

Summer 2021

Use of an Innovative Simulated-Virtual Training to Improve Dental Hygiene Students' Self-Reported Knowledge, Attitudes, and Confidence in Providing Care to Child Patients with Autism Spectrum Disorder

Kimberly Frances Cenzone
Old Dominion University, kcenz001@odu.edu

Follow this and additional works at: https://digitalcommons.odu.edu/dentalhygiene_etds



Part of the [Dentistry Commons](#), [Disability Studies Commons](#), [Educational Technology Commons](#), and the [Health and Physical Education Commons](#)

Recommended Citation

Cenzone, Kimberly F.. "Use of an Innovative Simulated-Virtual Training to Improve Dental Hygiene Students' Self-Reported Knowledge, Attitudes, and Confidence in Providing Care to Child Patients with Autism Spectrum Disorder" (2021). Master of Science (MS), Thesis, Dental Hygiene, Old Dominion University, DOI: 10.25777/esdx-v031
https://digitalcommons.odu.edu/dentalhygiene_etds/20

This Thesis is brought to you for free and open access by the Dental Hygiene at ODU Digital Commons. It has been accepted for inclusion in Dental Hygiene Theses & Dissertations by an authorized administrator of ODU Digital Commons. For more information, please contact digitalcommons@odu.edu.

**USE OF AN INNOVATIVE SIMULATED-VIRTUAL TRAINING TO IMPROVE
DENTAL HYGIENE STUDENTS' SELF-REPORTED KNOWLEDGE, ATTITUDES,
AND CONFIDENCE IN PROVIDING CARE TO CHILD PATIENTS WITH AUTISM
SPECTRUM DISORDER**

by

Kimberly Frances Cenzone
B.S. May 2015, Virginia Polytechnic Institute and State University
B.S.D.H. May 2019, Old Dominion University

A Thesis Submitted to the Faculty of
Old Dominion University in Partial Fulfillment of the
Requirements for the Degree of

MASTER OF SCIENCE

DENTAL HYGIENE

OLD DOMINION UNIVERSITY
August 2021

Approved by:

Ann Bruhn (Director)

Denise M. Claiborne (Member)

Jonna Bobzien (Member)

ABSTRACT

USE OF AN INNOVATIVE SIMULATED-VIRTUAL TRAINING TO IMPROVE DENTAL HYGIENE STUDENTS' SELF-REPORTED KNOWLEDGE, ATTITUDES, AND CONFIDENCE IN PROVIDING CARE TO CHILD PATIENTS WITH AUTISM SPECTRUM DISORDER

Kimberly Frances Cenzone
Old Dominion University, 2021
Director: Professor Ann Bruhn

Problem: As the diagnosis prevalence of Autism Spectrum Disorder (ASD) increases, it is important for dental hygiene students to be knowledgeable and comfortable in providing care to children with ASD. However, limited clinical experiences can result in decreased confidence in the ability to interact with children diagnosed with ASD in a clinical setting. Methodology: A convenience sample of 34, second-year dental hygiene students were recruited from a 4-year entry-level Dental Hygiene program. A simulated-virtual training (SVT) module was developed as an interactive approach for educating dental hygiene students on providing care to a child patient with ASD in a clinical setting. The SVT consisted of a scenario in which the clinician “interacted” with a child with ASD who was having difficulty in the dental environment. Students completed a pre-test and post-test survey that measured their knowledge, attitudes, and perceived confidence related to providing dental hygiene services to child patients with ASD. Descriptive statistics were used to describe the study sample. The Wilcoxon Signed Rank test was used to determine whether statistically significant differences existed between the key variables (i.e., knowledge, attitudes, and confidence) before and after receiving the SVT module; alpha was set at 0.05. The university’s Institutional Review Board approved this study (##20-139).

Results: An overall response rate of 97% was obtained for both surveys (n=33). Prior to receiving the SVT module, all dental hygiene students reported no clinical experience with providing care to children with ASD. There was a statistically significant difference observed between the pre and post-test surveys for the following: dental hygiene students' self-reported confidence to provide care to patients with ASD upon graduation (3.42 ± 0.94 vs. 3.97 ± 0.73), the assessment of the unique needs of children with ASD (3.33 ± 0.85 vs. 4.15 ± 0.51), and an understanding of the dental needs for children with ASD (3.52 ± 0.91 vs. 4.06 ± 0.66), $P < 0.05$. Dental hygiene students' confidence with performing dental hygiene services on children with ASD greatly increased, with statistically significant difference demonstrated from pre to post-test survey, for almost all dental hygiene services (i.e., oral exam, oral hygiene instruction, oral photos, radiographs, scaling, fluoride treatment); $P < 0.05$) except selective polishing. More importantly, 90% of students agreed that there is a need for additional/elective resources to help increase comfort in providing care to children with ASD. Conclusions: The SVT educational module increased students' knowledge, attitudes, self-perceived confidence, and comfort. Extending the SVT module to a larger sample of dental hygiene students as well as licensed/practicing dental hygienists may provide more insight on the knowledge, attitudes, self-perceived confidence, and comfort in providing care to children with ASD.

Copyright, 2021, by Kimberly Frances Cenzon, All Rights Reserved.

ACKNOWLEDGEMENTS

I first want to express my gratitude to my thesis chair, Professor Ann Bruhn. Thank you for your guidance, support, and mentorship throughout this whole process. Your passion and expertise on this topic made this research project successful and sparked a passion in me to continue on with future research on this topic. Secondly, thank you, Dr. Denise Claiborne, for offering your support every step of the way, especially sharing all your knowledge and time with statistical analysis. Thirdly, thank you, Dr. Jonna Bobzien, for sharing your expertise and knowledge with me. I am very grateful to have been given the opportunity to work with the three of you on this study.

To my family and friends, thank you for all the encouragement and support over the years. To Jake, thank you for always standing by my side and for pushing me to be my best. I love you so much. Lastly, to Mom and Dad, thank you for always believing in me, for guiding and supporting me since day one, and for allowing me to expand my horizons with every endeavor I take on. I love you both more than everything.

TABLE OF CONTENTS

	Page
LIST OF TABLES	vi
LIST OF FIGURES	vii
 Chapter	
I. INTRODUCTION	1
STATEMENT OF THE PROBLEM	2
SIGNIFICANCE OF THE PROBLEM	2
DEFINITION OF TERMS	4
HYPOTHESES	5
LIMITATIONS/ASSUMPTIONS	5
II. REVIEW OF THE LITERATURE	7
CHARACTERISTICS OF AUTISM SPECTRUM DISORDER	7
ORAL CHARACTERISTICS	9
DENTAL PROFESSIONALS' CONFIDENCE AND COMFORT LEVEL	10
PROVIDING CARE TO PATIENTS WITH ASD	14
SUMMARY	17
III. METHODOLOGY	19
DATA COLLECTION TOOL	19
INTERVENTION	20
PROCEDURES	21
DATA ANALYSIS	22
IV. RESULTS	24
V. DISCUSSION	28
DENTAL HYGIENE STUDENTS' EXPERIENCE PROVIDING CARE TO CHILDREN WITH ASD	28
DENTAL HYGIENE STUDENTS' KNOWLEDGE OF ASD	29
ATTITUDES OF DENTAL HYGIENE STUDENTS TOWARDS CHILDREN WITH ASD	31
DENTAL HYGIENE STUDENTS' SELF-PERCEIVED CONFIDENCE	32
DENTAL HYGIENE STUDENTS' COMFORT	33
LIMITATIONS	34
VI. CONCLUSIONS	35

	Page
REFERENCES	36
APPENDICES	48
A. IRB APPROVAL LETTER.....	48
B. INVITATION LETTER TO DENTAL HYGIENE STUDENTS.....	49
C. PRE-INTERVENTION SURVEY	50
D. POST-INTERVENTION SURVEY.....	59
E. SAMPLE OF SVT MODULE	68
VITA.....	70

LIST OF TABLES

Table	Page
1. Characteristics and Background of Dental Hygiene Students	42
2. Pre-Post Intervention Knowledge Scores	43
3. Pre-Post Intervention Change in Dental Hygiene Students' Attitudes	44
4. Pre-Post Intervention Reported Confidence to Perform Dental Hygiene Services	45

LIST OF FIGURES

Figure	Page
1. Didactic and Clinical Experiences Prior to Receiving the SVT Module.....	46
2. Additional Information Provided by Students Related to the SVT Module.....	47

CHAPTER I

INTRODUCTION

The National Autism Association (NAA) states that Autism Spectrum Disorder (ASD) is a developmental disorder affecting an individual's ability to communicate, interact, behave, and learn, and it is the fastest growing developmental disorder.¹ Over the past couple decades in the United States alone, there has been a significant increase in the number of children diagnosed with ASD. Current prevalence rates estimate 1 in 54 children are diagnosed with ASD, with males affected five times more than females.² With the publication of the American Psychiatric Association's fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) in 2013, substantial changes were made to the diagnosis of ASD; such as, the removal of sub-diagnoses, which included Autistic Disorder, Asperger Syndrome, Pervasive Developmental Disorder Not Otherwise Specified, Rett's Disorder and Childhood Disintegrative Disorder.³ With the significant increase in childhood diagnoses and changes made to the DSM-5, it is important that professionals are aware of ASD and the characteristics associated with this disorder.

According to the Centers for Disease Control and Prevention (CDC), ASD is a life-long disorder that is often diagnosed before 3 years.⁴ Studies show about 80%-90% of children with ASD begin to show symptoms by 24 months of age.⁴ Major differences associated with ASD include social delays, varying levels of communication, and unusual interests or behaviors.⁴ Likewise, there are several characteristics that a child with ASD might exhibit such as eye contact avoidance, loneliness, speech and language skills delay, unusual sensory reactions (i.e., sound, taste, look, feel), unresponsiveness to their name by 12 months of age, and inability to adapt to minor changes. Other symptoms can include hyperactivity, impulsivity, short attention span, aggression, self-injury, temper tantrums, unusual eating and sleeping habits, unusual mood

or emotional reactions, lack of fear or more fear than expected, and unusual reactions to the way things sound, smell, taste, look, or feel.⁴

Statement of the Problem

Children with ASD require detailed oral hygiene home care and routine dental hygiene visits. However, access to dental services can be challenging due to the behavioral complexities associated with the condition. Dental professionals receive education on treating patients of varying special needs in their dental and dental hygiene curriculum; yet may not have had a specific clinical encounter in providing care to children with ASD. This lack of training may be attributed to limited access to the ASD population. Experiential training related to children with ASD within the curricula for dental professionals is limited and unknown in the dental hygiene curriculum. Creating innovative experiential learning via simulated or virtual trainings for dental hygiene students that focuses on providing care to child patients with ASD is warranted.

The study intended to address the following research questions:

- 1) What are the self-perceived knowledge and attitudes of dental hygiene students in providing care to child patients with ASD?
- 2) What are dental hygiene students' self-perceived confidence to provide care to child patients with ASD?
- 3) Is there an increase in dental hygiene students' self-perceived knowledge, attitudes, and confidence to provide care to child patients with ASD after a simulated-virtual training experience?

Significance of the Problem

As the ASD population increases, oral health implications need to be considered.⁵⁻⁸ Studies have shown significant differences between child patients with ASD and child patients

without ASD regarding oral hygiene.^{5,6,8,9,10} Child patients with ASD typically require assisted tooth brushing, have a higher prevalence for dental caries, have a higher incidence for gingivitis and periodontal disease, delayed tooth eruption, and have increased harmful oral habits such as mouth breathing, tongue thrusting, xerostomia, and bruxism.^{5-8,10} All of these characteristics negatively impact a child's oral health resulting in the need for dental support and intervention techniques. Many children with ASD have increased anxiety when visiting the dental office, which leads to difficulty communicating their feelings, sensory sensitivities, and a fear of the unknown.⁶ Since many children with ASD cannot effectively communicate, behaviors occurring during dental procedures may be perceived as noncompliant or uncooperative behaviors, which may be problematic for dental professionals.^{5,7,9,11}

There are a limited number of studies that have examined the confidence of dental professionals with managing child patients with ASD,¹¹⁻¹⁵ and no studies have focused on dental hygienists. Dental hygienists specialize in preventative techniques and treatments, making it imperative for them to have the knowledge and understanding to treat children with ASD. While dental hygienists are exposed to education content in their didactic curriculum on providing care to patients with ASD, research has shown that there is a lack of experiential training.⁵⁶⁻⁵⁸ The most recent *Commission on Dental Accreditation (CODA), Standards for Dental Hygiene Education*, standard 2-12 states, "Graduates must be competent in providing dental hygiene care for the child, adolescent, adult, geriatric, and special needs patient populations."¹⁶ Therefore, dental hygiene programs may have varying definitions of competency and clinical experiences that students received related to special needs patients and may not be inclusive of patients with an ASD diagnosis. Research shows there is a high percentage of dental professionals who report inadequate preparation during their formal training to meet the clinical needs of children with

ASD. This lack of training can lead to a decrease in clinicians' comfort level to provide treatment resulting in limited access to care.¹¹⁻¹⁵ Despite this possibility, no studies have specifically examined the educational preparation and practice behaviors of dental hygienists.

Definition of Terms

The following terms are defined to help the reader understand the context of each terms in this study.

- *Autism Spectrum Disorder (ASD)*: A condition that is related to how the brain develops that impacts how a person “perceives and socializes with others, causing problems in social interaction and communication.”¹⁷ The term “spectrum” in this disorder refers to the wide range of symptoms that an individual can have as well as the severity of their disorder.¹⁷
- *Centers for Disease Control and Prevention (CDC)*: The leading national public health institute of the United States and one of the major operating components of the Department of Health and Human Services. The CDC works to protect America from health, safety, and security threats.¹⁸
- *Commission on Dental Accreditation (CODA)*: CODA's mission states, “The Commission on Dental Accreditation serves the public and profession by developing and implementing accreditation standards that promote and monitor the continuous quality and improvement of dental education programs.”¹⁹
- *Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5)*: The “authoritative volume that defines and classifies mental disorders in order to improve diagnosis, treatment, and research.”²⁰ The DSM-5 is the most recent edition.

- *National Autism Association (NAA)*: The NAA's mission is to “respond to the most urgent needs of the autism community, providing real help and hope so that all affected can reach their full potential.”²¹ The NAA achieves its mission through advocacy, research, education, direct tools, thoughtful awareness, and hope.
- *Simulated-Virtual Training (SVT)*: The educational intervention module that was developed for this study. This module is an interactive approach to train dental hygiene students in providing care to child patients with ASD in the dental hygiene care environment.

Hypotheses

The following null hypotheses were tested at the 0.05 level significance:

- 1) There will be no statistically significant difference in the knowledge level of dental hygiene students to provide care for child patients with ASD before or after receiving an ASD SVT as measured by *The Survey of Dental Hygiene Students' Knowledge, Attitudes, and Perceived Confidence Treating Children with ASD*.
- 2) There will be no statistically significant difference in attitudes and self-perceived confidence of dental hygiene students to provide care for child patients with ASD before or after receiving an ASD SVT as measured by *The Survey of Dental Hygiene Students' Knowledge, Attitudes, and Perceived Confidence Treating Children with ASD*.

Limitations/Assumptions

Limitations of this study include:

- The participants in the study included a convenience sample of all female, second-year dental hygiene students from one university's dental hygiene program located in an urban metropolitan area in southeastern U.S.

- Some students may have had an experience of treating a child patient with ASD while others may not have.
- Self-reporting recall bias due to the recall of information related to prior educational training and patient experiences related to ASD.
- Social desirability with participants responding to the questions in a way that would be viewed favorable.
- Homogenous sample

Assumptions of this study include:

- All participants answered the surveys honestly and completely.
- The simulated-virtual training worked properly during the study with no complications.
- The self-administered survey was not made public to the participants prior to the day of the study.

CHAPTER II

REVIEW OF THE LITERATURE

To provide a theoretical framework for this study, recent and relevant literature is included regarding ASD and dental clinicians' knowledge, confidence and comfort in providing care to patients with ASD in the dental hygiene environment.

Characteristics of Autism Spectrum Disorder

The National Institute of Mental Health defines ASD as a “development disorder that affects communication and behavior” with characteristics ranging in severity based on social communication impairments and restricted, repetitive behaviors.²¹ The DSM-5 describes the severity of ASD by levels to include: “Level 0 = none, Level 1= mild requiring support, Level 2 = moderate requiring substantial support, and Level 3 = severe requiring very substantial support.”²² Prior to the DSM-5, the diagnosis of ASD had subcategories of disorders including Asperger Disorder and not otherwise specific Pervasive Development Disorder.²³ In the DSM-5, the subcategories were removed, and all previous sub categorical disorders included in the spectrum of ASD diagnosis, created a broader, more complex population for ASD.

Characteristics of children with ASD include delays or lack of verbal communication, linguistic development and social interaction impairment, aversion to change, quick frustration, hyperactivity, anxiety, and sensory issues.^{5-7,9,11,12,23,25-28} Children with ASD are easily frustrated due to their communication challenges, which can trigger violent self -injurious behaviors, and they are especially sensitive to environmental and daily scheduling changes. Individuals with ASD may also experience unusual or unpredictable body movements or seizures. These characteristics can create difficulties and challenges not only for the individual, but healthcare professionals working with the child.^{5-7,9,11,12,23,25-28}

The U.S. Department of Health and Human Services and various literature details these characteristics, which can lead to challenges children with ASD face when in a healthcare setting, such as during a dental and dental hygiene visit.^{5-7,9,11,13,23,25-28} These challenges include communication and behavior problems, unusual responses to stimuli within the dental setting, unusual and unpredictable body movements, and seizures. Communication problems are one of the main concerns surrounding ASD, which causes a challenge when interacting or treating individuals with ASD in close contact settings and within personal space.^{13,23} Delli et al. described how children with ASD are unable to engage in the environment they are in, thus creating difficulties in a positive relationship between the clinician and child.²³ The dental environment can also create anxiety for children with ASD due to their heightened sensory awareness. Bright lights, loud noises, unfamiliar textures, tastes, and smells can all contribute to the emotional discomfort that children with ASD may experience.²³ Stein et al. reported that when compared to children without ASD, children with ASD were afraid of, disliked, and complained more about loud sounds, drilling, bright lights, instruments in the mouth, being leaned back in the chair, and smells in the dental setting.⁷ Chandrashekhar and Bommangoudar described how difficulty managing emotions, paired with repetitive body movements, could be a safety concern when using sharp dental instruments.²⁹ Many children with ASD have a low frustration threshold, which can lead to them being easily irritated and engaging in bizarre vocalizations.²⁹ Gandhi and Klein stated that one of the most challenging and distressing behavior encountered by dental professionals providing care to patients with ASD is self-injurious behavior.²⁸ More than 75% of self-injurious behaviors involved the head and neck region and can be increased due to the patient's inability to communicate physical pain. Oral self-injury can be characterized by trauma to the gingival tissues and cheek or lip biting.²⁸

Considering the potential existence of these self-injurious behaviors, it is understandable why treating individuals with ASD in a dental setting can be challenging and difficult for dental professionals, including dental hygienists. The equipment used by dental hygienists in the clinical environment can produce loud sounds when various treatments are performed. For example, during procedures such as instrumentation and polishing of the teeth, as well as using the saliva ejector to suction water out of the mouth, which is disliked by children with ASD. In addition, the reclining of the dental chair and use of the dental unit light may overstimulate a child with ASD. The combination of these heightened sensory concerns may pose challenges during a dental visit for children with ASD.

Oral Characteristics

With an earlier diagnosis, a broader spectrum, and more complex types and severities of ASD, oral implications of children must be considered. There is a discrepancy in the literature regarding evidence of increased caries risk in children with ASD. Ghandi and Klein mentioned that a number of studies have explored the topic of caries status of children with ASD and the results have been conflicting.²⁸ Some studies reported that individuals with ASD have a higher risk of dental caries than individuals without ASD.^{10,25,33,35,40,41} For example, Nagendra et al. suggested that children with ASD have a higher prevalence of dental caries due to an increased need with assistance in toothbrushing.⁵ Conversely, Da Silva et al. stated that although some literature suggests children with ASD have a high prevalence of caries, there is a plethora of literature that suggests dental caries occur at a similar, or lower rate, in children with ASD when compared to same aged-peers without ASD.^{8-10,32,42-48} Specifically, the results of some literature indicated that since children with ASD typically do not have an interest in snacking and are quite selective in their food choices, they have lower caries experiences compared to children without

ASD.^{31,49} Overall, these inconsistent literature results support the need for future research in order to get a more solidified and valid result.

The prevalence of additional conditions, which occur more frequently in children with ASD (i.e., seizures, bruxism, tongue thrust), and the medications used to treat those conditions may also pose dental problems. For example, seizures give rise to trauma and injury to the oral cavity. In addition, taking Phenytoin, which is a commonly prescribed medication for children with ASD to control seizures, and this can result in phenytoin-induced gingival hyperplasia.⁵ Furthermore, various literature lists oral clinical manifestations in children with ASD including bruxism, tongue thrusting, and self-injurious behavior, that create ulcerations in gingival tissues, erosion, poor dietary habits, increased tartar build up, pica (eating objects and substances), tooth crowding, open bite, and poor oral hygiene home care.^{5-7,10,23,28} Finally, DeMattei et al. compared the oral health status of individuals with other special needs, including ASD, mental retardation, or developmental disabilities, and concluded that literature on the oral health status of individuals with ASD is inadequate. Prior research by DeMattei found no known ASD specific oral manifestations, but rather, oral problems due to ASD related behaviors.^{10,30}

Dental Professionals' Confidence and Comfort Level

With various oral characteristics and manifestations, children with ASD have an increased need for dental treatment and intervention. However, studies show that there is inadequate clinician confidence in treating children with ASD.^{14,50-52} Dao et al. found that the majority of general dentists did not feel well prepared to treat patients with special needs.¹⁴ In this study, a sample of 208 general dentists responded to a self-administered survey that asked questions about the types of special needs patients they treated, ASD being one. The study concluded that 60% of general dentists surveyed would not accept pediatric patients with ASD

for dental treatment. In addition, a majority of the dentists did not feel that dental school adequately prepared them to provide the proper treatment and interventions for individuals with special needs.¹⁴ The participants agreed that there was a lack of experience, training, and education of treating these individuals in dental school.¹⁴ Waldman and Perlman found that dentists reported a lack of clinical experiences in providing care for patients with special needs during dental school, while Wolff et al. found that 50% of dental students reported not receiving any clinical training in managing patients with mental retardation and 75% reported only little or no education or clinical training in managing patients with special needs.^{50,51} Research demonstrated students' dental education related to treating special needs individuals had a high correlation with their behavior and confidence as a clinician. This lack of confidence played a major factor in their consideration of treating individuals with special needs.¹⁴ In 1980, Block and Walken's study concluded that dental students who participated in an extramural program during which they treated patients with mental retardation, had more confidence and felt more relaxed in their dental practice.⁵² The results of these studies revealed that many factors, such as inadequate preparation in school and lack of clinical experiences, play a role in dental clinicians' ability to treat patients with developmental disabilities. However, having a solid skills basis through more didactic and clinical education can improve attitudes and increase confidence.

The comfort level of clinicians when treating children with ASD goes hand in hand with the confidence level of clinicians and research shows both stem from educational curriculum background.^{12-14,50,52,56-58} Weil et al. aimed to understand the attitudes and behaviors of members of the Special Care Dentistry Association (SCDA) in providing care to patients with ASD.¹³ The study concluded that while over half of the respondents felt confident treating children and adults with ASD, nearly half of the respondents did not feel their professional education prepared them

adequately for treating patients with ASD. Dougall et al. performed a study that aimed to establish a consensus in regard to what skills, knowledge, and attitudes were deemed essential for practicing dental clinicians to be comfortable in treating patients with special needs.⁵⁶ Clinicians felt they usually lacked the skills to provide dental care for individuals with disabilities and noted that individuals with disabilities were three times less likely to receive care than individuals without disabilities.⁵⁶ The participants in the study agreed that school curriculum should shift away from traditional educational methods of emphasizing the patient's medical diagnosis and shift toward a more patient-centered treatment approach according to function or environment to increase their confidence as practicing dental clinicians.⁵⁶ This approach focuses on the needs and wishes of the patient rather than their specific diagnosis.⁵⁶

Dental Students: A study performed by Klinert et al. aimed to see if an interactive module would increase dental student's confidence in treating child patients with developmental disabilities.¹⁵ This study chose to use a child with Down Syndrome in the interactive module with two interactive, multimedia, virtual patient modules that targeted dental students.¹⁵ The modules created simulated an actual patient encounter where the dental student had to make decisions throughout that would result in successful treatment outcomes. The results of the pre-survey showed that a majority of the students felt they would have difficulty with interacting and treating the patient with Down Syndrome; however, results of the post-test, taken after completing the module, revealed an increase in the dental students' confidence level for treating patients with special needs. After completing the module, there were significant changes in both knowledge and perceived difficulty in treating patients with special needs among dental students. This study supported earlier literature findings stating computer-based learning experiences can

be a useful adjunct for clinical training and an effective strategy tool to increase clinician competency in caring for children with developmental disabilities.^{15,53-55}

Mohebbi et al. found that a lack of properly trained dentists resulted in those practitioners being hesitant in providing care to patients with disabilities.¹² Therefore, their study aimed to evaluate the effectiveness of training senior dental students on oral health care for patients with disabilities. Seventy, sixth year dental students, from Tehran University of Medical Sciences, participated in the study by completing a self-administered questionnaire before and after engaging in an intervention. The questionnaire was comprised of five sections on background information, knowledge and attitudes of dental students about oral health care for patients with disabilities, barriers of working with these patients, and the importance of student training.¹² Utilizing a quasi-experimental approach, the intervention consisted of a 10-day training comprising of four sessions, which included: a discussion on oral health care in patients with disabilities, lecture presentations, group presentations on students' experience in treating patients with disabilities, attendance, observation and examinations of children with ASD, and student presentations on items learned during the intervention. At baseline, the knowledge and attitude scores of participants participating in the invention versus participants in the control group who did not receive the intervention were very similar. However, results showed a significant improvement by the intervention group, when compared to the control group, in the dental students' knowledge and attitudes towards oral health care of patients with disabilities. Therefore the study revealed that the intervention presented was influential in changing students' knowledge and attitudes.¹²

Krause et al. explored how both U.S. and Canadian dental schools educated their students about patients with special needs in their curriculum.⁵⁸ Data was collected from a web-based

survey and showed that 91% of programs covered special needs in their curriculum, but only 64% offered a separate special needs course to their students. Most programs covered treatment of patients with more prevalent disabilities such as ASD, Down Syndrome, and motion impairments and the majority of programs planned to increase both clinical and extramural experiences.⁵⁸

Dental Hygiene Students: Dehaitem et al. reported the findings from their research survey that evaluated curricula regarding treating patients with special needs sent to 240 U.S. dental hygiene (DH) program directors (PDs).⁵⁷ The survey found that out of the 102 DH PDs, 98% of programs provided lectures, 83.3% implemented case studies, 62.7% used videos, and 53% provided demonstrations for interacting with populations of patients with special needs. However, only 42% of PDs reported that dental hygiene students were required to have clinical experience.⁵⁷ Dehaitem et al. surprisingly found that most DH PDs believe that there was not a lack of faculty expertise to incorporate special needs into the curriculum. However, they agreed that curriculum overload impacted the amount of special needs material that was incorporated. Lastly, 29.4% of PDs supported an increase in their students' clinical experiences to allow for more opportunities to interact with individuals with special needs.⁵⁷ Adding additional educational methodology on clinical and extramural experiences to dental hygiene curriculum could increase clinician comfort levels.

Providing Care to Patients with ASD

Management of children with ASD is an important skill that clinicians must have when providing care within the dental setting. Due to communication deficiencies and challenges with their behavior, being well-versed and knowledgeable in techniques and approaches to support patients with ASD would be beneficial. These techniques and approaches would provide

positive experiences and lead to successful treatment outcomes. Delli et al. described behavioral management approaches to help with dental therapy of patients with ASD.²³ Using visual pedagogy can allow for a child with ASD to experience a dental treatment. Managing hypersensitivity factors in the dental setting can decrease anxiety and reduce oral defensiveness. Methods such as creating relaxing light conditions, playing rhythmic music, and/or having the patient listen to their favorite music video or CD can relieve anxiety or stress the patient may encounter.²³

The “tell-show-do” technique with short, clear commands, and differential verbal reinforcement can help relay information to patients with ASD.²³ The “tell-show-do” technique is described as a basic and effective exposure therapy and a way to introduce dental instruments, equipment, or procedures to a patient.^{29,62} By telling the patient what is going to be done, demonstrating how it is going to be done, and then doing the said procedure, can ease anxiety and apprehension for patients with ASD. Chandrashekhar and Bommangoudar described communication devices such as Smart/Scan™ 32 pro and Picture Exchange Communication System® (PECS), which are often used as alternative communication techniques for persons with ASD who have little to no verbal communication skills.²⁹ A systematic review on technologies to assist children with ASD by Elmore et al. also discussed how the PECS system helped children learn how to express wants, needs or feelings to a communicative partner, thus stimulating social interaction.²⁷ The PECS system utilizes cards that pair a simple picture with an associated word, phrase, or sentence, allowing children with ASD to learn a “larger and more complex vocabulary while associating those words with pictures and ideas.”⁶³ The PECS system requires the child to physically present cards to others, which also initiates social interaction. Sensory techniques are another method to help decrease exposure of auditory and taste stimuli

for children with ASD. An example of this technique is to slowly introduce toothbrushing to a child with ASD by using a washcloth, toothbrushes with different textures and design, or an electric toothbrush, since toothpaste and a regular toothbrush can feel and taste harsh.²⁹

A study conducted by Pilebro et al. found the positive effects of using visual pedagogy as a communication tool for children with ASD both at home and in school.²⁶ It was concluded that the visual pedagogy method was useful in teaching oral hygiene techniques such as toothbrushing and was a widely used tool for communication.²⁶ Video technology has been found to be an ideal educational tool due to the ASD population favoring visual stimulation.²⁷ Children with ASD tend to be more engaged in verbal and physical imitation when viewing electronic screen media such as video technology.²⁷ Mobile applications are another popular device that are specifically beneficial to children with ASD who learn best through repetition. Mobile devices and applications offer convenience and portability which can be a valuable tool to educate children with ASD.²⁷ The aforementioned interventions can aid dental professionals in managing patients with ASD in the clinical setting.

A study done by Anderson et al. examined the interprofessional collaboration between dental hygiene (DH) students and communication sciences & disorders (CSD) students to evaluate the oral health needs of children with ASD.⁶⁴ Interprofessional education (IPE) and collaboration (IPEC) is becoming a widely used tool for many health programs because its goal is to not only improve patient health outcomes, but enhance patient experiences and reduce health care costs.⁶⁴ For the study, faculty from a Midwest University identified four children with an existing diagnosis of ASD with dental anxiety and unmet dental needs. Each child was assigned to a group that was comprised of one CSD and two DH students.⁶⁴ The DH students interviewed the children's parents to obtain information on the child's oral health including past

history and concerns/barriers and observed the CSD students interacting with the children during a speech-language session. Interprofessional collaboration between the students occurred to create and develop visual support strategies to be presented and implemented with the children during the intervention. These strategies included social stories, which are visual systems that utilize either written and/or pictorial cues, that are used proactively to assist children with ASD to learn the skills needed better cope with social situations. For this study, the social stories that were developed by the DH and CSD students demonstrated the social communication skills expected by the children with ASD while the DH student performed an oral screening, reviewed toothbrushing instructions, and a simulated dental prophylaxis.⁶⁴ The CSD student reviewed the social stories with the child patient before the DH student provided dental care. To evaluate the results of the study, a feedback session with students from both disciplines and all supervising faculty was completed. Students who participated in the study felt more confident in recognizing the characteristics of ASD, developing visually structured strategies, and the importance of interprofessional collaboration to help parents prepare children with ASD prior to dental appointments.⁶⁴

Summary

Dental professionals, including dental and dental hygiene students, have varying educational preparation, which translates to disparities in knowledge, attitudes, and self-perceived confidence, and comfort levels when providing care to individuals with developmental disabilities and special needs. To the researcher's observation, most of the literature has focused on dentists' knowledge and practice behaviors associated with providing dental care to patients with special needs; there is limited literature that addressed child patients with ASD.^{11,13} Further, only a limited number of studies have examined dental hygienists' knowledge, attitudes, and

self-perceived confidence and comfort with providing care to children with ASD. Further research is needed to examine dental hygienist students' comfort and knowledge treating child patients with ASD.

CHAPTER III

METHODOLOGY

A mixed methods approach, including a one-group pre-post-test design, was used to examine dental hygiene students' self-reported knowledge, attitudes, perceived confidence, and comfort toward dental hygiene care management for children with ASD before and after participating in an educational intervention module (simulated-virtual training). The simulated-virtual training module was referred to as SVT module. Second-year dental hygiene students, 18-years or older from the Old Dominion University, School of Dental Hygiene were recruited for the study, which consisted of three sections: a pre-test survey, educational intervention (SVT), and post-test survey. Old Dominion University's Institutional Review Board approved the research study #20-139 (Appendix A).

Data Collection Tool

An investigator designed survey, "Dental Hygiene Students' Knowledge, Attitudes, and Perceived Confidence Treating Children with ASD" was adapted from Mohebbi et al., which measured dental students' knowledge, attitudes/confidence, and barriers in providing oral health care to patients with disabilities.¹² In the present study, the survey was modified to managing children with ASD while performing dental hygiene services. Since questions were adapted from Mohebbi et al., an expert panel of dental hygienists reviewed the survey for face and content validity.¹² In addition, the survey was piloted twice among a small sample of dental hygiene students who had graduated in 2019. Modifications were made to the survey after the results were received from the pilot tests. The final pre-and post-survey contained 32- items that consisted of true/false, multiple choice, and 5-point Likert-scales with two open-ended questions.

The survey included the following key content areas: n=7 (demographic and background questions); n=5 (knowledge statements about ASD); n= 9 (attitude statements toward providing care to children with ASD); n=7 (confidence statements related to the dental hygiene services); and n=4 (comfort statements related to providing care to child patients with ASD). The two open-ended questions asked participants the following: (1) To describe any additional information that they would like to share concerning their prior learning or clinical experiences related to providing care for child patients with ASD, and (2) To describe their perceived confidence after completing the SVT educational module on providing care to child patients with ASD in their future clinical experiences (Appendix C and D). The survey was administered online via Qualtrics® (Qualtrics Lab, Provo, Utah) software.

Intervention

The SVT module was developed as a web-based interactive activity, created with Articulate Storyline® 360, to increase dental hygiene students' knowledge and awareness to providing care to children with ASD in a simulated dental hygiene care environment. The SVT simulated the behaviors of a child with ASD who is having trouble in the dental care setting. Dental hygiene student participants were required to utilize theoretical, conceptual, and critical thinking skills to correctly respond to a series of 11 scenarios that focused on the dental hygiene process of care. The 11 clinical scenarios required dental hygiene students to answer a variety of questions in the form of selecting all answers that applied, putting answers in a specific order/sequence, and selecting the correct answer. If the dental hygiene student answered the scenario question incorrectly, the module would allow a second attempt. When the question was answered correctly, an explanation of the correct answer was provided. The SVT was developed and designed by dental hygiene faculty members, a graduate student, and the institution's Center

for Learning and Teaching personnel, which consisted of instructional technology specialists, a graphic designer, multimedia manager, and a lead instructional designer (Appendix E). The final product was imported into the Blackboard Organizational® page, “SODH Virtual Training Module for Autism Spectrum Disorder.” Each dental hygiene student had unlimited attempts to complete the module.

Procedures

Dental hygiene students were invited to participate through their Old Dominion University email addresses (Appendix B). Students who expressed interest in participating in the study were provided an informed consent document, which they returned with signature. Once the informed consent was obtained, participants were enrolled into the Blackboard Organizational page, “SODH Virtual Training Module for Autism Spectrum Disorder.” After recruitment ended, participants received an email notification to complete the pre-test survey, which was located in the Blackboard system. Participants had one week to complete the pre-test survey. The following week, the SVT module opened for participants to complete. Two weeks after completion of the SVT module, participants received an email notification to complete the post-test survey. The total data collection occurred over 8 weeks, with bi-weekly reminders provided. In order to anonymously match pre-post-test survey responses, participants were asked to create a unique identification that included the following:

Step 1 – The first initial of your mother’s first name (example: Jane = J)

Step 2 – The day and month of your mother’s birthday (example: August 12 = 12-08)

The unique identifier is thus J-12-08

Further, to increase and maintain participation throughout the study, participants were informed that they would receive a \$10 Amazon e-gift card after completion of all elements of the research study. Therefore, after completion of the post-test survey, participants were instructed to provide

an email of their survey submission confirmation page so that an Amazon e-gift card could be provided.

Data Analysis

Descriptive statistics such as means, standard deviations, counts, and frequencies were based on the level of measurement for each variable. Data assumptions of normality, homogeneity, skewness, and kurtosis were examined to determine the appropriate statistical analysis. For the measure of knowledge, there were five statements with the response options of true/false and multiple choice. Participants received a score of one or zero for correct and incorrect responses respectively, for a maximum score of 5 points (0-5). The total mean scores for each statement were analyzed using the Wilcoxon Signed Rank test to compare statistically significant difference from before and after receipt of the SVT. In addition, the percentage of participants who correctly answered each statement from before and after the SVT was examined. For the measures of attitude and comfort, a 5-point Likert scale (1=strongly disagree to 5= strongly agree and 1=very little importance to 5=very important) was used. Lastly, confidence was measured using a 5-point Likert scale (1= very little confidence to 5= very confident). The Wilcoxon Signed Rank test determined statistically significant differences for all Likert-scale items. All quantitative data was analyzed using IBM® SPSS® Software V.26 and alpha was set at 0.05. The two open-ended questions were qualitatively analyzed using a general inductive approach.⁶⁶ The first researcher reviewed all text from each question and developed themes. Providing only the themes for each open-ended question, independently, a second researcher paired the text to the themes. Next, both researchers reviewed and discussed the themes, sub-themes, and corresponding statements to determine final agreement. Lastly, a third

reviewer examined the final tables to establish trustworthiness of the content with the themes and sub-themes.⁶⁶

CHAPTER IV

RESULTS

There was a total of 34 second-year dental hygiene students invited to participate in the research study. Thirty-three students completed the pre-test survey, intervention, and post-test survey for a response rate of 97%. All participants were female, with 63.6% aged 18-24 years followed by 30.3%, aged 25-34 years, and a majority of the participants 45.5% were White (Table 1). Most participants (87.8%) reported receiving formal instruction on providing dental hygiene care to individuals with ASD. The type of formal instruction noted from respondents included lecture/face to face, online, or a combination of both. When asked which dental hygiene courses the formal instruction was provided, respondents reported dental hygiene theory and radiology courses. Nearly 40% of the respondents reported receiving 1-2 hours of formal instruction. However, prior to the intervention, 100% of participants reported not providing care to a patient with ASD (Table 1).

Five statements, including three true/false and two multiple choice questions, were used to assess the participants' knowledge prior to and after the SVT intervention. In general, the dental hygiene students' knowledge improved on three out of five statements, but without statistical significance. For example, prior to receiving the SVT 42.4% of students correctly responded to the statement, "Children with ASD prefer soft and sweet foods" compared to 66.7% after participating in the SVT module. Two knowledge questions/statements, "Children with ASD prefer soft and sweet foods" (0.42 ± 0.51 vs. 0.67 ± 0.48) and "Children with ASD tend to show ability to cooperate in dental treatment" (0.79 ± 0.42 vs. 0.94 ± 0.24) improved after receiving the intervention and were marginally statistically significant $P=0.06$ (Table 2).

Eight statements using a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5) and one statement using a five-point Likert scale ranging from very little importance (1) to very important (5) were used to assess attitudes of participants towards children with ASD. Statistically significant differences and improvements were observed for participants' reported attitudes to the following statements before and after receiving the SVT: "I feel confident that I can provide care to patients with ASD upon graduation" (3.42 ± 0.94 vs. 3.97 ± 0.73 , $P=0.01$), "I understand how to assess the unique needs of children with ASD" (3.33 ± 0.85 vs. 4.15 ± 0.51 , $P<0.001$), and "I feel that I understand the dental needs of children with ASD" (3.52 ± 0.91 vs. 4.06 ± 0.66 , $P=0.02$) (Table 3). The mean perceived confidence improved for all dental hygiene students with statistical significance for all dental hygiene services (i.e., oral exam, OHI, oral photos, radiographs, scaling, fluoride treatment) except one (selective polishing) after receiving the SVT intervention ($P \leq 0.05$) (Table 4).

A five-point Likert scale ranging from strongly disagree (1) to strongly agree (5) was used to assess three different strategies that could potentially increase dental hygiene students' comfort levels in providing care to children with ASD. The three strategies assessed were providing care to more patients with ASD within clinical sites, additional or elective resources given to students, and having personal experience with an individual with ASD (i.e., family member or friend diagnosed with ASD). All disagreements and "don't know" responses were combined into one category, and all agreements combined into another category creating a binary variable for comfort. Prior to participating in the SVT 87.9% of dental hygiene students agreed that there was a need for additional/elective resources; however, after participating in the SVT, 90.9% of dental hygiene students agreed with this statement. Surprisingly, the perceived need for having personal experience with an individual with ASD decreased after the

intervention, with 93.9% of dental hygiene students agreeing prior to the SVT and 90.9% after. The strategy of providing care to more patients with ASD within clinical sites stayed the same from pre to post intervention, with 90.9% of students agreeing that there was a need for this strategy.

Prior to completing the SVT, dental hygiene students were asked, “Please provide any additional information that you would like to share concerning your learning or clinical experience regarding child patients with ASD.” A total of seven students provided comments to this statement and the following theme (i.e., didactic and clinical background) and sub-themes (i.e., patient management, clinical experience, didactic curriculum) emerged. Students’ perceived confidence to manage children with ASD was low. One student reported, “I am ashamed to say that I am quite intimidated to treat a patient, child or adult, with severe autism.” Another student reported, “I am concerned with how to handle patients when they do go into a meltdown.” In terms of clinical experience, only one student reported working with children who has ASD. The student shared, “I have worked with children with ASD. I feel treating them the same as others is what works best. Taking your time is needed in understanding the patients’ needs and family concerns when it comes to dental care.” Lastly, one student reported wanting more time within the curriculum to ensure adequate preparedness to care for child patients with ASD (Figure 1).

After completing the SVT, dental hygiene students were asked, “How confident do you feel about providing care to child patients with ASD in your future clinical experiences?” The themes of informative and preparedness emerged from the students’ responses (n=8). Students reported that the module was valuable and a great educational resource. Some of the responses included: “This module would be a great educational resource in the future to teach students on how to better treat ASD patients.” “I enjoyed taking this course and overall felt I gained valuable

information.” More importantly, students perceived that the module helped in their knowledge, understanding, and preparedness to provide care to child patients with ASD. One student reported, “I don’t know how many patients I will encounter that will have ASD, but I do know for sure that I will be able to treat them in a way that makes them feel as comfortable as possible. I will know how to address the situation if they get anxious or don’t want to cooperate, while getting them to trust me.” Other students reported, “I feel that with more hands-on and one to one will help increase our abilities to care for a patient with ASD. The more knowledgeable the better we will be as clinicians, with the understanding that each individual will be unique in care. Being prepared will definitely make their care a positive one.” “I really enjoyed this experience and I believe that topics like this are very important in order to prepare the dental hygiene students to feel confident when treating patients with ASD.” (Figure 2)

CHAPTER V

DISCUSSION

Individuals diagnosed with ASD encounter many challenges when in the dental environment.^{5-7,9,11,13,23,25-28} Lack of communication, self-injurious behaviors, heightened sensory awareness and increased anxiety, can all create confounding barriers for accessing dental treatment in children with ASD.^{5-7,9,11,13,23,25-29} In addition, many dental professionals overall do not feel confident and comfortable in providing care to individuals, specifically children with ASD.^{12-14,50-52,56-58} One main reason why dental professionals do not feel confident and comfortable treating children with ASD in the clinical environment is due to a lack of educational preparation and hands on clinical experiences, which was found in the present study as only a few hours of curriculum were devoted to treating individuals with ASD.⁵⁶⁻⁵⁸ Literature supports the need for additional educational or extramural programs to increase confidence and comfort in caring for children with ASD.^{12,52,59-61} Results from the present study indicated that after receiving the SVT module, the greatest increase was found in dental hygiene students' confidence in performing dental hygiene services on children with ASD. There were statistically significant differences in some aspects of hygiene students' attitudes and comfortability in providing care, and results showed an overall increase in dental hygiene students' knowledge in providing care to children with ASD post intervention.

Dental Hygiene Students' Experience Providing Care to Children with ASD

In the present study, 100% of participants stated that prior to the intervention, they had not provided care and felt intimidated and less confident treating a patient with ASD during their clinical curriculum. Reasoning for this included lack of interaction and experience with these individuals, and there was an agreement that didactic courses were not adequate enough to

ensure proper care of these patients. Similarly, participants in Dao et al. study agreed that there was a lack of experience, training, and education of treating individuals with special needs in dental school, making them feel inadequately prepared to provide the proper treatment as a professional.¹⁴ Almost 41% of respondents from Dao's study stated they were less than or not well enough prepared to provide care to individuals with special needs, with a majority agreeing that their undergraduate education did not prepare them well. Similar to Dao's findings, Wolff et al. found that 75% of dental students reported little or no education or clinical training in managing patients with special needs.⁵¹ Waldman and Perlman also found that dentists reported this same lack of clinical experience in dental school regarding providing care to individuals with special needs.⁵⁰ Romer et al. discovered that in their study, dental students said they received limited education experiences in regard to care of individuals with disabilities.⁶⁸ Casamassimo et al. found similar results, with only one-fourth of general dentists reported having hands-on experiences with children with special health care needs.⁶⁵ Previous study findings correlate with the present study regarding inadequate clinical experiences while in a school setting. The qualitative responses prior to the intervention were also all consistent with previous literature, showing that students do not feel confident, comfortable, or adequately prepared to provide care to children with ASD.^{12-14,50-52,56-58} Dougall et al. noted dental clinicians agreed that in order to increase their confidence in providing care to individuals with disabilities, school curriculum should shift away from the traditional educational methods of focusing on the patient's medical diagnosis and focus more on patient-centered treatment approaches.⁵⁶

Dental Hygiene Students' Knowledge of ASD

Findings from the present study found that there was an increase from pre to post survey and SVT intervention in knowledge of treating a patient with ASD for three of the five

statements presented, “Children with ASD prefer soft and sweet foods”, “Children with ASD tend to show ability to cooperate in dental treatment”, and a question about prevalence and proportion of male to female children with ASD. Surprisingly, two of the statements, “Children with ASD are at a higher risk for oral disease” and a question asking to describe patients with ASD, had a decrease from pre to post survey. Of the three statements that increased in knowledge, “Children with ASD prefer soft and sweet foods” and “Children with ASD tend to show ability to cooperate in dental treatment” only showed marginally statistically significant results. One possible reason for this outcome was that the SVT module primarily focused on what a clinician should do during the dental hygiene process of care when providing care for a child with ASD. Dental hygiene students watched a brief introduction video at the beginning of the SVT module; however, the video did not thoroughly go over the knowledge statements asked in the survey. This omission of information is one factor we aim to improve in future research. Statements implemented in the survey included oral characteristics of ASD, general descriptions of individuals with ASD, managing patients with ASD in the dental setting, and prevalence of the ASD population. The results from the present study found that the dental hygiene students did not have a clear and consistent increase in knowledge about individuals with ASD for all statements presented from pre to post survey. Inconsistencies in the present study show similarities with past literature, where in evaluating the oral characteristics of individuals with ASD compared to individuals without special needs, there are conflicting, inconsistent results.^{8-10,28,31,32,35,40-49} Furthermore, inconsistency has been found when comparing prevalence of dental caries in individuals with ASD versus individuals without disabilities.^{8-10,28,31,32,35,40-49} While the present study did not specifically look at all oral characteristics of children with ASD, the results showed similarities with previous literature.

Attitudes of Dental Hygiene Students Toward Children with ASD

After the intervention, the majority of dental hygiene students (79%, n=26) felt confident that they could provide care to patients with ASD upon graduating, 94% (n=31) of students felt that they understood how to assess the unique needs of children with ASD, and 82% (n=27) felt that they understood the dental needs of children with ASD. Results from the present study were consistent with the results of the Mohebbi et al. study, in which dental students' knowledge and attitudes towards the oral health care of patients with disabilities improved after receiving an intervention.¹² Krause et al. found that only 64% of U.S. and Canadian dental schools offered a special needs course separate from the curriculum, and a majority of programs planned to increase both clinical and extramural experiences.⁵⁸ Results from Casamassimo et al. study indicated that more than 40% of general dentists found additional training pertinent to treating children with special health care needs very desirable or desirable.⁶⁵ Dehaitem et al. did highlight in their study that curriculum overload and limited time were the most frequently reported reasons for minimal content related to caring for individuals with a special needs.⁵⁷ However, neglecting the topic of special needs in both dental and dental hygiene school curricula has potentially led to limited access of care to these individuals.⁵⁷ In the present study, the SVT module was designed to be completed from start to finish in a shorter period of time, while the intervention used in Mohebbi et al., included a 10-day intervention. Still, results from the present study and Mohebbi et al. were similar, suggesting that short-term training is beneficial and can improve students' attitudes in providing care to children with ASD. This finding highlights the importance of providing additional experiences for student clinicians during their formal training while addressing time constraints in already heavy dental and dental hygiene curricula.

Dental Hygiene Students' Self-Perceived Confidence

After receiving the SVT intervention, an increase in confidence for all dental hygiene services noted was exhibited. More astoundingly, the results showed all but one of the services to be statistically significant. The results demonstrated the unique scenario of the SVT module, which focused on each step of the dental hygiene process of care. The SVT progressed scenario by scenario from meeting the child patient in the waiting room, to having the child sit in the chair, to taking radiographs, scaling, polishing, and applying the fluoride treatment. Dental hygiene students received an immediate response and feedback for each scenario if they chose the correct answer choice and were allowed two attempts per question to get the correct answer with the ability to restart the scenario after initial completion. Similar to the intervention used in the present study, Kleinert et al. used a virtual patient module in their study that presented a 10-year-old child with Down Syndrome that had a painful tooth.¹⁵ The module helped increase dental students' competence and decrease their perception of difficulty in caring for children with developmental disabilities. Results from the study found that a virtual module was an effective educational tool, while preparing students to be sensitive and competent professionals.¹⁵ Kleinert et al. study found their educational module provided an experience that simulated the dental setting while implementing problem-solving and dentist-patient communication skills, an important experience that this present study additionally found true. The literature discusses various techniques and tools to help increase engagement with children with ASD in the dental setting. The "tell-show-do" technique has been described as an effective reinforcement to communicate information to patients with ASD.^{13,23,29,62} Many of the scenarios presented in the module of the present study followed the "tell-show-do" technique in order to make the simulated experience comfortable for both the child with ASD and the clinician. Other

literature mentions techniques that include visual pedagogy, video technology, mobile applications, and communication devices.^{26,27,29} Future research could implement these techniques into a virtual educational module to further evaluate how these tools can increase clinician confidence and comfort.

Dental Hygiene Students' Comfort

Comfort was assessed by evaluating strategies that may improve dental hygiene students' comfort levels in providing care to children with ASD. The most valuable finding was that there was an increase in agreement that additional/elective educational resources are an important strategy. The agreement with this strategy increased by 3% (87.9% pre-intervention vs. 90.9% post-intervention). Of the three strategies mentioned, this was the only strategy that increased from pre to post, which highlights the importance of offering additional/elective educational resources to help increase clinician comfortability when interacting with children with ASD in the dental setting. Jones and Miller also examined effectiveness of using an educational module to understand dental hygiene students' attitudes towards persons with disabilities.⁶⁷ Their educational module consisted of a DVD and a facilitated class discussion about patients with special needs and was offered to the same 2-year community college and 4-year university for five consecutive years.⁶⁷ Results from this study found that the educational module increased the participants' attitudes score over the five-year period. The educational module allowed for participants to gain a better understanding for a patient-centered approach and advocacy when working with individuals with disabilities.⁶⁷ Overall, the results of this study correlated with past literature in that educational modules can increase and improve attitudes towards individuals with ASD and special needs as a whole.

After receiving the module intervention, students felt more confident to treat children with ASD and create a meaningful, trustworthy relationship with them. The SVT module provided a direct patient care experience virtually and overall contributed to their educational experiences. Overall, the SVT module solidified that additional educational resources are an integral and valuable experience to ensure that dental hygiene students are knowledgeable, comfortable, and confident in providing quality care to children with ASD.

Limitations

Several limitations may have influenced the results of this study. First, the use of a convenience sample resulted in a relatively small and homogenous sample size. In addition, participation occurred via self-selection. Second, recall bias could have occurred due to the recall of information from prior educational training and patient experiences related to ASD. Third, social desirability may have taken place because participants could have responded to the questions in a way that would be viewed favorable. Despite these limitations, a reasonable and high response rate was obtained for the survey. Future studies should increase the sample size by inviting dental hygiene students within other locations statewide. In addition, the SVT module could be designed as a continuing education course to reach practicing dental hygienists.

CHAPTER VI

CONCLUSIONS

The SVT module increased dental hygiene students' knowledge, attitudes, perceived confidence, and comfort to provide care to children with ASD. A vast majority of participants' confidence in performing dental hygiene services increased after receiving the intervention, and this was due to the layout of the SVT module guiding the student step by step through the dental hygiene process of care. The intervention included small overall increases from pre to post intervention in knowledge of working with children with ASD. The SVT module created experiential learning for dental hygiene students, which allowed them to provide the highest level of care for children with ASD in a risk-free environment. Findings underscore the need for more research about this topic, with the recommendation to extend this study to more dental hygiene students as well as practicing dental hygienists.

REFERENCES

1. National Autism Association (NAA). Autism fact sheet [Internet]. 2020 [cited 2020 Nov 24]. Available from: https://nationalautismassociation.org/resources/autism-fact-sheet/?gclid=EAIaIQobChMIw42l4P3i5wIVjJOzCh3yxwhvEAAyAAEgK7L_D_BwE
2. Centers for Disease Control and Prevention (CDC). Data and statistics on autism spectrum disorder [Internet]. 2019 [cited 2020 Feb 14]. Available from: <https://www.cdc.gov/ncbddd/autism/data.html>
3. Hyman S. New DSM-5 includes changes to autism criteria [Internet]. News1 Am Acad Pediatr. 2013 [cited 2020 Nov 24]. Available from: <https://www.aappublications.org/content/early/2013/06/04/aapnews.20130604-1>
4. Centers for Disease Control and Prevention (CDC). Signs & symptoms | autism spectrum disorder (ASD) [Internet]. 2020 [cited 2020 Feb 19]. Available from: <https://www.cdc.gov/ncbddd/autism/signs.html>
5. Nagendra J, Jayachandra S. Autism spectrum disorders: dental treatment considerations. J Int Dent Med Res. 2012;5(2):118-21.
6. National Institute of Dental and Craniofacial Research (NIDCR). Practice oral care for people with autism [Internet]. 2020 [cited 2020 Nov 24]. Available from: <https://www.nidcr.nih.gov/sites/default/files/2017-09/practical-oral-care-autism.pdf>
7. Stein LI, Polido JC, Lopez Najera SO, Cermak SA. Oral care experiences and challenges in children with autism spectrum disorders. Pediatr Dent. 2012;34(5):387-91.
8. da Silva SN, Gimenez T, Souza RC, Mello-Moura AC, Raggio DP, Morimoto S, et al. Oral health status of children and young adults with autism spectrum disorders: systematic review and meta-analysis. Int J Paediatr Dent. 2017;27(5):388-98.
9. Du RY, Yiu CK, King NM. Oral health behaviors of preschool children with autism spectrum disorders and their barriers to dental care. J Autism Dev Disord. 2019;49(2):453-9.
10. DeMattei R, Cuvo A, Maurizio S. Oral assessment of children with an autism spectrum disorder. J Dent Hyg. 2007;81(3):1-11.
11. Weil TN, Ingelhart MR. Dental education and dentists' attitudes and behavior concerning patients with autism. J Dent Educ. 2010;74(12):1294-1307.

12. Mohebbi SZ, Chinipardaz Z, Batebi A. Effectiveness of training senior dental students on oral health care for disabled patients. *Eur J Dent Educ*. 2014;18(4):214-21.
13. Weil TN, Bagramian RA, Inglehart MR. Treating patients with autism spectrum disorder – SCDA members’ attitudes and behavior. *Spec Care Dentist*. 2011;31(1):8-17.
14. Dao LP, Zwetchkenbaum S, Inglehart MR. General dentists and special needs patients: does dental education matter? *J Dent Educ*. 2005;69(10):1107-15.
15. Kleinert HL, Sanders C, Mink J, Nash D, Johnson J, Boyd S, et al. Improving student dentist competencies and perception of difficulty in delivering care to children with developmental disabilities using a virtual patient module. *J Dent Educ*. 2007;71(2):279-86.
16. Commission on Dental Accreditation (CODA). Accreditation standards for dental hygiene education programs [Internet]. 2019 [cited 2020 Feb 12]. Available from: https://www.ada.org/~media/CODA/Files/2019_dental_hygiene_standards.pdf?la=en
17. Mayo Clinic. Autism spectrum disorder – symptoms and causes [Internet]. 2020 [cited 2020 Nov 24]. Available from: <https://www.mayoclinic.org/diseases-conditions/autism-spectrum-disorder/symptoms-causes/syc-20352928>
18. Centers for Disease Control and Prevention (CDC). About CDC 24-7 [Internet]. 2020 [cited 2020 Nov 24]. Available from: <https://www.cdc.gov/about/organization/cio.htm>
19. Commission on Dental Accreditation (CODA). CODA mission [Internet]. 2021 [cited 2020 Nov 24]. Available from: <https://www.ada.org/en/coda>
20. American Psychiatric Association (APA). About DSM-5 [Internet]. 2020 [cited 2020 Nov 24]. Available from: <https://www.psychiatry.org/psychiatrists/practice/dsm/about-dsm>
21. National Autism Association (NAA). Mission statement [Internet]. 2020 [cited 2020 Nov 24]. Available from: <https://nationalautismassociation.org/about-naa/mission-statement/>
22. American Psychiatric Association (APA). Desk reference to the diagnostic criteria from DSM-5. Arlington: American Psychiatric Association; 2013. p. 27-30.
23. Delli K, Reichart PA, Bornstein MM, Livas C. Management of children with autism spectrum disorder in the dental setting: concerns, behavioural approaches and recommendations. *Med Oral Patol Oral Cir Bucal*. 2013;18(6):862-8.
24. Centers for Disease Control and Prevention (CDC). What is autism spectrum disorder? [Internet]. 2020 [cited 2020 Nov 24]. Available from: <https://www.cdc.gov/ncbddd/autism/facts.html>

25. Jaber MA. Dental caries experience, oral health status and treatment needs of dental patients with autism. *J Appl Oral Sci.* 2011;19(3):212-7.
26. Pilebro C, Bäckman B. Teaching oral hygiene to children with autism. *Int J Paediatr Dent.* 2005;15:1-9.
27. Elmore JL, Bruhn AM, Bobzien JL. Interventions for the reduction of dental anxiety and corresponding behavioral deficits in children with autism spectrum disorder. *J Dent Hyg.* 2016;90(2):111-20.
28. Gandhi RP, Klein U. Autism spectrum disorders: an update on oral health management. *J Evid Based Dent Pract.* 2014;14:115-26.
29. Chandrashekhar S, Bommangoudar JS. Management of autistic patients in dental office: a clinical update. *Int J Clin Pediatr Dent.* 2018;11(3):219-27.
30. Regn JM, Mauriello SM, Kulinski RF. Management of the autistic patient by the dental hygienist. *J Pract Hyg.* 1999;8:19-23.
31. Lowe O, Lindemann R. Assessment of the autistic patient's dental needs and ability to undergo dental examination. *ASDC J Dent Child.* 1985;52(1):29-35.
32. Shapira J, Mann J, Tamari I, Mester R, Knobler H, Yoeli Y, et al. Oral health status and dental needs of an autistic population of children and young adults. *Spec Care Dentist.* 1989;9(2):38-41.
33. Altun C, Guven G, Akgun OM, Akkurt MD, Basak F, Akbulut E. Oral health status of disabled individuals attending special schools. *Eur J Dent.* 2010;4(4):361-6.
34. Luppapanornlarp S, Leelataweewud P, Putongkam P, Ketanont S. Periodontal status and orthodontic treatment need of autistic children. *World J Orthod.* 2010;11(3):256-61.
35. Subramaniam P, Gupta M. Oral health status of autistic children in India. *J Clin Pediatr Dent.* 2011;36(1):43-8.
36. Mohinderpal Chadha G, Kakodkar P, Chaugule V, Nimbalkar V. Dental survey of institutionalized children with autistic disorder. *Int J Clin Pediatr Dent.* 2012;5(1):29-32.
37. Vajawat M, Deepika P. Comparative evaluation of oral hygiene practices and oral health status in autistic and normal individuals. *J Int Soc Prev Community Dent.* 2012;2(2):58-63.
38. El Khatib A, El Tekeya M, El Tantawi M, Omar T. Oral health status and behaviours of children with autism spectrum disorder: a case-control study. *Int J Paediatr Dent.* 2014;24(4):314-23.

39. Yashoda R, Puranik M. Oral health status and parental perception of child oral health related quality-of-life of children with autism in Bangalore, India. *J Indian Soc Pedod Prev Dent*. 2014;32(2):135-9.
40. Marshall J, Sheller B, Mancil L. Caries-risk assessment and caries status of children with autism. *Pediatr Dent*. 2010; 32(1):69-75.
41. Burgette JM, Rezaie A. Association between autism spectrum disorder and caregiver-reported dental caries in children. *JDR Clin Trans Res*. 2019;20(10):1-8.
42. Nelson LP, Getzin A, Graham D, Zhou J, Wagle EM, McQuiston J, et al. Unmet dental needs and barriers to care for children with significant special health care needs. *Pediatr Dent*. 2009;33(1):29-36.
43. Namal N, Vehit HE, Koksall S. Do autistic children have higher levels of caries? A cross-sectional study in Turkish children. *J Indian Soc Pedod Prev Dent*. 2007;25(2):97-102.
44. Fahlvik-Planefeldt C, Herrstrom P. Dental care of autistic children within the non-specialized Public Dental Service. *Swed Dent J*. 2001;25(3):113-8.
45. Loo CY, Graham RM, Hughes CV. The caries experience and behavior of dental patients with autism spectrum disorder. *J Am Dent Assoc*. 2008;139(11):1518-24.
46. Slayton RL. Autism spectrum disorder (ASD) may lead to lower prevalence and severity of dental caries than in children without ASD. *J Evid Based Dent Pract*. 2010;10(2):105-6.
47. Vellappally S, Gardens SJ, Al Kheraif AA, Krishna M, Babu S, Hashem M, et al. The prevalence of malocclusion and its association with dental caries among 12-18-year-old disabled adolescents. *BMC Oral Health*. 2014;14:123.
48. Fakroon S, Arheiam A, Omar S. Dental caries experience and periodontal treatment needs of children with autistic spectrum disorder. *Eur Arch Paediatr Dent*. 2015;16(2):205-9.
49. Orellana LM, Silvestre FJ, Martinez-Sanchis S, Martinez-Mihi V, Bautista D. Oral manifestations in a group of adults with autism spectrum disorder. *Med Oral Patol Oral Cir Buccal*. 2012;17(3):415-9.
50. Waldman HB, Perlman SP. Preparing to meet the dental needs of individuals with disabilities. *J Dent Educ*. 2002;66(1):82-5.
51. Wolff AJ, Waldman HB, Milano M, Perlman SP. Dental students' experiences with and attitudes toward people with mental retardation. *J Am Dent Assoc*. 2004;135(3):353-7.

52. Block MJ, Walken JW. Effect of an extramural program on student attitudes toward dental care for the mentally retarded. *J Dent Educ.* 1980;44(3):158-61.
53. Jeffries PR. Development and testing of a hyperlearning model for design of an online care course. *J Nurs Educ.* 2005;44(8):366-72.
54. Garret BM, Callear D. The value of intelligent multimedia simulation for teaching clinical decision-making skills. *Nurse Educ Today.* 2001;21(5):382-90.
55. Frisby AJ, Lane JL, Carr AM, Ross E, Gottlieb RP. Development and evaluation of an interactive multimedia clinical skills teaching program designed for the pediatric clerkship. *Teach Learn Med.* 2006;8(1):18-21.
56. Dougall A, Pani SC, Thompson S, Faulks D, Romer M, Nunn J. Developing an undergraduate curriculum in Special Care Dentistry – by consensus. *Eur J Dent Educ.* 2013;17(1):46-56.
57. Dehahitem MJ, Ridley K, Kerschbaum WE, Inglehart MR. Dental hygiene education about patients with special needs: a survey of U.S. programs. *J Dent Educ.* 2008;72(9):1010-9.
58. Krause M, Vainio L, Zwetchkenbaum S, Ingleheart MR. Dental education about patients with special needs: a survey of U.S. and Canadian dental schools. *J Dent Educ.* 2010;74(11):1179-89.
59. Shah AH, Fateel AA, Al-Nakhli O. Dentists and dental students opinion regarding dental treatment of patients with special needs. *J Pak Dent Assoc.* 2011;20(2):98-105.
60. Pani SC, AlShalan A, AlSaigh H, Shaheen R, Radwan W. Saudi dental students' perception of their education in special care dentistry and its effect on their confidence to render care. *J Dis Oral Health.* 2012;13(1):19-26.
61. Faulks D, Freedman L, Thompson S, Sagheri D, Dougall A. The value of education in special care dentistry as a means of reducing inequalities in oral health. *Eur J Dent Educ.* 2012;16(4):195-201.
62. Klingberg G. Behavior management – children and adolescents. In: Nunn J, editor. *Disability and oral care.* London: FDI Dental Press; 2000. pp.82-92.
63. What is PECS? Picture Exchange Communication System. Pyramid Educational Consultants, Inc. [Internet]. [cited 2020 Nov 24] Available from: <http://www.pecsusa.com/pecs.php>

64. Anderson KL, Self TL, Carlson BN. Interprofessional collaboration of dental hygiene and communication sciences & disorders students to meet oral health needs of children with autism. *J Allied Health*. 2017;46(4):97-101.
65. Casamassimo PS, Seale NS, Ruehs K. General dentists' perceptions of educational and treatment issues affecting access to care for children with special health care needs. *J Dent Educ*. 2004;68(1):23-8.
66. Thomas DR. A general inductive approach for analyzing qualitative evaluation data. *Am J Eval*. 2006;27(2):237-46.
67. Jones DM, Miller SR. Effectiveness of an educational module on dental hygiene students' attitudes towards persons with disabilities. *J Dent Hyg*. 2018;92(4):27-34.
68. Romer M, Dougherty N, Amores-LaFleur E. Predoctoral education in special care dentistry: paving the way to better access? *ASDC J Dent Child* 1999;66:132-5.

Table 1. Characteristics and Background of Dental Hygiene Students

N=33	n	%
Gender		
Male	0	0
Female	33	100
Age Range		
18-24	21	63.6
25-34	10	30.3
35-44	2	6.1
Race		
White	15	45.5
Hispanic/Latino	1	3
Black/AA	8	24.2
Native Amer/AI	0	0
Asian/Pacific	7	21.1
Other	2	6.1
Formal ASD* Instruction		
Yes	29	87.8
No	4	12.1
Courses		
Theory	26	89.7
Other (i.e., all courses/research study, radiology, therapies)	3	10.3
Hours of Formal Instruction		
1hr-2hr	13	39.4
3hr-4hr	12	36.4
5hr-6hr	3	9.1
6hr+	1	3
Provided Care to ASD Pat.		
Yes	0	0.0
No	33	100.0

*ASD refers to Autism Spectrum Disorder

Table 2. Pre-Post Intervention Knowledge Scores

Pre-Knowledge	Correct n (%)^a	mean(sd)	Post- Knowledge	Correct n (%)^a	mean(sd)	p-value
Prefer soft and sweet foods	14(42.4)	0.42(0.51)	Prefer soft and sweet foods	22(66.7)	0.67(0.48)	0.059
Cooperate w/dent tx	26(78.8)	0.79(0.42)	Cooperate w/dent tx	31(93.9)	0.94(0.24)	0.059
Higher risk oral disease	30(90.9)	0.91(0.29)	Higher risk oral disease	28(84.8)	0.85(0.36)	0.317
Description of Pts. w/ASD*	12(36.4)	0.36(0.49)	Description of Pts. w/ASD	10(30.3)	0.30(0.47)	0.637
Prevalence of ASD	15(45.5)	0.45(0.51)	Prevalence of ASD	20(60.6)	0.61(0.50)	0.197

Note: Responses were evaluated and scored based on correct response, i.e., a response of don't know or incorrect response =1; correct=1. The maximum possible total score was 5 (ranging 0-5).^a The percentage of students who correctly responded to the statement out of n=33 students.

*ASD refers to Autism Spectrum Disorder

Table 3. Pre-Post Intervention Change in Dental Hygiene Students' Attitudes

	Pre-Attitudes mean (sd)	Post-Attitudes mean (sd)	P-value
Confident to provide care to pts w/ASD* upon graduation	3.42(0.94)	3.97(0.73)	0.01
Understand how to assess unique needs of children with ASD	3.33(0.85)	4.15(0.51)	<0.001
Comfortable working w/children w/ASD	3.30(0.98)	3.73(0.91)	0.13
Working w/children w/ASD is stressful	3.36(0.86)	3.33(1.01)	0.99
Foresee routinely providing care to children w/ASD	3.03(0.77)	3.12(1.02)	0.83
Prefer to work in private practice that refer children w/ASD to a specialist	2.70(0.92)	2.70(1.05)	1.0
Prefer not to work w/individuals w/ASD	2.15(0.97)	2.39(0.89)	0.21
Feel I understand the dental needs of children w/ASD	3.52(0.91)	4.06(0.66)	0.02
Importance of educating students about tx of children w/ASD	4.85(0.36)	4.97(0.17)	0.10

Note: Wilcoxon Signed Rank Test used to determine statistical significance between mean attitude values are based on Likert scales of 1=strongly disagree to 5= strongly agree and 1=very little importance to 5=very important

*ASD refers to Autism Spectrum Disorder

Table 4. Pre-Post Intervention Reported Confidence to Perform Dental Hygiene Services

Pre-Confidence	mean(sd)	Post-Confidence	mean(sd)	P-value
Oral Exam	3.71(0.93)	Oral Exam	4.30(0.59)	0.01
OHI	3.45(1.09)	OHI	4.00(8.83)	0.02
Photos	2.85(0.97)	Photos	3.45(1.09)	0.04
Technique/rad safety exposing rads	2.64(0.78)	Technique/rad safety exposing rads	3.33(1.14)	0.03
Scaling	3.06(0.79)	Scaling	3.58(0.90)	0.01
Polishing	3.70(0.68)	Polishing	3.94(0.70)	0.16
Fluoride Tx	3.94(0.70)	Fluoride Tx	4.33(0.65)	0.05

Note: Wilcoxon Signed Rank Test used to determine statistical significance between mean confidence are based on Likert scale of 1=very little confidence to 5=very confident

Figure 1. Didactic and Clinical Experiences Prior to Receiving the SVT Module

Patient Management

“I am ashamed to say that I am quite intimidated to treat a patient, child or adult, with severe autism.”

“I am concerned with how to handle patients when they do go into a meltdown.”

Clinical Experience

“I haven’t gotten the chance to work with someone who has ASD.”

“Learning about patients with ASD in theory and through CE courses has helped to understand certain aspects of proper patient care. However, I believe that more clinical experience would be beneficial to increasing my confidence in treating ASD patients.”

“My reason for being less confident is because I have personally never met or interacted with children with ASD in clinic or outside of clinic. I feel like experience is a great way to better learn how to work with children with ASD.”

“I have worked with children with ASD. I feel treating them the same as others is what works best. Taking your time is needed in understanding the patients’ needs and family concerns when it comes to dental care.”

Didactic Curriculum

“I feel like more time could be spent making sure we are confident in our abilities to provide care to child patients with ASD. A couple of lectures aren’t really adequate in ensuring proper care to these patients.”

Didactic and Clinical Experiences

Figure 2. Additional Information Provided by Students Related to the SVT Module

Informative	Preparedness
“Awesome SVT educational module!:)”	“I don’t know how many patients I will encounter that will have ASD, but I do know for sure that I will be able to treat them in a way that makes them feel comfortable as possible. I will know how to address the situation if they get anxious or don’t want to cooperate, while getting them to trust me.”
“This module would be a great education resource in the future to teach students on how to better treat ASD patients.”	“I really enjoyed this experience and I believe that topics like this are very important in order to prepare the dental hygiene students to feel confident when treating patients with ASD.”
“I enjoyed taking this course and overall felt I gained valuable information.”	“I feel that with more hands-on and one to one will help increase our abilities to care for a patient with ASD. The more knowledgeable the better we will be as clinicians, with the understanding that each individual will be unique in care. Being prepared will definitely make their care a positive one.”
	“I understand more about patients with ASD because of this course.”

APPENDIX A



IRB APPROVAL LETTER

OFFICE OF THE VICE PRESIDENT FOR RESEARCH

Physical Address

4111 Monarch Way, Suite 203
Norfolk, Virginia 23508

Mailing Address

Office of Research
1 Old Dominion University
Norfolk, Virginia 23529
Phone(757) 683-3460
Fax(757) 683-5902

DATE: December 2, 2020

TO: Denise Claiborne, Ph.D.
FROM: Old Dominion University Institutional Review Board

PROJECT TITLE: [1639292-3] Use of an Innovative Simulated Virtual Training (SVT) to Improve Dental Hygiene Students' Self-Reported Knowledge, Attitudes, and Confidence in Providing Care to Child Patients with ASD: A Pilot Study

REFERENCE #: 20-139
SUBMISSION TYPE: New Project

ACTION: APPROVED
APPROVAL DATE: December 2, 2020
NEXT REPORT DUE: December 1, 2021
REVIEW TYPE: Expedited Review

REVIEW CATEGORY: Expedited review category # 7

Thank you for your submission of New Project materials for this project. The Old Dominion University Institutional Review Board has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a project design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulations.

This project has been determined to be a MINIMAL RISK project. Based on the risks, this project does not require continuing review. You will receive an annual check in reminder. Please complete the annual check in form and submit it for administrative approval by your next report due date of December 1, 2021.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Federal regulations require that each participant receives a copy of the consent document.

Please note that any revision to previously approved materials must be approved by this committee prior to initiation. Please use the appropriate revision forms for this procedure.

All UNANTICIPATED PROBLEMS involving risks to subjects or others (UPIRSOs) and SERIOUS and UNEXPECTED adverse events must be reported promptly to this office. Please use the appropriate reporting forms for this procedure. All FDA and sponsor reporting requirements should also be followed.

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to this office.

Please note that all research records must be retained for a minimum of three years after the completion of the project.

If you have any questions, please contact Danielle Faulkner at (757) 683-4636 or dcfaulkn@odu.edu. Please include your project title and reference number in all correspondence with this committee.

APPENDIX B

INVITATION LETTER TO DENTAL HYGIENE STUDENTS

Email Subject: Research Study Participation Invitation

Dear Dental Hygiene Student:

We invite you to participate in a research study that will help us to understand your knowledge, attitudes, and confidence related to Autism Spectrum Disorder (ASD). Specifically, you will participate in a simulated virtual training module that will consist of a clinical scenario in which you will “interact” with a child who has ASD in the dental environment. In addition to completing the simulated virtual educational training module, you will complete two anonymous self-administered electronic surveys through a Qualtrics® link.

All three of the above-mentioned elements related to the research project, will take roughly 1 hour to complete total over the course of 4-6 weeks. If you would like to participate in this research study, please respond to this email **no later than January 15, 2021**. You will then receive an informed consent form to review, sign, and return. Thereafter, you will be enrolled into a Blackboard® Organization titled, “SODH Virtual Training Module for Autism Spectrum Disorder” where you will complete the pre-intervention survey that will be time sensitive; followed by the SVT for you to complete. Roughly, two weeks following the completion of the SVT, you will receive the post-intervention survey. Once the post-intervention survey is complete and you have emailed a confirmation of completion, you will receive a \$10 Amazon gift card as a thank you for participating in the study.

If you have any questions, please contact Kimberly Cenzone at kcenz001@odu.edu, Dr. Denise Claiborne at dclaibor@odu.edu, or Professor Ann Bruhn at abruhn@odu.edu.

Kimberly F. Cenzone, RDH, BDSH
Graduate Teaching Assistant
Gene W. Hirschfeld School of Dental Hygiene
4608 Hampton Blvd. Room 3107
Old Dominion University
Norfolk, VA 23529
757-683-4314 Office

APPENDIX C

PRE-INTERVENTION SURVEY

Pre-Survey: DH Students' Knowledge, Attitudes, and Perceived Confidence Treating ASD Children

Thank you for participation in this anonymous survey. This survey will be used to describe dental hygiene students' knowledge, attitudes, and perceived confidence in providing care for children with autism spectrum disorder (ASD) diagnosis in aggregate form.

Please preference your responses below as providing care to children with ASD.

In order for the surveys to remain anonymous, but also for your pre and post surveys to be matched, please create a unique identifier using the instructions below.

Step 1 – The first initial of your mother's first name (example: Jane = J)

Step 2 – The day and month of your mother's birthday (example: August 12 = 12-08)

The unique identifier is thus J-12-08

What is the gender you most identify with?

☐ Male

☐ Female

☐ Other (specify) _____

☐ Prefer not to disclose

Please indicate your age range:

- ☐ Under 18
 - ☐ 18 - 24
 - ☐ 25 - 34
 - ☐ 35 - 44
 - ☐ 45 - 54
 - ☐ Over 55
-

Please indicate your race:

- ☐ White
 - ☐ Hispanic or Latino
 - ☐ Black or African American
 - ☐ Native American or American Indian
 - ☐ Asian/Pacific Islander
 - ☐ Other
-

Have you received formal instruction in your dental hygiene program on providing care to a patient with ASD?

- ☐ Yes
- ☐ No
- ☐ If you answered yes, please specify the type of instruction given (i.e. lecture, laboratory simulations, online media-based learning). _____
-

If "yes" to formal instruction, please provide the courses that focused on providing care to patients with ASD (i.e. anatomy, theory, radiology, etc.).

If "yes" to formal instruction, how many hours so far in your academic dental hygiene program were dedicated to learning or providing care to patients with ASD?

- ☐ 1-2 hours
- ☐ 3-4 hours
- ☐ 5-6 hours
- ☐ 6+ hours
-

Have you provided care to a child with ASD during your clinical curriculum?

☐ Yes

☐ No

Please respond to the following statements:

	True	False	Don't Know
Children with ASD prefer soft and sweet foods.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Children with ASD tend to show ability to cooperate in dental treatment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Children with ASD are at a higher risk for oral disease.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Which of the following describes patients with ASD?

☐ Reaction to others and tendency to communicate

☐ Inability in using correct pronoun

☐ Speaking regularly and with rhythm

☐ Using correct words

☐ Don't know

To the best of your knowledge, which of the following displays the prevalence and proportion of male to female children with ASD?

- ☐ One in 100 children/female 5 times larger than male
- ☐ One in 54 children/female 5 times larger than male
- ☐ One in 54 children/male 5 times larger than female
- ☐ One in 100 children/male 5 times larger than female
- ☐ Don't know

Respond to the following by indicating: Strongly Agree, Agree, Don't Know, Disagree or Strongly Disagree

	Strongly Agree	Agree	Don't Know	Disagree	Strongly Disagree
I feel confident that I can provide care to patients with ASD upon graduation.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I understand how to assess the unique needs of children with ASD.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am comfortable working with children with ASD.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Working with children with ASD is stressful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

I foresee myself routinely providing care to children with ASD.

☐ ☐ ☐ ☐ ☐

I would prefer to work in a private practice that refer children with ASD to a specialist.

☐ ☐ ☐ ☐ ☐

I would prefer not to work with individuals who have ASD.

☐ ☐ ☐ ☐ ☐

I feel that I understand the dental needs of children with ASD.

☐ ☐ ☐ ☐ ☐

How do you rank the importance of educating students about the treatment of children with ASD?

- ☐ Very Important
- ☐ Important
- ☐ Don't Know
- ☐ Little Importance
- ☐ Very Little Importance

Please rate each of the below listed skills by your perceived level of confidence when providing care to a child patient with ASD.

	Very Confident	Confident	Don't Know	Little Confidence	Very Little Confidence
Oral Examination	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Oral Hygiene Instructions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Taking Photographs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Technique and radiation safety when exposing dental radiographs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scaling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Polishing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fluoride Treatment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Rate how each of the following may contribute to a higher comfort level in providing care to children with ASD.

	Strongly Agree	Agree	Don't Know	Disagree	Strongly Disagree
More patients with ASD within clinical sites.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Additional/elective educational resources.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Personal experience i.e. (family member or friend with ASD).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (specify)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please provide any additional information that you would like to share concerning your learning or clinical experience regarding child patients with ASD.

APPENDIX D

POST-INTERVENTION SURVEY

Post-Survey: DH Students' Knowledge, Attitudes, and Perceived Confidence Treating ASD Children

Thank you for participation in this anonymous survey. This survey will be used to describe dental hygiene students' knowledge, attitudes, and perceived confidence in providing care for children with autism spectrum disorder (ASD) diagnosis in aggregate form.

Please preference your responses below as providing care to children with ASD.

In order for the surveys to remain anonymous, but also for your pre and post surveys to be matched, please create a unique identifier using the instructions below.

Step 1 – The first initial of your mother's first name (example: Jane = J)

Step 2 – The day and month of your mother's birthday (example: August 12 = 12-08)

The unique identifier is thus J-12-08

What is the gender you most identify with?

☐ Male

☐ Female

☐ Other (specify) _____

☐ Prefer not to disclose

Please indicate your age range:

- ☐ Under 18
 - ☐ 18 - 24
 - ☐ 25 - 34
 - ☐ 35 - 44
 - ☐ 45 - 54
 - ☐ Over 55
-

Please indicate your race:

- ☐ White
 - ☐ Hispanic or Latino
 - ☐ Black or African American
 - ☐ Native American or American Indian
 - ☐ Asian/Pacific Islander
 - ☐ Other
-

Have you received formal instruction in your dental hygiene program on providing care to a patient with ASD?

- ☐ Yes
 - ☐ No
-

If you answered yes, please specify the type of instruction given (i.e. face to face lecture, laboratory simulations, online media-based learning).

If "yes" to formal instruction, please provide the courses that focused on providing care to patients with ASD (i.e. anatomy, theory, radiology, etc.)

If "yes" to formal instruction, how many hours so far in your academic dental hygiene program were dedicated to learning or providing care to patients with ASD?

- ☐ 1-2 hours
- ☐ 3-4 hours
- ☐ 5-6 hours
- ☐ 6+ hours
-

Have you provided care to a child with ASD during your clinical curriculum?

☐ Yes

☐ No

Please respond to the following statements:

	True	False	Don't Know
Children with ASD prefer soft and sweet foods.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Children with ASD tend to show ability to cooperate in dental treatment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Children with ASD are at a higher risk for oral disease.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Which of the following describes patients with ASD?

☐ Reaction to others and tendency to communicate

☐ Inability in using correct pronoun

☐ Speaking regularly and with rhythm

☐ Using correct words

☐ Don't know

To the best of your knowledge, which of the following displays the prevalence and proportion of male to female children with ASD?

- ☐ One in 100 children/female 5 times larger than male
- ☐ One in 54 children/female 5 times larger than male
- ☐ One in 54 children/male 5 times larger than female
- ☐ One in 100 children/male 5 times larger than female
- ☐ Don't know

Respond to the following by indicating: Strongly Agree, Agree, Don't Know, Disagree or Strongly Disagree

	Strongly Agree	Agree	Don't Know	Disagree	Strongly Disagree
I feel confident that I can provide care to patients with ASD upon graduation.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I understand how to assess the unique needs of children with ASD.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am comfortable working with children with ASD.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Working with children with ASD is stressful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I foresee myself routinely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

providing care
to children
with ASD.

I would prefer
to work in a
private
practice that
refer children
with ASD to a
specialist.

I would prefer
not to work
with
individuals
who have ASD.

I feel that I
understand
the dental
needs of
children with
ASD.

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How do you rank the importance of educating students about the treatment of children with ASD?

- ☐ Very Important
- ☐ Important
- ☐ Don't Know
- ☐ Little Importance
- ☐ Very Little Importance
-

Please rate each of the below listed skills by your perceived level of confidence when providing care to a child patient with ASD.

	Very Confident	Confident	Don't Know	Little Confidence	Very Little Confidence
Oral Examination	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Oral Hygiene Instructions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Taking Photographs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Technique and radiation safety when exposing dental radiographs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scaling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Polishing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fluoride Treatment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Rate how each of the following may contribute to a higher comfort level in providing care to children with ASD.

	Strongly Agree	Agree	Don't Know	Disagree	Strongly Disagree
More patients with ASD within clinical sites.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Additional/elective educational resources.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Personal experience i.e. (family member or friend with ASD).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (specify)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

After completing the SVT educational module, how confident do you feel about providing care to child patients with ASD in your future clinical experiences?

Describe how this SVT educational module has increased your knowledge or attitudes towards the topic of ASD and dental care.

Please provide any additional information that you would like to share.

APPENDIX E

SAMPLE OF SVT MODULE

1

In the waiting room, the child is anxious and apprehensive about meeting the hygienist



How should the hygienist respond? Select all that apply.

- ☒ Talk to the child
- ☐ Be friendly and comforting
- ☒ Lift face shield and explain its purpose
- ☒ Take the child directly to the operatory

Sorry!

The child is not willing to go back to the cubicle with you yet.

Make an effort to talk to the child until they warm up and are comfortable. ASD patients need more than a quick "Hello."

4

The child is very antsy in the chair because of sensory issues



How should the hygienist respond?



Give the child the dark patient treatment glasses



Give the child the clear patient treatment glasses

CHECK ANSWER

6

The child doesn't like the vibration of an electric toothbrush and only brushes once daily



What is the **BEST** way to perform oral health instruction here?

- ☐ Show the child a toothbrushing video
- ☐ Talk to the child about toothbrushing
- ☒ Demonstrate using a typodont and manual toothbrush
- ☐ Discuss toothbrushing with guardian only

Correct!

If an ASD patient has sensory issues with electric oral health aids, take the time to demonstrate manual brushing on a typodont.

[Next](#)

8

The hygienist will use the suction and air/water syringe in the child's mouth



Select Yes, if the hygienist should respond this way.

- ☐ No ☒ Yes Immediately squirt water into the child's mouth
- ☐ No ☒ Yes Allow child to hold the suction and air/water syringe
- ☐ No ☒ Yes Have the child close on the suction to see how it feels
- ☐ No ☒ Yes Explain and show the functions of the dental chair and bracket table

Correct!

The child accepts the two tools in their mouth and closes for suction.

Make an effort not to use instruments on ASD patients without warning. They may have sensory issues with the sound or feel.

[Next](#)

VITA

NAME: Kimberly Frances Cenzone, RDH
ADDRESS: 4608 Hampton Blvd
 Norfolk, VA 23529

EDUCATION:

In Progress	Old Dominion University Norfolk, VA Master of Science, Dental Hygiene
2019	Old Dominion University Norfolk, VA Bachelor of Science, Dental Hygiene
2015	Virginia Polytechnic Institute and State University Blacksburg, VA Bachelor of Science, Biological Sciences

PROFESSIONAL EXPERIENCE:

Present	Adjunct Clinical Instructor, Department of Dental Hygiene, Old Dominion University, Norfolk, VA
2019-Present	Dental Hygienist (Temp), Virginia Beach, VA
2019-2021	Graduate Teaching Assistant, Department of Dental Hygiene, Old Dominion University, Norfolk, VA

GRANTS RECEIVED:

2020	The ADHA Institute for Oral Health Research Grant – Use of an Innovative Stimulated Virtual Training (SVT) to Improve Dental Hygiene Students' Self-Reported Knowledge, Attitudes, and Confidence in Providing Care to Child Patients with ASD: A Pilot Study.
------	--

HONORS, RECOGNITION, AWARDS, AND PRIZES:

2019	The American Association of Public Health Dentistry's Community Dentistry and Dental Public Health Award
2018, 2019	Michele Leonardi Darby Global Health Scholarship Award

MEMBERSHIP IN PROFESSIONAL SOCIETIES:

2017-Present	American Dental Hygienists' Association
2017-Present	Virginia Dental Hygienists' Association
2017-Present	Tidewater Dental Hygienists' Association