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Assessing Nurse Practitioners' Knowledge and Clinical Practice with Regard to the Oral-Systemic Link

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A thesis

presented to

the faculty of the Department of Allied Health Sciences

East Tennessee State University

In partial fulfillment

of the requirements of the degree

Master of Science in Allied Health

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by

Angela Haynes

December 2020

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Keywords: oral-systemic link, nurse practitioner oral health education, integration of oral health, behavioral health models, oral health awareness, oral health promotion, interprofessional

ABSTRACT

Assessing Nurse Practitioners' Knowledge and Clinical Practice with Regard to the Oral-Systemic Link

by

Angela Haynes

Nurse Practitioners (NPs) comprise a significant portion of the U.S. primary care workforce and play an essential role in patients' health awareness, prevention strategies, disease management, and in providing appropriate provider referrals. Nurse Practitioners receive education on the oral-systemic connection, yet, there have been limited studies on the clinical practice of NPs assessing the oral cavity to evaluate the condition of the teeth and the oral tissues. The purpose of this study was to explore the nurse practitioners' knowledge and practice habits of assessing the oral cavity for diseases or abnormalities in the mouth that can, in turn, affect overall health. A total of 66 NPs were included in the study, primarily female (91%) with master's degrees (77%). While knowledge and education were not significantly associated, this research found significant associations between confidence and assessments, less than one-third (30.3%) were confident in their knowledge and ability to evaluate oral abnormalities.

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DEDICATION

I dedicate this work to my wonderful husband, Dwayne. Your love and support through this process has been amazing. Your patience and encouragement through all of this meant the world to me, and I am beyond lucky to share life with you.

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LIST OF ABBREVIATIONS

Adverse Pregnancy Outcomes (APO)

American Academy for Oral Systemic Health (AAOSH)

American Dental Education Association (ADEA)

Cardiovascular Disease (CVD)

Centers for Disease Control and Prevention (CDC)

Department of Health and Human Services (DHHS)

Electronic Health Record (EHR)

Health Belief Model (HBM)

Institute for Oral Medicine (IOM)

Nurse Practitioner (NP)

Nursing Role Effectiveness Model (NREM)

Oral Health Nursing Education and Practice (OHNEP)

Periodontal Disease (PD)

Registered Nurse (RN)

Rheumatoid Arthritis (RA)

Social Economic Status (SES)

World Health Organization (WHO)

Chapter 1. Introduction

Medical providers, including nurse practitioners, receive education on periodontal disease and widely accept the negative role it has on diabetes and cardiovascular disease (Llambes et al.,2015). Yet, the whole-body effects of oral conditions are not always recognized (Islam et al., 2017). Most oral diseases and conditions share modifiable behavioral risk factors such as tobacco, alcohol, and unhealthy diets (high in sugar) with the leading non-communicable diseases, including cardiovascular diseases, cancer, diabetes, and chronic respiratory diseases (WHO, 2020). Oral health is vital to systemic health and the opportunity to use primary care as an avenue for oral health assessment, promotion, and referral could improve health outcomes.

In 2019, the American Academy for Oral Systemic Health (AAOSH) estimated that at least 80% of American adults have gingival inflammation (gingivitis). Gingivitis is an early stage of periodontal disease (PD). When caught early, it can be reversed to gingival health (gum health) with the implementation of routine dental prophylaxis (cleanings) and the application of good oral hygiene habits like correct brushing and flossing techniques (Stephens et al., 2018). Poor oral health and the presence of oral disease are largely preventable, but oral disease remains the most common non-communicable disease and may affect all populations throughout their lifetime (WHO, 2020). The Global Burden of Disease Study (2017) estimated that oral disease affects more than 3.5 billion people worldwide.

Dentistry primarily focuses on two conditions: dental caries and periodontal disease (Russell & Mayberry, 2008), while the primary care provider focuses on whole body care. Numerous pathways connect oral diseases to many medical conditions and warrants the assessment of the oral cavity (Phillips & Hummel, 2016). Research is ongoing regarding ways to identify all routes through which the mouth can be a potential source or pathway of pathology

affecting all the organs and body systems (Gilliam, 2017). There are eleven different organ systems in the human body, and each of these systems is connected to the oral cavity (Gilliam, 2015). The oral cavity tissues may exhibit early and distinct signs of systemic disease involvement with these complex systems (Gilliam, 2015). The exacerbation of numerous chronic inflammatory diseases and conditions are associated with poor oral health (Dolce et al., 2017).

Moreover, oral tissues manifest early signs of systemic disease and should not be ignored (Porter et al., 2017). According to Gaddey (2017), autoimmune diseases, endocrine disorders, hematologic issues, and neoplastic processes often manifest early oral signs. Jean-Pierre (2016) found the evidence is growing of the strong association between oral inflammation due to periodontal disease (PD) and the occurrence of chronic diseases such as cardiovascular disease, diabetes mellitus (DM), rheumatoid arthritis (RA), respiratory disease, and dementia. The vast array of viral infections with oral lesions requires the primary care provider to be knowledgeable of both oral manifestations and modes of transmission (Scully & Samaranayake, 2015). Additionally, changes in the oral tissues are often the first sign of those suffering from pemphigus vulgaris, thrombocytopenia, and Crohn's disease (Chi et al., 2010).

Multiple studies have reported the connection between periodontal disease (PD), diabetes mellitus (DM), and cardiovascular diseases (CVD) (Joseph et al., 2016; Llambes et al., 2015). Diabetes has been linked to the development and progression of PD (WHO, 2020). Spontaneous bleeding in the oral cavity should prompt testing for DM, HIV, thrombocytopenia, leukemia, and referral to a dental provider for evaluation of PD (Chi et al., 2010). Many systemic conditions manifest oral manifestations in the early stages that could lead to early diagnosis (Gaddey, 2017). Oral displays can be specific and valuable to the clinician in diagnosis (Islam, 2011). According to Harber et al. (2015), more attention should be placed on the evaluation of the mouth as it is

part of the head. Nurses are trained and routinely examine the head, ears, eyes, nose, and throat (HEENT) and incorporate the "O" (oral); the assessment of the oral cavity by visual examination of the teeth, gums, tongue, palate, and mucosa (HEENOT) (Harber et al., 2015). Medical providers need to assess more than the tonsils and tongue when looking in the mouth (Gilliam, 2017).

Nurses comprise the largest group in the healthcare workforce and are vital to public health and the promotion of healthy lifestyles (While, 2014). The American Association of Nurse Practitioners (AANP, 2019) reported that more than 80% of NPs are certified in primary care and trained at the graduate level to diagnose disease. Does this training include oral disease? For numerous reasons, patients often consult their primary healthcare provider when suffering from pain or other complications of a dental nature (Dolce et al., 2017). If comprehensive, whole-body care is to be the goal of our healthcare systems, oral health cannot remain a separate, less valued area of health and disease treatment (Arigebede et al., 2012). NPs are in a great position to play a pivotal role in promoting good oral health, screening for oral and dental abnormalities, and facilitating referrals for dental care (Wooten et al., 2011).

Given the evidence of the impact of oral health on overall health, the promotion of good oral care and the practice of assessing the oral cavity should be the standard of primary, patient-centered care (Kossioni et al., 2018). The mouth has traditionally been separated from the rest of the body by the medical community, but recent evidence supports the integration of oral health in primary care (Jablonski, 2014). Prevention of oral diseases can be enhanced through increased awareness (assessment), sharing of electronic records, increased referrals between medical and dental care providers, and oral health education and promotion by non-dental providers (Atchison et al., 2018).

Best practice approaches in the treatment and management of complex patients with systemic conditions require a multidisciplinary approach involving collaboration between medical and dental providers. Routine assessments of the oral cavity may increase the number of referrals from NPs to oral care professionals and promote interprofessional collaboration between healthcare and dental professionals (Jablonski et al., 2014).

Statement of the Problem

Tooth decay is one of the most common diseases in the U. S., and tobacco use is the cause of 75-90% of oral cancers. The CDC, in 2015, reported in *Oral Health Basics* that more than 80% of the population had at least one cavity by age 34. The US spends more than $124 billion on dental care costs, an average of over 34 million school hours lost due to dental disease, and emergency dental problems resulted in over $45 billion in lost productivity for our workforce (CDC, 2015). Most oral disease is due to poor oral hygiene practices. Therefore NPs performing oral health assessments and educating patients on the promotion of good oral health are essential to population health improvement strategies (Dolce et al., 2012).

There is a vast array of literature showing evidence of the need for more interaction between medical and dental health professionals (Arigebede et al., 2012). Healthcare providers should receive educational training by dental professionals (dentists or dental hygienists) on how to perform an oral health assessment, to distinguish between healthy and diseased oral tissues, and on ways to educate and motivate patients on the relationship of poor oral health to systemic disease (Dolce et al., 2018). Moreover, an understanding of the manifestation, detection, and maintenance of oral disease to improve health outcomes is essential for all healthcare providers (Dolce et al., 2012).

Evidence-based medicine recommends oral health promotion and oral disease prevention as a high priority for non-dental health care providers (Satcher & Nottingham, 2017). Nurse Practitioners provide an essential role in health care education, disease prevention, and management. The literature is scarce concerning NP oral-systemic link knowledge and clinical practice of assessing the oral cavity.

Purpose of the Study

The purpose of this study was to explore the NPs knowledge and application of the oral-systemic link in clinical practice. A secondary intention was to assess the practice habits of evaluating the oral cavity condition and referrals to oral health providers.

Significance of the Study

This study was conducted in rural west Tennessee. There are only 50 dentists per 100,000 residents in Tennessee compared to the national average of 60 per 100,000, resulting in access to care concerns in many areas of the state (TDH, 2017). Tennessee ranks 38th in dental health for the nation (TDH, 2017). According to the 2017 Tennessee Department of Health (TDH) annual report, *Healthier people, thriving communities: Our vision for Tennessee*: 61 of 95 counties in the state of Tennessee are designated as shortage areas for primary care. In contrast, 93 of the 95 counties in Tennessee are dental care shortage areas (TDH, 2017).

Tennessee began a Public Health Nurse Fluoride Varnish program in the state in 2004 to help respond to the access to dental care issues. The Tennessee program allows public health nurses (RNs) to apply fluoride varnish and offer dental screenings. This public health nurse program targets children from birth to five years of age. The program, offered in all 95 counties at the 126 health departments, is only available up to age 20, which excludes most of the adult population.

Oral health is vital to overall health for all ages (Clark et al., 2016), and therefore, access to care to all ages remains a concern. If oral care providers and the more than 10,000 nurse practitioners in Tennessee collaborated concerning delivery of oral health education and dental provider referrals for individuals of all ages, a significant positive impact on the oral health and systemic health of communities in Tennessee could occur. The study could be replicated utilizing a larger population of nurse practitioners or for comparison with the other primary care providers.

Theoretical Framework

The Health Belief Model (HBM) provided the theoretical framework for this study (Solhi et al., 2010). Population oral health care reform efforts could include behavior modification and health improvement strategies by utilizing non-dental health care providers to assist in the education and promotion of good oral health strategies (Nash et al., 2018). While improvements to oral health prevention strategies have occurred since Surgeon General Satcher's 2000 report on the magnitude of poor oral health, oral health remains a disparity in the US (Nottingham & Satcher, 2017). A community approach to improving oral health behavior is needed. Many vulnerable populations do not have adequate means or access to oral health services (Treadwell et al., 2007). Healthcare professionals' delivery of information on how to obtain dental care and maintain oral health during clinical encounters could be beneficial to patients' perceptions of the relationship of oral health to systemic health (Yevlahova & Stur, 2009). By deliberately distinguishing a connection between oral health and overall health, NPs could increase patient motivation toward preventive oral health practices (Jablonski, 2014). Ghaffari and colleagues (2018) found that an educational intervention driven by the Health Belief Model (HBM) was effective in promoting preventive behaviors for tooth decay during pregnancy.

Research Questions

This study intended to answer the following research questions:

1. Do nurse practitioners have knowledge of the oral-systemic link?
2. Do nurse practitioners examine the condition of the oral cavity?
3. Do nurse practitioners promote oral health?
4. Do nurse practitioners refer to oral health (dental) providers?

Delimitations and Limitations

This study was delimited to nurse practitioners within an area of west Tennessee. A convenience sample of primary care nurse practitioners known by the author through professional associations was selected to participate in the study. Utilizing a convenience sample is a weakness, more statistical value could be assessed from a larger sample of respondents.

A cross-sectional study design was utilized, and the data was collected over two months in the summer of 2020. A weakness of a cross-sectional design is that the results were limited to a certain point in time and will not provide information on past trends or changes. Findings from this study only applied to nurse practitioners who participated in the research study and cannot be generalized to the entire NP population. Data were collected via electronic surveys, which can lack validity due to the respondents' knowledge, beliefs, and understanding of the questions. There was no face to face interaction with respondents, which could be perceived as a strength in providing respondents the freedom to choose whether or not to participate without feeling pressured to respond to a face to face request to complete the survey.

Assumptions of Research

This study was conducted under the assumption that all participants understood the questions and answered the surveys truthfully. Surveying primary care nurse practitioners was

assumed to be the best source for information on the oral-systemic knowledge and clinical oral assessment practices of NPs. Findings from this study reflect self-reported data. Additional studies and future research are needed to assess improvements in oral health care from the nurse practitioner population in raising oral health awareness.

Operational Definitions

Collaborative Care: nurse practitioners and oral care providers having a referral pathway and sharing relevant patient information to provide the best standard of care.

Education: Education received seeking an advanced practice nursing degree

Interdisciplinary Education: teaching separate healthcare disciplines together on the same topic from different perspectives.

Interdisciplinary Team: Comprehensive, collaborative health care delivered by healthcare providers from different disciplines, specifically nurse practitioners and oral health providers.

Knowledge: NP knowledge on the relationship of oral health to overall health.

Nurse practitioner (NP): is a post master's degree nurse recognized by state policy as primary care provider capable of providing a wide variety of basic health services.

Oral Health Assessment: the act of assessing the oral cavity including the teeth, gingiva, floor of the mouth, tongue, and the hard and soft palate for the signs of health or disease.

Oral Cavity: the tongue, gingiva (gums), teeth, and hard and soft palate

Oral Health Education: explaining, demonstrating, or providing information on good oral habits.

Oral Health Promotion: promoting the importance of oral health to overall health.

Oral Health Providers: Dentist (DDS or DMD), Registered Dental Hygienist (RDH), or any oral health specialty (Pedodontist, Periodontist, Oral Surgeon, or Endodontist)

Oral-systemic link: the relationship between oral and systemic disease.

Referral: nurse practitioners' referral to an oral health (dental) provider.

Chapter 2. Literature Review

The Relevance of Oral Disease to Medicine

Medical-Dental Divide

Primary medical health care remains somewhat divided from oral health and dentistry. Many factors are contributing to the separation of care, including different insurance coverage and models, cost of care, and a failure to integrate oral health needs and care with medical needs and subsequent care (Harnagea et al., 2017). The integration of oral health information in electronic health records is negligible, inadequate referral systems exist, and oral health care knowledge of primary care physicians and NPs is lacking (Harnagea, 2017). The incorporation of oral health assessments in primary care has multiple advantages (Harber et al., 2015). Primary care providers have more predictable contact with children, pregnant women, patients with chronic disease, and other vulnerable populations with fewer means and less access to dental care (Jablonski et al., 2014).

Phillips and Hummel (2016) reported the following standard guidelines need to be developed:

> 1). A description of practice guidelines for integrating oral health assessments into the primary care visit.
>
> 2). The need for health practitioners to have a clear understanding of what can be accomplished in the primary care setting to protect and promote oral health.
>
> 3). The development of a systematic approach to the efficient delivery of an oral health assessment in the scheduled appointment time.
>
> 4). The development of a sustainable model of communication and collaboration between dental and primary care providers. (pp. 167-172).

Oral Integration in the Electronic Health Record (EHR)

Medicine and Dentistry have historically remained siloed from one another. However, a growing amount of evidence shows the need for integration and collaboration (Dolce et al., 2017). A significant barrier to oral integration into primary care is the lack of an integrated electronic health record that incorporates oral health information and treatment. The electronic health record (EHR) is a vital component of healthcare (Berner et al., 2005). Both professions utilize electronic health records but typically do not use the same EHR (DiGangi, 2012). The sharing of clinical findings could enhance patient management and improve primary care outcomes (Atchison et al., 2018). The lack of oral integration in the EHR remains a significant barrier in reducing overlap in care and creates challenges in the exchange of information between professionals in dentistry and medicine. Leadership and input from various stakeholders are needed to develop a comprehensive electronic health record (EHR), including an oral health component that ensures the sharing and utilization of all health data by all healthcare providers (Batterham et al., 2016).

The Periodontal Disease Link

Periodontal disease (PD) is recognized as one of the most abundant sources of chronic inflammation in the body (Gilliam, 2017). Periodontitis is one of the most common infectious diseases (Singhrao et al., 2015). There is a growing body of evidence on the secure connection between oral inflammation and multiple chronic systemic diseases such as cardiovascular disease (CVD), diabetes (DM), rheumatoid arthritis (RA), respiratory disease, and dementia (Jean-Pierre, 2016). The bacteria in PD are widely accepted as a contributing factor to the prognosis of many chronic diseases (Urse, 2014). A body of evidence linking periodontal disease to systemic disease exists, and the knowledge gap between primary care outcomes and oral health is

narrowing. Yet, the prevalence of preventable oral diseases remains a significant global problem (WHO, 2020).

Periodontal disease (PD), diabetes mellitus (DM), and cardiovascular diseases (CVD) are present in a significant portion of the U. S. adult population (Southerland et al., 2006). An infected periodontium may provide an enormous and continuous bacterial load into the circulatory system, providing a pathway to multiple organ systems. It may cause irreversible damage to the immune system (Xiaojing et al., 2000). Infections associated with chronic PD are related to abnormalities in the endocrine, respiratory, musculoskeletal, reproductive, and cardiovascular systems (Arigbede et al., 2012).

Cardiovascular Disease

Atherosclerosis is the narrowing of arteries due to the deposition of plaque. Multiple studies demonstrated an association between bacteria from poor oral hygiene and PD to the plaque accumulation (Kane, 2017). Periodontitis may stimulate the C-reactive protein, which forms deposits on weak blood vessels (Li et al., 2000). Several researchers have linked PD as an independent risk factor for CVD (Beck et al., 2000; Holmlund et al., 2017; Humphrey et al., 2008; Southerland et al., 2006). Many have proposed mechanisms of how oral bacteria present in periodontal disease leads to the development of CVD (Li et al., 2000). The risk of infective endocarditis following invasive dental procedures such as extractions, root canals, and periodontal (gum) treatment is well documented (Li et al., 2000). Communication and collaboration between the dental team and the cardiologist or primary care provider could help identify individual patient recommendations to help identify and help minimize the risk based on the patient's most recent cardiovascular assessment (Mosley et al., 2014).

Diabetes Mellitus

Diabetes mellitus and periodontal disease have a bidirectional relationship and are among the most common chronic diseases (Genco & Bornakke, 2020). Diabetes increases the risk of developing PD, and PD adversely affects glycemic control (Genco & Borgnakke, 2020). Periodontal therapy for diabetic patients is crucial in the management of diabetes (Jeffcoat et al., 2014). Preventive oral care and periodontal treatment can impact glycemic control (Kane, 2017).

Pulmonary Disease

Periodontal disease (PD) is associated with multiple pulmonary diseases. Aspiration pneumonia, a leading cause of mortality in older frail populations (Kossioni et al., 2018), most often occurs when heavily colonized periodontal bacteria from poor oral health is aspirated into pulmonary tissues (Manger et al., 2017). Pneumonia, emphysema, and chronic bronchitis all involve the aspiration of bacteria from the oral cavity (Kane, 2017). According to Zeng et al. (2012), many studies suggest chronic obstructive pulmonary disease (COPD) has a strong association with PD; they share the risk factors: smoking, age, obesity, and socioeconomic status (SES).

Adverse Pregnancy Outcomes

There is a body of evidence pointing to the role of oral bacteria in intrauterine infections as a factor in adverse pregnancy outcomes (APO) (Han, 2011). Changes to gingival tissues during pregnancy are associated with changes in hormone levels. Pregnant women with periodontal disease have a 7.5 times greater chance of having a pre-term, low birth weight baby (Kane, 2017). Wooten et al (2011) completed a study regarding NPs and certified nurse midwives' knowledge, opinions, and practice behaviors regarding periodontal disease and adverse pregnancy outcomes. The survey responses indicated these practitioners had limited

knowledge of oral health (Wooten et al., 2011). The results of this study suggest better interprofessional collaboration could improve the perceptions and oral health care of pregnant patients (Wooten et al., 2011). Wu et al (2015) researched the relationship between gingival inflammation and pregnancy and indicated an association between increased pregnancy hormones and a decline in gingival health (Wu et al., 2015).

Dementia

Multiple studies have shown an association between chronic inflammation from PD and an increased risk of dementia and Alzheimer's (Singhrao et al., 2015). Periodontal disease and Alzheimer's share common risk factors related to the presence of inflammation and may impact brain function (Gilliam, 2017). Elevated systemic inflammation may contribute to the worsening of existing brain pathology (Gilliam, 2017). A recent meta-analysis study (Nadim et al., 2020) concluded that population-based strategies in prevention of periodontal disease could reduce the dementia burden.

Rheumatoid Arthritis (RA)

Periodontal disease is associated with the higher risks of rheumatoid arthritis (RA) in the musculoskeletal system (Arigbede et al., 2012). RA is a chronic, immune-mediated inflammatory disease (Mays et al., 2012). Oral manifestations of RA can include temporomandibular joint involvement. An increased association between RA and PD has been the focus of several studies (Mays et al., 2012). Manual dexterity can be compromised in some RA patients. Oral hygiene tools and techniques may need to be tailored to accommodate the manual abilities of each individual.

The Magnitude of the Oral Manifestations of Systemic Disease

According to Satcher (2000), an oral examination can reveal early signs and symptoms of more than 90% of systemic disease. Many systemic conditions will manifest in the oral cavity before evidence shows elsewhere (Salas-Vega et al., 2015). Oral manifestation of numerous systemic disorders may vary in frequency and presentation (Porter et al., 2017). Routine examination of the oral cavity may reveal mucosal changes, inflammation, or bleeding indicative of systemic disease (Salas-Vega et al., 2015). It is likely that with the renewed focus on oral assessment and a better understanding of the oral-systemic connection, the number of individuals diagnosed with oral manifestations of systemic diseases will continue to rise (Porter et al., 2017).

Oral and Other Cancer

According to Montero and Patel (2015), oral cancer is a common malignancy, and the most common risk factors are the use of tobacco and alcohol. The chronic human papillomavirus (HPV) infection carries a risk of malignant transformation (Syrjanen, 2018). According to the CDC (2015), HPV has a causal role in nearly all cervical cancers, and many penile, anal, vaginal, vulvar, and oropharyngeal cancers. The American Cancer Society (2020) estimates that more than 53,260 people have oral and oropharyngeal cancer, and an estimated 10,750 will die from these cancers. Oral cancer treatment options are improved with early disease detection and best served by a multidisciplinary treatment approach (Montero & Patel, 2015). Early detection of these cancers may allow for more treatment options and improved outcomes.

Malignancies in the oral cavity are usually described by anatomical location: lip, tongue, the floor of mouth, gingiva, buccal mucosa, retromolar trigone, or the hard palate (Montero & Patel, 2015). According to Ibsen and Phelan (2018), types of oral malignancies may include squamous cell carcinoma, adenocarcinoma, melanoma, fibrosarcoma, chondrosarcoma,

osteosarcoma, liposarcoma, angiosarcoma, lymphangiosarcoma, leiomyosarcoma, and rhabdomyosarcoma. Squamous cell carcinoma constitutes more than 90% of oral cancers (Montero & Patel, 2015). Leukoplakia (white patches that do not rub off) and erythroplakia (red patches) may have a premalignant tendency. Red or white spots, of longer than a two-week duration, may indicate the need for referral. Leukemia, lymphoma, and multiple myeloma may have oral involvement (Ibsen & Phelan, 2018). Dental radiographs can lead to early diagnosis of malignancies.

There are numerous oral complications like mucositis, xerostomia, dental caries, and oral candidiasis associated with the treatment of cancer. Many of these oral complications require dental treatment or palliative care strategies by medical providers (Perry et al., 2015).

Endocrine Disorders

In 2017, Gaddey predicted that up to 44 million of the US population might be affected by diabetes (DM). The bidirectional link between DM and PD and the importance of maintaining oral health to aid in glycemic control have been discussed earlier in this paper. Other endocrine disorders like hyperthyroidism and hypothyroidism can manifest oral changes. Hypothyroidism may present with thickened lips or an enlargement of the tongue (Ibsen & Phelan, 2018). Addison's disease, an adrenal disorder, may first present as hyperpigmentation in the oral cavity (Gaddey, 2017).

Oral Manifestations of Viral Infections

Herpes Virus

There are two major forms of the herpes simplex virus: type 1 and type 2. Oral infections are type 1, and genital infections are type 2. The initial oral outbreak of herpes simplex is sometimes referred to as primary herpetic gingivostomatitis. The primary outbreak may exhibit

systemic symptoms like fever, malaise, swelling of the cervical lymph nodes, along with multiple ulcerations, and mucosal vesicles (Ibsen & Phelan, 2018). The herpes virus may remain in a latent state and later manifest as a recurrent herpes simplex infection (Ibsen & Phelan, 2018). Recurrent herpes most commonly occurs on the vermilion border of the lips and is frequently called a cold sore or fever blister (herpes labialis) (Neville et al., 2009). Recurrent herpes can manifest intraorally on the hard tissue that covers bone like the hard palate or gingiva (Ibsen & Phelan, 2018).

Varicella-Zoster Virus (VZV)

The varicella-zoster virus causes both chickenpox (varicella) and shingles (herpes zoster). Both may have oral manifestations and typically don't cross the midline of the mouth (Ibsen & Phelan, 2018). Herpes zoster often occurs with an association to an immunocompromised state in conjunction with certain malignancies, such as leukemia and Hodgkin disease (Ibsen & Phelan, 2018).

Coxsackievirus

The coxsackievirus is usually associated with hand, foot, and mouth disease and sometimes acute lymphonodular pharyngitis (Scully & Samaranayake, 2016). The lymphoid tissue of the soft palate with lymphonodular pharyngitis can display yellowish or dark pink nodules on the tonsillar pillars (Ibsen & Phelan, 2018). It is typically a self-limiting disease commonly causing dehydration from painful ulcers, making eating and swallowing difficult. There have been rare complications of pneumonia, encephalitis, and meningitis (Scully & Samaranayake, 2016). Herpangina is initiated by the coxsackievirus and includes fever, malaise, sore throat, difficulty swallowing, and vesicles on the soft palate (Ibsen & Phelan, 2018).

Epstein-Barr Virus

The Epstein-Barr virus is associated with numerous oral diseases, including infectious mononucleosis, nasopharyngeal carcinoma, Burkitt lymphoma, and hairy leukoplakia (Ibsen & Phelan, 2018). The Epstein-Barr virus is characterized by fever, malaise, sore throat, swollen lymph nodes, an enlarged spleen, and palatal petechiae early in the onset of disease (Ibsen & Phelan, 2018). Infectious mononucleosis is typically self-limited and resolves within 4-6 weeks. Reoccurrence occurs in some patients, and treatment is not usually required. Oral presentation of hairy leukoplakia occurs most commonly with patients infected with human immunodeficiency virus (HIV) (Ibsen & Phelan, 2018).

Paramyxovirus

The paramyxovirus is responsible for measles and mumps. Measles present early in the disease stages with Koplik spots (small red macules with white centers) in the oral cavity (Ibsen & Phelan, 2018). Mumps is characterized by swelling of the glands, often beginning with the salivary glands (Neville et al., 2009).

Human Immunodeficiency Virus (HIV)

Patients with HIV will often suffer from opportunistic diseases in the oral cavity such as candidiasis, herpes simplex infection, herpes zoster, hairy leukoplakia, Kaposi sarcoma, lymphoma, linear gingival erythema (LGE), necrotizing ulcerative gingivitis (NUG), necrotizing ulcerative periodontitis (NUP), necrotizing stomatitis, spontaneous gingival bleeding, aphthous ulcers, bilateral parotid gland enlargement, and macular melanin pigmentation (Neville et al., 2009). The dental care setting has been proposed as a possible venue for rapid HIV testing (Siegel et al., 2012).

Human Papillomavirus (HPV)

Oral HPV infections have been linked to sexual behavior, mother to child during the intrauterine period, and saliva (Syrjanen, 2018). The most common clinical oral manifestation of HPV is the oral papilloma/condyloma (Syrjanen, 2018). HPV lesions are typically found on the squamous epithelium and can be described as cauliflower-like in appearance (Neville et al., 2009). The other oral lesions that look like the papilloma are the verruca vulgaris (common wart) and the condyloma acuminatum (venereal wart) (Ibsen & Phelan, 2018). Treatment of benign HPV lesions includes surgical removal, cryotherapy, electrosurgery, laser therapy, and trichloroacetic acid (Syrjanen, 2018).

Common Oral Infections

Fungal Infections

Oral candidiasis is a result of the overgrowth of Candida albicans and is the most common oral fungal infection (Ibsen & Phelan, 2018). There are numerous conditions associated with this overgrowth, including antibiotic therapy, chemotherapy, corticosteroid therapy, dentures, DM, HIV, xerostomia, and an immune-compromised state (Neville et al., 2009). The types of oral candidiasis are pseudomembranous, erythematous, denture stomatitis, chronic hyperplastic, and angular cheilitis. Topical or systemic antifungal medications are used in the treatment of oral candidiasis. Deep fungal infections can manifest oral lesions secondary to primary involvement of the lungs (Neville et al., 2009).

Bacterial Infections

A dental abscess is a localized bacterial infection at the apex of a tooth (periapical) and may be linked to periodontal disease, caries, or trauma. Periapical infections can spread through the bloodstream and possibly result in systemic complications. Ludwig's angina is a dangerous

infection primarily resulting from an infection of the second or third molars and is characterized by a diffuse bilateral swelling (cellulitis) in the submandibular and sublingual areas (lower jaw). Immediate referral to an oral surgeon is recommended as an airway obstruction may occur from the swelling, and advanced cases may require the airway to be secured with surgical drainage (Candamourty et al., 2012).

Oral Manifestations of Autoimmune Diseases

Sjogren Syndrome

Sjogren syndrome is an autoimmune disease affecting the salivary and lacrimal glands (Saccucci et al., 2018). It is diagnosed based on clinical oral presentation (Saccucci et al., 2018). Palliative treatment with saliva substitutes and salivary secretion can be increased by taking pilocarpine (Saccucci et al., 2018). Good oral hygiene habits are needed to help prevent decay from the xerostomia.

Behcet's Disease

Behcet's disease (BD) is a chronic, multisystem inflammatory disease with the early onset of oral ulcers (Mays et al., 2012). After the start of oral ulcers, BD manifests mucocutaneous lesions recurring in the genitalia, skin, oral cavity, and involves the ocular, vascular, digestive, and nervous systems (Mays et al., 2012). Oral lesions are described as well-defined white to yellowish lesions with red rim (Mays et al., 2012). Clinical management of this disease typically involves systemic immunosuppressive therapy and palliative treatment for pain associated with ulcerations. (Mays et al., 2012).

Systemic Lupus Erythematosus (SLE)

Systemic lupus erythematosus (SLE) is a severe, chronic autoimmune disorder. SLE can be varied in clinical presentation and commonly has oral discoid lesions (Saccucci et al., 2018). Skin damage was recorded in many SLE cases (Saccucci et al., 2018).

Crohn's Disease (CD)

The first signs of Crohn's disease (CD) may include diffuse mucosal swelling or a cobblestone mucosal appearance along with localized gingivitis (Chi et al., 2010). Crohn's disease is an inflammatory bowel disease that may affect any of the alimentary canal from the mouth to the anus (Chi et al., 2010). The clinical management of CD is to suppress the inflammatory response. Patients with CD are prone to nutritional deficiencies, are at an increased risk for oral cancer, and are best treated with a multidisciplinary approach (Chi et al., 2010).

Pemphigus Vulgaris

Pemphigus vulgaris is a chronic immune-mediated disorder (Ibsen & Phelan, 2018). In more than 50% of the cases, the first sign is blisters or vesicles in the oral mucosa (Saccucci et al., 2018). Pemphigus vulgaris is often associated with SLE and RA. Treatment includes high-dose corticosteroids and often immunosuppressive drugs, and a multidisciplinary approach between medical and dental providers works best for these patients (Saccucci et al., 2018).

Mucous Membrane Pemphigoid (MMP)

Mucous membrane pemphigoid (MMP) is a group of immune-mediated chronic blistering conditions involving oral, genital, conjunctival, and skin mucous membranes (Saccucci et al., 2018). MMP is benign but a chronic disease that requires continuous treatment strategies (Saccucci et al., 2018).

Lichen Planus

Lichen planus is a chronic, benign, inflammatory disease affecting the oral mucosa or skin (Neville et al., 2009). The oral mucosa lesions typically present in a lacelike pattern on the mucosa. Lichen planus is a chronic disease, and treatment is only indicated when lesions are symptomatic. Treatment includes topical corticosteroid medications (Ibsen & Phelan, 2018).

Sarcoidosis

Sarcoidosis is a multisystem granulomatous disease with distinct painless ulcerations of the tongue. Oral involvement of sarcoidosis can be a sign of organ involvement and is usually accompanied by loose teeth due to bone loss. Corticosteroids are the treatment of choice in patients with symptoms. Other drugs, such as chloroquine, methotrexate, infliximab, and thalidomide, are also used in the treatment of sarcoidosis (Suresh & Radfar, 2005).

Rheumatoid Arthritis (RA)

Rheumatoid arthritis (RA) is a chronic, immune-mediated inflammatory disease. Oral manifestations of RA can include temporomandibular joint involvement (Mays et al., 2012). An increased association between RA and PD has been the focus of several studies (Mays et al., 2012). RA patients may need modification of existing oral hygiene devices or the implementation of specialized oral hygiene aids.

Connective Tissue Disorders with Oral Manifestations

Ehlers Danlos (EDS)

Oral manifestations are observed in all Ehler Danlos (EDS) patients (Mitakides & Tinkle, 2017). EDS is a hereditary disorder affecting the connective tissue and collagen throughout the body (Mitakides & Tinkle, 2017). Oral soft tissue is often thin and fragile with this syndrome

(Mitakides & Tinkle, 2017). Patients with EDS present clinically with significant skin hyperlaxity and often have temporomandibular joint (TMJ) involvement.

Dental visits should be short, and careful attention paid to fragile tissues to avoid injury, and dental surgery should be avoided when possible (Mitakides & Tinkle, 2017). Early-onset of periodontitis is associated with EDS. A variety of medications are used to treat the symptoms of this disorder, including muscle relaxants, anti-inflammatories, mood elevators, pain medications, and Botox injections (Mitakides & Tinkle, 2017). Physical therapy also offers help with range of motion issues with this disease.

Scleroderma

Scleroderma is a chronic autoimmune connective tissue disorder. Systemic scleroderma (systemic sclerosis) may have near-total organ involvement. Esophageal dysmotility is common, predisposing patients with systemic sclerosis to gastroesophageal reflux disease (GERD). Patients with scleroderma often have difficulty in opening the mouth wide enough for dental procedures. Patients with systemic sclerosis face a wide range of oral manifestations and complications to dental procedures. Special considerations must be made regarding local anesthesia due to the loss of vascular integrity (Derbi & Borromeo, 2018). Treatment requires a multidisciplinary approach between medical and dental providers.

Oral Manifestations of Hematologic Diseases

Oral manifestations for all types of anemia may include pallor, erythema, tissue atrophy, and angular cheilitis (Neville et al., 2009). Iron deficiency anemia is the most common type of anemia in the US (Ibsen & Phelan, 2018). Plummer-Vinson syndrome is a rare development of longstanding iron deficiency and has an increased risk of oral and esophageal cancer (Ibsen & Phelan, 2018). Pernicious anemia is a vitamin B12 deficiency. Oral manifestations of pernicious

anemia include angular cheilitis, mucosal pallor, ulcerations, and burning, pain, or other changes in the tongue (Ibsen & Phelan, 2018). Sickle cell anemia is an inherited disorder involving the red blood cells (Neville et al., 2009). Oral manifestations of sickle cell are seen on dental radiographs. Antibiotics are essential in managing infections. Aplastic anemia is a life-threatening blood disorder. Oral signs of aplastic anemia include infection, spontaneous bleeding, petechiae, and purpuric spots (Ibsen & Phelan, 2018).

Thrombocytopenia

Thrombocytopenia is a condition involving a low level of platelets. Idiopathic thrombocytopenic purpura is an acquired platelet disorder that has the early manifestation of spontaneous bleeding gingiva. Collaboration with the hematologist would be the best approach before planned invasive dental procedures with any platelet abnormality (Islam et al., 2017).

Oral Manifestations of Eating Disorders

Erosion is a loss of tooth structure from contact with acid. The eating disorder bulimia may exhibit acid wear on teeth from frequent vomiting (Ibsen & Phelan, 2018). Anorexia nervosa is another eating disorder linked to a fear of gaining weight and self-deprivation of food (Ibsen & Phelan, 2018). Signs of malnutrition are visible in the oral cavity, and irritation of the lips and oral mucosa may be present. Erythematous lesions are often present on the palate from the purging behavior involved in bulimia.

Effects of Medications on the Oral Cavity

There are over 500 documented medications that have oral manifestations, and these may be intensified in the elderly and medically compromised patients (Kane et al., 2017). Primary care practitioners and dental care providers should collaborate and communicate on the treatment and medication manifestations of these complex patients (Kane et al., 2017). There is a

magnitude of evidence of the need for interprofessional education and collaboration between dental and primary care providers, such as NPs, to reduce overlap in care and improve health outcomes (Dolce et al., 2017).

Toward an Interprofessional Approach

According to Atchison, Rozier, and Weintraub (2018), an estimated 108 million Americans see a health care provider but not a dental care provider. Primary care practitioners have a low degree of knowledge of periodontal disease (Varela-Centelles et al., 2018, p. 915), indicating that oral care providers need to work collaboratively with primary care providers. Dental providers promote oral health and prevention strategies. Still, access to dental care remains an issue in some populations suggesting that oral health promotion by nurses could play a significant role in the improvement of their patients' oral health knowledge (Dolce et al., 2012).

Atchison, Rozier, and Weitraub (2018) reported the need for increased oral health training for all healthcare providers to assist dental providers in reducing the widespread epidemic of preventable oral health issues. Healthcare providers need adequate training to use oral health assessments to educate patients on the relationship of oral health to systemic disease and its role in disease manifestation, detection, and maintenance (Dolce et al., 2012). The Institutes of Medicine (IOM) published a report in 2011, citing a lack of oral health knowledge for non-dental health care professionals. The IOM (2011) suggested multidisciplinary teams could better address population health with non-dental healthcare professionals; thereby, increasing their role in oral health care and promotion. The evidence of the link of oral health to systemic health is overwhelming, and the connection deserves collaborative care strategies from medical and dental providers alike (Atchison et al., 2018).

The disjointed primary oral health care in America could be an argument to influence universal health coverage (Fisher et al., 2018). Historically, there has been a distinct separation of the mouth from the rest of the body regarding healthcare, but current evidence supports the integration of oral health into primary care (Atchison et al., 2018). More communication and collaboration between medicine and dentistry is essential (Atchison et al., 2018).

Nurse practitioners are in an excellent position to fill some of this void by providing oral health and caries risk assessments, along with appropriate oral health education (Jablonski et al., 2014). Furthermore, oral health is part of primary health care, and better frameworks are needed to establish mechanisms for referrals between oral health professionals and other healthcare professionals (Atchison et al., 2018).

Nurse Practitioners' Role in Collaborative Care

The integrative collaboration of medicine and dentistry is a complex task; however, it is needed to accomplish an integrated health system that includes oral health assessment tools and referral strategies (Atchison et al., 2018). To date, poor oral health remains a silent and widespread epidemic (Benjamin, 2010). According to Baelum (2011), increasing oral health awareness is going to require collaboration between medical and dental communities. In 2016, the US Department of Health and Human Services called for an increased focus on multidisciplinary practitioner collaboration and improved educational tools to provide comprehensive prevention strategies in health care (US DHHS, 2016).

Nurse practitioners are vital to primary care of all populations (Wooten et al., 2011) and instrumental in educating and guiding patients' preventive care knowledge and behaviors (Jablonski et al., 2014). Stakeholders and advocates agree that a shift toward interprofessional education and collaboration is critical for a change to occur (Manski et al., 2015). According to

the 2019 NP Fact Sheet by the American Association of Nurse Practitioners (AANP), there are more than 270,000 NPs in the US. The AANP reports that 99% of NPs have graduate degrees, and over 87% are certified in primary care. Nurse practitioners play a vital role in primary care of the population and are instrumental in educating and guiding patients' preventive care knowledge and behavior.

The focus on improvements to population health includes improving educational tools and increased collaboration among multidisciplinary practitioners, trained to provide more comprehensive health care prevention strategies (Wilder et al., 2008). The integration of medicine and dentistry requires a complex collaboration; however, the need for integrated oral health assessment tools, population approaches to oral health promotion, and referral strategies could advance this collaboration (Atchison et al., 2018).

This collaboration would require enhancements to educational frameworks and curricula with the addition of interdisciplinary education of the oral-systemic link. One of the goals of the American Dental Education Association (ADEA, 2017), is to seek health care providers who will develop and support new oral healthcare models within an integrated health system addressing the needs of the entire population. The addition of demonstrable oral hygiene techniques and case-based educational models involving the oral-systemic link to current curricula may raise educational effectiveness in oral health knowledge and promotion (Dolce, 2012).

Nurse Practitioners' Readiness for Improving Oral Health

Oral health of an individual significantly impacts total health and is included in nursing education; yet, some nurses still report a lack of knowledge and skills to conduct an oral assessment and lack of confidence to explain and demonstrate oral health instructions and techniques (Nash et al., 2018).

Given the evidence supporting the oral-systemic link to overall health, various scholars have raised concerns regarding oral health knowledge, and training nurses possess and whether they apply this knowledge in clinical practice (Dolce et al., 2017). These questions are raised by some scholars citing cases in which nurses have shown a lack of knowledge of the oral-systemic link (Holmlund et al., 2017).

With the magnitude of their workforce and training in whole-body wellness strategies, NPs with appropriate education may play a significant role in improving the quality of the oral health of multiple populations and improve access to care for many (Dolce, 2012). The Nursing Role Effectiveness Model (NREM) focuses on the contribution of nursing care to enhance patient outcomes. With adequate didactic and clinical education, nurse practitioners could integrate oral health prevention and promotion strategies into clinical practice (Atchison et al., 2018). Furthermore, improvements in oral health could contribute to improved health outcomes and decreased morbidity (Dolce et al., 2012).

Nurse Practitioners' Role in Oral Behavior Modification

Preventive health behaviors and the modification of poor health behaviors may have the most significant impact by utilizing a population approach, with a common goal of improving health care for all, including the underserved populations (DiMarco et al., 2009). Oral health is overlooked in public health care systems (Kelly, 2016), and NPs are in a great position to influence patients' health beliefs and health behaviors across the life span and provide a broad range of health promotion and disease prevention activities (Jablonski et al., 2014).

Nurse practitioners also serve a substantial role in population health care and care to those unable to care for themselves and in the training of the registered nurses (RNs) (Zimmerman, 2015). The Health Belief Model (HBM) and other health behavior models and

theories are often associated with preventive care strategies and utilized as tools to educate and to motivate patients to understand the perceived benefits of modifying and improving preventive health behavior (Solhi et al., 2010).

Examples of models that focus on helping individuals assume responsibility for their health are: The Health Belief Model (HBM), Transtheoretical Model (TTM), Theory of Reasoned Action (TRA), Self-Efficacy, Locus of Control, and Sense of Coherence (Hollister & Anema, 2004). The Health Belief Model (HBM) was developed by Hockbaum in the 1950s and was first utilized by the US Public Health Service to motivate parents to have their children immunized. The guiding principle of the HBM is that individual health practices are based on personal choices and the perceived need for preventive care. The application of the HBM in regards to oral health during primary care visits can aid the health care provider in educating and motivating patients regarding the importance and consequences involved in their oral health and its relationship to their overall health (Solhi et al., 2010).

The transtheoretical model (TTM) was developed in the late 1970s by Prochaska and DiClemente. TTM rests on the belief that individuals go through stages of change rather than quickly changing their behavior (Hollister & Anema, 2004). The TTM includes six stages of change: pre-contemplation, contemplation, preparation, action, maintenance, and termination. The possibility of relapse is the final stage in this model.

According to the Theory of Reasoned Action (TRA), people make decisions based on their values, knowledge, and attitudes, and it happens in a sequence of changes. Changes can impact others, and social contexts can affect behavior (Hollister & Anema, 2004). Self-Efficacy, Locus of Control, and Sense of Coherence are associated with the Social Cognitive Theory

proposed by Bandura and are about individuals changing the behavior as a result of gaining knowledge, their environment, and seeing results (Hollister & Anema, 2004).

There is no "one size fits all" approach when it comes to modifying health behavior. However, individuals must first believe that the benefits associated with a health behavior will outweigh the effort it will require of them. There is a recognized need for oral health awareness and the delivery of oral health information in health care encounters (Dolce, 2012).

Summary

Research of all the oral-systemic links to disease is ongoing. There are numerous oral manifestations of systemic disease and oral complications from medication(s). Oral health affects whole-body health and is connected to the quality of life. According to Sun et al. (2015), there were more than 2 million dental disease-related visits to the emergency room. Dental disease is a common reason for visits to primary care NPs. Oral disease is mostly preventable, and nurse practitioners are positioned to assist in reducing the rates of oral disease with the implantation and utilization of oral health assessments (screenings), oral-systemic health education (assessing oral hygiene), and collaborative care (invention and referral) with dental care providers (Stephens et al., 2018).

Documentation and information sharing should, at a minimum, include: oral health care history, oral health practices, tobacco and alcohol consumption and tobacco cessation recommendations, dietary counseling, and the results of an oral health assessment (screening) along with any prescribed medications, referrals, or other recommendations (Atchison et al., 2018). Primary prevention strategies and interventions from more than just dental care providers can reduce the oral disease burden and improve whole-body health and quality of life (WHO, 2018).

Chapter 3. Methodology

Overview

The study assessed NPs knowledge of the oral-systemic link and their practice of evaluating the oral cavity. There has been an increased awareness of the connection between oral health and systemic disease in recent years, and NPs are at the forefront of primary care (Dolce et al., 2018). Many systemic diseases have oral manifestations. NPs assessing the oral cavity during primary care encounters could lead to early diagnosis and treatment and improve the overall quality of life by improving health outcomes. The intended result of the study is to provide data about the inclusion of oral health assessment and oral health-related interventions by NPs as part of their new and routine patient examinations.

Research Questions

More specifically, this study sought to answer the following four questions: 1). Do nurse practitioners have knowledge of the oral-systemic link? 2). Do nurse practitioners routinely examine the condition of the oral cavity? 3). Do nurse practitioners promote oral health? 4). Do nurse practitioners refer to oral health (dental) providers?

Research Design

This study used a non-experimental, exploratory design (Cottrell & McKenzie, 2011) that collected data about nurse practitioners' knowledge of the oral-systemic link and their clinical practice habits related to assessing the oral cavity. This design was chosen since an experimental research design was not appropriate for this study. The study was designed to answer the four research questions and to collect community data. A cross-sectional study best fit the researcher’s time frame: there was not adequate time for the researcher to complete a cohort

study. Cross-sectional research provides a good measure of current practices (Cottrell & McKenzie, 2011). The East Tennessee (ETSU) Institutional Review Board (IRB) deemed the study exempt.

The study was not intended to determine cause and effect data and the research variables were not manipulated. The data collected was self-reported and unable to be deemed error-free, which is a weakness of this research design (Cottrell & McKenzie, 2011). A weakness in the cross-sectional design is that it can be biased and doesn't show time order, and it is more difficult to link causation (Cottrell & McKenzie, 2011). A strength of this simple design is the ability to capture a snapshot of current information and practices. This quantitative study was cross-sectional and utilized descriptive research statistics.

Survey Instrument Design

I developed a 32 question survey instrument (Appendix A), some of the questions were developed with extracted information from two studies "North Carolina cardiologists knowledge, opinions, and practice behaviors regarding periodontal disease and cardiovascular disease" (Mosley et al., 2014) and "North Carolina internists and endocrinologists' knowledge, opinions, and behaviors regarding periodontal disease and diabetes: Need and opportunity for interprofessional education" (Owens et al., 2011), with the permission of one of the authors of both studies, Rebecca Wilder (Appendix C). Ms. Wilder gave me permission to modify the information to align with my research questions and respondents. The questionnaire was pilot tested prior to opening the study. The questionnaire for this study was intended to investigate the NPs knowledge of the oral-systemic link, clinical practice of assessing the oral cavity, oral health promotion, and referral to dental providers.

Question 1 asked if the respondent's NP certification was in the state of Tennessee or in another state. Question 2 asked if respondent was certified in primary care. Question 3 asked about the respondents' highest degree. Questions 4 -7 were demographical and adapted from the study "North Carolina 'Cardiologists' Knowledge, Opinions, and Practice Behaviors Regarding the Relationship between Periodontal Disease and Cardiovascular Disease" (Mosley et al., 2014). These demographics were slightly modified to better align with the participants in this study and data from these questions was utilized to determine if there were differences in clinical practice habits based on age, gender, working hours, or experience. Questions 8-11 were about the NPs education and perceptions adapted and modified to fit NPs, rather than MDs from the study "North Carolina 'Internists' and 'Endocrinologists' Knowledge, Opinions, and Behaviors Regarding Periodontal Disease and Diabetes: Need and Opportunity for Interprofessional Education" (Owens et al., 2011). Questions 12-20 were developed to assess oral-systemic knowledge. Question 21 was on confidence when examining the condition of the oral cavity. Questions 22-25 assessed their practice habits pertaining to oral assessments. Question 26 addressed the frequency of assessing the lymph nodes of the head and neck. Question 27 addressed frequency of providing oral health education to patients and the promotion of receiving routine preventive care. Questions 29-31 were about their referral practices to oral health providers. Finally, Question 32 collected data about the primary reasons for not referring to a oral health (dental) provider.

Population

The population of this study included licensed nurse practitioners. To determine the utilization and knowledge of the oral-systemic link and to determine the practice of assessing the

oral cavity, the study utilized a convenience sample of NPs. Nurse practitioners reporting on their practice habits is the best source of data for the research.

Informed Consent

The survey first had the respondent agree to participate and then asked the respondent to attest to the inclusion criteria of being licensed as a nurse practitioner. The survey required the inclusion criteria of being a licensed NP to be met in order to begin the survey. Checking the box for the confirmation of inclusion criteria opened the survey questionnaire and confirmed the participants' eligibility and willingness to participate in the study.

Pilot Test of Survey Instrument

The study's survey was pilot tested by three NPs. Two of the pre-test survey respondents were NP faculty members, one from the University of Tennessee Health Science Center and one from the University of Memphis. The third pre-test of the survey instrument was completed by a practicing NP working in a primary care practice. The faculty members and a primary care NP were emailed a copy of the questionnaire (Appendix A) and the pilot study feedback form (Appendix B). All pilot test respondents stated it took less than five minutes for them to complete the questionnaire. Their recommendations listed on the pilot feedback form included: the addition of the option of a non-nursing doctoral degree as a response choice to the question of educational degree, and to include response choices including transportation and indigent care as possible barriers to referrals. The survey instrument was modified to include the recommendations.

Data Collection

The email addresses were obtained from personal clinical practice experience, professional affiliations, through volunteer work at local volunteer free health clinics, and

referrals from friends of NPs. A convenience sample of 148 nurse practitioners were emailed a participation letter with a link to the consent letter for review and the participant was asked to check a box attesting to the eligibility of participation in the study by meeting the inclusion criteria of being a licensed nurse practitioner. REDCap was utilized to build the survey questionnaire, and the link was sent from my ETSU student email account. Those in the sample were sent two follow up letters to encourage the completion of the survey at an interval of two and four weeks from the date of the initial participation request letter. Data was collected for one month from July 30 – August 30, 2020, via REDCap electronic research platform (Harris et al., 2009). Sixty-six nurse practitioners fit the inclusion criteria and consented to the study, and their response data were reported.

Data Analysis

The data collected in REDCap survey software was exported to Microsoft Excel and imported into IBM SPSS version 25 (IBM Corp, 2017) software for analysis. Descriptive univariate analyses for all survey questions are presented in tables using percentages for categorical variables. Bi-variate associations explored key variables of interest, to include associations between:

- Education (education in association of poor oral health and presence of systemic disease) and Knowledge (oral-systemic knowledge)
- Knowledge (oral-systemic knowledge) and
    - Confidence (confidence in knowledge and ability to evaluate abnormalities in the oral cavity)
    - Assessment Practices (frequency of assessing)
    - Referring practices (frequency of referring)

- Confidence (confidence in knowledge and ability to evaluate abnormalities in the oral cavity) and
    - Assessment Practices (frequency of assessing)
    - Referring practices (frequency of referring)

As all variables are categorical, bivariate analyses utilize Chi-Square tests with alpha value of 0.05 to test significance.

Summary

Primary outcomes for the three questions guiding this research included Questions 11-20 on oral-systemic knowledge. Knowledge was categorized by percentages of correct responses. Questions 22-26 were on the frequency of oral assessment, and Question 27 asked about providing oral health promotion. Question 28 asked about the reasons for not routinely performing an oral health assessment. Questions 29-32 were on the referral to dental providers. The final survey Question 32 explored the reasons for not referring to an oral health provider. Associations were explored for these variables with demographics and perceived education, as well as examining associations directly between knowledge and practice (Table 3, 4, & 5). All data were analyzed using IBM SPSS version 25.

Chapter 4. Results: Presentation and Analysis of the Data

Introduction

There is a growing body of research on the relevance of oral health to primary care. The purpose of this study was to determine the oral-systemic knowledge, the practice of assessing the oral cavity, and the referrals to dental care providers by NPs. The following questions guided this study:

1. Do nurse practitioners have knowledge of the oral-systemic link?
2. Do nurse practitioners examine the condition of the oral cavity?
3. Do nurse practitioners promote oral health?
4. Do nurse practitioners refer to oral health (dental) providers?

To address these questions, the survey was divided into the following domains: oral health education, oral-systemic knowledge, and perceptions, confidence in knowledge and ability to evaluate oral cavity, oral health examination, oral health promotion practice, and referrals for oral care.

Respondents

The inclusion criterion required all respondents to be a licensed nurse practitioner, and the majority were licensed to practice in Tennessee. Forty-two were licensed in only Tennessee, 19 were licensed in TN and another additional state, and 5 respondents were not licensed in TN but licensed in another state (Figure 1). The majority (81.8% were certified in primary care (Figure 2).

Figure 1.

State of Licensure

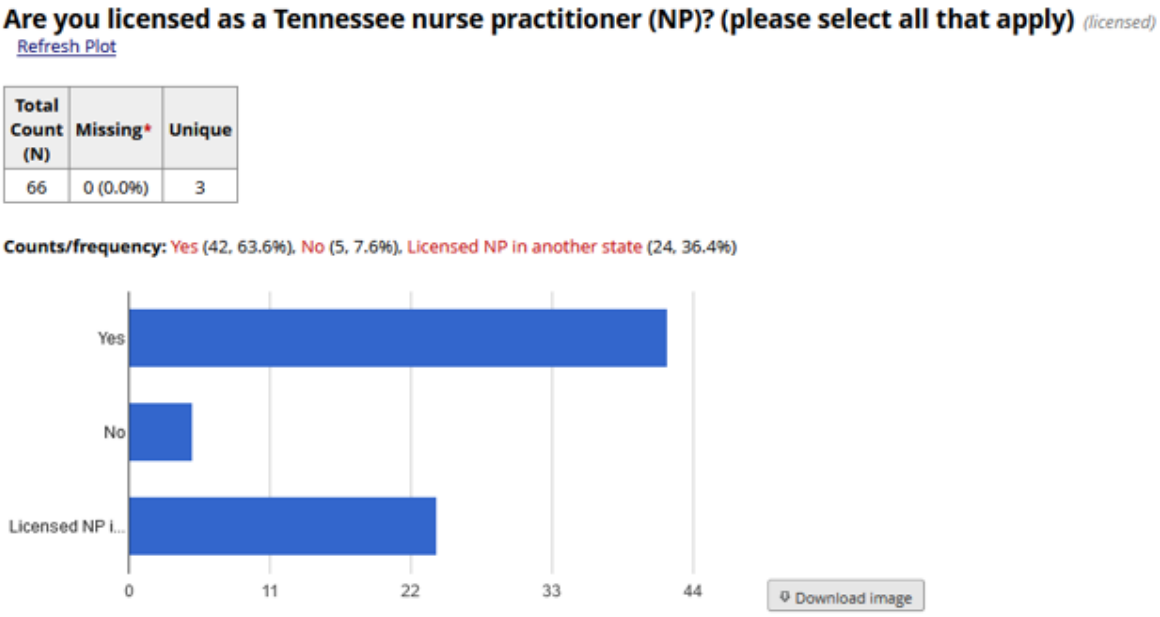
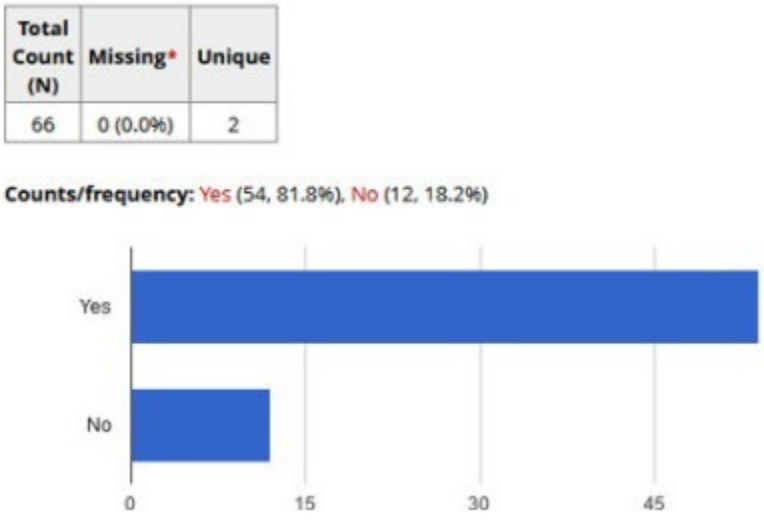


Figure 2.

Number of Responding NPs Certfied in Primary Care

Are you certified in primary care?



Response Rate

A total of 148 NPs were emailed the survey, and 106 clicked on the survey link. Forty of the responses were excluded because they did not meet the inclusion criteria of having current licensure or because they did not complete any of the survey questions. A total of 66 respondents' data were reported and used for analysis, giving a response rate of 45%.

Descriptive Results

Nearly all respondents were female (90.0%) and aged between 31 to 40 years (40.9%) or 41-50 years (28.8%; Table 1). Just over three-fourths of respondents reported their highest degree as a master's degree in Nursing (MSN), with another fifth (19.7%) reporting holding a Doctor in Nursing Practice (DNP), and the majority were certified in primary care (81.8%). Approximately two-thirds were certified as a nurse practitioner in Tennessee (63.6%, with and without being certified in any other state), with the other third being certified only in other states (36.4%). While 10.8% had more than twenty years of practice experience, most had ten or fewer years, with 40.0% having less than five years of practice experience and another 26.2% having 6-10 years of practice experience. The most common practice settings were primary care (56.1%), specialty practice (18.2%), government facilities (6.1%), public health clinics (6.1%), and others (6.1%), with respondents being allowed to select more than one type of practice setting due to the possibility of multiple applicable descriptions (e.g., public health clinic focused on primary care, government facility specialty practice, etc.) (Table 1).

Table 1.

Demographic Characteristics of Nurse Practitioners (N=66)

Variable	% (n)
Age	
< 30 years	6.1% (4)
31-40 years	40.9% (27)
41-50 years	28.8% (19)
51-60 years	18.2% (12)
61-70 years	6.1% (4)
> 70 years	0.0% (0)
Gender	
Female	90.9% (60)
Male	9.1% (6)
Prefer Not to Answer	0.0% (0)
Other	0.0% (0)
Highest Degree	
Master's in Nursing (MSN)	77.3% (51)
Doctor in Nursing Practice (DNP)	19.7% (13)
Doctor of Philosophy (PhD)	1.5% (1)
Non-Nursing Doctorate Degree	1.5% (1)
Other	0.0% (0)
Total Years Practiced as a NP	
< 5 years	40.0% (26)
6-10 years	26.2% (17)
11-15 years	13.8% (9)
16-20 years	9.2% (6)
> 20 years	10.8% (7)
Certified in Primary Care	
Yes	81.8% (54)
No	18.2% (12)
Licensing State(s)	
Tennessee *(with or without other states)*	63.6% (42)
Only Another State	36.4% (24)
Practice Setting*	
Educational Clinic	0.0% (0)
Government Facility	6.1% (4)
Hospital	7.6% (5)
Long-term Care	1.5% (1)
Occupational Health Care	4.5% (3)
OB/GYN	12.1% (8)
Primary Care	56.1% (37)
Public Health Clinic	6.1% (4)
Specialty Practice	18.2% (12)
Non-Clinical Practice	1.5% (1)

Other	6.1% (4)

*can select multiple

Education

Overall, education received was most frequently rated as "Fair" or "Poor" but varied by specific subject (Table 2). For education in prevention of oral diseases, 58.5% rated their education as "Fair" and 20.0% rated it as "Poor" with less than a fifth of participants rating it as "Good" (3.1%) or "Very Good" (15.4%). For education in association of poor oral health and presence of systemic disease, ratings were higher with 49.2% rating their education as "Good", though a third still rated their education as "Fair" (32.3%). For education in periodontal (gum) disease, again half rated their education as "Fair" (51.5%) and almost a third rated their education as "Poor" (28.8%), and no participants rated their education as "Very Good" (0.0%). (Table 2)

Oral-Systemic Knowledge, Perceptions, and Confidence in Evaluation

General perceptions of fair or poor education were reflected in participants self-report of knowledge and confidence (Table 2). Just over a fourth of participants reported their oral-systemic knowledge as "Good" (24.2%) or "Very Good" (3.0%) while more than half reported their oral-systemic knowledge as "Fair" (57.6%). Approximately one-third of participants are confident in their knowledge and ability to evaluate abnormalities in the oral cavity (30.3%), while another third were not-confident (34.8%) or unsure of their confidence (34.8%). (Table 2)

Table 2.

Education, Oral-Systemic Knowledge and Perceptions, Confidence, Oral Health Examination and Oral Health Promotion Practice, and Referrals for Oral Health Among Nurse Practitioners (N=66)

	% (n)
Education	
Education in Prevention of Oral Diseases	
Very good	3.1% (2)
Good	15.4% (10)
Fair	58.5% (38)
Poor	20.0% (13)
Very Poor	3.1% (2)
Education in Association of Poor Oral Health and Presence of Systemic Disease	
Very good	7.7% (5)
Good	49.2% (32)
Fair	32.3% (21)
Poor	9.2% (6)
Very Poor	1.5% (1)
Education in Periodontal (Gum) Disease	
Very good	0.0% (0)
Good	12.1% (8)
Fair	51.5% (34)
Poor	28.8% (19)
Very Poor	7.6% (5)
Oral-Systemic Knowledge and Perceptions	
Oral-Systemic Knowledge	
Very good	3.0% (2)
Good	24.2% (16)
Fair	57.6% (38)
Poor	13.6% (9)
Very Poor	1.5% (1)
Confidence	
Confidence in Knowledge and Ability to Evaluate Abnormalities in the Oral Cavity	
Confident	30.3% (20)
Non confident	34.8% (23)
Unsure	34.8% (23)
Oral Health Examination and Oral Health Promotion Practice	
Frequency of Assessing the Oral Cavity in a New Patient Exam	
Almost Always	16.7% (11)
Often	28.8% (19)
Sometimes	30.3% (20)
Only if patient requests	16.7% (11)
Never	7.6% (5)
Frequency of Assessing the Oral Cavity in an Existing Patient	
Almost Always	4.5% (3)
Often	25.8% (17)
Sometimes	36.4% (24)
Only if patient requests	25.8% (17)
Never	7.6% (5)

Frequency of Assessing the Oral Cavity in Patient With Poor Glycemic Control	
Almost Always	10.6% (7)
Often	25.8% (17)
Sometimes	36.4% (24)
Only if patient requests	13.6% (9)
Never	13.6% (9)
Frequency of Assessing the Lymph Nodes of the Head And Neck	
Almost Always	40.9% (27)
Often	43.9% (29)
Sometimes	13.6% (9)
Only if patient requests	1.5% (1)
Never	0.0% (0)
Frequency of Oral Health Promotion to Patients	
Almost Always	7.6% (5)
Often	31.8% (21)
Sometimes	37.9% (25)
Only to patients with uncontrolled systemic disease	4.5% (3)
Only if patient requests	13.6% (9)
Never	4.5% (3)
Referrals for Oral Health	
Frequency of Referring Patients to an Oral Health Care Provider (Dental) When Patient Expresses Concern About Mouth or Teeth	
Almost Always	66.7% (44)
Often	16.7% (11)
Sometimes	13.6% (9)
Only if patient requests	3.0% (2)
Never	0.0% (0)
Frequency of Referring Patients to an Oral Health Care Provider (Dental) When Patient Does NOT Express Concerns, But You Have Concerns	
Almost Always	31.8% (21)
Often	28.8% (19)
Sometimes	27.3% (18)
Only if patient requests	9.1% (6)
Never	3.0% (2)
Comfort Referring Patients with Oral Health Issues	
Almost Always	51.5% (34)
Often	28.8% (19)
Sometimes	16.7% (11)
Only if patient requests	3.0% (2)
Never	0.0% (0)

Oral Health Examination and Oral Health Promotion Practice

A wide variation was seen in the frequency of assessment during exams (Table 2). The most commonly reported assessment was the lymph nodes of the head and neck, with 40.9% reporting they assess these “Almost Always” and another 43.9% reporting assessing these

"Often". The oral cavity is assessed much less frequently, both for new and existing patients. In new patient exams, only 16.7% reported assessing the oral cavity "Almost Always", while 28.8% reported "Often" and 30.3% reported "Sometimes". In existing patients the frequency of assessing the oral cavity was even less frequent with only 4.5% reporting assessing the oral cavity "Almost Always", 25.8% reporting "Often", 36.4% "Sometimes", and over a fourth assessing the oral cavity only if the patient requests it (25.8%). Less than ten percent of participants report providing oral health promotion to patients "Almost Always" (7.6%), with most reporting it as "Often" (31.8%) or "Sometimes" (37.9%). (Table 2)

Referrals for Oral Health

Most participants were comfortable referring patients with oral health issues "Almost Always" (51.5%) or "Often" (28.8%); however referrals were more frequent when the patient expressed a concern about their mouth and teeth rather than when the nurse practitioner had concerns but the patient did report a concern (Table 2). Two-thirds of participants reported "Almost Always" referring patients to an oral health care provider when the patient expressed a concern about mouth or teeth, with another 16.7% reporting "Often", and 13.6% reporting "Sometimes". Concerns expressed by patients are not consistently ignored, as no participants reported "Never" referring to an oral health care provider when their patient expressed a concern. Referring practices were less frequent when the provider, but not the patient, expressed concerns with only 31.8% reporting "Almost Always" referring, 28.8% reporting "Often" referring, and 27.3% reporting "Sometimes" referring. Additionally, while the percentage is small, 3.0% of participants reported "Never" referring patients to an oral health care provider when the patient didn't express concerns but when they did have concerns (Table 2).

Bivariate Associations

No significant association was found between education in association of poor oral health and presence of systemic disease with oral-systemic knowledge (Table 3).

Table 3.

Association between Education in Association of Poor Oral Health and Presence of Systemic Disease and Oral-Systemic Knowledge Among Nurse Practitioners (N=66)

Association of Poor Oral Health and the presence of Systemic Disease and oral-systemic knowledge	Oral-Systemic Knowledge					
	Very Good % (n)	Good % (n)	Fair % (n)	Poor % (n)	Very Poor % (n)	p-value
Very Good	20.0% (1)	20.0% (1)	60.0% (3)	0.0% (0)	0.0% (0)	
Good	0.0% (0)	31.3% (10)	56.3% (18)	12.5% (4)	0.0% (0)	
Fair	4.8% (1)	23.8% (5)	57.1% (12)	14.3% (3)	0.0% (0)	0.502
Poor	0.0% (0)	0.0% (0)	66.7% (4)	33.3% (2)	0.0% (0)	
Very Poor	0.0% (0)	0.0% (0)	100% (1)	0.0% (0)	0.0% (0)	

No significant association was found between oral-systemic knowledge and confidence in knowledge and ability to evaluate abnormalities in the oral cavity; however, some significant associations were found between oral-systemic knowledge and assessment and referring practices (Table 4). A significant association was found between oral-systemic knowledge and frequency of assessing the oral cavity for a new patient and existing patient exams. For new patient exams, out of those that rated their oral-systemic knowledge as "Very Good" or "Good", 50.0% and 18.8% reported assessing the oral cavity "Almost Always". Conversely, out of those that rated their oral-systemic knowledge as "Poor" or "Very Poor", no one reported assessing the oral cavity more than "Sometimes". While overall assessment was reported as less frequent for existing patients, there was still a significant association found with oral systemic knowledge. Most participants who reported their knowledge as either "Very Good" or "Fair" reported assessing the oral cavity in existing patients "Often" (50.0%, 31.3%, 26.3%, respectively) or

"Sometimes" (50.0%, 31.3%, 44.7%, respectively). Conversely, participants rating their knowledge as "Poor" were more likely to report assessing the oral cavity "Only if Patient Requests" (33.3%) or "Never" (44.4%) (Table 4). No significant association was found between oral-systemic knowledge and referring patients when the patient expressed a concern; however, oral-systemic knowledge was significantly associated with frequency of referring patients to an oral health care provider when the patient did not express concerns, but the provider had concerns (Table 4). All of those that rated their knowledge as "Very Poor" reported "Never" referring (100.0%), while 100% of those that reported their knowledge as "Very Good" referring patients at least sometimes ("Sometimes" 50.0%, "Often" 50.0%). Surprisingly, most of those that rated their knowledge as "Poor" reported "Almost Always" referring (77.8%). (Table 4)

Table 4.

Association of Oral-Systemic Knowledge with Confidence, Oral Health Examination and Oral Health Referral Practices among Nurse Practitioners (N=66)

	Confidence In Knowledge And Ability To Evaluate Abnormalities In The Oral Cavity					
Oral-Systemic Knowledge	**Confident % (n)**	**Not Confident % (n)**	**Unsure % (n)**			**p-value**
Very good	100% (2)	0.0% (0)	0.0% (0)			
Good	43.8% (7)	18.8% (3)	37.5% (6)			
Fair	26.3% (10)	36.8% (14)	36.8% (14)			0.110
Poor	11.1% (1)	66.7% (6)	22.2% (2)			
Very Poor	0.0% (0)	0.0% (0)	100% (1)			
	Frequency Of Assessing The Oral Cavity In A New Patient Exam					
Oral-Systemic Knowledge	**Almost Always % (n)**	**Often % (n)**	**Sometimes % (n)**	**Only Patient Requests % (n)**	**Never % (n)**	**p-value**
Very good	50.0% (1)	0.0% (0)	0.0% (0)	50.0% (1)	0.0% (0)	
Good	18.8% (3)	43.8% (7)	25.0% (4)	6.3% (1)	6.3% (1)	
Fair	18.4% (7)	31.6% (12)	36.8% (14)	13.2% (5)	0.0% (0)	0.002
Poor	0.0% (0)	0.0% (0)	22.2% (2)	33.3% (3)	44.4% (4)	

Very Poor	0.0% (0)	0.0% (0)	0.0% (0)	100% (1)	0.0% (0)	
	Frequency Of Assessing The Oral Cavity In An Existing Patient					
Oral-Systemic Knowledge	**Almost Always % (n)**	**Often % (n)**	**Sometimes % (n)**	**Only Patient Requests % (n)**	**Never % (n)**	**p-value**
Very good	0.0% (0)	50.0% (1)	50.0% (1)	0.0% (0)	0.0% (0)	
Good	6.3% (1)	31.3% (5)	31.3% (5)	25.0% (4)	6.3% (1)	
Fair	5.3% (2)	26.3% (10)	44.7% 917)	23.7% (9)	0.0% (0)	0.037
Poor	0.0% (0)	11.1% (1)	11.1% (1)	33.3% (3)	44.4% (4)	
Very Poor	0.0% (0)	0.0% (0)	0.0% (0)	100% (1)	0.0% (0)	
	Frequency Of Referring Patients To An Oral Health Care Provider (Dental) When Patient Expresses Concern About Mouth Or Teeth					
Oral-Systemic Knowledge	**Almost Always % (n)**	**Often % (n)**	**Sometimes % (n)**	**Only Patient Requests % (n)**	**Never % (n)**	**p-value**

No significant association was found between confidence in knowledge and ability to evaluate abnormalities in the oral cavity and the frequency of referring patients; however, confidence was significantly associated with frequency of assessing the oral cavity (Table 5). For new patient exams, participants reporting as confident or unsure about their confidence were more likely to assess the oral cavity “Almost Always” (15.0%, 26.1%, respectively) or “Often” (50.0%, 21.7%, respectively) than those that were unconfident. For existing patient exams, those that reported being not confident were more likely to report “Never” assessing the oral cavity (17.4%) compared to those that were confident (5.0% reporting “Never”) or unsure about their confidence (0.0% reporting “Never”) (Table 5).

Table 5.

Association between Confidence and Oral Health Examination and Referral Practices among Nurse Practitioners (N=66)

Confidence in Knowledge and Ability to Evaluate Abnormalities in the Oral Cavity	Frequency Of Assessing The Oral Cavity In A New Patient Exam					
	Almost Always % (n)	Often % (n)	Sometimes % (n)	Only Patient Requests % (n)	Never % (n)	p-value
Confident	15.0% (3)	50.0% (10)	25.0% (5)	5.0% (1)	5.0% (1)	
Non confident	8.7% (2)	17.4% (4)	43.5% (10)	13.0% (3)	17.4% (4)	0.021
Unsure	26.1% (6)	21.7% (5)	21.7% (20)	30.4% (7)	0.0% (0)	
	Frequency Of Assessing The Oral Cavity In An Existing Patient					
Confidence in Knowledge and Ability to Evaluate Abnormalities in the Oral Cavity	Almost Always % (n)	Often % (n)	Sometimes % (n)	Only Patient Requests % (n)	Never % (n)	p-value
Confident	5.0% (1)	50.0% (10)	25.0% (5)	15.0% (3)	5.0% (1)	
Non confident	4.3% (1)	8.7% (2)	47.8% (11)	21.7% (5)	17.4% (4)	0.038
Unsure	4.3% (1)	21.7% (5)	34.8% (8)	39.1% (9)	0.0% (0)	
	Frequency Of Referring Patients To An Oral Health Care Provider (Dental) When Patient Expresses Concern About Mouth Or Teeth					
Confidence in Knowledge and Ability to Evaluate Abnormalities in the Oral Cavity	Almost Always % (n)	Often % (n)	Sometimes % (n)	Only Patient Requests % (n)	Never % (n)	p-value
Confident	70.0% (14)	20.0% (4)	10.0% (2)	0.0% (0)	0.0% (0)	
Non confident	60.9% (14)	17.4% (4)	17.4% (4)	4.3% (1)	0.0% (0)	0.937
Unsure	69.6% (16)	13.0% (13)	13.0% (3)	3.0% (2)	0.0% (0)	
	Frequency Of Referring Patients To An Oral Health Care Provider (Dental) When Patient Does NOT Express Concerns, But You Have Concerns					
Confidence in Knowledge and Ability to Evaluate Abnormalities in the Oral Cavity	Almost Always % (n)	Often % (n)	Sometimes % (n)	Only Patient Requests % (n)	Never % (n)	p-value
Confident	30.0% (6)	45.0% (9)	15.0% (3)	10.0% (2)	0.0% (0)	
Non confident	43.5% (10)	17.4% (4)	26.1% (6)	8.7% (2)	4.3% (1)	0.447
Unsure	21.7% (5)	26.1% (6)	39.1% (9)	8.7% (2)	4.3% (1)	

Chapter 5. Summary, Discussion, Conclusions and Recommendations

Summary

Given the magnitude of oral manifestations of disease in the oral cavity and the relevance of the oral cavity condition to systemic disease, the NPs are vital to population health approaches to oral and systemic disease recognition, maintenance, and referrals to oral health providers. The results found in this research provide insights into the four main guiding questions:

Do nurse practitioners have knowledge of the oral-systemic link?

Overall, over half the participants reported their education and knowledge (Table 2) of the oral-systemic link as "Fair" (57.6). Interestingly, over half of the NPs rated their education as fair/poor, yet they all have advanced degrees (at least master's level). This finding may be related to primarily two issues. The first issue is oral health is a very small part of nursing education. The second issue could be related to remembering the oral health education if it has been a long time since they were in school. Requiring an oral health continuing education course for primary care providers could improve knowledge and offer current evidence-based oral health statistics and strategies. A primary care oral-health certification course and competency could improve knowledge and confidence.

Do nurse practitioners examine the condition of the oral cavity?

There were wide variances in the frequency of examinations of the oral cavity (Table 2). In new patient exams, only 16.7% reported assessing the oral cavity "Almost Always", while 28.8% reported "Often" and 30.3% reported "Sometimes". In existing patients, the frequency of assessing the oral cavity was even less frequent with only 4.5% reporting assessing the oral cavity "Almost Always", 25.8% reporting "Often", 36.4% "Sometimes", and over a fourth assessing the oral cavity only if the patient requests it (25.8%). However, the NPs reported

assessing the lymph nodes of the head and neck very frequently with 40.9% reporting they "Almost Always" assess and 43.9% report checking these nodes "Often". Oral-systemic knowledge, confidence in oral assessment skills, and perceived time constraints seem to be the most likely barriers preventing oral health assessments from being part of routine primary care examinations.

Do nurse practitioners promote oral health?

Less than ten percent of participants report providing oral health promotion to patients "Almost Always" (7.6%), with most saying it as "Often" (31.8%) or "Sometimes" (37.9%) (Table 2). Understanding the relevance of oral health in managing a systemic disease is key to improving oral health promotion and practices. The NPs are very instrumental in influencing their patients' perceived need for preventive and routine care. The HBM model, found throughout nursing literature, is an ideal framework for educating patients on the relevance of oral health to their overall health and their perception of the benefit of good oral health.

Do nurse practitioners refer to oral health (dental) providers?

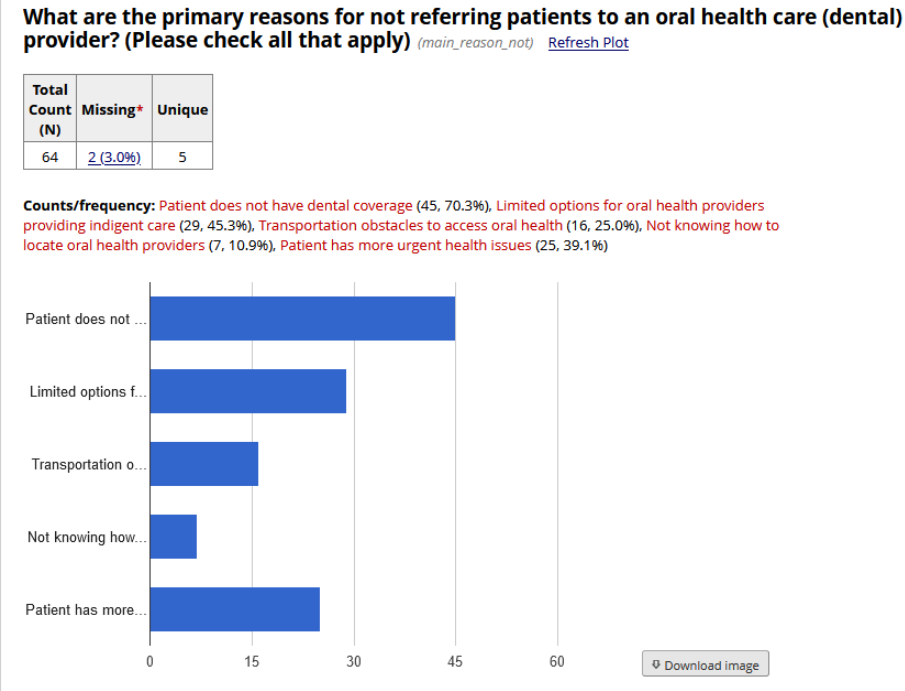
Most participants in this study were comfortable referring patients with oral health issues "Almost Always" (51.5%) or "Often" (28.8%). However, referrals were more frequent when the patient expressed concern about their mouth and teeth rather than when the nurse practitioner had concerns, but the patient did not report a problem (Table 2). This finding could be related to the patients not accepting the referral recommendation due to perceptions of their oral condition not being associated with their chief complaint.

I think referrals could be increased by more collaborative care and interdisciplinary training models during medical and dental provider education and the addition of oral health assessment competencies and certifications for primary care NPs.

The primary reason for not referring to an oral health care provider was the patient not having dental coverage 70.3 %. This finding was not a surprise. The lack of dental coverage has been a long-standing barrier to care, leaving patients without the financial means to follow up with oral care referrals. The next most common reason for not referring was the limited options for dental care for indigent populations (45.3%). This is a widespread issue affecting numerous vulnerable populations and needs more attention from policymakers, legislators, and providers working together to implement population care strategies, access to care, and reimbursement. The transportation obstacles to care were 25%. This population includes access to care issues like not having transportation and not easily transported patients with other debilitating problems. The best resolve for this complex issue would be better, more readily available mobile dental care options or contracted dental providers on staff. Some 10.9% reported not knowing how to locate an oral health provider. This issue might be improved by increasing the use of collaborative care models and collaborative education (interdisciplinary) models and educating dental, medical, and allied health students together on interdisciplinary communication and teamwork. There is overlap in care and coordinated patient care could help reduce overlap and improve health outcomes. More joint continuing education opportunities could help facilitate provider interaction, communication, and referrals. Finally, 39.1% answered the patient has more urgent health issues than their oral care (Figure 3).

Figure 3.

Reasons for Not Referring to Dental Provider



Conclusion

The study highlights the magnitude of oral manifestations of systemic disease and the relevance of oral health assessment and promotion in primary care. The study showed room for improvement in oral-systemic knowledge, education, and confidence in assessing the oral cavity. These results support recommendations for more interprofessional training and education in oral health and in the practice of assessing the health of the oral cavity. There are still numerous communication barriers, health records, and coding and reimbursement for this overlap in disciplines. Oral health is integral to overall health, and oral health assessment and promotion by non-dental providers is warranted.

Oral health is integral to overall health and is part of comprehensive care. The findings of this study aim to improve oral-systemic health across the lifespan and highlight the need for the shift to including the "O" to the standard HEENT examination to using the HEENOT examination to include the Oral Cavity (O) and the development of competencies based on this examination (Harber et al., 2015). This study's findings are also consistent with Dolce et al. (2018) study on expressing the need for more in-depth oral health training and competencies in the NP curriculum include the teaching of oral health strategies and assessments by dental professionals.

Recommendations

There is a renewed focus on improved health outcomes and population health strategies, including the integration of oral health into primary care (Atchison et al., 2018).This study has highlighted the need for the inclusion of oral health assessment and promotion in primary care. Knowledge didn't make NPs included in this study refer more based on patient concern. Still, it did make them refer more based on their concerns. These findings highlight the need for additional content and training with oral health providers to ensure the NPs are confident in their oral-systemic knowledge and assessment abilities. Improvements to the NP curriculum, such as the inclusion of collaborative education and oral-systemic education and assessment training by oral health providers (dentists or hygienists), could improve primary care nurse practitioners' knowledge and confidence in assessing the health of the oral cavity and improve collaborative care. Future studies are with those who educate NPs to determine if they see a gap in NP curricula with regard to oral health and if they would be willing to utilize dental professionals as educational resources. More community-based research data should be collected to assess the

population health improvements from the inclusion of routine oral health assessments in primary care.

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APPENDICES

Appendix A. Data Questionnaire

1. Are you licensed as a Tennessee nurse practitioner?
   - ☐ Yes
   - ☐ No
   - ☐ Licensed NP in another state

2. Are you certified in primary care?
   - ☐ Yes
   - ☐ No

3. What is your highest degree?
   - ☐ MSN
   - ☐ DNP
   - ☐ PhD
   - ☐ Non-Nursing Doctorate Degree
   - ☐ Other, please explain _____

4. What is your gender?
   - ☐ Female
   - ☐ Male
   - ☐ Prefer not to answer
   - ☐ Other

5. What is your age range?
   - ☐ < 30
   - ☐ 31-40
   - ☐ 41-50
   - ☐ 51-60
   - ☐ 61-70
   - ☐ > 70

6. How many total years have you practiced as a nurse practitioner?
   - ☐ < 5 years
   - ☐ 6-10 years
   - ☐ 11-15 years
   - ☐ 16-20 years
   - ☐ More than 20 years

7. What best describes your practice setting(s)? (please select all that apply)
   - ☐ Educational Clinic
   - ☐ Government Facility
   - ☐ Hospital
   - ☐ Long-term care
   - ☐ Occupational Health Care
   - ☐ OB/GYN
   - ☐ Primary Care
   - ☐ Public Health Clinic
   - ☐ Specialty Practice
   - ☐ Non-Clinical Practice
   - ☐ Other, please explain _____

8. How would you rate the education you received in the prevention of oral diseases?
   - ☐ Very good
   - ☐ Good
   - ☐ Fair
   - ☐ Poor
   - ☐ Very Poor

9. How would you rate the education you received regarding the association of poor oral health and the presence of systemic disease?
   - ☐ Very good
   - ☐ Good
   - ☐ Fair
   - ☐ Poor
   - ☐ Very Poor

10. How would you rate the education you received regarding periodontal (gum) disease?
    - ☐ Very good
    - ☐ Good

☐ Fair
☐ Poor
☐ Very Poor

11. How would you rate your oral-systemic knowledge?
☐ Very good
☐ Good
☐ Fair
☐ Poor
☐ Very poor

12. Which one of the following oral conditions is most often associated with systemic disease?
☐ Dental Caries
☐ Macroglossia
☐ Periodontal Disease
☐ Tori

13. Gingivitis includes swollen gingiva and is a reversible condition.
☐ Correct
☐ Incorrect
☐ Unsure

14. Periodontitis is worse than gingivitis.
☐ Correct
☐ Incorrect
☐ Unsure

15. Periodontal disease is associated as an independent contributor to numerous systemic conditions.
☐ Correct
☐ Incorrect
☐ Unsure

16. The primary etiologic factor in periodontal disease is related to which of the following?
☐ Decay
☐ Family History
☐ Microbial Plaque
☐ Sugar Consumption

17. Numerous diseases may manifest early signs in the oral cavity.
☐ Correct
☐ Incorrect
☐ Unsure

18. There is scientific evidence of the association of periodontal disease and poor glycemic control.
    ☐ Correct
    ☐ Incorrect
    ☐ Unsure

19. Controlling oral inflammation and infection is important in the management of cardiovascular disease.
    ☐ Correct
    ☐ Incorrect
    ☐ Unsure

20. Knowledge of the oral-systemic link helps assess an individual's health.
    ☐ Correct
    ☐ Incorrect
    ☐ Unsure

21. I am confident in my knowledge and ability to evaluate abnormalities in the oral cavity.
    ☐ Correct
    ☐ Incorrect
    ☐ Unsure

22. How often do you assess the condition of the oral cavity as part of of a new patient's initial exam?
    ☐ Almost Always
    ☐ Often
    ☐ Sometimes
    ☐ Only if patient requests
    ☐ Never

23. How often do you assess the condition of the oral cavity of an existing patient?
    ☐ Almost Always
    ☐ Often
    ☐ Sometimes
    ☐ Only if patient requests
    ☐ Never

24. Do you assess the condition of the oral cavity if a patient has poor glycemic control?
    ☐ Almost Always
    ☐ Often
    ☐ Sometimes
    ☐ Only if patient requests
    ☐ Never

25. Select the areas/structures that you examine in the oral cavity. (You may select more than one response)
    - ☐ Pharyngeal area
    - ☐ Tongue
    - ☐ Teeth
    - ☐ Palate
    - ☐ Gingival tissues
    - ☐ Cheeks
    - ☐ None of the above, I do not examine the oral cavity

26. How often do you assess lymph nodes of the head and neck?
    - ☐ Almost Always
    - ☐ Often
    - ☐ Sometimes
    - ☐ Only if patient requests
    - ☐ Never

27. When do you promote oral health to patients?
    - ☐ Almost Always
    - ☐ Often
    - ☐ Sometimes
    - ☐ Only if patient requests
    - ☐ Never

28. If you do not routinely perform an oral health assessment, what are the primary reason(s)? (You may select more than one response)
    - ☐ Patient not willing to pay for oral health assessment
    - ☐ Not reimbursed by third party payers
    - ☐ Not cost effective, takes too much time
    - ☐ Not comfortable with oral assessment skills
    - ☐ I feel it is the responsibility of oral health providers
    - ☐ I do not feel it is necessary or needed
    - ☐ I do not treat primary care
    - ☐ I routinely perform an oral assessment

29. Do you refer patients to an oral health care (dental) provider when they express concern about their mouth or teeth?
    - ☐ Almost Always
    - ☐ Often
    - ☐ Sometimes
    - ☐ Only if patient requests
    - ☐ Never

30. Do you refer patients to an oral health care (dental) provider when they do not express concern about their mouth, but you have concerns about their oral health?
    - ☐ Almost Always
    - ☐ Often
    - ☐ Sometimes
    - ☐ Only if patient requests
    - ☐ Never

31. I am comfortable referring patients with oral health issues.
    - ☐ Almost Always
    - ☐ Often
    - ☐ Sometimes
    - ☐ Only if patient requests
    - ☐ Never

32. What are the primary reasons for not referring patients to an oral health care (dental) provider? (Please check all that apply)
    - ☐ Patient does not have dental coverage
    - ☐ Limited options for oral health providers providing indigent care
    - ☐ Transportation obstacles to access oral health providers
    - ☐ Not knowing how to locate oral health providers
    - ☐ Patient has more urgent health issue

Appendix B. Pilot Study Feedback Form

Thank you for participating in the pilot portion of this study. Please take a moment to review and respond to the following questions. Your feedback is important and will impact the success of this research study.

1. Were the questions easy understood? If not, what was unclear and needed clarification?_____

_____

2. Are there any additional questions that should be added? If yes, please provide an example of content._____

_____

3. Are there any questions that should be deleted? If so, which questions?_____

_____

4. How much time did it take to complete the questionnaire?

_____

_____

5. Any additional comments or suggestions to questionnaire?

Appendix C. Request and Permission to Use and Modify Survey

SCHOOL of GRADUATE STUDIES
EAST TENNESSEE STATE UNIVERSITY

ETSU
Dr. Deborah Dotson
Committee Chair
198 S. Dossett Dr.
Hutcheson Hall room 103
Johnson City, TN 37614
(423) 439-7888

Department of Graduate Allied Health Sciences

RE: Permission to use an existing survey

5/17/2020

Angela Haynes, RDH
Graduate Student ETSU
775 Fairway Drive
Covington, TN 38019

Dear Rebecca Wilder,

I am a master's student from East Tennessee State University writing my masters' thesis tentatively titled "Assessing the Nurse Practitioners' Knowledge and Clinical Practice with Regard to the Oral-Systemic Link" under the direction of my thesis committee chaired by Dr. Deborah Dotson.

I would like your permission to reproduce and possibly modify (to better fit my respondents) the survey instruments used in "North Carolina cardiologists' knowledge, opinions, and practice behaviors regarding the relationship between periodontal disease and cardiovascular disease" and "North Carolina internists' and endocrinologists' knowledge, opinions, and behaviors regarding periodontal disease and diabetes: Need and opportunity for interprofessional education".

- I will use this survey only for my research and will not sell or use it with any compensated or curriculum development activities.
- I will include the copyright statement along with my submission of my work.
- I will send a copy of my research study and any publication to your attention.
- **I will acknowledge the University of North Carolina Adams School of Dentistry and the authors of the studies in any publication(s) that transpire from the UNC research.**

Below is a release statement for your signature. If you grant permission to use the survey instrument data, please indicate by signing this letter and returning to me either through postal mail or email.

With Gratitude,

Angela Haynes, RDH
zarh33@etsu.edu
Masters Candidate

Agreed and accepted by Rebecca S. Wilder, Professor Date: May 21, 2020

VITA

ANGELA YORK HAYNES

Education:	A. S. Dental Hygiene (May 1990), Northeast Mississippi Community College, Booneville, MS
	B.S. Dental Hygiene (Aug. 2012), East Tennessee State University, Johnson City, Tennessee
	M.S. Allied Health (Dec. 2020), East Tennessee State University, Johnson City, Tennessee
Professional Experience:	Clinical Dental Hygienist; Union City, Tennessee, 1990-1992
	Clinical Dental Hygienist; Ripley, TN, 1992-2017
	Clinical Instructor, Department of Periodontology, University of Tennessee, College of Dentistry, Memphis, Tennessee, 2017-present
Honors and Awards:	Outstanding Achievement in Community Dentistry, American Association of Public Health Dentistry, 2013
	Outstanding Dental Hygienist, Tennessee Dental Hygienists' Association, 2016
	Thomas P. Hinman Faculty-Student Mentoring Award UTHSC,2018
	Cashion-Schmitt Award for Continuing Education, Tennessee Tennessee Dental Hygienists' Association, 2018