRA priority area, Clinical Dental Hygiene Care: Investigates how dental hygienists use emerging science to reduce risk in susceptible patients.

Often, the dental hygienist is the oral health care professional who provides prevention and intervention services. This ever-evolving role may someday include addressing obesity to improve general

health as well as oral health. With the growing prevalence of obesity in the US, dental hygienists are ideally suited to provide obesity counseling services to their patients. Before this can happen, we must first

assess practicing dental hygienists' general preparedness, attitudes and confidence. Currently, it is unknown whether dental hygienists in private practice have an interest in providing additional education for obesity or in offering interventions for this serious health problem. Because obesity is not generally known to have a direct effect on oral health, many dental hygienists may not even be aware of their potential role. Neither their confidence nor their skills to apply current knowledge have been explored. Additionally, it is not known whether dental hygiene education is preparing dental hygienists of the future for this task.

The purpose of this cross-section survey was to determine factors that affect dental hygienists' confidence in their ability to modify their current dietary counseling and behavior modification skills to assist their patients in the prevention and management of obesity. Methods to prepare dental hygienists for this role was also explored.

Review of the Literature

Oral and Systemic Health Issues Related to Obesity

Overweight and obesity are generally defined as excess body weight and measured by body mass index (BMI). A BMI for adults is calculated as weight in kilograms divided by height in meters squared. This is used to express weight adjusted for height.^{9,10} The US Dietary Guidelines defines healthy weight as a BMI of 18.5 to 24.9, overweight as 25 to 29.9 and obesity as 30 or greater.¹¹ With children, the BMI number is calculated the same as adults, however, it is also calculated using age and sex specific percentiles and can be referred to as BMI-for-age.¹²

Many health problems are related to overweight and obesity.^{7,13-21} Obesity can cause significant disability and shorten life expectancy.^{13,22,23} Studies have shown that obese individuals have a 10 to 50% increased risk of death from all

causes, compared to healthy weight individuals.²⁴

Because obesity is a well-established risk factor for diabetes, it is no surprise that the incidence of diabetes has increased with the rise in obesity.⁷ There is a well-established relationship between diabetes and periodontal disease.^{25,26} Therefore, this indirect relationship between obesity and periodontal disease is of great importance to the dental team and may provide a link between obesity and oral health that will serve as the foundation for the role of the oral health team in addressing obesity.

The question regarding a link between childhood obesity and an increase in dental caries has also been examined. Macek and Mitola²⁷ reported that there is no significant association between BMI for age and the prevalence of dental caries. However, another study gives evidence that there may be an association. Hilgers et al²⁸ reported that the mean number of smooth surface lesions on permanent molars significantly increased with a higher BMI. In short, the relationship between childhood obesity and dental caries is proving to be complex and equivocal.

The Role of the Dental Hygienist in Obesity Counseling

One of the responsibilities of the dental hygienist is to routinely offer nutritional counseling to their patients who are at risk for dental caries.²⁹ It is not known to what degree this service can be modified to address obesity and obesity risk factors. Previous studies have reported that 80% of North Carolina dentists are interested in offering nutritional counseling to help patients with weight loss (A. Curran, DDS, MS, University of North Carolina-Chapel Hill School of Dentistry, oral communication, October 2007). However, they feel that lack of trained personnel is a barrier in offering obesity intervention to their patients.³⁰ This lack of training may be a negative influence on den-

tal hygienists' confidence despite the fact that dental hygienists may be the ideal personnel to deliver obesity education to their patients. They have a history of providing care to their patients that falls outside primary dental hygiene care. However, there is a paucity of reported evidence on the confidence of dental hygienists to advise overweight/obese adults or children on weight-related issues. For dentists and dental hygienists to be effective partners in obesity prevention and management, factors affecting dental hygienists' confidence as well as level of training must be assessed.

Measuring Self-Confidence in Dental/Medical Providers

In attempting to assess confidence of health care providers in general, there is a dearth of published data regarding confidence levels in obesity education and counseling. Steptoe et al³¹ reported on student nurses' limited confidence in their training and ability to motivate changes in diet and physical activity. Less than half of the student nurses felt they were properly trained to give lifestyle counseling advice, while 25% felt it was difficult to counsel patients about an alternative lifestyle. Half of the student nurses felt they could offer their patients lifestyle counseling and almost 75% said the identification of obesity is a very important part of their day-to-day work.³¹

It is unknown whether dental hygienists have the confidence to adapt their dietary counseling and behavior modification skills to address healthy weight issues. Moreover, no studies could be found that specifically address dental hygienists' confidence in providing obesity counseling and education. However, previous studies of confidence among dental hygienists have been investigated in other areas of health promotion and disease prevention, including dietary counseling,³² oral cancer screenings,³³ tobacco cessation³⁴⁻³⁶ and health promotion in general.³⁷ In these studies, self-

confidence was related to self-perceived knowledge and skill level of the dental hygienist.^{32,35,36} Edwards et al reported that dental hygienists were least confident in engaging staff members in developing smoking cessation plans assessing nicotine dependence and making the appropriate referral, but were confident in counseling a patient when it pertained to the reason for the patient's visit.³⁵ Mullen et al reported that dental hygienists had the highest self-efficacy in counseling patients about blood pressure and smoking.³⁷

The purpose of this study was to determine if dental hygienists are confident in their ability to use their dietary counseling and behavior modification skills to assist in the prevention and management of obesity.

Methodology

This study used a cross-sectional survey design to assess the confidence of North Carolina dental hygienists in the prevention and management of obesity. In addition, it assessed their attitudes, opinions and educational preparedness to counsel patients who are obese and those who are at-risk for obesity about health concerns associated with this serious issue. The survey was approved by the University of North Carolina (UNC) Biomedical Institutional Review Board. The "Dental Hygienists' Role in Addressing Obesity" survey research instrument was developed specifically for this study. Content validity was assessed by a panel of 4 UNC School of Dentistry dental educators who have experience in survey methodology and obesity. No other measures of the instrument's validity or reliability were conducted.

The participants for the survey were recruited from participants (n=345) attending a continuing education (CE) course for dental hygienists on prevention-related issues that was sponsored by UNC-Chapel Hill School of Dentistry. Dental hygiene students, dentists,

Table I

Domains
A. Planning –Help develop an office-wide plan to address obesity for patients –Help an individual patient develop a weight loss plan
B. Inquiry –Respond with accurate information to a patient's inquiry about weight loss
C. Initiation –Initiate a conversation with a patient about weight-related health issues –Discuss with a patient the specific health risks associated with obesity and the importance of weight loss
D. Direction –Be successful in getting patients/parents to follow your weight loss advice –Refer patients/parents to a specialist who will help with weight loss

dental assistants and members of the general public who attended the course were excluded. The non-coded, anonymous questionnaire, along with a cover letter describing the study and the confidentiality statement, was included in the registrants' packets. As an incentive to participate, respondents who deposited their name and phone number in a separate bin were eligible for a cash drawing.

Questionnaires were produced using Teleform, an optically scanned format that simplifies data entry. The main outcome variable was the level of confidence that dental hygienists felt while advising obese patients on achieving their weight goals. To determine the level of confidence, domains were constructed based on the face content of the questions. Table I lists the domains together with the items from the questionnaire that made up each domain.

Descriptive statistics were generated for all study variables and domains. The Mantel-Haenszel row mean score statistic was used to compare the domain scores between dental hygienists in general versus specialty practice, between those with a 2 year versus a 4 year degree, between dental hygienists who self-reported as under/normal weight versus overweight/obese and among cohorts based on year of

graduation. Associations between the domain scores of confidence and education and training were assessed using the Spearman correlation. General linear models were used to quantify the association between the outcome and the independent variables. The alpha level was set at 0.05 for all analyses.

Results

Personal and Practice Demographics

Of the 345 dental hygienists that attended the CE course, 246 (71.3%) responded to the questionnaire. The demographic characteristics of the study sample are illustrated in Table II and the practice characteristics of the study sample are illustrated in Table III. The majority of participants were Caucasian non-Hispanic females with a 2 year degree who worked in suburban general practices that do not accept Medicaid. Ages and years in practice were equally distributed.

Attitudes and Opinions

Eighty-two percent of the respondents agreed they would be more likely to offer advice on weight loss if specific oral health problems are found to be associated with obesity. The majority of respondents (95%) agreed that dental hygienists have a role in helping patients improve nutrition, but only

36% felt that dental hygienists have a role in helping patients achieve weight loss goals. Ninety-four percent expressed a desire to have a greater influence on their patients' overall health. However, only 12% expressed a willingness to discuss weight issues without the patient initiating the conversation.

The attitudes and opinions on perceived roles were statistically different when comparing the year of graduation. Those who earned their degree between the years of 1958 and 1984 agreed most often with the statement that dental hygienists have a role in discussing weight loss issues with their patients ($p=0.02$).

Confidence

Table IV illustrates confidence in the ability to provide counseling for overweight and obese patients in a variety of areas. The respondents were most confident in discussing with their patients specific health risks associated with obesity and the importance of weight loss. They appeared to be least confident in getting their patients to follow their weight loss advice.

The average score for confidence in planning an obesity intervention was statistically different between those respondents in general practices versus specialty practices, with those in specialty practices reporting more confidence ($p=0.04$). On average, those in specialty practices were more confident in initiating conversations about obesity ($p=0.002$). Confidence in directing patients to a weight loss specialist and influencing patients to follow their weight loss advice among dental hygienists with a 4 year degree was statistically different than respondents with a 2 year degree ($p=0.02$).

Education and Training

Most participants (90%) reported they were taught nutritional counseling, but far fewer were trained to obtain height and weight measurements (14%), or to interpret a BMI

Table II: Demographics of study population (n=246)

Characteristic	N	Percent Distribution
Gender		
Female	236	97.9
Male	5	2.0
Age		
< / = 34	74	31
35–47	86	36
>47	79	33
Race		
Caucasian	222	92.9
Other	17	7.1
Ethnicity		
Hispanic	3	1.4
Non-Hispanic	209	96.6
Highest dental hygiene degree		
2 year degree	156	65
4+ year degree	84	35
Year Degree Earned		
1958–1984	69	29
1985–2000	85	36
2001–2008	85	36
Number of Years Employed		
< or = 7 years	85	35.6
8–21 years	79	33
>21 years	75	31
Self-Reported Weight		
Underweight/Normal	149	62
Overweight/Obese	92	38

Percentages may not add to 100 due to rounding

score (25%). Over one-third knew how to apply their behavior modifications skills learned in school to weight loss issues (37%), and some (29%) knew how to identify risk factors for obesity, but fewer (18%) knew how to refer a patient to a specialist.

Dental hygienists with a 4 year degree reported receiving more education and training about obesity than those with a 2 year degree ($p=0.03$). Those who earned their degree between the years of 2001 to 2008 received more training in nutritional counseling, more on topics of obesity as a health issue and

more behavior modification skills that could be applied to weight loss issues when compared to the graduates of earlier years ($p<0.001$).

A multivariate analysis was undertaken between the domains of confidence and education and training (Table V). The Spearman correlation was used to examine the strength of this relationship. There was a statistically significant correlation between most of the domains in confidence and the perception of education and training received. However, the associations were weak. Education and training explains only 5 to 10% of the variability

ity in the confidence domains. These data reveal that the more education and training dental hygienists perceived they had, the more confident they appeared to be.

Discussion

In 2007, adult obesity rates rose in 31 states. In 19 states, 25% of the adult population is obese.³⁸ North Carolina is no exception. The rate of overweight and obese adults in North Carolina has increased from 46% in 1990³⁹ to approximately 63% in 2005, giving the state the seventeenth highest prevalence rate of adult overweight/obesity in the United States.⁴⁰ In 2007, North Carolina ranked eleventh in obesity, with 28% of the adult population considered obese.⁶

The purpose of this study was to determine if dental hygienists are confident in their ability to use their dietary counseling and behavior modification skills to assist in the prevention and management of obesity. It was hypothesized that dental hygienists would have a positive attitude toward promoting the health of these patients, but they would lack the confidence to carry out obesity counseling. Results showed that most dental hygienists would like to have a greater impact on their patient's overall health, but they felt they lacked the requisite training to address obesity-specific topics with their patients. This lack of training may be contributing to lack of confidence in specific tasks.

Many respondents reported they would not consider providing obesity-related counseling unless a link between obesity and oral health were established. Research on a direct relationship between obesity and oral health is lacking. However, there is an association between obesity and diabetes and diabetes and inflammation.^{41,42} This occurs when the fat cells, adipocytes, secrete pro-inflammatory cytokines into the plasma. These cytokines can lead to insulin resistance and then to diabetes mellitus.⁴¹ Some

Table III: Frequency of practice characteristics for study population (n=246)

Characteristic	N	Percent Distribution
Emphasis of Practice		
General/family dentistry	193	81
Pediatrics	7	3
Periodontics	18	7.6
Other	20	8.4
Practice Setting		
Urban	87	36.7
Suburban	109	45.9
Rural	41	17.3
Acceptance of Medicaid or Other Assistance		
Yes	81	34.5
No	154	65.5

Percentages may not add to 100 due to rounding

Table IV: Dental Hygienists' Perceived Confidence (n=244)

How confident are you in your ability to perform the following?	Respondents reporting "highly confident or confident" (percentage)
Discuss with a patient the specific health risks associated with obesity and the importance of weight loss	65
Direct patients to a specialist who will help with weight loss	60
Respond with accurate information to a patient's inquiry about weight loss	58
Initiate a conversation with a patient about weight-related health issues	37
Help an individual patient develop a weight loss plan	29
Help develop an office-wide plan to address obesity	28
Get patients/parents to follow your weight loss advice	18

researchers have associated this hyper-inflammatory state with exacerbation of periodontal infections because of the exaggerated response caused by the infecting organisms. This evidence-based information may help provide a point of discussion for dental hygienists when they are counseling patients with diabetes. By becoming more knowledgeable about such associations, the dental hygienists may

learn of more direct associations between obesity and periodontal health as they are discovered.

In the United States, obesity carries some degree of social stigma. For dental hygienists to overcome the effects of this stigma, a non-judgmental attitude is needed. Our study showed that 17% of dental hygienists thought overweight people lack will power compared to normal weight people, and 17%

thought most overweight problems are inherited. Comparisons of attitudes and opinions were made between dental hygienists and the year of graduation from dental hygiene school. It was shown that many who graduated prior to 1984 believed that dental hygienists have a role in obesity education and counseling. This same group perceived an increase in the number of overweight patients and felt that overweight people lack will power when compared to normal weight people. Negative attitudes such as these are not uncommon, and have been documented to exist with other health professionals.^{43,44} Because of the attitudes expressed in this study, the investigators recommend increased education to inform dental hygienists about the issue of obesity and how to better manage patients suffering with this serious health problem.

Changes in dental hygiene education programs will be needed to include an evaluation of the extent to which current dental hygiene curricula prepare dental hygienists to meet the needs of patients affected by obesity. Because obesity is a multi-factorial health problem, a variety of skills will be needed to work with individuals who are obese. This study sought to determine whether dental hygienists' education and training in nutrition, dietary counseling and behavior modification has created a confidence level that is adequate for addressing obesity in adults. This study made an assumption that dental hygienists already possess the training and expertise to expand into the area of obesity education for their patients, but we found that a large percentage of North Carolina dental hygienists had not received education or did not recall having received training on how to manage obesity. High quality CE courses taught by experts in the field could focus on obesity as a health issue. These courses should include topics such as: obtaining weight, obtaining height measure-

Table V: Correlation between confidence domains and perception of education and training received (n=244)

Education		
Confidence	Spearman Correlation	p-value
Planning	.15	.02*
Inquiry	.22	<.001*
Initiation	.10	.12
Direction	.17	.01*
Training		
Planning	.22	<.0001*
Inquiry	.25	<.001*
Initiation	.14	.04*
Direction	.27	<.001*

*Statistically significant (p<.05)

ments, interpreting a BMI score and identifying a person at-risk for obesity, all of which could add to increasing confidence levels of dental hygienists.

There was a statistically significant correlation between many of the domains in confidence and the perception of education and training received (Table V), but the associations were weak. Education and training explained 5 to 10% of the variability in the confidence domains. It should be noted, however, that the figures underscore that the more education and training dental hygienists have, the more confident they become.

This study aimed to determine how attitudes and opinions, as well as education and training, affect North Carolina dental hygienists' confidence in providing obesity education and counseling. It was hypothesized that dental hygienists would feel confident in providing this service to their patients. This study revealed that many North Carolina dental hygienists do feel confident in many aspects of obesity counseling. Forty-three percent responded that they were confident in planning obesity programs, 70% were confident in answering patient inquiries regarding obesity, 60% were confident in initiating conversations about health risks associated with obesity and 73% were

confident in directing patients to a weight loss specialist.

When comparing dental hygienists who worked in general practices with those who worked in specialty practices, results showed that dental hygienists in specialty practices felt more confident in the domains of planning and initiating than those in general practices. This mirrors a study of United States female physicians by Frank et al,⁴⁵ who found that specialty physicians such as obstetricians, gynecologists and pediatricians were more likely to provide nutrition and weight counseling to their patients. The current study also found that dental hygienists in specialty practices were more confident in the area of obesity education and counseling. Perhaps this is due to the nature of care in many specialty practices, since they tend to have patients with more advanced needs for oral health care. Additional research on barriers to providing obesity counseling may shed some light on the difference between general and specialty practice.

Additional research in the area of obesity education and counseling should focus on the current dental hygiene curriculum content that teaches skills applicable to identifying patients who are at-risk for obesity, as well as counseling patients on weight loss or mainte-

nance. Research is needed on educational needs of dental hygienists who choose to be part of an obesity prevention team.

A national survey of dental hygienists is needed to investigate factors that affect their confidence in providing obesity education and counseling to their patients, and how those concerns compare to the present study. For example, do dental hygienists in California or Colorado feel more confident about obesity counseling than dental hygienists in North Carolina? Generally speaking, do dental hygienists who graduated from 4 year institutions feel more confident about obesity counseling than graduates from community colleges? This study found that dental hygienists in specialty practices are more confident than those who work in general practices. Further research of dental hygienists working in specialty practices may reveal why this group perceived themselves as more confident. A rationale could be determined about the specific factors that made them more confident and if those factors are transmissible to dental hygienists working in general practices. Also, these results only apply to obesity among adults. Future studies are needed to determine the attitudes and opinions of dental hygienists about addressing obesity among their pediatric patients.

There are several limitations to this study. This was a non-random, convenience sample limited to North Carolina dental hygienists. This sample limits the ability to generalize the findings and conclusions to the general population of registered dental hygienists. However, because North Carolina has the eleventh highest rate for adult obesity⁶ and the fifth highest rate of overweight youths,⁴⁶ the opinions of our respondents are relevant. It

is assumed that these dental hygienists encounter a greater number of obese patients, as well as patients who are at-risk for obesity, and they are generally more aware of obesity-related concerns than dental hygienists in states with lower rates of adult obesity.

The presence of non-responder bias had the ability to affect the results by skewing the data, due to the missing data on many of the questions. However, the missing data was adjusted for by using the Mantel-Haenszel row mean score. Conversely, intentional deception on the part of the respondents, poor memory and misunderstanding of the questions are other limitations that may have affected survey results but could not be adjusted for. While this survey had a relative high response rate (71%), factors such as inadequate explanation of the questionnaire or lack of interest in the subject may have contributed to the decision of 29% to not respond.

There is much work to be done before the incorporation of obesity education and counseling into the dental office becomes routine. Recent graduates and those with a baccalaureate degree have had more obesity education and more education on nutritional and obesity counseling than graduates before 2001. More CE courses may be needed to explain the important connections between obesity and oral health, as well as additional research into the nature of these links. Additional CE courses could also increase dental hygienists' confidence in developing weight loss plans for their patients by teaching dental hygienists how to develop these plans. Additional education will have a positive impact on their confidence in initiating conversations about weight-related health issues, developing office-wide

plans to address obesity and getting patients to follow their weight loss advice.

Conclusion

North Carolina dental hygienists agreed about their role in patients' overall health, and indicated that they may be willing to incorporate obesity counseling into their daily practice. However, 40% of respondents expressed not advising patients on obesity until an oral-systemic link is found. This lack of a link may be undermining their confidence. Dental hygienists should continue to conduct and monitor research on possible links between obesity and oral health. As dental hygienists increase their knowledge about obesity, confidence may well increase. As confidence grows, obesity education and counseling may become a common dimension of the dental hygiene treatment plan.

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