

## Psychosocial and Skill-based Differences between Dental and Dental Hygiene Students Regarding Secondary Prevention of Eating Disorders

Rita D. DeBate<sup>1\*</sup>, Deborah Cragun<sup>1</sup>, Herbert H Severson<sup>2</sup>, Jennifer Bleck<sup>1</sup>, Tegwyn Brickhouse<sup>3</sup>, Debra Heysek<sup>4</sup> and Kim Isringhausen<sup>5</sup>

<sup>1</sup>Department of Community & Family Health, College of Public Health, University of South Florida, USA

<sup>2</sup>Deschutes Research, Inc., USA

<sup>3</sup>Department of Pediatric Dentistry, School of Dentistry, Virginia Commonwealth University, USA

<sup>4</sup>Department of Dental Hygiene, Hillsborough Community College, USA

<sup>5</sup>Oral Health Promotion and Community Outreach, School of Dentistry, Virginia Commonwealth University, USA

### Abstract

**Objective:** A long-standing challenge in oral health education is preparing dental and dental hygiene students to address oral/systemic health issues with their patients, particularly regarding sensitive topics such as eating disorders. Oral health providers can play a key role in secondary prevention through early identification and referral of patients exhibiting signs of disordered eating behaviors. Dental and dental hygiene academic competencies include prevention counseling, health promotion, and interpersonal and communication skills, but there are differences across these groups in terms of whether they address oral signs of disordered eating behaviors with their patients.

**Methods:** As part of a larger prospective study, the current study sought to determine the extent to which psychosocial and skill-based factors differ among dental and dental hygiene students in order to guide changes to academic training. A baseline Likert-type questionnaire was completed by dental (n=476) and dental hygiene (n=190) students from 27 oral health classes at 10 accredited dental and dental hygiene schools across the United States. Pretest data were analyzed to determine whether significant baseline differences exist between dental and dental hygiene students. Hierarchical linear models (HLM) were conducted using restricted maximum likelihood estimation.

**Results:** No statistically significant differences between dental and dental hygiene students regarding knowledge of eating disorders and related oral manifestations. However, as compared with dental students, dental hygiene students were more likely to perceive they have a role in secondary prevention of eating disorders but reported less knowledge regarding appropriate procedures for secondary prevention and report higher self-efficacy regarding secondary prevention behaviors.

**Conclusion:** Implications include the need for multi-disciplinary training for preparing dental and dental hygiene students to address sensitive oral/systemic health issues such as eating disorders with their patients.

**Keywords:** Dental students; Dental hygiene students; Eating disorders; Secondary prevention

### Introduction

It is increasingly accepted that oral health is connected to general health, and numerous oral/systemic health conditions (e.g., cardiovascular disease, diabetes, eating disorders, STIs, substance abuse, violence and trauma) have demonstrated the interrelationship between oral, physical, and mental health [1,2]. Accordingly, oral health providers are often the first health care professional in primary, secondary (i.e., screening, diagnosis, referral), and tertiary (i.e., oral treatment, member of a treatment team) prevention of oral/systemic health issues [1]. These roles in prevention require the acquisition of numerous cross-disciplinary psychosocial and skill-based competencies ranging from role beliefs and commitment, to collaborative care, identification skills pertaining to oral/systemic health issues, critical thinking and communication skills, and collaborative decision making [1,3]. A long-standing challenge in both dental and dental hygiene education is preparing future clinicians to participate in prevention of oral/systemic health issues [4-8].

In particular, dentists and dental hygienists have a unique opportunity for secondary and tertiary prevention of eating disorders, as they are often the first health professional to observe the overt health effects of disordered eating behaviors [9-12]. Disordered eating behaviors are comprised of restricting (e.g., unhealthy dieting, severe caloric restriction, meal supplements, skipping meals), purging (e.g., laxative, diuretic, diet pill use/misuse, self-induced vomiting) [13,14],

and bingeing. Disordered eating behaviors often progress to clinical eating disorders, which include Anorexia Nervosa, Bulimia Nervosa, Binge Eating Disorder, and Eating Disorders Not Elsewhere Classified (EDNEC) [15]. Both disordered eating behaviors and clinical eating disorders are significant public health concerns [16-19] that manifest with oral signs and symptoms as early as 6 months following consistent behavior [20]. Oral health issues resulting from disordered eating behaviors present as signs of malnutrition [21-31], dehydration [27,31-33] and vomiting [21-24,27,30,32,34-38]. Although oral health providers have the opportunity for secondary and tertiary prevention of eating disorders, these behaviors are often not performed despite a perceived ethical obligation [39]. Common barriers to secondary

**\*Corresponding author:** Rita D. DeBate, Department of Community & Family Health, College of Public Health University of South Florida, 13201 Bruce B. Downs Blvd, Tampa, FL 33612, USA, Tel: 813-974-6683; Fax: 813-974-5172; E-mail: [rdebate@health.usf.edu](mailto:rdebate@health.usf.edu)

**Received** January 02, 2014; **Accepted** March 11, 2014; **Published** March 15, 2014

**Citation:** DeBate RD, Cragun D, Severson HH, Bleck J, Brickhouse T, et al. (2014) Psychosocial and Skill-based Differences between Dental and Dental Hygiene Students Regarding Secondary Prevention of Eating Disorders. *Oral Hyg Health* 2: 123. doi: [10.4172/2332-0702.1000123](https://doi.org/10.4172/2332-0702.1000123)

**Copyright:** © 2014 DeBate RD, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

prevention include fear of offending patients, fear of misdiagnosis, and uneasiness with patient communication [39].

There are several psychosocial and skill-based competencies for oral health providers in regards to delivering secondary and tertiary prevention of eating disorders. With regard to required psychosocial and skill based competencies, foundational knowledge regarding basic and clinical science principles and clinical presentation of oral and systemic manifestations and conditions of eating disorders is important [2], but may be insufficient to guarantee secondary and tertiary prevention behaviors [40]. Beyond knowledge, fundamental attitudes, beliefs, and values are crucial for supporting and providing the motivation for oral/systemic prevention behaviors [2]. More specifically, with regard to eating disorders, role beliefs, perceived severity of eating disorders and perceived benefits of secondary prevention of eating disorders have been found to be associated with the likelihood of dental hygienists' performance of secondary prevention behaviors including: assessing dental patients for oral cues of disordered eating, providing specific home-dental care instructions for patients suspected of disorder eating, arranging a more frequent recall program, making referrals for treatment for patients suspected of disordered eating, and communication with the patients' primary care provider [40]. Lastly, skills and self-efficacy in clinical assessment, basic mental health assessment, differential diagnosis, communication, patient education, and formulation of treatment options are needed [2]. For example, high self-efficacy among both dentists and dental hygienists was found to be associated with increased odds of secondary prevention of eating disorders [40]. Most noteworthy, dental hygienists with high self-efficacy were five times more likely to refer patients and four times more likely to communicate with the patient's primary care provider [40], suggesting that self-efficacy is a strong predictor of secondary prevention behavior.

Although both dental and dental hygiene academic competencies include prevention counseling, health promotion, and interpersonal and communication skills [41], the skills needed for each may not be adequately addressed or uniformly integrated in oral health training curricula [5]. For example, with regard to secondary prevention of eating disorders, studies have found that training oral health professionals in such practices as assessment, patient approach/communication, behavior change strategies, and referral resources is lacking in their educational preparation [39,40,42-44]. In a study of dental and dental hygiene curricula with regard to secondary prevention of eating disorders, results revealed more dental hygiene programs (97%) than dental schools (79%) include eating disorders in their respective curricula ( $p=.003$ ) [42]. More specifically, only 75% of dental programs and 88% of dental hygiene program included patient education regarding oral signs of disordered eating behaviors [42]. Additionally, a review of dental and dental hygiene curricula revealed that only 58% of dental programs and 56% of dental hygiene programs included communication skills with regard to approaching patients about sensitive oral/systemic issues [42]. In recent years there have been several suggestions aimed at improving dental training in regards to knowledge of oral/systemic topics, higher order thinking skills, attitudes, interpersonal skills, personal values, and multidisciplinary training [45-47]. Despite growing literature and a call for dental education reform in 2010 [41], dental educators had just recently begun advocating for education reform [46]. Nonetheless, there is still a lack of standardized, comprehensive curriculum regarding disordered eating behaviors and communication/ interpersonal skills.

Since psychosocial and skill-based factors are strongly associated

with whether oral healthcare providers address oral signs of disordered eating behaviors with their patients it is crucial to include training on secondary prevention of eating disorders in oral health education. To gain broader insights into educational needs, this study sought to assess psychosocial and skill-based factors pertaining to secondary prevention of eating disorders among both dental and dental hygiene students.

## Conceptual Framework

The current study was part of a larger study that developed and evaluated an eating disorder specific training program for dental and dental hygiene students [48]. Guided by the Health Belief [49] and Information Motivation Behavioral Skills [50] models, Table 1 depicts the conceptual framework for the current study. The Health Belief Model (HBM) postulates that a person's likelihood to take action is dependent on four main psychosocial constructs. The first two include: 1) perceived susceptibility (i.e., the belief that individuals are at risk for disordered eating behaviors; and 2) perceived severity (i.e., the belief that disordered eating behaviors can cause serious damage to oral and physical health). Together these two constructs form an overall assessment of the perceived threat associated with eating disorders [51]. The third construct perceived benefits [51] is the belief that the benefits of engaging in secondary prevention of eating disorders can reduce the threat of associated oral/systemic health conditions. The fourth construct is perceived barriers [51]. With regard to secondary prevention of eating disorders, perceived barriers such as fear of misdiagnosis or offending the patient may prevent oral health providers from performing [39]. Generally speaking, according to the Health Belief Model, the perceived benefits associated with a behavior must substantially outweigh the barriers in order for individuals to perform the behavior [51].

The Information Motivation Behavioral Skills (IMB) Model [50] connects the constructs from the HBM [49] to other key factors such as knowledge, attitudinal beliefs, and skills that together should contribute to an individual's self-efficacy (i.e., confidence in one's ability to perform the behavior in a variety of situations) [51]. As the name implies, the IMB model has three interrelated components that influence behavioral adoption [50]. The following describes these components in reference to the current study: 1) Information regarding disordered eating behaviors and associated physical manifestations as well as skills-based knowledge (i.e., how to assess signs of disordered

Information Motivation Behavioral Skills (IMB) Contingency	Health Belief Model (HBM) Mechanisms
Information	Knowledge of types and characteristics of eating disorders Knowledge of physical manifestations of eating disorders Knowledge of oral manifestations of disordered eating behavior
Motivation	Perceived severity of disordered eating behaviors Perceived susceptibility of eating disorders Perceived role beliefs Perceived benefits of and Perceived barriers to secondary prevention
Behavioral Skill	Knowledge about how to perform the following secondary prevention skills: Differential diagnosis Patient communication regarding sensitive topics Patient specific treatment plans Referral to treatment Self-efficacy regarding secondary prevention skills

**Table 1:** Conceptual Framework for Secondary Prevention of Eating Disorders by Oral Health Providers.

eating behavior, differential diagnosis, and communication of findings with the patient); 2) Motivation which includes attitudes about one's roles and responsibilities in identifying and addressing signs of disordered eating, perceived threat, and costs/benefits of performing the behaviors; and, 3) Behavioral skills which refers to self-efficacy and skills that are needed to perform the preventative behaviors [50].

## Methods

### Participants

As part of a the prospective, group-randomized controlled trial, a baseline Likert-type questionnaire was completed by 476 dental and 190 dental hygiene students from 27 oral health classes at ten accredited dental and dental hygiene schools/universities across the continental United States. Classes were randomized into either an intervention condition that included a web-based training program (n=15 classes; 8 dental, 7 dental hygiene) or a control condition with no additional training beyond the standard curriculum (n=12 classes; 6 dental, 6 dental hygiene). Course instructors introduced the study as a supplement to coursework. Monetary compensation was provided to students in both conditions and prior to completing the pre-test assessment students registered online and provided consent to participate. Additional details regarding the main study design and procedures have been published elsewhere [48]. For the purposes of the current study only pretest data were analyzed to determine whether significant baseline differences exist between dental and dental hygiene students regarding knowledge, attitudes, and self-efficacy to address disordered eating behaviors.

### Measures

A web-based instrument based on the conceptual framework for the current study was employed to assess knowledge, psychosocial, behavioral skill, and self-efficacy regarding secondary prevention of eating disorders in addition to socio-demographic factors.

**General knowledge:** Assessment of knowledge of eating disorders and oral findings included a composite score of 7 multiple-choice questions where correct responses were coded with a 1 and incorrect responses were coded with a 0. Responses were summed and ranged from 0 to 7. A representative sample of questions included the following (correct responses in parentheses):

- Oral findings associated with disordered eating behaviors can be categorized as signs of... (dehydration, vomiting, malnutrition).
- Angular chelitis is an extra-oral finding that can be associated with the following disordered eating behavior(s) (Severe food restriction).

**Psychosocial factors:** The assessment of psychosocial factors included role beliefs, perceived susceptibility, perceived severity, perceived benefits, and perceived barriers.

Professional and legal role beliefs were assessed with 8 items rated on a 4-point Likert-type scale ranging from "strongly disagree" (0) to "strongly agree" (3) and demonstrated good internal consistency reliability ( $\alpha = .872$ ). Representative questions included the following:

- Dental professionals have a professional responsibility to communicate with patients about how certain oral findings can be associated with disordered eating behaviors once other possible etiologies have been ruled out.

- Liability in identifying patients with eating disorders is an important issue in dentistry.

Scores were averaged to create a scale measure ranging from 0 to 3, with higher scores indicating a stronger belief that OHPs have a professional and legal responsibility to perform behaviors related to secondary prevention of disordered eating behaviors.

The perceived susceptibility sub-scale was comprised of 9 items asking to what extent the student agrees that various individuals, who do not fit the stereotype (i.e., young, very thin, female), could present with oral signs of disordered eating behaviors ( $\alpha = .912$ ). Examples included: "a female who is average weight for her height"; "a 10-year old girl"; "an athletic male". These items were rated on a 4 point Likert-type scale ranging from "strongly disagree" (0) to "strongly agree" (3). Scores were averaged to create a final scale ranging from 0 to 3, with higher scores indicating a higher level of perceived susceptibility among a broader range of individuals who are all potentially at risk for disordered eating behaviors.

The perceived severity sub-scale comprised 5-items which were rated on the same scale as the susceptibility items. Examples include: "Disordered eating behaviors can cause life-threatening health problems" and "Disordered eating behaviors can cause significant and extensive damage to the teeth and/or oral cavity". Scores were averaged to create a final subscale from 0 to 3, with higher scores indicating higher perceived severity.

The perceived benefits scale consisted of 5-items rated on the same Likert-type rating scale as the above measures. Examples include: "Addressing disordered eating behaviors with patients will show patients that I care about their oral and overall health"; "Communicating with patients about the link between eating behaviors and oral health will lead to improved oral health". Scores were averaged to create a final subscale from 0 to 3, with higher scores indicating higher perceived benefits.

The perceived barriers sub-scale consisted of 5 Likert-type items including the following: "I am concerned that I may misdiagnose a patient with signs of disordered eating behaviors"; "I do NOT have resources needed to make appropriate referrals for patients with signs of disordered eating behaviors". Scores were averaged to create a final subscale from 0 to 3, with higher scores indicating higher perceived barriers.

**Behavioral skills and self-efficacy:** Assessment of skills-based knowledge regarding how to approach patients, communicate findings, and treat patients with signs of disordered eating behaviors was obtained with a 10-item composite score where correct responses were coded with a 1 and incorrect responses were coded with a 0. Responses were summed and ranged from 0 to 10. A sample of questions included the following (correct responses in parentheses):

- Which of the following would be best when evaluating a patient who exhibits oral signs of disordered eating behaviors (Rule out the most common and/or least sensitive of the possible underlying causes first).
- In order to provide the most effective care, a patient treatment plan should... (be tailored based on a patient's stage of readiness to address the underlying problem).

**Perceived self-efficacy:** It was assessed with 7 items rated on a 4-point Likert-type scale, ranging from "not at all confident" (0) to "very confident" (3). The Cronbach's alpha for self-efficacy was

.91, representing good internal consistency reliability. A sample of representative behaviors included the following: recognizing oral findings associated with disordered eating behaviors; approaching a patient who presents with oral signs associated with disordered eating behaviors; prescribing patient-specific home-dental care instructions for patients with oral signs associated with disordered eating behaviors; and, assessing patient readiness to determine and/or address the underlying cause of the oral finding(s). Scores were averaged to create a scale measure ranging from 0 to 3, with higher scores indicating higher self-efficacy.

**Socio-demographic factors:** Sex, race/ethnicity, age, any prior clinical experience, previous course on eating disorders and oral findings, knowing someone with an eating disorder, and year in academic training were included to ensure that potential differences between dental and dental hygiene students were not attributable to other key differences, such as gender, that are either known or hypothesized to exist between these two groups of students.

### Data Analysis

HLM version 7.0. was used to assess for socio-demographic differences between dental and dental hygiene students while accounting for the clustered nature of the data. Multi-level modeling was conducted using restricted penalized quasi-likelihood estimation with a Bernoulli distribution at the individual level for variables with binary response categories. Year in the program and age were treated as continuous variables using hierarchical linear modeling with restricted maximum likelihood estimation and the Newton-Raphson algorithm.

Eight hierarchical linear models (HLM), one for each of the dependent variables of interest (self-efficacy, knowledge, role beliefs, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, skills-based knowledge), were conducted using restricted maximum likelihood estimation and the Newton-Raphson algorithm. The independent variables for each respective model included a constant and a group indicator. In a second round of models, dummy variables were added to each original model to control for potential confounding factors (i.e., gender, age, and prior clinical experience).

### Results

Table 2 describes the socio-demographic characteristics of dental (n=476) and dental hygiene students (n=190) collected from the baseline questionnaire. Statistically significant differences were observed between the two groups in terms of gender, race, and current or previous enrollment in a clinical practice course. Specifically, a significantly higher proportion of dental hygiene students were female (94.2% vs. 51.9%, p<.001) and were currently or previously enrolled in a clinical practice course (93.2% vs. 60.9%, p<.001). With regards to race, dental students had a significantly higher proportion of Asians than dental hygiene students (25.8% vs. 10.0%, p<.001) and a significantly lower proportion of American Indian/Alaska Native students (0.4% vs. 2.6%, p<.05).

Results pertaining to knowledge, psychosocial, behavioral skill, and self-efficacy are presented in Table 3. No statistically significant differences were observed between dental and dental hygiene students with regard to general knowledge of eating disorders and oral findings, perceived susceptibility, perceived severity, perceived benefits, and perceived barriers. However, results revealed that although dental hygiene students were more likely to report a professional and legal responsibility to perform secondary prevention than dental students (p<.001), dental hygiene students had lower behavioral skills-based

knowledge than dental students (p=.006). Dental hygiene students were also observed to report having higher self-efficacy regarding eating disorder specific secondary prevention (p< 0.001).

### Discussion

As growing evidence supports the relationship between oral and systemic health, the foundational preparation of dentists and dental hygienists requires the acquisition of numerous cross-disciplinary psychosocial and skill-based competencies. The purpose of this study was to assess foundational knowledge, psychosocial factors, behavioral skills and self-efficacy among dental and dental hygiene students with regard to the oral/systemic health issues associated with eating disorders. Based on a theory-driven conceptual framework, results of the current study indicate differences between dental and dental hygiene students in psychosocial factors, behavioral skills, and self-efficacy with regard to eating disorder specific secondary prevention.

Variables	Dentists n (%)	Dental Hygienists n (%)	P-value*
Gender			
Male	229 (48.1)	11 (5.8)	<0.001*
Female	247 (51.9)	179 (94.2)	
Age			
18-20 years	5 (1.1)	12 (6.3)	0.187
21-25 years	329 (69.3)	105 (55.3)	
26-30 years	108 (22.7)	38 (20.0)	
31-35 years	24 (5.1)	21 (11.1)	
36-40 years	7 (1.5)	10 (5.3)	
> than 40 years	2 (0.4)	4 (2.1)	
Ethnicity			
Hispanic or Latino	38 (8.0)	33 (17.4)	0.184
Race			
White	322 (67.6)	134 (70.5)	0.401
Black/African American	6 (1.3)	7 (3.7)	0.282
Asian	123 (25.8)	19 (10.0)	<0.001*
Native Hawaiian/ Pacific Islander	7 (1.5)	1 (0.5)	0.291
American Indian/ Alaska Native	2 (0.4)	5 (2.6)	0.016*
More than one	21 (4.4)	9 (4.7)	0.691
No race	18 (3.8)	20 (10.5)	0.113
Year in Program			
First	192 (40.3)	103 (54.2)	0.228
Second	209 (43.9)	64 (33.7)	
Third	58 (12.2)	9 (4.7)	
**Fourth	17 (3.6)	14 (7.3)	
Previous course covering eating disorders			
Yes	194 (40.8)	112 (58.9)	0.098
No	282 (59.2)	78 (41.1)	
Currently or previously enrolled in a clinical practice course			
Yes	290 (60.9)	177 (93.2)	<0.001*
No	186 (39.1)	13 (6.8)	
Know someone with an eating disorder			
Yes	291 (61.1)	117 (61.6)	0.901
No	185 (38.9)	73 (38.4)	

\*Test are significant at p<.05 and were therefore controlled for in second set of hierarchical linear models

\*\*One DH student reported being in their 5<sup>th</sup> year of training and was included with the fourth year students

**Table 2:** Socio-demographic comparisons of participating dental (n=476) and dental hygiene (n=190) students.



Variable	Dental student M (SD)	Dental Hygiene student M (SD)	P-Value	P-Value**
General knowledge of eating disorders/oral findings	3.65 (0.90)	3.62 (0.89)	0.729	0.056
Behavioral skills-based knowledge	4.17 (1.45)	3.96 (1.46)	0.133	0.006*
Self-efficacy	1.47 (0.54)	1.76 (0.49)	<0.001*	<0.001*
Role beliefs	2.16 (0.49)	2.37 (0.47)	<0.001*	<0.001*
Perceived susceptibility	1.72 (0.63)	1.68 (0.53)	0.463	0.074
Perceived severity	2.71 (0.35)	2.79 (0.32)	0.013	0.616
Perceived benefits	2.33 (0.41)	2.43 (0.41)	0.012	0.031
Perceived barriers	1.86 (0.57)	1.54 (0.63)	0.040	0.045

\*Tests are significant using the Holme's step-down procedure to control for type I error

\*\*p-value controlling for socio-demographic variables including gender, previous course covering eating disorders (ED), being a 1st year D/DH student, clinical experience, race/ethnicity (Asian, Hispanic.)

**Table 3:** Comparisons between dental and dental hygiene students on HBM mechanisms.

More specifically, results revealed dental hygiene students had higher professional and legal role beliefs and reduced barriers to perform secondary prevention. The importance of this finding can be supported by the following: 1) according to the Health Belief Model, the likelihood of engaging in prevention behavior is decreased when perceived barriers outweigh perceived benefits [51]; and 2) attitudes regarding the role that the oral healthcare provider has in the delivery of oral/systemic patient care is critical in motivating and supporting collaborative patient-centered care [2]. In other words, even if barriers were removed, dentists and dental hygienists will not engage in secondary prevention behaviors associated with oral/systemic health issues if they don't believe it is part of their role as a healthcare provider. Furthermore, although results indicated dental students with greater behavioral skills knowledge, dental hygiene students were observed with greater secondary prevention self-efficacy. This finding is particularly noteworthy, in that (a) knowledge has been found to be a necessary component, but not sufficient for guaranteeing performance of eating disorder specific secondary prevention behaviors [40], while (b) self-efficacy has been found to be a very strong predictor of secondary prevention behavior [40].

Subsequently, the results of the current study suggest support for interdisciplinary collaborative training for ensuring optimal care for oral/systemic health issues. A collaborative practice training model is built around the assumption that dentists and dental hygienists work together each offering unique and differing roles and professional expertise to optimal patient-centered care [1,3]. In order for collaborative decision-making and patient care to occur, each team member needs to recognize and value the unique contribution of each profession [2,3]. Subsequently, in relation to the findings of the current study, implications may suggest continuation of psychosocial training among dentists and behavioral skill training among dental hygienists. More importantly, implications point towards the development of such cross-professional or inter-professional competencies with the understanding that depth and breadth may vary by professional training, with the expectation that a collaborative practice training model will build on the unique roles and expertise of the dentist and dental hygienist as part of the treatment team. Thus, with regard to the training of future oral healthcare professionals, it is critical to determine best practices for facilitation of collaborative practice training. Learning and valuing collaboration in the training environment via inter-professional education, problem-based and case-based learning strategies, and

service-learning experiences may increase a collaborative practice model that works toward a shared responsibility for addressing oral/systemic health issues [2,3,52,53].

The results of the current study should be interpreted with certain limitations. Although students were from different dental and dental hygiene programs across the United States, this was a non-representative sample. A second limitation is that due to the study population (dentists and dental hygienists in training) we were unable to assess actual behaviors; thus, a key aspect of the IMB model could not be assessed. Based on the differences in role belief, procedural knowledge and self-efficacy found in this study, further research to determine whether differences carry over into practice is warranted. Thus, additional studies are needed to identify whether differences in behavioral precursors translate into behavioral differences among dental and dental hygiene students and to determine how this translates into their future practice. Despite limitations, results suggest the need for interdisciplinary training with regard to knowledge, psychosocial and behavioral skills factors necessary for addressing the growing oral/systemic health issues facing 21st century patient care. Future research is needed to identify best practices for collaborative training models, which develop the necessary foundation for addressing complex oral/systemic health issues like eating disorders.

#### Acknowledgement

This study was funded by the National Institutes of Health NIMH 1RC1DE020274-01

#### References

1. Wilder RS1, O'Donnell JA, Barry JM, Galli DM, Hakim FF, et al. (2008) Is dentistry at risk? A case for interprofessional education. *J Dent Educ* 72: 1231-1237.
2. Formicola A1, Valachovic RW, Chmar JE, Mouradian W, Bertolami CN, et al. (2008) Curriculum and clinical training in oral health for physicians and dentists: report of panel 2 of the Macy study. *J Dent Educ* 72: 73-85.
3. Swanson Jaecks KM (2009) Current perceptions of the role of dental hygienists in interdisciplinary collaboration. *J Dent Hyg* 83: 84-91.
4. Gibson-Howell JC (2010) Women's health topics in dental hygiene curricula. *J Dent Hyg* 84: 35-42.
5. Yoshida T1, Milgrom P, Coldwell S (2002) How do U.S. and Canadian dental schools teach interpersonal communication skills? *J Dent Educ* 66: 1281-1288.
6. Tedesco LA (1995) Issues in dental curriculum development and change. *J Dent Educ* 59: 97-147.
7. Kassebaum D, Hendricson WD, Taft T, Haden NK (2004) The dental curriculum at North American dental institutions in 2002-03: A survey of current structure, recent innovations, and planned changes. *Journal of Dental Education* 68: 914-931.
8. Hendricson WD1, Cohen PA (2001) Oral health care in the 21st century: implications for dental and medical education. *Acad Med* 76: 1181-1206.
9. Stege P, Visco-Dangler L, Rye L (1982) Anorexia nervosa: review including oral and dental manifestations. *J Am Dent Assoc* 104: 648-652.
10. Roberts MW, Li SH (1987) Oral findings in anorexia nervosa and bulimia nervosa: a study of 47 cases. *J Am Dent Assoc* 115: 407-410.
11. Hazelton LR1, Faine MP (1996) Diagnosis and dental management of eating disorder patients. *Int J Prosthodont* 9: 65-73.
12. Harrison JL, George LA, Cheatham JL, Zinn J (1985) Dental effects and management of bulimia nervosa. *Gen Dent* 33: 65-68.
13. Littleton, H.L. and T. Ollendick (2003) Negative body image and disordered eating behavior in children and adolescents: what places youth at risk and how can these problems be prevented? *Clin Child Fam Psychol Rev* 6: 51-66.
14. Neumark-Sztainer D (1996) School-based programs for preventing eating disturbances. *J Sch Health* 66: 64-71.

15. American Psychiatric Association (2013) *Feeding and Eating Disorders*, American Psychiatric Publishing.
16. Haines J1, Neumark-Sztainer D (2006) Prevention of obesity and eating disorders: a consideration of shared risk factors. *Health Educ Res* 21: 770-782.
17. Neumark-Sztainer D1, Hannan PJ (2000) Weight-related behaviors among adolescent girls and boys: results from a national survey. *Arch Pediatr Adolesc Med* 154: 569-577.
18. Neumark-Sztainer D1, Wall M, Guo J, Story M, Haines J, et al. (2006) Obesity, disordered eating, and eating disorders in a longitudinal study of adolescents: how do dieters fare 5 years later? *J Am Diet Assoc* 106: 559-568.
19. Neumark-Sztainer DR1, Wall MM, Haines JI, Story MT, Sherwood NE, et al. (2007) Shared risk and protective factors for overweight and disordered eating in adolescents. *Am J Prev Med* 33: 359-369.
20. National Eating Disorders Association (2002) *Dental complications of eating disorders: Information for dental practitioners*.
21. Lo Russo L1, Campisi G, Di Fede O, Di Liberto C, Panzarella V, et al. (2008) Oral manifestations of eating disorders: a critical review. *Oral Dis* 14: 479-484.
22. Sandstead HR, Koehn CJ, Sessions SM (1955) Enlargement of the parotid gland in malnutrition. *Am J Clin Nutr* 3: 198-214.
23. Mandel L1, Kaynar A (1992) Bulimia and parotid swelling: a review and case report. *J Oral Maxillofac Surg* 50: 1122-1125.
24. Mandel L1, Surattanont F (2002) Bilateral parotid swelling: a review. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 93: 221-237.
25. Reamy BV1, Derby R, Bunt CW (2010) Common tongue conditions in primary care. *Am Fam Physician* 81: 627-634.
26. Tyler I1, Wiseman MC, Crawford RI, Birmingham CL (2002) Cutaneous manifestations of eating disorders. *J Cutan Med Surg* 6: 345-353.
27. Strumia R (2005) Dermatologic signs in patients with eating disorders. *Am J Clin Dermatol* 6: 165-173.
28. Strumia R (2009) Skin signs in anorexia nervosa. *Dermatoendocrinol* 1: 268-270.
29. Neiva RF1, Steigenga J, Al-Shammari KF, Wang HL (2003) Effects of specific nutrients on periodontal disease onset, progression and treatment. *J Clin Periodontol* 30: 579-589.
30. Lundgren JD1, Allison KC, Crow S, O'Reardon JP, Berg KC, et al. (2006) Prevalence of the night eating syndrome in a psychiatric population. *Am J Psychiatry* 163: 156-158.
31. Farah CS1, Lynch N, McCullough MJ (2010) Oral fungal infections: an update for the general practitioner. *Aust Dent J* 55: 48-54.
32. Cashman MW1, Sloan SB (2010) Nutrition and nail disease. *Clin Dermatol* 28: 420-425.
33. Dynesen AW1, Bardow A, Petersson B, Nielsen LR, Nauntofte B (2008) Salivary changes and dental erosion in bulimia nervosa. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 106: 696-707.
34. Ruff JC1, Koch MO, Perkins S (1992) Bulimia: dentomedical complications. *Gen Dent* 40: 22-25.
35. Frydrych AM1, Davies GR, McDermott BM (2005) Eating disorders and oral health: a review of the literature. *Aust Dent J* 50: 6-15.
36. Gandara BK1, Truelove EL (1999) Diagnosis and management of dental erosion. *J Contemp Dent Pract* 1: 16-23.
37. Bricker S, Langlais R, Miller C (2001) *Oral Diagnosis, Oral Medicine, and Treatment Planning*. PMPH-USA.
38. Porto IC1, Andrade AK, Montes MA (2009) Diagnosis and treatment of dentinal hypersensitivity. *J Oral Sci* 51: 323-332.
39. DeBate R, Tedesco L (2006) Increasing Dentists' Capacity for Secondary Prevention of Eating Disorders: Identification of Training, Network, and Professional Contingencies. *J Dent Educ* 70: 1066-1075.
40. DeBate RD1, Plichta SB, Tedesco LA, Kerschbaum WE (2006) Integration of oral health care and mental health services: Dental hygienists' readiness and capacity for secondary prevention of eating disorders. *J Behav Health Serv Res* 33: 113-125.
41. (2010) Commission on Dental Accreditation, *Accreditation standards for dental education programs*. Chicago
42. DeBate RD1, Shuman D, Tedesco LA (2007) Eating disorders in the oral health curriculum. *J Dent Educ* 71: 655-663.
43. DeBate RD1, Tedesco LA, Kerschbaum WE (2005) Knowledge of oral and physical manifestations of anorexia and bulimia nervosa among dentists and dental hygienists. *J Dent Educ* 69: 346-354.
44. DeBate RD, Tedesco LA, Kerschbaum WE (2005) Oral health providers and secondary prevention of disordered eating: an application of the transtheoretical model. *J Dent Hyg* 79.
45. Miller PM1, Ravenel MC, Mauldin MP, Sulkowski S, Lowndes A, et al. (2014) An online alcohol and oral health curriculum for dental students. *J Dent Educ* 78: 16-23.
46. Nadershahi NA1, Bender DJ, Beck L, Alexander S (2013) A case study on development of an integrated, multidisciplinary dental curriculum. *J Dent Educ* 77: 679-687.
47. Brondani MA1, Rossoff LP (2010) The "hot seat" experience: a multifaceted approach to the teaching of ethics in a dental curriculum. *J Dent Educ* 74: 1220-1229.
48. DeBate RD1, Severson HH, Cragun DL, Gau JM, Merrell LK, et al. (2013) Evaluation of a theory-driven e-learning intervention for future oral healthcare providers on secondary prevention of disordered eating behaviors. *Health Educ Res* 28: 472-487.
49. Rosenstock IM1, Strecher VJ, Becker MH (1988) Social learning theory and the Health Belief Model. *Health Educ Q* 15: 175-183.
50. Fisher JD1, Fisher WA, Bryan AD, Misovich SJ (2002) Information-motivation-behavioral skills model-based HIV risk behavior change intervention for inner-city high school youth. *Health Psychol* 21: 177-186.
51. Bandura A (1977) Self-efficacy: toward a unifying theory of behavioral change. *Psychol Rev* 84: 191-215.
52. Cragun DL1, DeBate RD, Severson HH, Shaw T, Christiansen S, et al. (2012) Developing and pretesting case studies in dental and dental hygiene education: using the diffusion of innovations model. *J Dent Educ* 76: 590-601.
53. Mouradian WE1, Huebner C, DePaola D (2004) Addressing health disparities through dental-medical collaborations, Part III: Leadership for the public good. *J Dent Educ* 68: 505-512.