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Preparing student dental hygienists in care of persons of developmental disabilities using a virtual patient module

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Preparing Student Dental Hygienists in Care of Persons with Developmental Disabilities Using a Virtual Patient Module

A Thesis

Presented in Partial Fulfillment of the Requirements for the

Degree of Masters of Science

in

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College of Graduate Studies

Eastern Washington University

by

Janis McClelland, RDH, BSDH

Spring 2021

Major Professor: Merri Jones, RDH, MSDH

THESIS OF Janis McClelland APPROVED BY

Merri Jones DATE 5-5-21

MERRI JONES, RDH, MSDH, GRADUATE STUDY COMMITTEE

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Date: 2021.05.06 08:06:42 -07'00'
Adobe Acrobat version: 2021.001.20150 DATE 5-5-21

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Theresa J. Martin DATE 5/6/21

THERESA J. MARTIN, RhD., GRADUATE STUDY COMMITTEE

Human Subjects Approvals

TO: Janis McClelland, Dental Hygiene
FROM: Dr. Theresa J. Martin, Chair – EWU IRB Human Subjects
DATE: Jan. 12, 2021
SUBJECT: Final Approval of HS-5976

Human subjects protocol HS-5976 entitled "Assessing Student Dental Hygienists' Competencies in Care of Persons with Developmental Disabilities Using a Virtual Patient Module" has been approved as an exemption from federal regulations under 45 CFR Part 46.104(d)(1-8).

A signed and approved copy of your application is attached.

Student research qualifying for an exempt review is valid for a period **one year**. **The timeframe for your project approval is Jan. 12, 2021 to Jan. 11, 2022.** If subsequent to initial approval, the research protocol requires minor changes, the Office of Grant and Research Development should be notified of those changes. Any major departure from the original proposal must be reviewed through a Change of Protocol application submitted to the IRB before the protocol may be altered. Please refer to HS-5976 on future correspondence as appropriate as we file everything under this number.

Cc: HS-5976 file
Prof. Merri Jones, RPI
Graduate Office

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HS-5976

Application for Exempt Research
EWU Institutional Review Board for Human Subjects Research

Principal Investigator (PI): Janis McClelland	*If PI is a student, an RPI is required.* Responsible Project Investigator (RPI) *(faculty/staff sponsor)*: Merri Jones, RDH, MSDH
Student Investigators, does the RPI have permission to renew the study in their own name after you have left the university? Yes X No ☐	
Department: Dental Hygiene Phone number: (208)-610-3675 E-mail: jmcclelland@eagles.ewu.edu	Department: Dental Hygiene Phone number: (509) 828-1320 E-mail: merri.jones@ewu.edu

Project Title: Assessing Student Dental Hygienists' Competencies in Care of Persons with Developmental Disabilities Using a Virtual Patient Module

For students only: Is this research being done to meet a course, thesis or other academic requirement? X Yes ☐ No
If yes, please specify: Under the direction of faculty, Master Degree in Dental Hygiene students use current research to write a thesis demonstrating mastery of a chosen topic.
If not, why is it being done?

Anticipated start date:	Anticipated end date:	Requested Length of approval						
		Quarter ☐ or Semester ☐ X	Fall ☐X	Winter ☐	Spring X☐	Summer ☐	1 year ☐	5 year (Faculty/Staff Only) ☐
1/11/21	2/18/21							

Funding: X ☐ Non-funded ☐ Internal funding ☐ External funding
Funding agency (if applicable):
Grant or Contract Number:

Check the type of exemption applicable to the project using the "Exemption Decision Aid:"
X☐ ☐ 2i. ☐ 2ii. ☐ 2iii. ☐ 3i. ☐ 3ii. ☐ 3iii. ☐ 4i. ☐ 4ii. ☐ 4iii. ☐ 4iv. ☐ 5. ☐ 6. ☐ 7. ☐ 8. 1.

Rationale for exemption. Why should this project be exempt?
The research study is exempt according to the guidelines. (1) Research conducted in established or commonly accepted educational settings, that specifically involves normal educational practices that are not likely to adversely impact students' opportunity to learn required education content or the assessment of educators who provide instruction. This includes most research on regular and special education instructional strategies, and research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

This study is evaluating senior student dental hygienists' knowledge and perceived sense of difficulty of treating persons with disabilities after viewing a virtual patient (VP) educational experience. Participants will be enrolled in the spring semester as senior students in the EWU Dental Hygiene program at the time of the study. Minimal risk will be involved, and participation is voluntary. Participants may withdraw at any time, free of academic consequences or impact on participants' grades.

Please state the purpose and methodology of the research:
The purpose of this study is to assess the impact of a virtual patient module on dental hygiene students' knowledge and perception of difficulty in addressing the dental needs of individuals with developmental disabilities (DD).
The proposed study will utilize a mixed-method design aimed to examine the effect of a VP module on dental hygiene students' knowledge and perception of difficulty in addressing dental needs of individuals with developmental disability.
Upon approval of the Eastern Washington University (EWU) Institutional Review Board (IRB) for approval of Exempt Category 1 status consent will be obtained. Prior to participation. the students will be informed of the minimal risk and that participation is voluntary.
A convenience sample composed of all (N=37) EWU senior dental hygiene students will be recruited to participate in the proposed study. Inclusion criteria includes enrollment in the Eastern Washington University (EWU) Dental Hygiene program with senior status at the time of the study. The setting of the study includes an online format using SurveyMonkey® and the Preservice Health Training (PHT) website to access the PHT VP module.
The independent variable is the virtual patient module. The DS module (Hunter's case) with an adolescent with DS presenting at a dental appointment. The dependent variables include 1) participants' knowledge of module content, and 2) participants' perception of difficulty in addressing dental needs of individuals with DDs. Equipment includes participants' personal computers, and the

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Application for Exempt Research

EWU Institutional Review Board for Human Subjects Research

Preservice Health Training (PHT) VP module. Computer software programs used to collect and analyze data include SurveyMonkey® and IBM SPSS® version 25.

Describe the procedures: what specifically will subjects do? If data are anonymous, describe the data gathering procedure for insuring anonymity.

The participates will be asked to:

- Complete a pre-test prior to completing the assigned DNHY 461S virtual patient (VP) module on Down syndrome
- Complete a post-test following completion of the assigned DNHY 461S VP module on Down syndrome.
- Agree to the informed consent statement. Completing the pre-test and post-test via SurveyMonkey® implies consent.

This study is minimal risk. Any potential risks from the study are not any different than those encountered in daily life. Participation in this study is voluntary. The online module should take approximated 1 – 1.5 hours to complete. The decision to not participate will in no way affect student's grades or academic status. Participants are free to withdraw your consent and discontinue participation at any time without judgment. You will not be personally identified in any report or publications that may result from this study. Only the Principal Investigators will know your identity. All your information will be kept confidential and neither your name nor any other information that could identify you will be revealed in this study. Any personal information about you that is gathered during this study will remain confidential. A unique identification code will be used to identify you in the study. Your identity will remain anonymous. There is no cost to participate, and you will be informed of study results.
As a thank you and incentive for participating in the study, participants completing both the pre-test and post-test will be entered into a drawing for a chance to receive one of 4 - $25 Amazon gift cards by providing an email address via a link in the post-test. This will keep your email separate from your responses to maintain anonymity.

Attach all proposed recruitment materials (scripts, texts, emails, flyers and/or social media posts), surveys, questionnaires, cover letters, information sheets, consent forms, etc.
Appendices A- J attached at the end of this form.

I certify that the information provided above is accurate and the project will be conducted in accordance with applicable Federal, State and university regulations:

PI Signature:

Janis McClelland,RDH, BSDH

Recommendations and Action:	**Date**	**Approve/Disapprove**
RPI Signature *(Needed only if PI is a student):* Merri Jones		☒ A D ☐
IRB Rep. or Dept. Chair: *(Needed if PI is a student OR for faculty PI if required by department)* N/A		☐ A D ☐
IRB Signature: ***Dr. Theresa J. Martin – approved 1/12/21***		☒ A D ☐

☐ Subject to the following conditions:

Approved from 1/12/2021 to 1/11/2022

Abstract

Purpose: The purpose of the study was to examine if participation in an interactive virtual patient (VP) module increased dental hygiene students' knowledge in caring for individuals with developmental disability (DD) and if participation in an interactive, VP module would impact dental hygiene students' perception of difficulty in caring for individuals with DD.

Methods: The study utilized a mixed-methods study design with a convenience sample composed of eighteen (*N*=18) dental hygiene students. A pre-test/post-test design was utilized in two measures based on the content of the VP module. The eight-item Disability Situations Inventory (DSI) measured perceived sense of difficulty in addressing dental needs of individuals with DD. The15-item knowledge test based upon content of the VP module served as a measure of knowledge. Thematic analysis was used to analyze open-ended qualitative items.

Results: Item level analyses on the DSI items demonstrated a significant decrease in perceived level of difficulty from pre-test to post-test (p = 0.000 [1.09E-08]. Results show a significant gain in knowledge (p = 0.04). The mean pre-test item score was 0.369 (M=0.369; SD=0.21). The mean post-test score was 0.447 (M=0.447; SD=0.225). Themes emerging in qualitative findings included: importance of communication, confidence in patient interaction, insight into parent perspective, and positive impact of the VP module.

Conclusion: The VP module was shown to be an effective tool in preparing dental hygiene students in the care of persons with DD through increased knowledge and confidence.

Acknowledgements

My most sincere thanks go to many that have had an impact on me while on my journey to a Master's Degree:

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- To Professor Theresa Martin for providing valuable insight into my research;
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Introduction/Literature Review

Introduction to the Research Question

The first U.S. Surgeon General report on oral health, *Oral Health in America,* highlights dental care as one of the greatest unmet healthcare needs for persons with developmental disabilities (DD), drawing attention to the problem of oral health disparities and the access to care (U.S. Department of Health and Human Services [HHS], 2000). According to the U.S. Census Bureau, nearly 50 million citizens have a long-term disability that challenges them on a daily basis (U. S. Census Bureau, 2000) and over 6 million individuals have DD in the U.S. (Disability Justice, 2020). Trends in deinstitutionalization, along with increasing life expectancies, have resulted in an increased population of persons with DD residing in community dwellings. This transition creates an access to care problem, as persons "mainstreaming" into society no longer have access to institutional health services, and thus the need to access basic health services in the community setting.

Current terminology in the literature on disability includes several terms, include *intellectual developmental disability* (IDD), *developmental disability* (DD) and *special needs patients*. Intellectual developmental disability is defined as "a disability characterized by significant limitations in both intellectual functioning and in adaptive behavior, which covers many everyday social and practical skills originating before the age of 18" (American Association of Intellectual and Developmental Disabilities [AAIDD], 2017 Definition, ¶ 1; Centers for Disease Control and Prevention [CDC],

2017). The term DD is described as a broader category of often lifelong disability that may be intellectual, physical, or both. Developmental disabilities include, but are not limited to autism, behavior disorders, brain injuries, cerebral palsy, Down syndrome (DS), fetal alcohol syndrome, spina bifida, and hydrocephalus (AAIDD, 2017; National Institutes of Health [NIH], 2017).

Individuals with DD face many challenges attaining and maintaining optimal oral health and general health, due to various, physical, cognitive, sensory, and behavioral conditions (Minihan et al., 2014). The provision of care often requires accommodations and modifications to treatment plans and to the provision of care. One of the most common DD is DS, a genetic disorder. Persons with DS may present with serious medical and dental conditions including an increased risk of cardiac, gastrointestinal, and musculoskeletal conditions, bruxism, periodontal disease, gingivitis, and microdontia (Kucik et al., 2013; Kleinert et al., 2007a).

Access to competent medical and dental care is key to attaining basic healthcare. One aspect of the problem related to unmet dental needs and access to dental care stems from dental professionals' reluctance to treat persons with DD due to lack of educational preparation (Dao et al., 2005; Waldman et al., 2005).

In 2004, the American Dental Association (ADA) Commission on Dental Accreditation (CODA) adopted a new standard for dental and dental hygiene education programs to ensure students have exposure to clinical and didactic educational opportunities to prepare them for care of persons with DDs, medically compromised patients, and other special needs populations. The term *special needs patient* (SNP) is a term common to current literature. As defined by CODA the SNP is "Those patients

whose medical, physical, psychological, cognitive or social conditions make it necessary to consider a wide range of assessment and care options in order to provide dental treatment for that individual (2020, p. 13). For the purpose of this literature review, the term developmental disability (DD) is used.

CODA (2020) stated in its Accreditation Standards for Dental Hygiene Education Programs (Standard 2-12) that "Graduates must be competent in providing dental hygiene care for the child, adolescent, adult, geriatric, and special needs patient populations" (p. 24). Standard 2-12 has been updated several times since first being adopted in 2004. The 2019 revisions implemented in July 2020 addresses the lack of training more comprehensively in dental care of intellectually and developmentally disabled patients. The accompanying statement of intent of this CODA (2020) standard states:

> An appropriate patient pool should be available to provide a wide scope of patient experiences that include patients whose medical, physical, psychological, developmental, intellectual or social conditions may make it necessary to modify procedures in order to provide dental hygiene treatment for that individual. Student experiences should be evaluated for competency and monitored to ensure equal opportunities for each enrolled student. Clinical instruction and experiences should include the dental hygiene process of care compatible with each of these patient populations. (pp. 24-25)

In order to improve access to care and eliminate oral health disparities, future dental professionals must receive the educational experiences preparing them to provide care for these vulnerable populations. Dental and allied dental programs are challenged to document competency for their graduates to meet Standard 2-12 regarding care of special

populations highlights the critical need to increase dental hygiene and dental students' clinical exposure to patients with DDs (CODA, 2019).

Statement of Problem

A major challenge is providing students with exposure to patients with DD as well as assessing student competence in providing the dental hygiene process of care. The literature shows the virtual patient (VP) pedagogy as an effective adjunctive method used to prepare students for clinical live patient interactions.

Preparing students to care for patients with DDs presents a significant challenge. Factors such as increased program competencies, required clinical experiences, establishing appropriate patient pools, limited resources, and reimbursement mechanisms present some of the challenges facing dental education. Students are often required to attain a minimum competence prior to providing patient care yet may lack access to patient populations. Furthermore, accreditation bodies now mandate demonstration of competence prior to graduation, as demonstrated in the ADA CODA standards. This challenge has been viewed as a paradox, whereby “the opposing forces of increased training expectations and reduced training resources have greatly impacted health professions education” (Cook & Triola, 2009, p. 303). This is ever more important in preparing dental hygiene students to care of persons with DDs. While the literature demonstrates use of VPs in dental, medical, and other health professions, little attention has been given to the effect of the VP pedagogy in dental hygiene curricula.

Research Question

The research questions for this proposed study were:

1) Does participation in an interactive, VP module increase dental hygiene students' knowledge in caring for individuals with DD?

2) Does participation in an interactive, VP module impact dental hygiene students' perception of difficulty in caring for individuals with DD?

Overview of Research

Trends in deinstitutionalization, increased life expectancies among persons with DD, and workforce education and training in care of persons with DDs, have shaped the access to care issue for this population. The oral health of many persons with DDs is poor, and access to dental care limited (World Health Organization [WHO], 2011). These trends have contributed to the number of individuals with DDs residing in the community and requiring dental care in private practice settings (Cole, 2004; Kleinert et al., 2007a; Waldman & Perlman, 2002).

Persons with Developmental Disabilities

Certain DD are largely physical issues, such as cerebral palsy or epilepsy. Some individuals may have a condition that includes a physical and intellectual disability, for example Down syndrome (DS) and autism (AAIDD, 2020). Down syndrome is a common disability described as a set of cognitive and physical symptoms that result from having an extra chromosome 21 or an extra piece of that chromosome. It is the most common chromosomal disorder causing mild to moderate intellectual disabilities. People with DS have an increased risk for certain medical conditions such as congenital heart defects, respiratory and hearing problems, Alzheimer's disease, childhood leukemia, and

thyroid conditions. Persons with DS also have distinct physical features, such as a flat-looking face, an upward slant to the eyes, and a single deep crease across the center of the palm (CDC, 2020).

Deinstitutionalization

Since the late 1960s, there has been a trend in deinstitutionalizing or "mainstreaming" of persons with DD from institutions to community-dwelling or residential living. This transition left a vulnerable population without the institutional in-house dental and medical services they were receiving. Numerous studies reveal that deinstitutionalization has resulted in increased numbers of patients with special needs who need to receive care in private practices (Clemetson et al., 2011; Sanders et al., 2008a; Kleinert et al., 2007a). There is an increase in the population of those with DD living in the United States. These individuals reside in neighborhoods and are members of families who are patients of record in community dental care practices. As a result, they are dependent upon local dentists for all oral health services (Holder et al., 2009). Sufficient oral health for this growing population is necessary to maintain a wholesome quality of life. Research studies verify adults with DD living in community settings lack preventive oral care (Al-Allaq et al., 2015; Lewis et al., 2002).

Living with Down Syndrome

Due to medical advances life expectancy of people with Down syndrome has improved over the past 20 years (Kucik, 2013). In the last 60 years life expectancy for persons with DS has increased from 10 years old to 60 years of age (CDC, 2020). As noted previously, persons with Down syndrome have increased risk for certain medical conditions requiring routine monitoring and preventive medical care. (National Down

Syndrome Society [NDSS], 2020). Students with DS are included in traditional academic classrooms in schools across the country. Increasingly, individuals with Down syndrome graduate from high school with diplomas and participate in postsecondary academic and college programs. Quality healthcare and positive family and community interactions enable people with Down syndrome to lead fulfilling and productive lives (NDSS, 2020).

Preparing a Competent and Confident Workforce

Research shows there are few practitioners in the community who are prepared to provide treatment for the increasing number of persons with DD, such as Down syndrome (Casamassimo et al., 2004; Kleinert, 2007a). The availability of dental providers trained to provide care to this population further complicates the issue of access to care (U.S. Surgeon General Report, 2000). Access to dental care poses a challenge for children and adults with DD because of difficulty finding a dentist who is trained and willing to care for young children or adults with simple or complex medical conditions (Waldman et al., 2018).

Numerous studies show students report their training and education to be inadequate, and that healthcare providers lack skills to provide care for persons with disabilities. Findings demonstrate a correlation between one's educational preparation in care of persons with DD and their confidence and willingness to provide care (Thomas et al., 2016; Vainio et al., 2011; Waldman et al., 2018).

Holder et al. (2009) conducted a survey to examine the perceptions of dental/medical educators and their students in the U.S. on the curricula importance of the diagnosis and treatment of individuals with DDs and their willingness to institute needed training. A total of (n = 2,219) surveys were distributed, (n = 795) were returned; a

response rate of 36%. The study results found the majority of dental/ medical school seniors and graduates expressed inadequate competency in the care of these patients. Half or more of the deans of the medical and dental schools reported that a curriculum focused on the care patients with disabilities was not a high priority in their school (Holder et al., 2009). The authors concluded there is need for increased didactic and clinical preparation of dental/medical school graduates in the care of individuals with special health needs and that curriculum modules provide an opportunity to prepare new graduates for the care of an increasing population of individuals with disabilities (Holder et al., 2009). This study shows limited education and clinical opportunities are offered in medical and dental school.

Increasing preparedness of dentists to provide care for persons with DD is essential (Anders & Davis, 2010). Clemetson, et al. (2011) refer to two dental schools that significantly increased the didactic and clinical training in special care dentistry, leading to a positive influence in treating those with special care needs in future practices. The authors found dental education to be lacking in preparation of future practitioners directly influencing their confidence and willingness to provide care to this population. Unqualified dental practitioners in treating persons with DD could result in a greater reduction of access to care.

To further expand Al-Allaq et al. (2015) noted dental schools should increase teaching students in regard to persons with DD, noting accreditation standards require graduates to be prepared however students often lack the confidence to treat persons with special care needs. Additionally, Waldman et al. (2005) reported 50% of dental students were provided fewer than 5 hours of didactic content during their educations and 75%

provided from 0 to 5% of their clinical experiences related to the care of individuals with special needs. Similar dental hygiene programs findings reported 48% of 170 programs had 10 hours or less of didactic training (including 14% with 5 hours or less); and 57% of programs reported no clinical experience (Waldman et al., 2005).

Fuad et al. (2015), conducted an investigative study to examine the need for predoctoral dental students to have special care dentistry curriculum stressed in their educations by assessing clinical and didactic clinical instructional experiences. The study showed experiences in managing special needs patients at the predoctoral level is inadequate and should be emphasized in the curriculum. Additionally, findings reveal there is a need to assure special needs patients get adequate care and that dental providers are educated in Special Care Dentistry (SCD). The outcome of the study provided a clear statement of the importance of predoctoral dental graduates knowing how to assess the treatment needs of patients with DD. The authors also noted the majority of dentist and dental hygienists require more clinical experience in treating this population.

Dao et al. (2005) investigated whether predoctoral dental education concerning the treatment of special needs affects general dentists' professional behavior, practice characteristics, and attitudes concerning special needs patients. Data was collected from 208 (n = 208) general dentists from a state dental association. To assess the effect of general dentists' perceptions of their dental education on their professional behavior, practice characteristics, and confidence levels/attitudes toward special needs patients, univariate analyses of variance were conducted with the independent variable "Quality of education." Respondents who had strongly disagreed or disagreed with the item "Dental school prepared me well to treat special needs patients" were grouped into a category of

"negative educational experience"; those respondents who strongly agreed or agreed with this statement were grouped into a category "positive educational experience;" and respondents who chose the neutral answer ("three" on five-point scale) were grouped into a category of "neutral experience." Dao et al. (2005) provided an overview of the research concerning educational efforts in this area with results from the data suggesting changes in the curriculum concerning special needs patients could make a difference in how future providers feel about treating special needs patients and how they orient their employees and establish practices to do so. Thus, these changes may reduce oral health disparities and increase access to dental care. Dao et al. (2005) further stated that when treating patients with special needs, quality education has a significant effect on future providers' professional behavior, practice characteristics, attitudes, and confidence. These positive effects can contribute to reducing the disparities between special needs patients and patients without special needs' oral health and access to care.

Barriers to Provision of Care

Casamassimo et al. (2004) reported that as little as 10% of the practitioners treated children with special needs on a regular basis. Dental professionals' lack of confidence to accept and treat children with special health care needs is a major concern. This may be due to lack of training or clinical experiences that include children with DD during their formal education. From the research, it is apparent that inclusion of formal training in dental curriculum and continuing education courses addressing the treatment of DD patients would improve dental students' competence in working with special needs children (Kleinert et al., 2007a; Wolff et al., 2004)

Lack of training in communication, treatment planning, and behavior management has been shown to leave some dentists feeling uncomfortable or unprepared to care for patients with DD. Research shows dentists who receive training in management of patients with special needs report a higher levels of comfort likelihood of treating patients with DD, overall (Holzinger, 2019). In a similar study (Nelson et al., 2017) dental care providers educated in specialized treatment protocols and applied behavior analysis were more successful in desensitization and individual reinforcements when treating special needs patients.

Lai et al. (2012) studied the unmet needs and barriers to dental care among children with autism spectrum disorders (ASD) reporting the importance for all dental health care providers to be trained in appropriate strategies for special needs patients. The study reported a survey of dental school programs revealed that only 64% offered a separate course about special needs patients. Lai et al. further reported 50.8% of dental students had no clinical experience in caring for patient with ASD or related intellectual/developmental disabilities (2012). These findings are in keeping with similar studies citing lack of confidence in treating patients with DD as a deterrent to providing care (Wolff, 2004) stemming from lack of training in treating patients with DDs (Weil & Inglehart, 2010; Vainio et al., 2011).

Vainio et al. (2011) conducted an exploratory study examining dental students' perspectives on their education regarding their education with patients with special healthcare needs (SHCN) at a Midwestern dental school. Predoctoral dental students (n = 397; 90%) responded anonymously to a paper-and-pencil survey. Results showed a positive correlation between students' perceived quality of their dental education and

their confidence in treating SHCN patient in future practice (p = .001). Furthermore, students' confidence was positively correlated with their intentions to include these patients in their patient families in their future professional practice (p=.001) (Vainio et al., 2011, p. 19). These findings corroborate the findings of other studies demonstrating the better students are prepared through curricular efforts, the more likely they will provide professional care for special needs populations (Chávez et al., 2011).

The importance of preparing dental professionals for the care of special populations is demonstrated most recently in a study by Sundu et al. (2020). In a national online survey of dentists (N=766) the majority "strongly agreed" or "agreed" that education, training, or other experiences working with people with special needs increased their awareness (92.2%), confidence (82.4%), and willingness (81%) to treat people with special needs and that it provided practical information (82.9%) and/or enhanced their skills (81.8%) in treating people with special needs. Proportionately, dentists agreed education and training in special needs increased their willingness, confidence, and/or provided practical information and enhanced their skills to treat these patients were more likely to provide dental treatment to "many" such patients than other survey respondents (67.2%-85.2% vs 56.0%-68.6%; p<.005). "Many" was defined as provision of dental services for 1 to 10 patients with special needs in all age groups or provision of dental care for 11 or more people with special needs in at least 1 of the 3 age cohorts (children, working-age adults, and adults 65 years of age and older). The results of this study imply education and training have a positive impact on dentists' willingness and preparedness to provide care for patients with special needs. The accompanying intent statement to the CODA standards on care of special populations for both dental and

dental hygiene programs is echoed in the implications of this study whereby the authors state, “Training a sufficiently sized and adequately prepared dental workforce to manage the care for populations with special health care needs is imperative for these patients to attain and maintain optimal oral and general health” (Sundu et al., 2020, p. 15). Given students may not have opportunities to provide treatment to persons with a DD during their clinical education an interactive VP instructional module can provide an alternative effective method to simulate real patient experiences (Kleinert et al., 2007a).

Defining the “Virtual Patient” Pedagogy

The term “virtual patient” (VP) has been used in the context of healthcare education since the early 1990s, with varying definitions. Based on the body of literature on VP in both the health sciences and academic research, the most commonly accepted definition of the VP is “An interactive computer simulation of real-life clinical scenarios for the purpose of medical training, education, or assessment. Users may be learners, teachers, or examiners” (Ellaway et al., 2006, p. 2). While the VP pedagogy has been used in medical education, its use in dentistry is relatively new.

VPs are organized in two categories: narrative design and problem-solving (Bearman, 2003). The narrative branch design is often used in VPs with an emphasis on cause and effect and decision-making leading to various outcomes. Narrative integrates the humanistic interaction into the educational intervention and may teach communication skills better than problem solving designs (Bearman et al., 2001). Branching is based on a tree-like structure of available pathways, used with knowledgebase contextualization to help solve a particular challenge (Ellaway, 2008).

The Value of Virtual Patients

What makes VPs valuable and unique is their ability to expose students to a range of virtually simulated clinical situations. Students can progress in a safe and self-paced manner, make mistakes and explore the consequences of those mistakes without harm to patients, and self-reflect unlike learning in clinical environments. With advances in technology, VPs have been used as computerized representations of realistic clinical cases and applied to teach clinical reasoning skills to a large number of students (Bateman et al., 2013). Skills such as patient interviewing skills, medical history taking, recordkeeping, and patient treatment planning can be further developed through the use of VPs. From the use of VP interactive audio/video elements, the student can experience interaction with his or her VP during a more realistic simulation encounter. Advantages of VPs in medical education, include efficiency, efficacy, standardization of experiences, interactivity, exposure to rare but critical cases, immediate feedback, and, most importantly, improvement of clinical skills in a non-threatening environment (Cederberg et al., 2012). In addition, the findings from Cook & Triola (2009) in a critical literature review suggest, the paradox of increased training expectations and reduced training resources has impacted health professions education. VPs may help to solve this pressing educational dilemma. Use of VP are ideal to promote clinical reasoning that can be developed through practice with multiple and varied cases. Another advantage to the educator is the use of VP in assessing learners (Cook & Triola, 2009).

Computer-assisted learning (CAL) can be beneficial in dental hygiene education competencies that require many hours of study or where insufficient clinical contact hours and live patient experiences are problematic (Seki et al., 2020). In a recent study

by Seki et al., (2020), Japanese fourth-year dental hygiene students (*N*=29) were given access to 5 interactive self-paced, independent learning cases. The findings indicated CAL simulation had a positive impact on improving the targeted skills. Advantages of CAL includes instant feedback, the ability to study independently, and the opportunity to learn when live-patient clinical experiences are limited. CAL simulation modules are designed to assist students in acquiring or promoting critical reason skills that are part of their competencies when experiences with live patient are insufficient. The study found further research is needed to investigate learning outcomes with a larger cohort.

Growing concerns of patient safety and the lack of patients with disabilities presenting to clinical settings is a challenge in dental hygiene education. According to the 2020 CODA Frequency of Citings Based on Required Areas of Compliance Report, Standard 2-12 is one of the most frequently cited standards following a dental hygiene education site evaluation (CODA, 2020). In dental hygiene education actual clinical interaction with persons with DD might not be possible. The use of VP offers a safe learning environment in preparation to care for persons with DD (Sanders et al., 2008a)

A VP can accompany traditional classroom instruction to create a deeper understanding of didactic content (Allaire, 2015). In this study, students reported feeling that the use of VP was effective in promoting confidence, problem-solving, and critical thinking in the clinical setting. Similarly, Benedict et al. (2013) described using VP cases to deliver foundational knowledge to students can maximize and provide a stronger learning experience. As a learning tool in medical school, VP was shown to be a valuable and useful tool within a course for improving history taking and clinical reasoning skills in pre-clinical learning (Icaza-Restrepo, 2018).

Using a qualitative study design, Peddle et al. (2019) utilized focus groups and individual interviews to explore the experience of undergraduate nursing students when interacting with a VP to develop non-technical skills using a case study methodology. Purposive convenience sampling was used to recruit first- and third-year nursing students from two university nursing programs in Victoria, Australia. Forty-five first-year and 31 third-year nursing students consented to participate in the study. Focus group transcripts were transcribed and coded for analysis using NVivo qualitative data analysis software (QRS International, version 11). The unit of analysis in this case study was the year level of the student. Findings in this study fill a gap in knowledge regarding when to introduce VP case studies into curriculum. One important finding highlighted by all students was that prior experience (as indicated by the year of study) altered their perception of cues and information in the case study scenarios, and that this affected the options they selected. Findings also indicated first-year students experienced challenges with terms and language used, and that the VP case study scenarios portrayed complicating learning. Conversely, third-year students conveyed that their prior experience enabled them to distinguish significant cues and important information more easily, thus enabling them to perceive the VP case study care situation more easily.

Furthermore, four themes emerged around the data on *how VPs enable learning to happen*, *learning surrounding the VP encounter*, *changing the way students perceive practice*, and *potential limitations to learning*. These finding support current evidence of the use of VP in a number of ways. Students felt the VP facilitated their learning by socializing them to the role in practice, and the opportunity to learn through their mistakes. Students noted that learning via ‘socialization to role’ involved two sub-

themes: “this is how I should be” and “develops self-confidence” (Peddle et al., 2019, p. 4). All students articulated that interacting with VPs enabled them to think and feel like nurses: *“It’s really making me see, putting myself in them and this is going to be me, this is what I’ve got to do, this is how it’s going to be, this is the relationship I need to have”* (Yr1/Grp11/Participant 3). First-year and third-year participants articulated that interacting with VPs helped them develop confidence in their abilities to respond and manage practice situation. As reported verbatim by one participant, *“I feel more confident in how to handle situations like that now. I feel a lot more prepared in handling a patient and [undertaking] risk assessments”* (Yr1/Grp4/Participant1) (p. 5). It is of interest to note that whereas first year students described using the VP scenarios for skill development, third-year students described how they used the scenarios as a point of reference to “benchmark” (Yr3/Grp2/Participant1), reflect on and assess their practice (p. 5). The finding from this research add to body of research on use of VPs to prepare students in the health profession for clinical practice through attainment of knowledge and self-confidence, while having the opportunity to engage in realistic simulation in a risk-free learning environment.

In a systematic review and meta-analysis by Cook et al. (2010), the authors summarized the positive effects of VP when used as an educational intervention with or without an intervention. Four qualitative, 18 no-intervention controlled, 21 noncomputer instruction comparative, and 11 computer-assisted instruction-comparative studies were found and analyzed. It was reported that use of VPs were consistently associated with improved and higher learning outcomes compared to no interventions for medical students, dental students, nursing students, and a variety of other healthcare providers.

Comparisons of different VP designs suggest that repetition until demonstration of mastery, enhanced feedback, and explicitly contrasting cases, and instructor use of advance organizer (an instructional tool) can improve learning outcomes. The authors called for further research in clarifying how to effectively implement the use of VPs for training (Cook et al., 2010; Hirumi et al., 2016).

Taglieri et al. (2017) evaluated the use of VP simulation in pharmacology curriculum. The purpose of the study was to assess the effect of a VP activity utilized in a pharmacy skills lab on student competence and confidence when conducting real-time comprehensive clinic visits with mock patients. The results indicated that student performance conducting clinic visits was higher in the intervention group (n =141) compared to the control group (n=140) and continued to improve in the subsequent module. More students in the intervention group asked each question and attained a higher overall score, compared with the students in the control group (n = 45; 18% and n = 53; 19%, respectively; p = <.001). The most noted positive aspect identified by the students was that the program realistically simulated a real patient, which was mentioned in 28% of the comments, followed by appreciating the ability to practice mentioned in 23% of the comments. It was reported that student performance was improved with repeated exposure to a computerized VP. The authors concluded that VPs enhanced student performance during mock clinic visits and the students felt the VP was realistic. Additionally, use of a VP simulation can increase student confidence while providing additional learning opportunities (Taglieri et al., 2017).

The use of VP can enhance real world reasoning, address student learning and communication weaknesses, and provide individualized learning experiences. VP

simulation has been accepted to show it facilitates learning when it is used in the appropriate conditions that include providing feedback, repetition, curriculum integration, individualized learning and controlled environment (Isaza-Restrepo et al., 2018). Because of the limitless possible variations in VP design, significant value can be placed on the use of VPs to affect the knowledge and behaviors in students' future practice (Cook & Triola, 2009).

Virtual Patient Model as a Form of Simulation

Simulation is defined as "an attempt to replicate some or nearly all essential aspects of a clinical situation so that the situation may be more readily understood and managed when it occurs for real in clinical practice" (Morton, 1995, p.76). The VP model is a form of simulation aimed to mimic real life (fidelity). Fidelity is the accuracy of the model or simulation when compared to the real world. As a low-fidelity form of simulation, VP simulation is an active learning strategy that uses computer-based VP to create a simulated patient experience that replicates as closely as possible an authentic clinical scenario (Allaire, 2015). The main form of educational VPs in the literature are interactive patient scenarios (IPCs) (Kononowicz et al., 2015). Notably, the application of the VP pedagogy is one where the student plays the role of a health care professional treating a computer based simulated patient; and should be distinguished from the use of the standardized patient, which involves a patient-actor trained to interact with the student (Saleh, 2010).

Virtual Patient Formats

As an educational intervention, VP simulation takes many forms, including but not limited to virtual case studies, standardized patients, computer-based simulations, with

the most sophisticated form being high-fidelity manikin simulation (Cook & Triola, 2009). Highly relevant to dental education, VP interventions have potential to "provide highly effective ways of addressing reduced student access to real patients, the need for standardized and well-structured educational patient encounters, and opportunities for students to practice in safe and responsive environments" (Ellaway, 2008, p. 170). Kononowicz et al. (2015) conducted a literature review to identify all articles with the term VP in the title or abstract. The aim of the research project was to categorize the various uses of the term VP and classified its use in healthcare education. These articles were categorized into: Education, Clinical Procedures, Clinical Research and E-Health. Based on a model by Talbot et al. (2012), the VPs assigned to the educational category were further classified into the following seven types: Case Presentation, Interactive Patient Scenario, Virtual Patient Game, High Fidelity Software Simulations, Human Standardized Patients, High Fidelity Manikins and Virtual Standardized Patients. Kononowicz et al. (2015) went on to align each of the seven VP classifications with the predominant educational competency and technological modality, as identified in each of the VPs in the educational classification (see Table 1).

Table 1

Adapted Virtual Patient Classifications with Two levels of Description

Class label	Predominant competency	Predominant technology	Short description
Case Presentation	Knowledge	Multimedia systems	Interactive multimedia presentation of a patient case to teach primarily basic medical knowledge
Interactive Patient Scenario	Clinical reasoning	Multimedia systems	Interactive multimedia presentation of a patient case to teach mainly clinical reasoning skills
VP Game	Clinical reasoning or Team training	Virtual worlds	Virtual world to simulate high-risk scenarios and team training situations (e.g. Second Life VPs)
High Fidelity Software Simulation	Procedural or basic clinical skills	Dynamic simulations or Mixed reality	Real-time simulation of human physiology to teach mainly procedures or skills such as surgical simulations
Human Standardized Patient	Patient communication skills	Multimedia systems	Video-recorded actors who role-play a patient to train patient communication skills
High Fidelity Manikin	Procedural and basic clinical skills,	Conversational characters	A virtual representation of a human being using artificial intelligence technologies and natural language processing to train communication skills
Virtual Standardized Patient	Patient communication skills	Conversational characters	A virtual representation of a human being using artificial intelligence technologies and natural language processing to train communication skills.

Virtual Patient Simulation in Dental Education

More recent literature demonstrates the use of VP simulation in dental education, whereby VP have been incorporated into the curriculum as an adjunct method to live patient encounters. Recognizing the growing popularity of the VP in dental education, Cederberg et al. (2012) conducted a study aimed to assess the extent to which VP are being utilized in dental education. The use of VPs for simulation of treating patients with

special needs in dental education provided an increase in the comfort level of the student when working with this population (Cederberg, 2012). In this study, it was found there are advantages with the use of VPs in dental education such as reinforcing basic science information and using uniform student experiences with immediate feedback. Furthermore, this study showed VPs that employ interactive components may further evolve to better prepare dental students for their first encounter with a live patient. Further research called for to determine if the use of VPs improves students' learning when provided an intervention more similar to a live patient experience. VPs are likely to play an increasing role in healthcare education (Cook & Triola, 2009).

Virtual Patient Outcomes

The VP model provides a means for students to achieve both learning outcomes and competency. These outcomes include, but are not limited to gain in knowledge, increased confidence, greater empathy, critical thinking, and problem-solving, and student satisfaction. VPs, in comparison with no intervention, are consistently associated with higher learning outcomes (Cook et al., 2010). From an evaluation standpoint, the VP model is "user friendly" from the technological perspective and considered an effective teaching method. There is a growing body of evidence that VP simulation increases learner confidence, namely in the context of caring for persons with DD and other special needs, and demonstration of more empathy (Janda et al., 2004; Vainio et al., 2011). Acquisition of knowledge has been shown in numerous studies, as well (Sanders et al., 2008; Kleinert et al., 2007; Taglieri et al., 2017; Peddle et al., 2019). The VP pedagogy has been incorporated into dental hygiene curricula with the aim to assess critical thinking skills (Allaire, 2014).

Critical Thinking

The impact of VPs on the critical thinking skills of health care providers was examined in two recent studies using the VP model as an instructional strategy. In a quantitative study investigating the effect of simulation on critical thinking abilities of undergraduate nursing students, Sullivan et al. (2009) implemented simulation scenarios in an undergraduate medical-surgical course composed of undergraduate nursing students (*N*=53) and found an increase in critical thinking scores as measured by the Health Science Reasoning Test (HSRT). Allaire (2015) conducted a pilot study to determine the effect simulation had on the critical thinking of undergraduate dental hygiene students (*N*=34). A pretest-posttest design using the HSRT evaluated the critical thinking skills of senior dental hygiene students before and after their experience with computer-based patient simulation cases. As a secondary aim, additional survey questions identified the students' perceptions of whether the experience had helped develop their critical thinking skills and improved their ability to provide competent patient care. Results showed a mean increase in HSRT scores of 0.77 from pretest to posttest. While there was no significant increase in mean scores, students reported feeling that the use of VP was "an effective teaching method to promote critical thinking, problem-solving, and confidence in the clinical realm" (Allaire, 2015, p. 1181).

These finding have implications to support the use of VP simulations in dental hygiene education as well the conclusions from a literature review by Cook and Trioli, "virtual patients should be designed and used to promote clinical reasoning skills" (2009, p. 303). This is important to consider, as clinical reasoning is a skill that is dependent on critical thinking skills (Allaire, 2015). Critical thinking has been deemed essential trait

for health professionals, as these skills prepare students to translate didactic knowledge to clinical decision making. The Dental Hygiene Process of Care uses the algorithm ADPIED (Assess, Diagnose, Plan, Implement, Evaluate, and Document) that helps the clinician develop these critical thinking skills. Implementing VPs using the model ADPIED requires the student to analyze, synthesize, and evaluate problems thus leading them through a clinical decision-making process of identifying patients health behaviors, attitudes, and oral health care needs (American Dental Hygienists' Association [ADHA] Standards for Clinical Dental Hygiene Practice, 2016).

Curricular Efforts in Care of Patients with Developmental Disabilities

Dental students' previous experience with persons with DDs predicts their comfort level in treating this population. Students with more experience reported greater comfort levels in treating such patients and higher anticipated comfort levels in treating them in future practice (DeLucia & Davis, 2009). Considering there is a high percentage of children and adults in the U.S. with DD and special needs requiring access to dental care, it seems essential to prepare future dental practitioners to assess the treatment need of these patients, and to be confident in providing care.

Dehaitem et al. (2008) surveyed U.S. dental hygiene program directors *(n* = 240) to explore how dental hygiene programs in the U.S. educate their students about treating patients with special needs. Data collected from a web-based survey (*n*= 102) (response rate= 49%) showed nearly all programs (98%) present content on special needs in lectures. However, only 42% of the programs required students to gain clinical experiences with patients with special needs. Most programs covered the treatment of patients with physical/sensory impairments such as hearing impairments (93.1 %),

psychopathologies (89.2 %), and adult-onset neurological disorders (89.2 %). Outcome assessments were usually done in a written exam (97.1 %), while objective structured clinical examinations (OSCEs) (9.8 %) and SP experiences (4.9 %) were less frequently used. Respondents identified "curriculum overload" as the biggest challenge to addressing special patient needs. Nevertheless, 29.4 % percent of the respondents indicated they support an increase in clinical experiences for students to give them increased opportunities to work with patients with special needs. Not all dental hygiene programs require students to provide clinical care for patients with special needs. Forty-three programs (42%) reported their students are required to treat patients with special needs, while 58 programs (56.9%) did not have such a requirement for their students (one did not respond). The authors concluded recommendations should be made to increase the opportunities for students to have clinical experiences with patients with special needs and to address the needs of patients with special needs more comprehensively in dental hygiene curricula.

The quality and content of undergraduate education in care of patients with DD correlates with students' confidence and their willingness to provide care for patients with special healthcare needs in their future practice. Future research should focus on clinical experiences increasing students' exposure to patients with DD in a way that increases their comfort level and decreases their perception of difficulty (DeLucia & Davis, 2009; Taglieri et al., 2017).

Dougall et al. (2012) reported the findings from a taskforce set up by the education committee of the International Association for Disability and Oral Health (IADH) examining the quality and content of undergraduate dental education in Special

Care Dentistry. Additionally, the taskforce collected information on the correlation of undergraduate dental education experiences with students' confidence and their expressed willingness towards providing care for patients with special healthcare needs in their future practice undergraduate level. The panel consisted of global experts with experience in teaching undergraduate students, delivering and developing educational programs in Special Care Dentistry. Using the Delphi technique (a systematic, interactive forecasting method which relies on a panel of experts), the panel consisting of 43 persons involved in teaching Special Care Dentistry, representing 30 countries compiled information to establish the core knowledge and skills needed by new dental professionals to be competent to treat persons with special needs care. The study aimed to identify core skills that should be included in undergraduate curriculum. This study also reported healthcare providers often lack the skills set to provide care for people with disabilities, leading to inequalities in health and reduced access to health care and that a significant percentage of students did not feel prepared to treat patients with special needs upon graduation. It has been suggested that within an already crowded undergraduate curriculum, there is not enough time to include teaching all of the identified core skill sets. However, many of the core skills identified by the panel were transferable across a curriculum and would encourage a person-centered approach to treatment planning based on the patient, rather than their specific diagnosis. Most of the core items identified as essential knowledge could be included in other components of the curriculum, already identified in undergraduate competencies (Dougall et al., 2012).

Similarly, Clemetson et al. (2012) conducted a study examining 54 U.S. dental schools to determine if the institutions were working towards meeting the 2006 CODA

standard on requiring graduating predoctoral dental students to be competent in assessing the treatment needs of special needs patients. A total of 167 surveys were mailed to representatives of the fifty-four dental schools. A total of 104 surveys (62%) were completed, representing 50 dental schools (93%). Results showed fewer than three-quarters of U.S. dental schools have students actively involved in treating patients with special needs. Of the responding participants, 63 percent of the individuals (59 percent of the schools) indicated their institution was in full compliance. The findings were disappointing and showed a history of underpreparing students to treat the increasing special needs population (Clemetson et al., 2012). If the dental schools efforts are not meeting the CODA standards with regards to preparing dental students to provide care for patients with special needs one may infer there will be a shortage of services because students who are not prepared to provide care for patients with special needs do not have the confidence and willingness to do so (Clemetson et al., 2012). The study found most dental schools are working towards meeting the newest CODA standard in dental education, Standard 2-25 Graduates must be competent in assessing and managing the treatment of patients with special needs (CODA, 2020) however, there is still concern about the ability of future practitioners to meet the needs of patients with special needs, resulting in a greater shortage of services for this expanding population.

Preservice Health Training Modules

A series of effectiveness studies on VP simulation in preparing healthcare professionals to treat persons with DD were conducted using the Preservice Health Training (PHT) modules developed by the University of Kentucky, Human Development Institute (HDI). Four studies on the effectiveness of the VP model have been

implemented among the health professions including predoctoral dental students (Kleinert et al., 2007a; Sanders et al., 2008a), physician assistant (PA) students (Kleinert et al., 2007b), nurse practitioner (NP) students (Sanders et al., 2008b). The PHT modules involve VP simulation with real patients with disabilities (see Table 2).

Table 2

Efficacy Studies Utilizing Preservice Health Training Modules

Authors	Sample Population	Curricular Context	Preservice Health Training (PHT) Module Title
Kleinert et al. (2007a)	Dental Students (3rd year) (*N*=51)	Pediatric Dentistry course	PHT Training for Student Dentists Case 2: Hunter
Kleinert et al. (2007b)	Physician Assistant students (*N*=42)	Physician Assistant curriculum	PHT for Student Physician Assistants Case 1: Julia PHT for Student Physician Assistants Case 2: Olivia
Sanders et al. (2008a)	Dental Students (3rd year) (*N*=44)	Pediatric Dentistry course	PHT for Student Dentists Case 1: Daniel
Sanders et al. (2008b)	Nurse Practitioner students (*N*=24)	Nurse Practitioner curriculum	PHT for Nurse Practitioners Case 1: Julia PHT for Nurse Practitioners Case 2: Olivia

Kleinert et al. (2007a) conducted a study aimed to determine whether a VP module simulating a dental visit for a child with Down syndrome would result in student dentists' increased knowledge in caring for individuals with DD, and in less perceived difficulty in the providing care for persons with DD. The variable of perceived difficulty served as a measure of students' level of comfort in treating persons with DD.

Student dentists (*N*=51) from the University of Kentucky College of Dentistry participated in the effectiveness study. While the completion of the VP module was required in the students' pediatric dentistry courses, participation in the research aspect of the study (pre-/post-tests) was voluntary. Instruments included 1) a pre-test/post-test knowledge measure consisting of 15 multiple choice items based on the module content, 2) an 8-item Likert scale Disability Situations Inventory (DSI) used to measure student dentists' perceived sense/level of difficulty in addressing the dental needs of individuals with DD before and after completing the VP module; and 3) the Usability Scale, which asked participants to rate 1) the need for this program, 2) general ease of use/navigational of the module, 3) content accuracy/comprehensiveness, 4) the value of interacting with the VP in providing care, 5) the value of additional module resources/information, and 6) any technical problems encountered in completing the module.

All students returned their pre-test/post-test packets (*n*=51; 100%). Fifty students (*n* = 50; 98%) completed both the pre- and post-tests for the perceived difficulty measure, and forty-nine students (*n*=49; 96%) completed both the pre- and post-knowledge measures. Results demonstrated significant changes in both knowledge and perceived level of difficulty for students upon completing the VP module. Mean scores for the 15-item knowledge pre-test and post-test were 6.7 (45% correct) and 10.7 (71% correct), respectively. This represents a relative gain of 59.2 % from pre-test measure. Paired sample *t*-tests demonstrated that gains in knowledge were significant from pre-test to post-test ($p<.001$), with thirteen of the fifteen items reaching significance at the $p=.05$ level.

The DSI included 8 items (representative of situations a dentist may encounter in a given case) on a 5-point Likert scale, with perceived level of difficulty ranging from 1 (not difficult) to 5 (difficult) resulting in a maximum score of 40. All participants completed the DSI (n = 51; 100%). The mean pre-test score was 26.3, reflecting an average pre-test rating of 3.3 for each of the eight items. The mean post-test score was 20.3, with an average item rating of 2.5 (lower scores indicating less perceived difficulty). Univariate analysis using paired sample t-tests demonstrated a significant decrease in perceived difficulty for representative situations after completion of the interactive module; (p<.0001).

All 51 students completed the Usability Scale (n=51). While this instrument provided study investigators with evaluation and feedback on the ease of use and ability for one to navigate through the CD-ROM module, it also serves as an instrument to evaluate the module as an instructional tool. In rating usefulness on a scale of 1-5, students agreed on the need of the program for themselves, with a mean rating of 3.5 fell between “some need” (3 on the scale) and “needed” (a rating of 4 on the scale). Interestingly, students rated the need for practicing dentists as slightly higher (a rating of 3.7).

Responses to the Usability Scale hold some implications for future use of the VP modules. Aspects of the module rated high on usability included “Contribution of video clips” (4.2),” Contribution of Decision Points to learning” (3.7), “Contribution of Information Points to learning” (3.9). These responses may provide insight or even best practices for future design and development of VP modules in curricula.

A gap in the literature appears to be timing: What is the best time to introduce VP modules into the curricula? In this study, third-year student dentists rated “Beneficial for training first-year students” (2.9) lower on the Usability Scale, and conversely, rated “Beneficial to training second/third-year students” (4.1) higher.

The limitations of this study provide guidance for future research. At the time of the study, the investigators could not identify any existing instrument that could measure student dentists’ perception of difficulty within the desired domain. Therefore, the DSI was designed and implemented; however, not as a validated instrument. The DSI has been validated in its use in a number of efficacy studies (Kleinert et al., 2007a; Kleinert et al., 2007b; Sanders et al., 2008a; Sanders et al., 2008b). Furthermore, because all third-year student dentists were required to complete the module as part of their pediatric dentistry course, a control group was not utilized. This is an important limitation, and thus it cannot be said that the reported improvements in knowledge and comfort level are entirely attributable to having completed the VP module. The study supports previous research findings on the use of computer-based or computer-assisted instruction (CAI) as an adjunctive method of instruction in preparing students for clinical interactions (Cook & Triola, 2009). These study results suggest VP simulation may represent an effective strategy for addressing accreditation standards in relation pediatric patients with DDs.

Addressing the critical need to increase dental students’ clinical exposure to patients with DD, Sanders et al. (2008a) incorporated a PHT module into a pediatric dentistry course at the University of Kentucky, College of Dentistry. The effectiveness study centered on the accommodations required for providing dental care for an adult patient with deafblindness. The purpose of the PHT VP module was to improve dental

students' comfort level when caring for individuals with significant sensory impairment (deafblindness), and to increase student dentists' knowledge regarding care of patients with significant sensory impairments. The VP module simulated an actual patient encounter by engaging the student in ongoing clinical decision-making and visual observations throughout the simulated patient interaction. A convenience sample comprised of dental students (enrolled in a third-year pediatric dentistry course) (N=44) were recruited to participate in the study. Pre- and posttest DSI measured dental students' level of comfort (i.e., perceived difficulty) in addressing the oral health needs of individuals with deafblindness. The DSI included 8 items (representative situations a dentist may encounter in a given case) on a 5-point Likert scale, with perceived level of difficulty ranging from 1 (not difficult) to 5 (difficult) resulting in a maximum score of 40 on the DSI scale. Thirty-eight (n=38; 86%) participants completed the DSI pre- and post-tests. Results of the DSI pre and post analysis demonstrated a significant level of improvement in student comfort level scores following completion of the VP module. Scores ranged from 8-40 (higher scores indicating higher level of perceived difficulty). Univariate analysis of the DSI using the paired t-test showed a significant decrease in scores from pre-test to post-test ($p < 0.001$) (Sanders et al., 2008, p. 209).

Additionally, students completed a pre and post 10 item multiple choice knowledge test. Knowledge items centered on the areas of specific communication issues frequently impacting individuals with deafblindness, the importance of conversing directly with the patient (i.e., "disability etiquette"); and knowledge of concerns among individuals with sensory impairments and how these concerns affect oral and dental care.

A total of 39 students (n=39; 88%) completed the pre- and post-test for knowledge. Paired t-test analysis demonstrated the gain in knowledge following completion of the VP module was statistically significant (p<0.001) (p. 209).

Forty students (n =40; 90%) completed the Usability Scale. Interestingly, this group of third-year student dentist study participants rated the usefulness of the VP module on sensory impairment much like a previous group of third-year student dentists rated the VP module on Down syndrome (Kleinert et al., 2007). On the three items related to need, the Usability Scale items employed a Likert scale from 1 to 5, with a rating of 1 indicating "No need" to a rating of 5 indicating "Greatly needed." Students agreed on their own "need for the program" with a mean rating of 3.7 between "some need" (a rating of 3 on the 5-point scale) and "needed" (a rating of 4 on the 5-point scale). Of note, students rated the need for practicing dentists as slightly higher, at 3.8, as did the participants in the study utilizing the VP module on Down syndrome (Kleinert et al., 2008).

Results of the Usability Scale are similar to previous ratings with dental students utilizing the PHT VP modules (Kleinert et al., 2007). For items other than "need", the Usability Scale utilized Likert scale from 1 to 5 with 1 indicating "Strongly Disagree" and 5 indicating "Strongly Agree." Aspects of the module rated high on the Usability Scale included "Usefulness of video clips" (3.7), "Contribution of Decision Points to learning" (3.61), and "Contribution of Information Points to learning" (3.6). Further, participants rated the "Benefit to first-year students" at 2.9, "Benefit to second-year students" at 3.7, and "Benefit for Practicing Dentists" at 3.85. Limitations of the study provide insight to interpretation of results as well as direction for future research. Due to

small group size, the effectiveness study lacked a control group. While the VP module was required in the pediatric dentistry course, the pre- and post-tests were completed voluntarily. Due to lack of a validated instrument to measure student comfort level in caring for persons with sensory impairment, the VP scenario was developed based on input from experienced professionals, dental faculty, and team members living with disabilities.

Authors acknowledged the importance of increased knowledge and improved attitudes/comfort levels are important; however, future research is needed to examine actually how this may translate to practice. Confounding variables were an additional limitation. Factors such as student interest in the topic and/or preexisting experience with or exposure to persons with disability were not controlled for in this study. It is recommended that future studies control for these variables by including a brief preliminary survey examining how student exposure/experiences may potentially correlate with their knowledge and level of comfort in treating patients with special needs.

A key implication of this effectiveness study centers on the goal of the VP module, “to model communication and clinical skills to generalize with patients with other developmental disabilities” (Sanders et al., 2008a, p. 211). While it cannot be assumed this generalization will take place as a result of the VP module, selecting a patient with disability, deafblindness in this case, researchers were able to expose student dentists to the critical accommodations for special needs individuals. The VP modules provide students with opportunities to practice, reflect, and engage in decision-making in the care of special populations in preparation for and prior to providing patient care in

clinical practice. These findings are supported in previous studies demonstrating VP simulation improves learner confidence, decision-making ability, and empathy in the care of persons with special needs (Kleinsmith et al., 2015; Kuthy, 2007).

The PHT module scenarios include actual patients presenting with varying DD, each in the context of patient-provider point of care, and across the spectrum of health care professionals. Two studies examined the effectiveness of the PHT VP modules among health professions students including NP and PA. Sanders et al. (2008b) conducted an effectiveness study of nurse practitioner (NP) students (N=25) to determine whether knowledge and comfort level in caring for children with DD would be improved through the implementation of the instructional modules. An interactive, multi-media, VP format was selected as the instructional design. Two scenarios were determined to illustrate the teaching-learning objectives: the first, a well-adolescent check-up for a 13-year-old girl with Down syndrome (Julia); and the second, a well-baby visit for an infant born at 26 weeks gestation (Olivia). Paired sample t-tests demonstrated that changes in perceived comfort were significant ($p < 0.0001$). In addition, changes in comfort level were significant for 75% of the individual items in the scale at the $p < 0.05$ level. The study found significant improvement in students' knowledge and comfort measures after completing the modules. Second, the study examined the effectiveness of a multimedia, VP instructional design for use with NP students. Overall, students rated the modules as easy to use and important to their overall training. This study supports earlier research showing that computer-assisted learning experiences can be a useful adjunct for clinical training.

Similarly, Kleinert et al. (2007b) conducted an effectiveness study with physician assistant (PA) students ($N = 42$) from the University of Kentucky. The study suggested that given PA programs may not always have access to this population within their clinical training rotations, it is difficult to teach PA students the knowledge and communication skills needed to care for children with DD. This study represented a response rate of 85.7% of the 49 students enrolled in the specific course for which the module was assigned. All 49 student*s (n* = 49) completed the modules to receive extra credit as part of the class. Participation in the pretests was voluntary. Forty-one students participating in the effectiveness study completed both the pre- and post-tests of the DSI. For those 41 students, the mean pretest score was 31.6 ± 6.9 (an average rating of 2.63 for each of the 12 items) and the post-test mean score was 26.0 ± 6.9 (an average rating of 2.17 for each of the 12 items), with lower scores indicating less perceived difficulty. Paired sample *t*-tests demonstrated that changes in perceived difficulty were statistically significant. All 42 participants ($N = 42$) completed both the pre- and post-knowledge tests. Univariate analysis via paired sample f-tests further demonstrated that gains in knowledge for both cases were significant. In addition, the report includes information about specific aspects of "user friendliness" and navigability of the module, the Usability Scale also functioned to evaluate the module's overall usefulness as an instructional tool. Students were asked to rate the features of the program on a Likert-type scale of 1 to 5, with 5 being the most useful or effective. Ratings for ease of use and navigability averaged over 4 on the 5-point scale; students rated the modules as more beneficial for second-year students than for first-year students. The primary purposes of the study was (a) to describe the development of two VP modules to prepare PA students to care for

pediatric patients with DD and (b) to assess students' knowledge and perceived level of difficulty in caring for these children before and after completion of the modules. Statistically significant improvement was found in both knowledge and perceived difficulty measures for these students.

Summary

Good oral health is essential to all and especially important to persons with DD. Patients with DD represent a significant percentage of the U.S. population seeking dental care as the trends in deinstitutionalization, along with increasing life expectancies, have resulted in an increased population of persons with DD residing in community dwellings. Barriers to care include lack of education and training leading to dental professionals having a reluctance to treat persons with DD. Addressing dental curriculum in the areas of specialized dental care to prepare students in the care of patients with DD presents a significant challenge due to increased program competencies, required clinical experiences, establishing appropriate patient pools, limited resources, and reimbursement mechanisms present some of the challenges facing dental education. Growing concerns of patient safety and the lack of patients with disabilities presenting to clinical settings is a challenge.

The use of VP simulation as an educational tool can assist in development of clinical reasoning and has the potential to raise student confidence and willingness to treat special needs patients in their future practices. Participation in VP simulation experiences provides a safe opportunity for students to practice decision-making, use newly gained knowledge, and become more empathetic before seeing real patients with special needs.

As the result of this literature review, the collective call for future research on this topic of curricular efforts using VP model in preparing students for caring for persons with special needs asserts that future research should focus on purposeful learning experiences designed to increase students' exposure to special needs populations in a way that increases students' knowledge, confidence, and subsequent comfort level and willingness to treat these patients.

Methodology

Research Method or Design

The research study utilized a mixed-method designed to examine the effect of a VP module on dental hygiene students' knowledge and perception of difficulty in addressing dental needs of individuals with DDs (see Table 3).

Table 3

Study Design

Pretest	Intervention	Posttest
DSI Pretest Knowledge Pretest Demographic items	Completion of the PHT module (Hunter's case)	DSI Posttest Knowledge Posttest Qualitative Items

Procedures

Human Subjects Protection/informed Consent

The research study was approved by the Eastern Washington University (EWU) Institutional Review Board (IRB) as Exempt Category 1 status. Informed consent stated minimal risk would be involved, and participation was voluntary, and participants were free withdraw at any time, free of academic consequences or impact on participants' grades. While completion of the PHT module on DS was required content in the Special Populations course, participation in the research aspect of the module was voluntary. To assure anonymity, SurveyMonkey settings was set to "anonymous responses." All data exported from SurveyMonkey was be kept in a password-protected computer only accessible by the PI.

Sample Source, Plan, Sample Size, Description of Setting

A convenience sample composed of all (N = 37) EWU senior dental hygiene students was recruited to participate in the proposed study. Inclusion criteria included enrollment in the EWU dental hygiene program with senior status at the time of the study. The setting of the study included an online format using SurveyMonkey and the Preservice Health Training (PHT) website to access the PHT VP module. The topic of DS was included in the Special Populations course; thus, course instructor served as research assistant.

Variables

The independent variable was the virtual patient module: The DS module (Hunter's case) with an adolescent with DS presenting at a dental appointment. The dependent variables included 1) participants' knowledge of module content, and 2) participants' perception of difficulty in addressing dental needs of individuals with DDs.

Instruments

Two previously validated instruments were used in this study: The DSI (Appendix A) pretest/posttest instrument and the knowledge pretest/posttest instrument (Appendix B). The DSI was developed to measure one's perception of difficulty in addressing dental needs of individuals with DDs before and after completing the virtual patient modules. The DSI included eight (8) items on potential "situations" dental hygienists may encounter in the care of persons with DD. Using the DSI, participants self-rated their perceived level of difficulty on a five-point Likert scale of 1-5 (1 being "not difficult" and 5 being "most difficult") (Appendix A). The pre- and post-test knowledge instrument was composed of 15 multiple-choice items related to the VP case

on Down syndrome (Hunter's case) (see Appendix B). Additionally, a demographic questionnaire along with preliminary questions on participants' background on exposure/experiences with person with DDs, specifically DS, were completed with the pre-tests (see Appendix C). A qualitative measure composed of four open-ended questions was included in the posttest (see Appendix D).

Equipment. Equipment included participants' personal computers and the Preservice Health Training (PHT) VP module. Computer software programs used to collect and analyze data include SurveyMonkey and IBM SPSS version 25.

Steps to Implementation

The PI sent a letter to the EWU dental hygiene program director requesting permission to conduct the study, as part of the spring semester of the 2021-2022 academic year. The course director of the *Special Populations* course served as research assistant. Following IRB approval, the PI provided the research assistant with a written script introducing the research study to the participants (see Appendix E). The research assistant facilitated access to the PHT module on DS (Hunter's case) through the professional learning coordinator at the University of Kentucky (UK) Human Development Institute (HDI). Following the research introduction, the research assistant sent an email to students containing a cover letter and consent form, and a SurveyMonkey link to complete the pre-test and demographic questionnaire (see Appendix F). The cover letter and consent form informed students of research procedures and directed participant questions to the PI. The form clearly stated that completing the VP module of DS was required as part of the EWU program curriculum; however, completion of the research aspect of the assignment was voluntary. One week following,

all students ($N = 37$) received a second email via SurveyMonkey that included access to the PHT module on DS (Hunter's) case. Students had one week to complete the required VP module. Following the assignment due date and closure of the VP module, students received a third email with a SurveyMonkey link to the posttest.

Summary

Introducing student dental hygienists to a VP module focused on patients with DDs could build knowledge, confidence, and willingness to treat patients in this population in their future practice. It is well established that the special needs population is increasing and there is a lack of training for dental professionals. The use of VPs can provide a means to educate dental hygiene students on caring for individuals with DDs.

Results

Description of Sample

The study employed a convenience sample composed of all 37 senior dental hygiene students enrolled in the EWU dental hygiene program. A total of 18 ($N = 18$) students participated in the study, for a response rate of 49%.

Participant demographics

Eighteen ($N = 18$) participants completed both the knowledge pre-test and the DSI pre-test. Thirteen ($n = 13$) participants completed the knowledge post-test and the DSI post-test. The majority of participants were between the ages of 18-22 years ($n = 10$; 59%) (Table 4). In a binary (yes/no) demographic question inquiring on prior experience in working with persons with DS, the majority of participants responded as having had no prior experience ($n = 14$; 87.5%). Those responding "yes" as having had prior experience described/qualified these experiences as *"Very little, and they were only 3yrs old. I have met a handful of people with Down syndrome"* and *"Yes, as a Nanny."*

Table 4

Demographic Characteristics

Characteristics	Frequency/Percentage
Age	
18-22	($n = 10$; 59%)
23-27	($n = 4$; 23%)
28-32	($n = 1$; 6%)
38>	($n = 2$; 12%)
Prior Experience	
Yes	($n = 2$; 12%)
No	($n = 14$; 88%)

Statistical Analysis

All data was collected using pre-tests and post-tests survey (see Appendices A-D). Computer software programs SurveyMonkey® and IBM SPSS® version 25 were used to collect and analyze data. The PI managed the data using Excel© and the statistician imported it into IBM SPSS Statistics®, version 25 for analysis. Data collection included both quantitative and qualitative data. Quantitative data was analyzed using descriptive and inferential statistics. Qualitative data was analysis using thematic analysis. Word coding was used to identify emerging themes.

Perceived Difficulty Measure

Of the 18 (*N*=18) participants, 18 (*n* = 18) completed the DSI pre-test and 13 (*n* = 13) completed the DSI post-test. Using the DSI, participants self-rated their perceived level of difficulty on a five-point Likert scale of 1-5 (1 being "not difficult" and 5 being "most difficult") (see Appendix A). The mean pre-test item score was 3.23 (SD=0.50). The mean post-test score was 2.24 (SD=0.49). The mean difference from pre-test to post-test was -0.995, with lower scores indicating less perceived difficulty. Item level analysis comparing the mean of each pre-test item to each post-test item demonstrated that changes in perceived difficulty were statistically significant at t(7) = 30.34, *p*= 0.000 (1.09E-08) (see Table 5, Table 6). Of note, there was a problem that occurred in linking time 1 to time 2 data. Due to this error, it cannot be stated that the differences participants' pre-test scores on perceived level of difficulty and their post-test scores on perceived level of difficulty can be analyzed using a paired t-test; however, what can be stated is that there was a significant difference between the pre-test scores of the test items and the post-test scores for the items.

Table 5

Descriptive Statistics of DSI Items

Time 1		*Time 2*		*Mean Difference (T2-T1)*	
Mean	3.23625	Mean	2.24125	Mean	-0.995
Standard Error	0.180158	Standard Error	0.17672	Standard Error	0.032787
Mode	3.61	Mode	2.54	Mode	-1.07
Standard Deviation	0.509564	Standard Deviation	0.499841	Standard Deviation	0.092736
Sample Variance	0.259655	Sample Variance	0.249841	Sample Variance	0.0086
Count	8	Count	8	Count	8
Confidence Level (95.0%)	0.426006	Confidence Level (95.0%)	0.417878	Confidence Level (95.0%)	0.077529
CI 95% Below	2.810244		1.823372		-1.072529
CI 95% Above	3.662256		2.659128		-0.917471

Table 6

DSI Frequency Distribution Pre-test and Post-test

		Not Difficult 1	2	3	4	Most Difficult 5
1. Conducting an oral exam for a child with Down syndrome whose speech you have great difficulty understanding.	Pre-	*n*=0	*n*=1	*n*=7	*n*=8	*n*=2
	Post-	*n*=0	*n*=7	*n*=5	*n*=4	*n*=0
2. Talking with the parents of a child with Down syndrome who adamantly refuse sedation for their child.	Pre-	*n*=0	*n*=2	*n*=4	*n*=1	n=1
	Post-	*n*=1	*n*=7	*n*=3	*n*=4	*n*=5
3. Treating a six-year-old child with Down syndrome who is fearful and squirms when you ask him to open his mouth so you can check his teeth.	Pre-	*n*=0	*n*=0	*n*=3	*n*=6	*n*=5
	Post-	*n*=0	*n*=3	*n*=8	*n*=1	*n*=1
4. Recognizing the common oral/dental findings which may present in a child with Down syndrome.	Pre-	*n*=2	*n*=4	*n*=8	*n*=4	*n*=0
	Post-	*n*=3	*n*=8	*n*=2	*n*=0	*n*=0
5. Building rapport with a 12-year-old boy having Down syndrome who has never received dental treatment.	Pre-	*n*=1	*n*=6	*n*=5	*n*=5	*n*=0
	Post-	*n*=7	*n*=4	*n*=2	*n*=0	*n*=0
6. Demonstrating effective oral hygiene to a ten-year-old child with Down syndrome who does not appear to be doing a good job with brushing and flossing his teeth.	Pre-	*n*=1	*n*= 4	*n*=3	*n*=2	*n*=0
	Post-	*n*=6	*n*=5	*n*=2	*n*=0	*n*=0
7. Clinical management of a child with a developmental disability whose teeth show significant effects of bruxism.	Pre-	*n*=0	*n*=7	*n*=4	*n*=7	*n*=0
	Post-	*n*=5	*n*=4	*n*=3	*n*=1	*n*=0
8. Treating a child with a cognitive disability who does not appear to understand your verbal instructions about what is going to happen next in the visit.	Pre-	*n*=0	*n*=2	n=5	*n*=8	*n*=2
	Post-	*n*=2	*n*=4	*n*=4	*n*=3	*n*=0

Knowledge Measure

Seventeen participants (*n* = 17; 94%) completed the knowledge pre-test and 11 (*n* = 11) completed the knowledge post-test (61%). Mean pre-test item score was 0.369 (*M*=0.369; SD=0.21). The mean post-test score was 0.447 (M=0.447; SD=0.225), with a *p* = 0.04 (see Table 7; Figure 1). Of note, there was a problem that occurred in linking

time 1 to time 2 data. Due to this error, it cannot be stated that the differences participants' pre-test scores on the knowledge test and their post-test scores on knowledge can be analyzed using a paired t-test; however what can be stated is that there was a significant difference between the pre-test scores of the knowledge items and the knowledge post-test scores for the items.

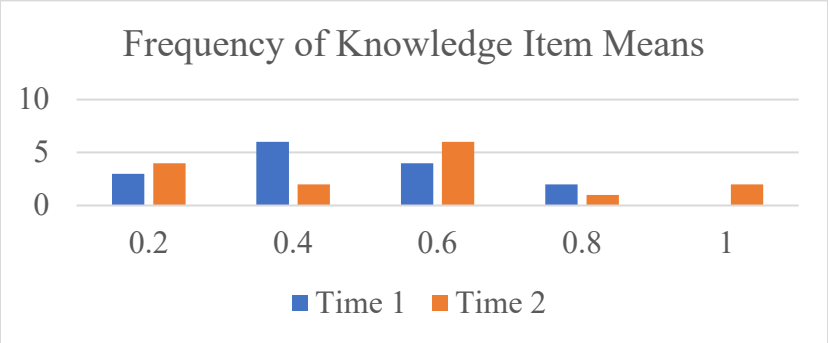
Table 7

Descriptive Statistics of Knowledge Items

Time 1 Mean		*Time 2 Mean*		*Mean Difference (T2-T1)*	
Mean	0.369363	Mean	0.44788	Mean	0.07852
Standard Error	0.053812	Standard Error	0.05819	Standard Error	0.03544
Mode	0.294118	Mode	0.54545	Mode	-0.0535
Standard Deviation	0.208413	Standard Deviation	0.22538	Standard Deviation	0.13724
Sample Variance	0.043436	Sample Variance	0.0508	Sample Variance	0.01884
Count	15	Count	15	Count	15
Confidence Level (95.0%)	0.115415	Confidence Level (95.0%)	0.12481	Confidence Level (95%)	0.076
CI 95% Below	0.253948		0.32307		0.00251
CI 95% Above	0.484778		0.57269		0.15452

Figure 1

Frequency of Knowledge Item Means



Qualitative results

Qualitative data was analyzed using thematic analysis. The qualitative measure was composed of four open-ended questions which were included in the post-test. Question 1 asked participants, "What is your number one "take away" from the virtual patient module?" The theme of communication emerged as the main theme in response. One participant said their number one take away was, "*What effective communication looks like between clinician and patient, and that it is important to remain confident, understanding, and patient*." The majority of participants mentioned the importance of communication and/or making the patient comfortable. The participants identified the importance of patience and provider confidence when providing care for a child with DS. Communication was also commonly reported as important, with several participants indicating that the modules had improved their knowledge of effective communication. Respondents reported their number one takeaway to be:

- *It doesn't need to be stressful for the patient or for the clinician*
- *It's better to make the patient feel comfortable and yourself feel*

comfortable than treat them and it go badly

- *We shouldn't feel scared to treat patients with special needs. We can prepare days in advance for any modifications*
- *What effective communication looks like between clinician and patient, and that it is important to remain confident, understanding, and patient*
- *I feel more confident caring for a persons with Down syndrome. I specifically learned treatment modifications and how to make them the most comfortable while having an efficient experience.*
- *Communication and oral manifestations to look for*
- *Build rapport*
- *Patients with Down syndrome usually can understand more than they can communicate.*
- *My number one takeaway is to treat a child with Down syndrome just like any other child. I may need a little more patience, but this will pay off by building a good rapport.*
- *Understanding how to tell show do in children with Down syndrome can help improve the appointment*
- *Addressing the patient first*

Question 2 asked, "When should the virtual patient modules be introduced into the curriculum?" (e. g., in which year/term, course(s), settings, etc.). There appeared to be a different theme for each answer with one participant stating, *"I think earlier rather than later. Especially if we were to see a patient in clinic that has 'needs' but we don't know how to treat them."* And another stating*, I think like what our program did, introducing*

public health into our senior year was best. I think the first year should be focused on instrumentation and getting the grasp of our patient care and professional responsibilities. Introducing it beginning senior year was best as we were starting to see more patients with diverse health conditions." There was little consensus among participants about when a virtual patient module should be introduced. Two (*n* = 2) participants indicated earlier in their education, while others believe it is important to have a better to already have some clinical experience. Three (*n* = 3) participants indicated this content should be included in the special populations course. Many participants identified a time in their course work that was less busy, though there was little agreement on when that was. One participant responded, *"I think earlier rather than later. Especially if we were to see a patient in clinic that has 'needs' but we don't know how to treat them."* Another response was, *"Fall. Students are less busy."* Placement in the curriculum had varied results, a student commented, "*I think senior year is appropriate. The first year is overwhelming with learning dental hygiene that throwing in care for special needs may not have the same effect as it does for a senior when their skills are more second nature."*

Question 3, "Did you find the Ask Dad section helpful? If so, how?" Eleven of the participants reported yes the Ask Dad section was helpful. One participant noted, "*Yes it gave me insight to how I should interact with a persons with Down syndrome. It showed me ways to make the patient the most comfortable without stepping any boundaries not consented too."* Another student noted, "*It was helpful. It's nice to hear from someone who really knows the situation. They are able to clarify misconceptions and stereotypes*." All participants agreed that the Dad Section was helpful, with

participants indicating it provided additional insight into the child and how to best provide care with the individual based on the history the dad was able to provide. Responses from participants included the following;

- *It was helpful. It's nice to hear from someone who really knows the situation. They are able to clarify misconceptions and stereotypes.*
- *Yes it gave me insight to how I should interact with a persons with Down syndrome. It showed me ways to make the patient the most comfortable without stepping any boundaries not consented too.*
- *Yes because the "dad" is the pro in this situation to know what works best for the kid.*
- *Yes, the parents are an integral aspect of the care team.*
- *I think so because it was helpful to see interaction with a parent.*
- *Yes, it was beneficial to learn how compliant they can be with gentle treatment. Like all patients.*
- *Yes. Offered insight to parent's views*
- *I did, the dad has much more insight to how things have run in the past and how that can affect appointments*
- *Yes it was a different perspective*
- *Yes. It provides answers to questions I didn't know I had*

Question 4 asked, "How impactful was the virtual patient module knowing this was a real person with Down syndrome?" Of the 11(*n=11*) participants 81.8% (*n=9*) responded that the VP being a real person with DS was very impactful and commented, "*Very!"* and *"Very impactful".* Not being able to interact with many people of Down

syndrome, it was good to see the interaction firsthand". The final question in the post-test survey asked if the VP module had an impact knowing the module was about a real person with DS. All participants reported that the module was impactful knowing this was a real person with DS. Six respondents said this made the module more realistic and or accurate. Participants also appreciated having the ability to see the interaction first-hand with one participant saying it "*was beneficial in imagining yourself in a similar situation and how to navigate the* appointment." Other responses included,

- *Very!*
- *It made it much more realistic knowing that it was that way.*
- *Very.*
- *I think it was very impactful and made the situation realistic; an actor without Down syndrome may not have provided as accurate of a representation of this scenario*
- *Made it more realistic and interactive. I really enjoy these modules, helps me understand more in depth how as a dental professional I care for persons with disabilities.*
- *Very Impactful!! It simulates a real experience*
- *Very impactful. Not being able to interact with many people of down syndrome, it was good to see the interaction first hand.*
- *I think it was very helpful. I liked the mix of quizzes, videos and readings. I especially liked the videos because I am more of a visual/hands on learner, and to see the dentist in action was beneficial in imagining yourself in a similar situation and how to navigate through the appointment.*

- *I thought it was helpful because it was an accurate representation.*
- *it was very impactful to read a real account*

Discussion

Summary of Major Findings

Findings from this efficacy study showed a gain in knowledge and decreased level of perceived difficulty in the care of persons with DDs, specifically DS. Qualitative data from the open-ended questionnaire demonstrate VP module had a positive impact on the students' confidence in treating an adolescent with DS.

Discussion

The purpose of the study was to examine if participation in an interactive, VP module increases dental hygiene students' knowledge in caring for individuals with DD and if participation in an interactive, VP module would impact dental hygiene students' perception of difficulty in caring for individuals with DD. When comparing the mean item scores, from the pre-test and post-test after the VP module (Hunter's Case) education intervention, there was a significant difference in the accuracy of participants on the knowledge test. Data for the knowledge test showed an increase in the knowledge in caring for persons with DS after completing the VP module. Additionally, the attitude towards caring for patients with DDs improved as seen in responses from students when asked if the VP module Hunter was impactful. Significant changes were found in perceived difficulty levels for students as a result of completing the module. The post-test DSI measurement demonstrated a significant decrease in perceptions of difficulty after completing the module.

Based on the study results, providing a VP module has the potential to increase educational preparation in the care of persons with DD and their confidence and

willingness to provide care. Lai et al., (2012) reported 50.8% of dental students had no clinical experience in caring for a patient with ASD or related intellectual/developmental disabilities. This study confirms previous studies citing lack of confidence in treating patients with DD as a deterrent to providing care (Wolff, 2004) and reluctance to treat this population stemming from lack of training in treating patients with DDs (Weil & Inglehart, 2010; Vainio et al., 2011).

As found in this study, increasing the preparedness of dental professionals to provide care for persons with DD is essential (Anders & Davis, 2010). This study showed a relationship to the Clemetson, et al. (2011) study that found when dental schools significantly increased the didactic and clinical training in special care dentistry, it led to a positive influence in treating those with special care needs in future practices.

As previous studies have noted (Taglieri et al., 2017), student performance is positively impacted by a VP that realistically simulated a real patient. Additionally stated, the use of a VP simulation can increase student confidence while providing additional learning opportunities. The results of this study similarly demonstrate promising findings to VPs being used as an educational tool. The DSI Likert scale and open-ended student responses validated that a VP could improve student confidence.

The DSI has been validated in its use in a number of efficacy studies (Kleinert et al., 2007a; Kleinert et al., 2007b; Sanders et al., 2008a; Sanders et al., 2008b). However, the data from this study could not find a consistent theme as to where the VP should be placed in the curriculum. The results of this study did however suggest that participation in the VP module is an effective educational intervention for addressing accreditation standards that mandate for demonstration of competence in providing dental hygiene care

for the child, adolescent, adult, geriatric, and special needs patient populations prior to graduation.

The results of this study are consistent with studies conducted by (Kleinert et al., 2007a), which investigated if an interactive VP would potentially be an effective tool to prepare dental students to provide care to children with DDs. Significant results were obtained in both perceived difficulty level and knowledge-based measures for student dentists. The study suggests VP simulation may represent an effective strategy for addressing accreditation standards in relation to pediatric patients with DDs.

This study was conducted to explore the effectiveness of using a virtual patient (VP) pedagogy as an adjunctive method to prepare students for clinical live patient interactions with a person with DS. The PHT modules were developed in response to the growing need for both competent and empathic dental care for individuals with DD's. The focus of the PHT project is to improve health professionals' attitudes toward patients with developmental disabilities by providing simulated (virtual patient) clinical exposure for students. It was demonstrated that such an exposure improved students' willingness to work with this population (Sanders et al., 2008a). Comparing the results of this pilot study to Sanders et al., where significant gains in both comfort and knowledge measures, this study found significant gains only in the comfort measure.

Additionally, this study can be compared to Kleinert et al., 2007a where the DSI was used to show statistical significance in the way a student feels and the comfort level in performing routine examination procedures on a person with DS. Results showed students gained confidence in providing care for persons with DD. For example, in situation # 5 *Building rapport with a 12-year-old boy having Down syndrome who has*

never received dental treatment, participants' perception of difficulty in this situation demonstrated less perceived difficulty.

The PHT modules represent an educational approach emphasizing family-centered care, communication skills, professionalism, and positive attitudes towards patients with DDs (Kleinert et al., 2007b). When asked open-ended questions participants provided a demonstration of understanding concepts presented in the modules that may generalize to all patients with DDs. This study, as did Kleinert et al., 2007a found providing students with adequate training is important, yet it is not always possible to ensure students have opportunities to treat patients with DD's. The PHT VP module is an effective tool to provide a simulation of clinical interactions for dental hygiene students. The findings from this study are in keeping with previous studies that the VP modules are effective in addressing accreditation standards in both dentistry and in dental hygiene in achieving competency in the care of special populations.

With a focus on the care for patients and communities, the emergence of the novel coronavirus COVID-19 has disrupted dental education and requires attention to provide a safe learning environment. The effects COVID-19 may change how future dental professionals are educated. "This pandemic presents practical and logistical challenges and concerns for patient safety, recognizing that students may potentially spread the virus when asymptomatic and may acquire the virus in the course of training" (Rose, 2020, p.1). Preparing student dental hygienists using virtual patient modules representing wide-ranging disabilities of treating persons with special needs could increase knowledge leading to more confident providers. It can be concluded that VPs can address the lack of patients with disabilities to provide real-life scenarios safely.

Additionally, using virtual patients can offer standardized and well-structured patient experiences in a safe environment that will serve the growing requirements for core curricula and guaranteed student experiences. More importantly, the COVID-19 pandemic has opened the way for the PHT modules to allow students to become familiar with interacting with persons with DDs and at-risk conditions, in a simulated, though realistic format. The PHT module characterizes the physical, cognitive, emotional, and oral circumstances typically associated with a child with DS. S

Several participants chose to not answer. However, due to the data received from the DSI 5-point Likert scale, it can be concluded that the students' participation in the VP module decreased their perception of difficulty in treating persons with DS. Significant changes were found in the students' perceived difficulty. Qualitative patterns of meaning and themes identified positive attitudes and perceptions towards treating patients with DS as a result of completing the VP module. This study is in agreement with previous studies regarding the importance of preparing students to care for patients with DD. It is imperative dental professionals are trained to provide care for this population. Deinstitutionalization and improved life expectancies have increased the population of adults and children seeking oral health care. The PHT modules include diverse populations such as patients with cerebral palsy and autism spectrum disorder and were produced in response to the continuing disparity in access to quality healthcare experienced by this patient population. Training that improves communication will affect provider sensitivity and are a means to prepare dental hygienists to promote culturally competent practice. The use of VPs can provide a means to educate dental hygiene students on caring for individuals with DD.

Limitations

Two main limitations of this study were the low response rate and the lack of a control group. Although the students were required to complete the PHT module as part of the curriculum, participation in the study was voluntary. Student performance on the post-test may have improved if the post-test performance had been included as part of students' evaluation for a grade in the course.

A third limitation was the number of participants that did not answer every survey question in the pre and post-test surveys. Many students "skipped" answers or did not completely follow the directions and it is uncertain as to the reason. It could be concluded they felt uncomfortable with predicting the correct answer. However, all qualitative data has been included for effective analysis of the VP on the confidence and willingness to treat persons with DS in the future. Another limitation was the inability to link pre-test and post-test data to each other due to an incorrect setting in the data collection section of SurveyMonkey.

Recommendations/Suggestions for Future Research

Recommendations for future studies include a larger population of study as well as including a control group. Future studies should consider survey fatigue. Careful consideration as to the timing of the research might alleviate survey fatigue among student populations. Choosing a time when students are not experiencing survey fatigue could lead to fewer abandoned surveys, ineffective results, or inaccurate survey results.

A control group would provide a way of determining if the VP module is effective in providing dental hygiene students with confidence and knowledge of treating a person with DS. Additional research could be beneficial to examine the effects of the PHT

module (Hunter) and if the increased confidence could be generalized for treating all patients with DDs. Further research into the timing of introducing the VP in the curriculum as well as use of the VP modules throughout the curriculum.

Future research into the long-term value and impact of completing the VP modules during dental hygiene education on the willingness to treat persons when practicing as a licensed dental hygienist. A final recommendation for further research is for the evaluation of the impact of COVID-19 and the use of VPs in dental hygiene education. Implications of the study findings include potential for better preparing licensed dental professional in the care of persons with DD through use of the VP modules in continuing education (CE) courses.

Conclusions

The VP module had significant impact on how senior undergraduate dental students perceived working with adolescent with DS. Overall, the study demonstrated that an interactive VP module can increase the confidence and ability to treat persons with DS. Furthermore, this study demonstrated that VP modules have a positive effect in providing training for dental hygienists on caring for persons with DDs.

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Appendix A

Disability Situations Inventory (DSI) Pretest/Posttest

Disability Situations Inventory (DSI) Pretest/Posttest (Hunter case) Some situations dental hygienist encounter may be difficult to handle, awkward, or embarrassing. Please evaluate how difficult you would find each of the following situations and circle the number, which corresponds to the difficulty on a scale of 1 to 5, with 5 the most difficult.					
	Not Difficult				Most Difficult
1. Conducting an oral exam for a child with Down syndrome whose speech you have great difficulty understanding.	1	2	3	4	5
2. Talking with the parents of a child with Down syndrome who adamantly refuse sedation for their child.	1	2	3	4	5
3. Treating a six-year-old child with Down syndrome who is fearful and squirms when you ask him to open his mouth so you can check his teeth.	1	2	3	4	5
4. Recognizing the common oral/dental findings which may present in a child with Down syndrome.	1	2	3	4	5
5. Building rapport with a 12-year-old boy having Down syndrome who has never received dental treatment.	1	2	3	4	5
6. Demonstrating effective oral hygiene to a ten-year-old child with Down syndrome who does not appear to be doing a good job with brushing and flossing his teeth.	1	2	3	4	5
7. Clinical management of a child with a developmental disability whose teeth show significant effects of bruxism.	1	2	3	4	5
8. Treating a child with a cognitive disability who does not appear to understand your verbal instructions about what is going to happen next in the visit.	1	2	3	4	5

Appendix B

Knowledge Pretest/Posttest

Knowledge Questions (Pretest)
Hunter Module Multiple Choice

1) Children with Down syndrome frequently demonstrate the following orofacial features:
   a) high, narrow palate
   b) mid-facial hypoplasia
   c) cleft palate
   d) a and b
   e) b and c

2) The concept of "Person-First" language refers *primarily* to:
   a) speaking to the person with the disability first
   b) identifying the person with the disability before beginning interaction
   c) putting the person before the disability; i.e., "child with Down syndrome", instead of "Down syndrome child"
   d) recognizing the uniqueness of communication modes specific to an individual with a disability
   e) a, b, and c

3) When conducting office visits with adolescents with Down syndrome, it is important to remember the following points concerning communicative ability:
   a) individuals with Down syndrome usually demonstrate moderate to severe intellectual disability (mental retardation), which severely limits verbal interaction
   b) persons with Down syndrome often experience deficits in sensory functions, such as hearing, which may result in speech difficulties
   c) anatomical differences in the pharynx, tongue, dentition, and oral cavity are often present and may result in distorted speech without reflecting cognitive ability
   d) b and c
   e) a, b, and c are all true

4) Speech pathology in individuals with Down syndrome is typically related to:
   a) structural alterations in the anatomy of the oral cavity, tongue, and/or oropharynx
   b) poorly developed grammatical skills
   c) middle or inner ear hearing loss
   d) facial nerve paralysis (Cranial Nerve 5)
   e) a, b, and c

5) When interacting with children having Down syndrome in the operatory setting, the dentist should make every effort to:
   a. direct conversation/questions primarily toward the individual rather than solely to parent/caregiver

b. provide for an assistant, as adolescents with Down syndrome are prone to act out verbally or physically when frustrated by an inability to communicate
c. establish rapport with the individual by showing respect and patience during communication
d. a and c
e. a, b, and c

6) Alterations in dentition frequently encountered in individuals with Down syndrome include all of the following EXCEPT:
a. taurodontism
b. amelogenesis imperfecta
c. oligodontia
d. microdontia
e. malocclusion

7) Which of the following conditions, when present in the child with Down syndrome, may necessitate antibiotic prophylaxis before certain procedures?
a. atlantoaxial instability
b. recent upper respiratory infection
c. history of cardiac surgery
d. leukemia
e. micrognathia

8) Which of the following is not an oral manifestation of Down syndrome?
a. scrotal tongue
b. anterior open bite
c. retrognathia
d. maxillary hypoplasia
e. tonic bite reflex

9) Delayed eruption of teeth is frequently encountered in children with Down syndrome but may be exacerbated by which of the following:
a. polycythemia
b. hypothyroidism
c. Turners syndrome
d. Microdontia
e. Gingival hypoplasia

10) Which of the following points *most* accurately reflects the quality of communication in children with Down syndrome?
a. neurological deficits typically result in very poor speech comprehension in individuals with Down syndrome
b. children with Down syndrome frequently exhibit echolalia
c. individuals with Down syndrome typically have better receptive than expressive language skills
d. children with Down syndrome *most* often use a computer-assisted augmentative device to communicate
e. b and c

11) Pediatric patients with Down syndrome who have a history of atlantoaxial instability require that the dentist ensure:
   a. frequent lab work to determine phosphorous levels
   b. careful positioning of the head/neck with proper support during treatment
   c. annual cervical radiographs
   d. a, b, and c
   e. b and c

12) All of the following are considered initial strategies to decrease the child's anxiety concerning dental treatment EXCEPT:
   a. establishing rapport with the child by conversing with him or her directly
   b. providing a social story for the child or parent to read before the appointment
   c. scheduling a preliminary "warm-up" visit a few days before the actual appointment
   d. prescribing a mild sedative for the child to be administered one hour before the visit
   e. all of these are excellent initial strategies

13) The increased occurrence of periodontal disease in children with Down syndrome is related to all of the following factors except:
   a. decreased t-lymphocyte function
   b. persistent dysphagia
   c. frequently poor/inconsistent oral hygiene
   d. malocclusion
   e. hypotonia of the orofacial musculature

14) Xerostomia and angular cheilitis are common in children with Down syndrome and are significantly related to all of the following EXCEPT:
   a. frequent upper respiratory infections
   b. anterior open bite
   c. small oral cavity with insufficient space for the tongue
   d. gastroesophageal reflux disease
   e. the need to lubricate lips during dental care

15) During the course of your oral examination of a child with Down syndrome, you discover ulcerative gingivitis and pinpoint hemorrhagic spots on the hard palate. You realize that these oral findings *may* be indicative:
   a. leukoplakia
   b. Guillian Barre' syndrome
   c. leukemia
   d. hemolytic anemia
   e. candida albicans

Appendix C

Demographic Questionnaire

What is your age?

- 18 - 22
- 23 - 27
- 28 - 32
- 33 - 37
- 38 and older

Do you have any prior experience in working with persons with Down syndrome?

- Yes
- No

Appendix D

Qualitative Questions

Qualitative Items (Four open-ended questions)
What is your number one “take away” from the virtual patient modules?
When should the virtual patient modules be introduced into the curriculum? (for example, which year/term, course(s), settings, etc.)?
Did you find the Ask Dad section helpful? If so, how?
How impactful was the virtual patient module knowing this was a real person with Down syndrome?

Appendix E

Research Script

Virtual Patient (VP) module Educational Intervention of Dental Hygiene Students

Research Assistant Instructions

Who: Merri Jones, EWU instructor

What: Introduction of research study to potential participants

When: Spring semester 2021 Week __

Where: Online/Zoom during Experiences in *Dental Public Health* course session

Why: Inform students of upcoming study and dates for email communications

Introduction Script:

"I wanted to take a moment to discuss a research study you are being asked to participate in. Janis McClelland is a MSDH student at EWU. She is conducting her thesis research study on the use of a virtual patient (VP) module in preparing dental hygiene students to care for children with developmental disabilities. Today, I will be forwarding you an email from Janis. The email will contain a cover letter and consent form. If you choose to participate in the research, you will complete a pre-test and demographic questionnaire SurveyMonkey® within the next week. One week from today, I will forward you a second email containing access to the VP module on Down syndrome (Hunter's case). You will have one week to complete the VP module. One week following closure of the VP module, you will receive an email with a link to the posttest via SurveyMonkey®. While completion of the module is required as part of EWU Dental Hygiene curriculum, participation in the research aspect is voluntary.

You are under no obligation to participate in the research, and your participation or non-participation will be strictly confidential. SurveyMonkey® will be used to complete assessments, and all data will remain anonymous. I will not have access to pre-test or post-test results, and scores on these assessments will have no impact students' grades.

If you have any questions, I encourage you to contact Janis. Her email address is jmcclelland@eagles.ewu.edu”

Appendix F

Cover Letter and Consent Form

Informed Consent Statement

My name is Janis McClelland, and I am currently enrolled in the Master of Science in Dental Hygiene degree program at Eastern Washington University. For my thesis, I will be conducting research on the effects of a virtual patient on dental hygiene students' knowledge and perception of difficult in addressing the dental needs of individuals with development disabilities.

If you choose to participate in the research, you will receive an email to the link to access SurveyMonkey® to complete a pre-test and demographic questionnaire. One week following, you will receive access to the VP module on Down syndrome (Hunter's case). You will have one week to complete the VP module. One week following closure of the VP module, you will receive an email with a link to the posttest and qualitative questions via SurveyMonkey®.

Please know that your participation in this study will be in partial fulfillment of your Eastern Washington University curriculum and that your responses are anonymous as they do not require you to disclose any identifying information. Minimal risk will be involved, and participation is voluntary. Participants may withdraw at any time, free of academic consequences or impact on participants' grades.

Your consent to participate in this study is implied when you participate in the virtual modules, lectures, access the survey and answer the questions. Your anonymous data from the pre-test, demographic questionnaire, post-test will be used for research and publication purposes.

As an incentive for participation, all students consenting to the research study and completing the entire research protocol will be entered into a drawing for a chance to receive one of 4 - $25.00 Amazon Gift Cards on March 1, 2021.

If you have any questions about the study, please contact the Principal Investigator, Janis McClelland: Phone: 208-610-3675 or Email: jmcclelland@eagles.ewu.edu

If you have questions or concerns about your rights as a participant in this research or any complaints you wish to make, you may contact Charlene Alspach, Executive Director, Grant & Research Development, at (509) 359-2517 or calspach@ewu.edu.

Thank you,

Janis McClelland, RDH, BSDH

Appendix G

Educational Intervention

PHT COURSE: DENTAL – HUNTER

Hunter is a ten-year-old boy with Down syndrome. The patient is played by an actor with this developmental disability.

In this pediatric case the patient, Hunter, is being seen for a dental checkup. The actor playing Hunter is an individual with Down syndrome.

Observe how best to facilitate effective clinical interactions in this situation.

Lesson 1: Preparation

Topic 1.1: You're the dentist
In this interactive case, you are playing the role of a dentist. You will interact with a virtual patient played by an actor with a developmental disability.

Note to Students
You are now ready to meet Hunter, your next patient. Hunter is a ten year old boy with Down syndrome. Hunter has been recently referred to you by his primary physician - you have not seen him before. His parents suspect that he has a cavity in one of his right lower molars. Your main task is to accommodate and respect both Hunter and his father's specific needs and concerns throughout the course of the dental visit.

Topic 1.2: Information Point: Person First Language

- When speaking to or about a person with a disability, it is important to focus on the person first and secondarily on the disability.

  Instead of using: Crippled with, suffering from, or afflicted with
  Substitute: Has, with

  Instead of using: Handicap
  Substitute: Disability

  Instead of using: Handicapped person,
  Substitute: Person with a disability, Individual with a disability

  Instead of using: Normal, healthy, able-bodied
  Substitute: Non-disabled

Instead of using Disease, defect,
Substitute: Condition

Instead of using: Confined to a wheelchair,
Substitute: Wheelchair user, uses a wheelchair

A quick review of important points from the readings to assist with your decision-making during this case.

Quiz 1.2: Inform Dental Assistant
How would you present Hunter's case to your dental assistant?
"Our next patient...

A. Has a Down syndrome handicap.
B. Is a child with Down syndrome.
C. Is a mentally retarded child with Down syndrome.
D. Has a Down syndrome handicap.

Feedback

A. Incorrect. When referring to individuals with disabilities, one should refer to the individual first, e.g., “child with Down syndrome.”
B. GOOD CHOICE! This choice demonstrates respect by recognizing Hunter as a "child" first.
C. Incorrect. You need not assume nor infer that your patient with Down syndrome is significantly cognitively disabled.
D. Incorrect. “Handicap” is not an acceptable term. Simply state that Hunter is a child with Down syndrome. You should not infer that this has resulted in a specific disability.

Topic 1.3: Communication Concerns
Information Point: Communication Concerns
The development of effective communication skills is an integral part of cognitive and social success for all individuals; and no less so for persons with Down syndrome. Nearly all individuals with Down syndrome experience some degree of difficulty with linguistic development. Most frequently encountered are problems involving grammar, expressive language, phonology, and articulation. Grammar may prove especially difficult for children with Down syndrome to master. It is important to remember that children with Down syndrome typically possess greater receptive than expressive language skills. Articulation and pronunciation difficulties may result in speech that is difficult for others to understand - especially those unfamiliar with the child. As many as 95% of parents express difficulty understanding their child with Down syndrome at some time.

It is no surprise that children with Down syndrome often experience difficulty with communication, articulation, and linguistic development. Both auditory and oral structural anomalies contribute to this phenomenon. Hearing loss due to inner or middle ear involvement is common, with 60-80% of children affected. It is impossible for the

child to correctly reproduce sounds which are heard poorly - or not at all. Articulation is commonly altered in persons with Down syndrome and is related to structural alterations of the tongue, palate, and facial muscles. Defects in dentition also may be present, such as malocclusion of teeth and/or missing teeth, which further contribute to articulation difficulties.

REVIEW RESOURCES

- Cognitive Variation in Down syndrome
- Special Dentistry Considerations for Children with Developmental Disabilities

A quick review of important points from the readings to assist with your decision-making during this case.

Quiz 1.3: Communication and Down Syndrome

In The Exam Room

Observe as the dentist takes the time to familiarize the dental assistant with what one may expect in caring for Hunter.

Communicative difficulties in children with Down syndrome, when present, are typically related to which of the following:

A. Structural alterations in the anatomy of the oral cavity, tongue, and/or oropharynx.
B. Poorly developed grammatical skills
C. Inner ear hearing loss
D. Typically a severe level of intellectual disability (mental retardation).
E. A, B, and C

Feedback

A. Partially correct; Although this is true, are there other factors involved?
B. Partially correct; Although this is true, what other issues are involved?
C. Partially correct; Sixty to eighty percent of persons with Down syndrome experience some auditory dysfunction. Are there other factors involved?
D. Incorrect. Children with Down syndrome typically fall within the mild-moderate range of intellectual disability.
E. Best Choice. All these factors may be involved with communication problems in persons with Down syndrome.

What educational points should be included when preparing office staff to care for children such as Hunter?

A. Level of communication skill does not necessarily reflect cognitive ability.
B. Children with developmental disabilities do not typically benefit from preventive instruction.
C. Children with developmental disabilities often become combative during medical treatment.

D. Children with developmental disabilities often benefit from a more structured, familiar, approach to their medical/dental care.
E. A and D

Feedback

A. Partially Correct. Expressive language skills frequently lag behind receptive skills in children with Down syndrome.
B. Incorrect. Children with developmental disabilities demonstrate a wide range of cognitive ability.
C. Incorrect. Any child may act out when confused, frightened, or unable to communicate. Children with developmental disabilities are not more likely to do so than others.
D. Partially Correct. All children benefit from receiving care in a familiar, structured, format - especially children with developmental disabilities who may become more anxious due to sensory and/or communication issues.
E. Good Choice! Both are vital points for dental office staff to consider.

Topic 1.4: Staff Preparation – See what happened

Educating the Dental Assistant

Observe as the dentist takes the time to familiarize the dental assistant with what one may expect in caring for Hunter.

[Video starts with "Rita our next patient is Hunter. He is a child with Down syndrome, who may need a restoration…]

NOTE: This movie models one correct approach to this situation. There are many correct ways to interact with patients. Use what you have seen to improve provider-patient communication.

Lesson 2: Interacting with the Patient

Topic 2.1: Interventions

Many children are apprehensive concerning dental care due to a variety of factors, including previous experiences with dentists, parental influences, or innate fear of the unknown. Children with developmental disabilities are no exception, and in fact may be more frightened due to lack of exposure to dental care, painful oral/physical conditions, or sometimes an intellectual disability, which may make the purpose of dental treatment difficult to understand.

The dentist should make a careful assessment of the child's cognitive and developmental levels in order to facilitate an appropriate level of communication. Dental office staff should be educated/prepared concerning specific issues that may arise when providing care to children with disabilities. These issues include the need for flexibility in scheduling, flexibility in positioning, potential behavioral interventions, and the need to convey an attitude of patience and respect.

The issue of whether or not to use sedation with children having developmental

disabilities in the pediatric population is one which evokes a strong reaction among parents of such children. Although some parents prefer sedation, many feel that sedation for their child simply reflects the dentist "taking the easy way out." Sedative medications are not without significant risks and they should only be used after all other strategies have been exhausted.

REVIEW RESOURCES

- Sedation
- Cognitive Variation in Children with Down Syndrome

A quick review of important points from the readings to assist with your decision making during this case.

Quiz 2.1: Interventions

Which of the following interventions would be most helpful when used by office staff caring for children with developmental disabilities?

A. Evaluating the child for the possibility of physical restraint or sedation.
B. Facilitating flexibility in treatment structure, treatment location, and positioning.
C. Careful assessment of the child's cognitive and communicative developmental level.
D. A, B, and C
E. B and C

Feedback

A. Incorrect. Sedation should only be used as a last resort in dental care.
B. Partially correct. It is certainly important to adapt the operatory environment for the child with a developmental disability. Is there anything else?
C. Partially correct. A developmental assessment is vital in order to tailor communication.
D. Incorrect due to response A. Sedation/restraint is used only as a last resort and is not best practice.
E. Good choice! Both represent good practice when caring for children with developmental disabilities.

What are some ways to gain Hunter's trust?

To begin the visit, what are some initial rapport-building strategies which may prove helpful?

A. Simply greet the parent cordially and get to work.
B. I would introduce myself and the dental assistant to Hunter and his father.
C. I would seat the child in the dental chair and ask the parent to leave the room.
D. Engage Hunter directly in small talk, e.g., comment on his interests and activities.
E. B and D

Feedback:

A. Incorrect. You must interact with Hunter directly in order to gain his trust.
B. Partially Correct. It is very important to introduce yourself directly to Hunter. Is there anything else?
C. Incorrect. You may need Dad's help in communicating with Hunter. Hunter may not be comfortable without Dad present.
D. Partially Correct. It is very important to establish rapport with Hunter.
E. Good Choice! Both are good initial rapport-building strategies.

Topic 2.2: Rapport Building – See what Happened.
Getting to Know Hunter and His Dad
Notice the dentist speaks directly to Hunter, establishing excellent rapport.
Note how the father assists in interpreting Hunter's responses.

[Video: Begins with "Good morning Mr. Jones I'm Dr. Mink"]
NOTE: This movie models one correct approach to this situation. There are many correct ways to interact with patients. Use what you have seen to improve provider-patient communication.

Topic 2.3: Information Point: Cardiovascular Concerns in Children with Down syndrome
Antibiotic Prophylaxis
Forty-six to sixty-two percent of persons with Down syndrome are born with some form of cardiac defect. The most common is Atrioventricular Septal Defect (59%), followed by Ventricular Septal Defect (19%), Atrial Septal Defect (9%), Tetralogy of Fallot (6%), Patent Ductus Arteriosis (4%), and other cardiac abnormalities (3%). Significant defects are typically discovered and repaired during the first year of life. Despite this early intervention, some children with such history may require continuing cardiac care throughout their lives.

Additionally, recent studies have suggested that children and adolescents with Down syndrome frequently demonstrate mitral valve prolapse or insufficiency, and/or atrial regurgitation. Therefore, it is important for the dentist to consult with the child's primary care provider concerning the need for antibiotic prophylaxis.

It is essential to obtain an accurate cardiac history. Not all children with history of cardiac surgery will require antibiotic prophylaxis. Although parents are often able to provide detailed information concerning the need for antibiotic therapy - in the event that the medical record is incomplete and/or the parents are unsure of the history, it is the dentist's responsibility to confer with the child's physician or primary care provider before performing potentially invasive procedures which may place the child at risk for endocarditis. It is thus advisable to familiarize one's self with the child's medical history far enough in advance of needed treatment to facilitate a quick phone call to the child's physician.

Atlantoaxial Instability

Atlantoaxial instability is a condition which may exist in children with Down syndrome which may be induced by laxity in the ligaments surrounding C1 (Atlas) and C2 (axis) vertebrae. This ligamentous laxity may allow injury to the cervical spinal cord (via shearing or compression) in significant cases. Children with Down syndrome are typically screened for this condition at various points in their development. A child with atlantoaxial instability may be cautioned against engaging in activities such as contact sports or trampoline activities as they may be at risk for cervical injury. The dental practitioner should use caution when positioning such pediatric patients by using ample head and neck support.

A quick review of important points from the readings to assist with your decision-making during this case.

Quiz 2.3: Atlantoaxial Instability

Atlantoaxial instability is a condition frequently occurring in children with Down syndrome and may necessitate…

A. Use of a mild sedative in conjunction with behavioral interventions.
B. An orthopedic consult prior to any treatment involving the mandible.
C. Extra support and care when positioning the head and neck for dental treatment.
D. All of the above

Feedback:

Atlantoaxial instability is a condition frequently occurring in children with Down syndrome and may necessitate…

A. Incorrect. Atlantoaxial instability should not necessitate sedation in itself.
B. Incorrect. The dentist, however, will want to review any medical records concerning the presence of this condition.
C. Good choice! This is a very important point of concern.
D. Incorrect. Atlantoaxial instability does not involve the mandible or necessarily require sedative use.

Lesson 3: Patient History

Topic 3.1: Medical History

In The Operatory

Might Hunter have any health conditions which could affect his dental treatment?

Alt-Text: A dentist discusses a patient file with a Dental Assistant

REVIEW RESOURCES

- Special Dentistry Considerations for Children and Adults with Down Syndrome
- Socialization Concerns in Down syndrome

Quiz 3.1: Medical History
Make a decision: What pertinent information may be obtained from exploring Hunter's general medical history?

A. Medical History review is not really indicated in Hunter's case.
B. A history of cardiac anomaly/surgery necessitating antibiotic prophylaxis.
C. Each child with Down syndrome is unique –the history may be necessary for some children but not for others.
D. Presence of atlantoaxial instability - which may necessitate a modification in positioning.
E. B and D

Feedback:

What pertinent information may be obtained from exploring Hunter's general medical history?

A. Incorrect. Children with Down syndrome may have medical issues which directly affect the provision of dental care - such as cardiac anomalies.
B. Partially Correct. This is certainly important to know. Is there another point of concern here as well?
C. Incorrect. All patients, especially those with special needs, benefit from a medical history review.
D. Partially Correct. It is true that some children with this condition require careful head and neck support to prevent potential injury. Anything else?
E. Good Choice! Both of these choices represent issues which may directly affect dental treatment.

Topic 3.2: See What Happened - Social Assessment- Problem History
Note how the opening questions addressing social assessment provide a good context for subsequent questions about general health history related to dental care. The dentist then investigates specific points about Hunter's general health history.

[Video: begins with “I just need to ask your dad a couple questions, Hunter, so let me talk to your dad a minute]
NOTE: This movie models one correct approach to this situation. There are many correct ways to interact with patients. Use what you have seen to improve provider-patient communication.

Topic 3.3: Parents’ Concerns
Parents’ Perceptions and Concerns Regarding Dental Care for the Child with Developmental Disabilities

Many dentists are reticent to accept children with significant developmental disabilities, as well other developmental disabilities as patients. In Kentucky alone this is an issue - although there are dentists who advertise, particularly online, that they either specialize in or accept children with disabilities into their practice, there is no centralized, readily accessible registry of such dental care providers in existence. According to the Kentucky Dentistry Association, there is no such resource available either to the public, or to potentially referring dentists in the state of Kentucky. Thus parents of children with developmental disabilities have the frustration of "sorting" through pediatric dentists in hopes of identifying someone proficient in - and open to - caring for their child with developmental disabilities. Pediatric dentists who do readily accept children with disabilities are often very busy - at times necessitating lengthy waits before obtaining an appointment.

The practice of both physically applied restraint and/or sedation to achieve compliance in the pediatric dental patient population is often a point of contention between dentists and parents. Some parents actually prefer that their child be sedated for dental care - for a variety of reasons - while others, particularly those parents of children with developmental disabilities, feel that physical restraint and sedation are both overused and simply reflect the dentist "taking the easy way out." Neither physical restraint nor sedation is without significant risk and should only be considered when all other avenues to deliver safe care have been exhausted. Nevertheless, there are some children with certain conditions - such as those which may produce uncontrolled movements of the head and neck - which may require sedation in order to be safely and sensitively treated for certain dental procedures (children and adults with severe cognitive disabilities may also fall into this category). It is important for the dentist to establish trust through open communication with the parent and patient when discussing treatment options/plans.

A quick review of important points from the readings to assist with your decision-making during this case.

Quiz 3.3: Sedation and Restraint

Many parents of children with disabilities consider sedation and restraint for dental procedures a last resort. However, circumstances which may necessitate the use of sedation or restraint include:

A. The child has a history of a behavioral disorder.
B. The child has a condition which produces uncontrolled movements of the head and neck.
C. The child refuses to open his or her mouth.
D. The child's cognitive level precludes his or her ability to understand the need for treatment.
E. B and D

Feedback:

A. Incorrect. This history alone would not necessitate consideration of sedation or restraint.

B. Partially correct. What other features may require consideration of sedation or restraint techniques?
C. Incorrect. There are other ways to help fearful or resistant patients before resorting to sedation or restraint.
D. Partially correct: What medical considerations may require consideration of sedation and restraint options?
E. Best choice. Both medical conditions and cognitive ability can be factors in the decision to use sedation or restraint.

Topic 3.4: See What Happened - Antibiotics and Sedation Concerns
Note how the issues of both sedation and antibiotic prophylaxis are carefully discussed with Hunter's father.

[Video starts with "Has Hunter had any experiences with coming to the dentist?]

NOTE: This movie models one correct approach to this situation. There are many correct ways to interact with patients. Use what you have seen to improve provider-patient communication.

Topic 3.5: Common Dental Findings in Children with Down Syndrome
Bruxism refers to a condition which involves grinding of the teeth. This grinding may occur unconsciously during sleep, or may occur during waking hours as a type of self-stimulating activity. Bruxism may be mild or significant enough to induce premature wearing of the tooth enamel. It seems most likely that bruxism has no single cause but may be related to the concurrence of malocclusion, temporal-mandibular joint dysfunction (due to ligamentous laxity), and/or generalized anxiety. Bruxism occurring during waking hours may be somewhat ameliorated by behavioral modification techniques. In persistent cases, or when the grinding happens mostly during sleep, a bite guard or other occlusive device may be indicated in order to spare tooth enamel.

Periodontal disease is often out of proportion to the amount of plaque on the teeth, and is thought to possibly be the result of a compromised immune response. As a result of bone loss, the tooth often becomes loose in the socket and may be lost. Conscientious oral hygiene should be encouraged in all children - particularly those with disabilities - for whom actually accomplishing this task may prove challenging.

Microdontia refers to a condition which involves an abnormally small tooth size. In addition, the roots tend to be small, and the molars frequently demonstrate taurodontism and elongated pulp chambers. Small root size may contribute to tooth loss in the event of disease, which is very common in children with Down syndrome. Microdontia also is important as it alters the appearance of the smile and thus has social implications.

Malocclusion is a common finding among children with Down syndrome. There are many factors responsible for this finding, mostly related to abnormal growth and development of the craniofacial complex. Malocclusion due to cross-bite may also occur

when primary teeth fail to shed on schedule. Conversely, premature loss of primary teeth, possibly due to decay, may allow the permanent teeth to "drift" out of position and thus induce orthodontic problems.

- Special Dentistry Considerations for Children and Adults with Down Syndrome
- A Parent's Perspective on Effective Dentistry: Tips for Family-Centered Care

A quick review of important points from the readings to assist with your decision-making during this case.

Quiz 3.5: Down Syndrome and Dental Issues

In The Operatory

Mentally review what you know about Down syndrome

Which of the items below frequently occur as a result of unmanaged bruxism?

A. Severe wearing of enamel
B. Fractured teeth
C. Soft tissue damage to tongue
D. A and B
E. A, B and C

Feedback:

A. Partially correct. Bruxism does cause severe wearing of enamel. Is there anything else?
B. Partially correct. Bruxism can cause fractured teeth. Is there anything else?
C. Incorrect. There is no evidence that bruxism causes soft tissue damage to the tongue.
D. Good Choice. Bruxism can cause both severe wearing of enamel and fractured teeth.
E. Incorrect because of C. There is no evidence that bruxism causes soft tissue damage to the tongue.

Make a decision: What are some dental concerns/findings which are often seen or reported in children with Down syndrome?

A. Presence of Microdontia
B. Malocclusion
C. Periodontal disease/gingivitis
D. Bruxism
E. All of the above

Feedback:

A. Partially Correct. This is certainly not uncommon. Is there anything else?
B. Partially Correct. Problems with malocclusion are common in children with Down syndrome.

C. Partially Correct. It is true that kids with Down syndrome have a greater incidence of periodontal disease. However, are there other concerns?
D. Partially Correct. Bruxism is frequently seen in children with Down syndrome. Are there other concerns?
E. Good Choice! All responses represent common findings in patients with Down syndrome.

Topic 3.6: See What Happened - Investigating Bruxism
Any history of dental symptoms, including bruxism, is now further investigated.

[Video starts with Dr. Mink, "Do you have any specific questions?"]
NOTE: This movie models one correct approach to this situation. There are many correct ways to interact with patients. Use what you have seen to improve provider-patient communication.

Lesson 4: Patient-Physical Interaction
Topic 4.1: Information Point: Behavior Management Strategies
Some simple strategies which may prove useful for gaining cooperation in the pediatric patient with Down syndrome are listed below.

1. First, discuss the child's communicative and intellectual abilities with the parent. Determining the level of communication is imperative to building a cooperative relationship with your patient with Down syndrome. The parent may be able to offer valuable advice as to what motivates his or her child. Investigate what types of management techniques have proven successful in the home environment and attempt to modify these for the dental setting.

2. Find out what time of day would be best to schedule the dental appointment; some children may be more cooperative either in the morning or afternoon.

3. Make sure the entire dental team has been educated concerning the proper attitude and treatment of patients with developmental disabilities. The continuum of care should begin with the office receptionist and extend to the dental assistant and the dentist.

4. Praise, praise, praise! Most children respond to compliments and praise, and children with Down syndrome are no exception. Reward good behavior and maintain a patient and positive affect.

5. Attempt to reduce distractions as much as possible. Some dentists (including those caring for typical adults and children) have employed music as an intervention to help patients relax.

6. Try beginning the oral examination by using only your gloved fingers, then progress to the use of dental instruments.

7. Make every effort to afford consistency in routine, staff, and location when working with children with developmental disabilities. Such patients tend to be more cooperative in a familiar setting with familiar faces.

8. DO NOT use physical restraint or sedation merely as a convenience. There are times when these measures may prove absolutely necessary - but this is the only time they should be used. The dentist should always use the least restrictive technique that will allow the patient to be treated safely.
9. Include the child, whenever possible, when conversing with the parent, rather than "talking about" the child in his or her presence.
10. Remember that children with Down syndrome may experience difficulty processing sequential information; thus, break any instructions down into succinct parts pertinent to the task at hand.
11. Modeling dental treatment on an older sibling, or another cooperative child may prove useful for some children.

REVIEW RESOURCES

- Behavioral Management Strategies for Pediatric Dental Patients with Developmental Disabilities
- Social Stories

A quick review of important points from the readings to assist with your decision making during this case.

Quiz 4.1: Behavior Management
In The Operatory
What strategies might you use to gain Hunter's cooperation?

Make a decision: What behavior management technique(s) may be most effective with a child such as Hunter?

A. Tell, show, do
B. Behavior techniques are not that effective with kids having Down syndrome.
C. Positively reinforce cooperative behavior.
D. Tell the child to sit quietly and not touch anything to prevent harming himself.
E. A and C

Feedback:

A. Partially Correct. "Tell, show, and do" is a well-accepted effective method. Is there anything else?
B. Incorrect. This is rarely the case - behavioral strategies are typically very effective with this population, as with all children.
C. Partially Correct. This is certainly an important strategy. Is there anything else?
D. Incorrect. This is not an effective method to gain the child's trust and cooperation.
E. Good Choice! Both demonstration and praise are important interventions to employ.

Topic 4.2: See What Happened - Hunter's Preparation Explored
The dentist explains the technique of “tell, show, and do” to Hunter’s father and queries how Hunter has been prepared for this visit.

[video starts with “one of the things we do Mr. Jones is we try to tell our patients what we are going to do, and then show them what we are going to do before we do it”]

NOTE: This movie models one correct approach to this situation. There are many correct ways to interact with patients. Use what you have seen to improve provider-patient communication.

Topic 4.3: Warm-up Visits and Diminishing Fear in Children
“Warm-up”, or desensitization visits to the dental office, may be particularly helpful for children whose specific disability may necessitate alterations in the physical set-up of the dental operatory - so that no last minute “surprises” occur that may be upsetting to both the child and parent. Such disabilities may include those resulting in significant physical limitations, such as paralysis, hemiplegia (from “stroke”), spasticity (e.g., in cerebral palsy), or seizure disorder. Potential positioning difficulties and any necessary modifications in the typical office procedure may be identified during the preliminary visit. This will hopefully increase a sense of security for the child on the actual day of dental treatment.

Many patients with significant physical restrictions may need to be treated while they remain in their wheelchair. For wheelchair users, adequate maneuverability within the actual dental operatory (and dental office facility) may be assessed via a preliminary trip to the dental office. For individuals with intellectual disability, a preliminary trip to the dental office helps to familiarize them both with the office environment and staff, and allows the staff to meet the patient with developmental disabilities as well. Depending on the individual child, more than one visit may be required before the child becomes comfortable enough for actual dental treatment to proceed (a good strategy unless, of course, emergency treatment is required).
Systematic desensitization also may be used to help gradually alleviate dental fears in the adult population; however, young children, particularly those with some degree of intellectual disability, typically require a concrete and experiential approach. The dentist may achieve this by first establishing rapport with the child through direct conversation. Next, the child should be desensitized to the dental operatory setting in general, as well as to the dental instruments. This may be achieved by allowing the child to see the instruments, touch them when possible, and observe their function.

Topic 4.4: Desensitization Visits


Alt-Text: A dentist speaks to Hunter, a young boy with Down syndrome

Desensitization visits are one useful strategy for diminishing fear in children.

The images below display a series of photographs demonstrating the potential effectiveness of such “warm-up” visits.


Alt-Text: Hunter and his dad play on the train table in the waiting room

Observe in this photo as Hunter enjoys the toys in the waiting area with his father. It is important that the waiting room be designed and furnished with children’s interests in mind. Engaging in play or reading books often helps children relax and become more comfortable with the clinic/office setting.


Alt-Text: Hunter holds a stuffed monkey while a dental assistant speaks to him in the waiting room

A preliminary visit affords the child with developmental disabilities not only exposure to the operatory setting, but also to all those who will be involved in his/her care. This photo depicts Hunter “getting to know” Rita, Dr. Mink’s assistant. Such “warm up” interactions help diminish anxiety on the day of actual treatment.


Alt Text: Dr. Mink explains the dental procedure while Hunter sits in the dental chair

Here Dr. Mink takes time to show Hunter both the dental operatory and dental chair where he will later sit for treatment. Such interventions require a minimal investment of time from the dentist but may really pay off later when the child returns for the actual visit.

Alt Text: Hunter is smiling as he sits in the dental chair

As you can see in this photo, Hunter is now feeling quite comfortable with the operatory setting! While all children with developmental disabilities may not respond as favorably, the preliminary visit also affords the dental office staff an opportunity to identify and prepare for potential areas of concern before the actual day of treatment.

REVIEW RESOURCES

- Behavioral Management Strategies for Pediatric Patients with Down Syndrome
- Pre-visit Strategies for Pediatric Patients with Developmental Disabilities

A quick review of important points from the readings to assist with your decision making during this case.

Quiz 4.4: Decreasing Fear

In The Operatory

Consider additional strategies to help prepare Hunter for treatment.Which of the following techniques for decreasing fear of dental treatment may be useful with Hunter?

A. Providing a preliminary visit to the dental office before treatment day.
B. Establishing rapport with the child through direct conversation and exuding an aura of patience.
C. Telling Hunter that "this will not hurt", as the dentist will be very careful.
D. A and B
E. A, B, and C

Feedback:

A. Partially correct. This is an excellent strategy for familiarizing kids with the operatory setting. Anything else?

B. Partially correct. It is imperative to converse with the child in a patient manner. Anything else?
C. Incorrect. Even most careful dentists cannot guarantee that treatment will never hurt!
D. Good Choice! Both are helpful strategies to decrease fear and increase compliance.
E. Incorrect due to C. Even the best dentists cannot guarantee that treatment will never hurt!

Make a decision - When working with a child such as Hunter, which of the following strategies may the dentist use to help him relax?

A. Explore the child's areas of interest with him or her.
B. Allow the child to exercise some choice within the context of the office visit-such as desired flavor of fluoride rinse or type of reward.
C. Have the child read a social story to prepare him/her for the dental visit.
D. A and B
E. All of the above.

Feedback

A. Partially Correct. This is important for establishing rapport. Anything else?
B. Partially Correct. Providing the child with some control over a potentially stressful situation is a good idea. Anything else?
C. Partially Correct. Social stories may be very useful to prepare children for new or stressful events - such as trips to the physician or dentist.
D. Partially Correct. Both responses will foster needed rapport. Is there anything else?
E. Good Choice! All three responses represent important interventions within the dentist-child interaction.

Topic 4.5: See What Happened - Tell, Show, Do Demonstration

Note how the dentist introduces Hunter to his dental assistant - a good practice, of course, with all patients!

Note the generous praise as the dentist actively involves Hunter in this very effective "tell, show, do" demonstration.

[Video: starts with Dr. Mink and Rita are seated on either side of Hunter, who is in the dental operatory chair. Dr. Mink "Hunter, this is Rita, she is my helper"]

NOTE: This movie models one correct approach to this situation. There are many correct ways to interact with patients. Use what you have seen to improve provider-patient communication.

Lesson 5: Patient-Parent Education
Topic 5.1: Independent Oral Hygiene

Mastery of Independent Oral Hygiene
Children with Down syndrome in general take longer to master basic care skills such as dressing, brushing their teeth, etc. This may be partially related to poorly developed fine motor skills. At times, children may become frustrated and resist developing or practicing such activities. It is important for the clinician to be aware of issues surrounding self-help skills for children with developmental disabilities. The clinician should assess the level at which the child uses such skills, and promote the use of more advanced skills when appropriate.

Although it is certainly important to encourage autonomous oral hygiene in all children, those with developmental delays may require a more tailored, supervised approach to produce adequate results. One regime that may prove helpful is to have parents encourage and allow the child to brush his or her teeth independently after meals, but then instruct parents to "clean" the teeth before bedtime, including flossing or helping the child floss. Use of oral rinses can be supervised at this time as well, if indicated. It is especially important to insure that the teeth are clean before bed - as saliva flow, with its natural, cleansing properties, diminishes during sleeping hours.

Enlisting the help of an occupational therapist may help in teaching children efficient oral hygiene skills. Delays in the mastery of age-appropriate self-care activities should be assessed and documented for children with developmental disabilities. This documentation is typically required to facilitate insurance coverage for needed occupational or physical therapy.

Practical oral care for people with Down syndrome (n.d.). Retrieved June 17, 2005 from http://www.nidcr.nih.gov/HealthInformation/DiseasesAndConditions/DevelopmentalDisabilitiesAndOralHealth/PracticalOralCareforPeopleWithDownSyndrome.htm

A quick review of important points from the readings to assist with your decision making during this case.

Quiz 5.1: Educating Parents
How should the dentist best address the issue concerning oral hygiene with Hunter's parents?

A. Encourage the parents to allow Hunter to care for his own teeth and trust him to do so.
B. Discuss the need for chlorhexidine rinse for Hunter as adequate oral hygiene is most likely not possible.
C. Inform the parents that Hunter will need to see an occupational therapist in order to develop fine motor skills.

D. Instruct the parents that while they should encourage Hunter to brush independently, they need to follow-up with a thorough cleaning each night.
E. All of the above.

Feedback:

A. Not the best choice. Children of Hunter's developmental age typically require assistance to insure adequate oral hygiene.
B. Incorrect. Although chlorhexidine rinse may be useful, it is not used in lieu of oral hygiene, and good hygiene is certainly possible with parental support.
C. Not the best choice. You don't have enough information to make this referral at this point.
D. Good choice! Autonomy should be encouraged without forfeiting scrupulous hygiene.
E. Incorrect. Response D is the best choice - the others contain unwarranted assumptions.

Topic 5.2: See what Happened – Home Dental Hygiene Explained

The dentist proceeds with the oral/dental examination while inquiring about Hunter's home dental hygiene habits. The importance of thorough oral hygiene is discussed and a recommendation for a bite guard is made.

[Video starts with Dr. Mink "Does Hunter take care of his own teeth?"]

NOTE: This movie models one correct approach to this situation. There are many correct ways to interact with patients. Use what you have seen to improve provider-patient communication.

Topic 5.3: Xerostomia and Angular Cheilitis

Among individuals with Down syndrome, there is a very high incidence of mouth breathing. This feature is related to the orofacial anomalies seen in the majority of individuals with Down syndrome, as well as the chronic upper respiratory infections experienced by many of these individuals. The oral cavity in persons with Down syndrome is typically small, resulting in insufficient space for the tongue, and thus an open-mouth, tongue-protruding habit is typically adopted. Dry oral mucosa, or xerostomia, and/or angular cheilitis (cracking at the corner of the lips), typically develops in these individuals and may be accompanied by halitosis from subsequent fissuring of the tongue, which may become severe.

Xerostomia also may contribute to the development of dental caries, as saliva normally functions as a natural cleanser for the teeth. Xerostomia when severe may contribute to the development of oral infections, i.e., bacterial colonization of the oral cavity. Patients exhibiting significant symptoms may benefit from daily use of an antimicrobial rinse such as chlorhexidine. If a particular patient cannot safely use a rinse, it is typically just as effective to apply using a toothbrush. Finally, when xerostomia or angular chelitis is

present, it is important to use some type of lip balm or petroleum jelly on the patient's lips to decrease painful splitting during dental treatment.

REVIEW RESOURCES

- A Parent's Perspective on Effective Dentistry: Tips for Family-Centered Care
- Xerostomia, Halitosis, and Angular Cheilitis

A quick review of important points from the readings to assist with your decision-making during this case.

Quiz 5.3: Interventions and Xerostomia and Angular Cheilitis

In The Operatory

In what ways can you improve Hunter's level of comfort?

Make a decision - What measures/interventions may be helpful for the dentist to consider when working with a child exhibiting xerostomia and/or angular cheilitis?

A. The dentist should apply some type of balm/ointment to the lips of patients exhibiting angular cheilitis in order to prevent tissue strain during examination and/or treatment.
B. The dentist should promptly order a GI consult to determine the etiology of such conditions in order that timely treatment may be prescribed.
C. An antibacterial oral rinse should be prescribed in children who have developed fissuring of the tongue secondary to xerostomia.
D. A and C
E. B and C

Feedback:

A. Partially correct. This really should be done with all patients - particularly those with pre-existing cheilitis.
B. Incorrect. Check again! These conditions alone do not warrant a GI consult.
C. Partially correct. This may certainly be indicated. Is there anything else?
D. Good Choice! Both are important interventions to consider.
E. Incorrect - due to response B. A GI consult is not necessarily indicated.

Topic 5.4: See what Happened – Hunter's Dental Cleaning

The dentist and his assistant now proceed to clean Hunter's teeth - their patience preserves Hunter's cooperation! Note how the dad knows the best strategy for enlisting Hunter's cooperation.

[Video starts with Dr. Mink "Ok put your glasses back on Hunter."]

NOTE: This movie models one correct approach to this situation. There are many correct ways to interact with patients. Use what you have seen to improve provider-patient communication.

Topic 5.5: Improving Oral Self-Care

Adjuncts and Techniques to Improve Oral Self-Care

It is very important for all children to develop good oral care habits. In children with developmental disabilities, such as those with disabilities resulting in motor skill deficits, achieving consistent and adequate oral hygiene may prove challenging. Children with Down syndrome and some other disabilities may experience difficulties with or delays in fine motor control, which may make effective brushing and flossing difficult to perform. When this is the case, it is important for parents and/or caregivers to "subsidize" the child's efforts in order to insure success. This may best be accomplished by encouraging the child to accept responsibility for his or her own oral care while assisting the child to complete the process - particularly before bedtime.

There are several ways to help the child achieve successful oral hygiene. A power toothbrush is a simple measure, which may be used to help a child brush more effectively. There are several types of inexpensive power toothbrushes available commercially which may be recommended by the dentist. Dental flossing adjuncts are also available; these typically consist of a plastic holder through which the dental floss may be stretched to facilitate ease in flossing. It may be beneficial to teach the child to floss by holding one end of the floss while the child holds the other. In those children who are unable to open their mouths for extended periods, a simple bite block may be fashioned from a tongue depressor padded with gauze and tape. This may be inserted gently in between the teeth to facilitate caregiver cleaning when self-care is not feasible. For individuals with limited grasp, the toothbrush handle may be lengthened or enlarged by wrapping for use by those with limited range of motion.

Additionally, recent research indicates that the introduction of Xylitol-containing products, such as chewing gum, wafers, or other snacks, may significantly lower the incidence of dental caries, and may even induce some remineralization of dental defects. Researchers continue to disagree as to the exact mechanism by which xylitol produces its anticariogenic effect; whether by merely increasing salivation, inhibiting bacterial colonization, or a combination of both.

REVIEW RESOURCES

- Dental Teaching Points for Parents of Children with Developmental Disabilities
- Cognitive Variation in Down Syndrome

A quick review of important points from the readings to assist with your decision-making during this case.

Quiz 5.5: Including Patient in Education

In The Operatory

Is Hunter brushing and flossing at home? Would you address this directly with him?

Make a decision - Is it appropriate to include Hunter in oral healthcare instruction at this point?

A. No, I would just talk to the father about dental care.

B. This is something that I would do when Hunter is a couple of years older.
C. Yes, I would show Hunter the appropriate way to brush his teeth.
D. A and B

Feedback:

A. Incorrect. Children with Down syndrome exhibit a wide range of cognitive ability and are typically capable of following such instruction.
B. Incorrect. Hunter is old enough, and probably mature enough, to benefit from such instruction.
C. Good Choice! Hunter is most likely able to benefit from this instruction.
D. Incorrect. A child of Hunter's age and maturity may certainly benefit from dental hygienic instruction.

Topic 5.6: See What Happened - Proper Brushing Techniques

The dentist first demonstrates proper brushing, and then has Hunter practice brushing his own teeth. This technique also reinforces correct brushing skills with Hunter's dad.

[Video starts with Dr. Mink "Hunter, we're going to show you how to brush your teeth."]

NOTE: This movie models one correct approach to this situation. There are many correct ways to interact with patients. Use what you have seen to improve provider-patient communication.

Topic 5.7: Oral Signs of Leukemia

Oral Signs of Leukemia and other Systemic Diseases

Many systemic diseases may first be detectable within the oral cavity. When administering dental care, it is important to conduct a thorough oral exam. It is particularly important for the dental practitioner to be aware of potential conditions which may occur with increased incidence in children with developmental disabilities. For example, there is an increased incidence of leukemia in children with Down syndrome; leukemia may present in the oral cavity as tiny bleeding points on the roof of the mouth, and gums that bleed easily in the absence of another cause, such as gingivitis. Additional oral signs of leukemia include deep mouth ulcers, particularly on the gums, oral yeast infections, and cold sores/fever blisters.

Note the following list of systemic diseases paired with potentially demonstrated oral findings:

Infectious Mononucleosis: Reddened, tender gums; tiny hemorrhages on the roof of the mouth; foul-smelling breath.

Measles: Koplik spots on the lips, cheeks, palate. Koplik spots are numerous bluish flat growths that resemble grains of salt. Candida infection, leukoplakia, and bleeding, foul-smelling gums may also be present.

Hemophilia: Routine dental cleaning may induce hemorrhage.

Crohn's disease and tuberous sclerosis: These diseases may present as multiple nodules in the mouth. Deep ulcers or holes may be present in the soft tissue.

Hypothyroidism: General enlargement of the tongue if present since infancy; thickening of the lips; deciduous teeth and/or adult teeth may fail to erupt.

A quick review of important points from the readings to assist with your decision making during this case.

Quiz 5.7: Systemic Symptoms

Which of the following systemic conditions may first present in the context of the oral examination?

A. Leukemia
B. Cystic fibrosis
C. Hypothyroidism
D. Malocclusion

Feedback

A. Partially correct. Leukemia is significantly more frequent in individuals with Down syndrome. Anything else?
B. Incorrect. Cystic fibrosis is not a specific concern in regard to oral findings.
C. Partially correct. Hypothyroidism is common in children with Down syndrome and requires timely and consistent treatment. Is there anything else of concern?
D. Incorrect. Although malocclusion is indeed common in persons with Down syndrome - it does not represent a "SYSTEMIC" disease.
E. Good Choice! Both leukemia and hypothyroidism may present via oral findings.

Lesson 6: Conclusion

Topic 6.1: Ask Dad

Alt-Text: Hunters dad sits in the dental operatory

You have now finished the interactive case designed to hone your skills in treating individuals with developmental disabilities. It is important to remember that Hunter and his father ARE NOT 'actors' in the usual sense, but are real people, who have had their own experiences in obtaining appropriate dental care.

Below, virtually ask Hunter's dad about his experience, hear his responses, and learn about strategies that have been helpful.

What suggestions would you have offered the dentist who saw Hunter at his very first checkup?

I would have offered the advice that Hunter is like most children. He responds well to direct communication, and that keeping Hunter involved in the conversation is very effective in getting Hunter to cooperate with dental and other medical procedures. Keeping Hunter engaged in the conversation is best accomplished by discovering his interests, for example, asking Hunter how old he is, where he goes to school, if he has pets, does he like sports or participate in extra-curricular activities. All children have likes and dislikes, and discovering those interests is key to gaining their confidence, which is needed by any dental or medical professional.

Hunter has fewer communication skills than some children his own age. However, the dentist should not assume that because Hunter has an extra chromosome he cannot communicate. It is insulting to Hunter. Hunter does become frustrated with others who do not listen to him and do not communicate directly with him. Hunter loves to be the center of attention and cooperates fully with those individuals who communicate with him. He is just like any other person who wants to be treated with dignity and respect. Hunter likes to see people he knows, and if he sees the dentist as a friend, he will cooperate fully during the treatment.

The advice that I would like to share with all health care professionals who treat children and adults with disabilities is to have patience and speak to the patient first. No one wants to be ignored, so please listen to all your patients. Take a minute to talk with your patients, learn something about them, as it will pay off big when it comes time to treat them.

Have Hunter’s visits to the dentist been any different from what you expected?

Hunter’s visits to the dentist have not been any different from what I would expect of a small child. I have been surprised in some ways how well Hunter follows instructions from the dentist. Hunter’s first visit to the dentist was when he was five years old. The first dentist we took Hunter to had difficulty examining Hunter’s teeth and then told us Hunter would need to go to a clinic that could sedate him. However, when we took him to the UK Pediatric Dentistry, where they deal with nothing but children patients, Hunter responded very well to the dentists. The dentists treated Hunter with a lot of patience and care during his first couple of visits. Now, Hunter loves going to the dentist to get his teeth looked at.

I know parents with children without disabilities who struggle with their children when going to the dentist. I believe the key difference is the dentist. Dentists who take a few minutes to introduce themselves to the patient will have more productive visits. Knowing

your patient can make the difference between struggling with the patient or having complete cooperation.

What suggestion would you give dentists and healthcare providers on how to successfully communicate with Hunter?

The one suggestion that I think is key to communicating with Hunter is, do not assume any predetermined level of communications skills or cognitive development. In other words, do not assume that because Hunter has Down syndrome that he is dumb and cannot understand you. Some children with Down syndrome operate at higher functioning skill levels than others, just as you would find among any other group of individuals. Hunter's cognitive development is above his speech development, which is usually the case with most people. We understand more than we can say.

So, I would offer the suggestion to spend at least 2-3 minutes talking directly to a child such as Hunter, with his parents present because they can often translate what their child is saying. Parents are the best interpreters. However, speak directly to Hunter, show him what you are going to do, and then do the procedure, but reassure him that you are a friend.

How do you prepare Hunter for a trip to the dentist?

We usually tell Hunter the day before the visit that he is going to the dentist and that his mom or I will pick him up from school early. Then we remind Hunter in the morning that today is the day he goes to see Dr. Mink. Hunter is usually excited. I impress on him that it is important to get his teeth looked by Dr. Mink, so they will stay healthy. I act like it is a special treat to see Dr. Mink, like going to get ice cream.

However, sometimes I am not sure whether he is excited to go to see Dr. Mink or about getting out early from school. But, Hunter seems to enjoy going to Dr. Mink's. He likes to look at the books in the waiting room and enjoys seeing the other children. Hunter is very sociable and enjoys going places. Hunter is very responsive to positive reinforcement, so I talk to him all the way home about how much fun that was and how well he cooperated. Then the next visit, I start the process again about what an adventure it is to go see Dr. Mink.

Dr. Mink is almost as exciting as ice cream. On the other hand, as Hunter is getting older, he seems to accept going to see Dr. Mink as just another event in his daily life, as he does the rest of his doctor's appointments. Hunter enjoys seeing people he knows.

How can dentists and other healthcare professions benefit from treating Hunter and other patients with disabilities?

From the dental and health care professionals that have treated Hunter, we have noticed that they seem to gain a great amount of satisfaction in treating Hunter. Professional

satisfaction is severely lacking in most professions, which leads to burnout and turnover. However, the medical professionals that have treated Hunter seem genuinely happy about their job. As an attorney, Hunter's mom has seen that professional satisfaction is often lacking in the legal field.

Yet the dentists, the doctors and other medical professionals who treat children with Down syndrome are clearly dedicated to their profession and seem genuinely satisfied with their work. Treating children with disabilities may take patience, but you will learn a lot from them. Treating persons with disabilities can teach you how to deal with any patient, which translates to any field of practice. Being able to treat many different types of patients can be both professionally and personally rewarding to any medical professional.

Topic 6.2: Video Library
[Insert a playlist of all the YouTube videos]
Topic 6.3: Resources

- Accommodating Patients with Deafness
- Accommodating Patients with Visual Impairment
- Assistive Technology
- Emergency Procedures for Dentists
- Incidence and Prevalence of Sensory Impairments
- Interacting with Persons with Disabilities
- Legal Issues Surrounding Informed Consent
- Nonverbal Communication in the Operatory
- Orientation and Mobility
- Service Animals and the ADA
- Syndromes Causing Sensory Loss
- Usher Syndrome
- Case Information Points (printable version)

Developmental Disability Resources

- Introduction to Developmental-Disabilities
- Common Forms of Developmental Disabilities
- Using Person First Language
- Interacting with Persons with Disabilities
- Interacting with a Person with Communication Difficulties

- Understanding the Use of Nonverbal or Behavioral Communication
- Importance of Nonverbal Communication
- Medical Conditions Commonly Associated with Developmental Disabilities

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Curriculum Vita

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Education

2021	Eastern Washington University, Spokane, WA Master of Science in Dental Hygiene, Candidate, May 2021
2016	Eastern Washington University, Spokane, WA Bachelors in Science
1993	Northeastern University, Boston, MA Associate Degree in Science
1993	Forsyth School for Dental Hygienist, Boston, MA Certificate in Dental Hygiene
1993	Loma Linda University, Loma Linda, CA Certificate in Expanded Functions
1973	Southern California School for Dental Careers, Anaheim Certificate in Dental Assisting

University Coursework

All university level coursework to advance my associates degree in science to a master degree in science

Licensure/Certification

2017	Dental Hygienist-Expanded Functions State of Wyoming	Lic# 1246
2015	Laser Certification-Arizona	
1996	Dental Hygienist Extended Access State of Idaho	Lic#1014-EA
1993	National Board	
1993	NERB	
1993	Dental Hygienist Commonwealth of Massachusetts	Lic#10108
1993	Dental Hygienist Expanded Functions State of California	Lic#15743EF
1973	CPR/Basic Life Support Level C	
1973	Certificate of Radiology	
1973	Registered Dental Assistant	

State of California

Work Experience/Registered Dental Hygienist

2008-2020	Dr. Kurt Petellin, DDS Coeur d'Alene, Idaho
2006-2011	Dr.Ty Corbridge,DMD Sandpoint, Idaho
1998-2008	Dr.Ronald Forsberg, DDS Sandpoint, Idaho
1996-1998	Dr.James Miller, DDS Sandpoint, Idaho
1993-1996	Dr.Thomas Gaffaney, DDS Periodontist Whittier, California Drs Eldon and Rob Parminter, DDS Whittier, California

Work Experience/Registered Dental Assistant

1980-1988	Dr. E. D. Chatterton, DDS Whittier, California
1975-1980	Dr. Andrew Nelsen, DDS Whittier, California
1973-1975	Dr. David Liss, DDS Whittier, California

Teaching Experience

2020-	EWU, Guest Lecturer, Ethics and Law
2019-	NIC, Dental Hygiene Program Director
2017- 2019	Sheridan College, Dental Hygiene Program
2015- 2017	Fortis College Dental Hygiene Program
2014- 2015	Mohave Community College, Dental Programs
2014	Bonner General Hospital Diabetes and Oral Health
1993	Bridgewater Middle School 8th Grade Dangers of Smokeless Tobacco

Consultant Highland Behavioral: Autism and Dental Care

Research

2020	Master Degree Thesis Research: Student Dental Hygienist Perceptions of Caring for Persons with

	Developmental Disabilities Using a Virtual Patient Module
2018	Training dental professionals in ASD
2017	Clinical Attachment Level: Faculty Calibration
2014	Internet Use: The Good, the Bad and the Rude
2013	Diabetes and Oral Health: Linking Diabetes Educators and Dental Hygienists

Scholarly Activities

2017-2019	Sheridan College
2016-	Western Society of Periodontology
2007-2008	Inland Northwest Dental Hygiene Study Club
1996-	North Idaho Dental Hygiene Society Study Club

Governor Appointments

2011- 2014	Member	Idaho State Board of Dentistry
2006- 2011	Member	Idaho State Board of Dentistry

Professional Achievements

2019-	Delegate	ADHA- Idaho
2019-	Chairman	North Idaho Dental Hygienists' Society
2018	Member	ADHA Constitute Advisory Committee
2018-2019		President, WyDHA
2016-2017	Member	Health Leadership Committee Special Olympics
2013-	Examiner	Commission on Dental Competency (CDCA)
2006-	Examiner	Western Regional Dental Boards (WREB)
2002-2003	President	Idaho Dental Hygienists' Association
2000	Participant	ADHA Leadership Symposium
1994-	Evaluator	Clinical Research Foundation

Professional Memberships

2018-	Member	Special Care Dentistry Association
2017-2019	Member	WyDHA
2016-2017	Member	AzDHA Board of Directors
2013	Member	Colgate Advisory Board
2013-	Member	Organization for Safety, Asepsis and Prevention
2011-	Member	Colgate Oral Health Advisor

2006-2014	Member	American Association of Dental Boards (AADB)
2002-	Member	Idaho Oral Health Alliance
1996-	Member	North Idaho Dental Hygiene Society
1993-	Member	American Dental Hygienists' Association

Grants

2013	Idaho Dental Hygienist Foundation Community Outreach

Scholarships

2013	Idaho Dental Hygienists Association
2011	The Pat Stearns Degree Completion Scholarship

Honors

2013- 2016	Dean's List	Eastern Washington University
1991-1993	Dean's List	Northeastern University

Personal Achievements

1985	Degree of Royal Purple International Order of Job's Daughters
1987	Honorary Life Membership Parent Teacher Association

Community Service

2019-2021	Volunteer	Veterans Smile Day, Dr. Rader
2018-	Ambassador	Autism Speaks Advocacy
2018-	Volunteer	Sheridan College Kindergarten Day
2018-	Volunteer	Sheridan College Give Kids a Smile Day
2014	Volunteer	Arizona Mission of Mercy
2014	Chairman	Penguin Plunge Sandpoint Special Olympic
2013	Volunteer	ADA Mission of Mercy New Orleans
2011-2014	Commissioner	City of Sandpoint Idaho Parks and Recreation
2010-	Volunteer	Vietnam Veterans of America
2010-	Volunteer	America's Toothfairy Dental Program
2000-	Director	Special Smiles ~ Special Olympics
1998-2014	Volunteer	Give Kids a Smile Day- Coeur d'Alene, Idaho

Continuing Education

Varied topics in excess of licensure requirements.