

Innovations in Dental Hygiene Education

Knowledge, Attitudes and Perceptions of Dental Hygiene and Dental Therapy Students towards End-stage Renal Disease: A pilot study

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ABSTRACT

Purpose Chronic kidney disease is highly prevalent in the general population and can progress to end-stage renal disease (ESRD). The purpose of this pilot study was to assess dental hygiene and dental therapy students' knowledge, attitudes, and perceptions towards ESRD and evaluate the feasibility of a larger scale study.

Methods A convenience sample (n=59) of dental hygiene (DH) and dual degree DH/dental therapy students were invited to participate in an electronic survey for the pilot study. The investigator designed survey consisted of a total of 37 items: demographics (4), perceived knowledge, confidence, importance and attitudes (14), knowledge of chronic kidney disease (18). The knowledge questions were adapted from the Chronic Kidney Disease Self-Management Knowledge Tool (CKD-SMKT) with permission. Descriptive statistics and the non-parametric two-sample Wilcoxon rank sum test were used to analyze the data.

Results Twenty-five participants completed the survey for a 42% response rate. Fewer than half (36%) perceived having some knowledge regarding ESRD, its oral manifestations (28%) and mental health implications (12%). The importance of managing oral health for ESRD was rated by most respondents as "very important" or "extremely important" (76%). Respondent attitudes indicated high interest (68%) regarding employment in hospital settings to care for individuals with ESRD. Knowledge scores from the CKD-SMKT were low in the categories of general knowledge of ESRD and dental hygiene care modifications for individuals with ESRD.

Conclusion Results of this pilot study indicate that using a validated instrument on a national sample is feasible to determine the knowledge, attitudes and perceptions of dental hygiene students regarding ESRD. Future research should include knowledge and awareness of hypertension, diabetes, and the role that management of chronic kidney disease plays in the prevention of ESRD.

Keywords dental hygiene students, dental therapy students, end stage renal disease, chronic kidney disease, knowledge, attitudes, perceptions

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INTRODUCTION

Chronic kidney disease (CKD) is an irreversible progressive condition that can ultimately advance to end-stage renal disease (ESRD) requiring replacement therapies such as hemodialysis, peritoneal dialysis and kidney transplantation.^{1,2} Chronic kidney disease is highly prevalent in the population. Nearly 37 million individuals United States (US) have CKD contributing to the estimated 746,557 cases of ESRD.^{3,4} Chronic kidney disease is often associated with cardiovascular disease (CVD) and poorly controlled diabetes in addition to a family history of renal disease.³ Individuals with CKD may be asymptomatic for many years until their renal dysfunction advances to ESRD.³

The American Dental Hygienists' (ADHA) has long advocated for regular blood pressure screening within a dental setting as part of the standard of care.⁵ Hypertension presents with little to no clinical signs and is frequently associated with CKD.^{1,3,6,7} Dental hygienists play a key role in screening for undiagnosed or poorly controlled hypertension. Medical follow-up is essential for individuals at risk of developing CKD due to hypertension. It is estimated that more than half of the individuals on kidney dialysis have cardiovascular disease.⁷

Diabetes is another comorbidity for CKD. According to the Centers for Disease Control and Prevention (CDC), an estimated 37.3 million individuals have been diagnosed with diabetes, while another 8.5 million have the condition but are undiagnosed and 96 million have prediabetes.⁸ Dental hygienists can play a key role in diabetes prevention through risk assessment, management, and referral.^{5,9} Assessment and screening for both hypertension and diabetes are critical for the management of CKD and the prevention of ESRD.¹⁰

Renal failure or ESRD requires ongoing replacement therapy either through the use of a medical filtration device (dialysis) or a kidney transplant for survival.^{1,11} Dialysis treatment aims to prolong life expectancy and assist those awaiting a kidney transplant by supporting the declining kidney function.^{1,11} Although kidney transplantation has a much higher long-term survival

rate than dialysis treatment, some individuals may not be candidates for a transplant. In addition, there is a shortage of organs for donation with waiting periods on the average of 3 to 5 years as well as other access to care issues.¹²

ESRD and Oral Health

Maintaining optimal oral health is a critical component of the general health and well-being of an individual with ESRD.¹³ Poor oral hygiene, dental caries and periodontal disease are associated with increased mortality in patients with ESRD and oral pathologies associated with inflammation can contribute to cardiovascular events in this population.^{1,10}

Individuals with ESRD receiving hemodialysis may present with oral manifestations related to the poor state of their physical and emotional health, medical treatment, and lack of motivation for oral self-care.¹⁴ In addition to an increased incidence of caries and periodontal disease, other common oral conditions include generalized pallor of the mucosa due to anemia, increased susceptibility to bleeding, candidiasis and lichenoid-like infections.^{1,15-17} It is also important to note the association of periodontal disease to diabetes, a leading cause of ESRD.¹⁸⁻²⁴

Chronic inflammation and periodontitis may also be associated with increased mortality in individuals receiving hemodialysis treatment for ESRD.^{25,26} Further, the chronic episodes of inflammation associated with periodontitis, may lead to vascular injury, increased levels of C-reactive protein and renal insufficiency.^{25,27,28}

The incidence of ESRD in the US is anticipated to rise to between 971,000 and 1,259,000 individuals by 2030 and there is a need to focus on the prevention of CKD and ultimately ESRD.²⁹ Oral health care professionals need to understand the pathophysiology, systemic, and oral implications of individuals with ESRD. The identification of risk factors for CKD are essential when providing high-quality, evidence-based care. Dental hygienists have a unique role in the health care team to assess, identify, and refer individuals

with hypertension, diabetes, and CKD to prevent ESRD. However, to fully engage in this role, dental hygienists must be well-informed on the importance of prevention of ESRD. It is not known how prepared dental hygiene (DH) and dual degree dental hygiene/dental therapy (DH/DT) students feel regarding ESRD prior to completion of their entry-level education. The purpose of this pilot study was to assess the knowledge, attitudes and perceptions of DH and DH/DT students towards the importance of ESRD and determine the feasibility of a larger scale study to identify gaps in the dental hygiene curriculum and better prepare graduates to be part of the health care team for this growing population.

METHODS

This single site, cross-sectional, descriptive pilot study was determined exempt by the University of Minnesota (UMN) Institutional Review Board (STUDY00009626).

The non-probability convenience sample consisted of DH and dual degree DH/DT students from the classes of 2020 and 2021. Students in the sample population were in their 3rd and 4th year at the UMN School of Dentistry (SOD). The sample population (n=59) was invited to participate in the study via email addresses obtained from the UMN SOD intranet. Inclusion criteria for the sample included DH or dual degree DH/DT undergraduate students enrolled in classes at the UMN SOD during the period of July 2020 to August 2020.

Dental hygiene and DH/DT students received an invitation to participate, and an informed consent form the week of July 1, 2020. Consenting participants then accessed the electronic survey (Qualtrics; Provo, UT, USA). Follow-up emails were sent out to non-responders to increase response rate. Data collection concluded at the end of August 2020. No incentives were provided to the participants.

Instrument

The investigator designed survey instrument was developed from the student investigator's literature review and input from faculty advisors. Scholarly journal research articles were reviewed and analyzed

to facilitate the formation of the survey by evaluating previous measurement instruments and questionnaire delivery.^{26,30-32} The 37-item instrument included five demographic questions; fourteen items assessing perceived knowledge, confidence and attitudes adapted with permission from a previously validated instrument;³⁰ and eighteen knowledge items modified with permission from the Chronic Kidney Disease Self-Management Knowledge Tool (CKD-SMKT).³²

The investigator developed survey was pilot tested by eight UMN SOD DH faculty with content expertise and experience in survey design. Questions were reviewed for content, clarity and potential bias and modifications were made based on the feedback of the pilot testers.

The final instrument consisted of questions formatted with Likert-scales, matrix tables, and rating type responses. There were eight perception items to assess knowledge (3), confidence (2), and importance (3) on a 5-point Likert-scale and four attitude items on a 3-point Likert-scale. The 18 items from the modified CKD-SMKT had choices of "true," "false" and "don't know" for the general knowledge categories of ESRD (4 items), treatment and management (4 items), oral manifestations (5 items), and dental hygiene care (5 items). No tests were conducted on the survey to determine validity or reliability.

Data Analysis

The variables analyzed were perceived knowledge, attitudes perceptions regarding ESRD. Attribute variables in this study included previous education of DH and DH/DT students, as well participant age due to the non-traditional students with prior degrees in the DH/DT program. Knowledge-based items from the CKD-SMKT were divided into general knowledge, treatment and management, oral manifestations, and dental hygiene care.

Statistical analysis was performed using SAS version 9.4 (SAS Institute; Cary, NC, USA). Frequency distributions were used for demographics, perception of knowledge, attitude, and perception questions. Correct knowledge responses were summed. A non-parametric, two-sample Wilcoxon rank sum test

was used to compare the knowledge scores of the sub-groups in the sample; $p < 0.05$ was considered statistically significant.

RESULTS

Of the DH and dual degree DH/DT students ($n = 59$) enrolled at the UMN SOD, 25 completed the survey for a 42% response rate ($n = 25$). Most respondents were 4th year DH or DH/DT students (64%), were 18-24 years of age (72%), and had not received a prior certificate, associate, or baccalaureate degree (56%). There was no statistical significance in the number of correct knowledge responses and participants with previous education (certificates, associate, or baccalaureate degrees) ($p = 0.458$). Participant demographics are shown in Table I.

Table I. Demographics

Program and year	n (%)
Dental Hygiene, Year 3	6 (24.0)
Dental Hygiene, Year 4	9 (36.0)
Dental Therapy, Year 3	3 (12.0)
Dental Therapy, Year 4	7 (28.0)
Age (years)	
18-24	18 (72.0)
25-30	6 (24.0)
31-36	1 (4.0)
Previous certificate or degree	
None	14 (56.0)
Certificate	1 (4.0)
BA	4 (16.0)
BS	6 (24.0)

Fewer than half of the respondents perceived they had “some knowledge” about ESRD (36%), oral manifestations (28%), and the mental health implications of ESRD (12%). Perceived confidence for treating individuals with ESRD was low (24%) while the perceived importance of ESRD as a clinical disorder and managing oral health was rated “very important” or “extremely important” (76%). However,

communicating regarding the oral health condition of an individual with ESRD to the healthcare team was low (39%). Perception-based responses assessing knowledge, confidence, and importance are shown in Table II.

All respondents agreed that it was worth their time to learn more about ESRD. Most agreed that they would like to learn about ESRD in continuing education courses and seminars (72%). A majority of respondents also agreed that DHs and DH/DTs are a critical part of the health care team when caring for individuals with ESRD (92%) and that DHs and DH/DTs should be employed in hospital settings to care for individuals with ESRD (68%). Participant attitudes towards ESRD are shown in Table III.

General knowledge of ESRD scores were low; less than half (40%) identified hypertension and diabetes as the most common causes of ESRD. However, 60% of the respondents recognized that diabetes could make dialysis more difficult. Most respondents knew that dialysis is a method to filter waste products and toxins from the blood (84%), that there are two types of dialysis treatment (hemodialysis and peritoneal) (64%), and that hemodialysis is a time-consuming medical treatment (72%). Responses were mixed regarding knowledge of oral manifestations including awareness of an orange pallor of the oral mucosa (32%), xerostomia (72%), metallic taste (60%), presence of petechiae (64%), and oral candidiasis (68%). In general respondents had low levels of knowledge regarding special dental hygiene care considerations for individuals with ESRD with only about a third (36%) correctly responding that prophylactic antibiotics are not required. However, most recognized that periodontal inflammation is more severe for individuals with ESRD (72%). Knowledge scores are shown in Table IV.

DISCUSSION

There is limited evidence on the knowledge, attitudes, and perceptions of dental hygienists regarding individuals with ESRD or regarding individuals with CKD with the goal of preventing ESRD. Research

Table II. Perception-based items (n=25)

Perception of knowledge	No knowledge	Slight knowledge	Some knowledge	Fairly knowledgeable	Very knowledgeable
	n (%)	n (%)	n (%)	n (%)	n (%)
How knowledgeable do you feel about ESRD as a dental hygienist/therapist?	5 (20.0)	7 (28.0)	9 (36.0)	3 (12.0)	1 (4.0)
How knowledgeable do you feel about the oral manifestations of ESRD?	9 (36.0)	5 (20.0)	7 (28.0)	4 (16.0)	—
How knowledgeable do you feel about the mental health implications of ESRD?	9 (36.0)	10 (40.0)	3 (12.0)	3 (12.0)	—
Perception of confidence	Not confident at all	Slight confidence	Somewhat confident	Fairly confident	Extremely confident
	n (%)	n (%)	n (%)	n (%)	n (%)
How confident do you feel about treating patients with ESRD?	8 (32.0)	6 (24.0)	6 (24.0)	3 (12.0)	2 (8.0)
How confident do you feel recommending appropriate dental hygiene adjuncts to ESRD patients?	8 (32.0)	4 (16.0)	9 (36.0)	4 (16.0)	—
Perception of importance	Not important	Somewhat important	Important	Very important	Extremely important
	n (%)	n (%)	n (%)	n (%)	n (%)
As a clinical disorder ESRD is _____.	—	—	6 (24.0)	6 (24.0)	13 (52.0)
Managing the oral health of patients with ESRD is _____.	—	1 (4.0)	5 (20.0)	6 (24.0)	13 (52.0)
Communicating the oral health condition of an ESRD patient with the healthcare team of an ESRD patient is _____.	—	—	4 (16.0)	6 (24.0)	15 (60.0)

Table III. Attitude-based items (n=25)

	Disagree	Neutral	Agree
Statement	n (%)	n (%)	n (%)
It is worth my time as a dental hygienist/therapist to learn more about ESRD.	—	—	25 (100)
I would like to learn more about ESRD via courses or seminars.	—	7 (28.0)	18 (72.0)
I am a crucial part of the health-care team when caring for patients with ESRD.	1 (4.0)	1 (4.0)	23 (92.0)
I think dental hygienists/therapists should be employed in hospital settings to care for ESRD patients.	1 (4.0)	7 (28.0)	17 (68.0)

on the management of ESRD population and prevention of ESRD has focused on primary health care providers, and specialists including nephrologists.^{26,31,32} Literature has established that dental hygienists may be well-suited for the leading position of integrated health care models in nontraditional health care settings including hospitals and long-term care facilities.^{33,34} Furthermore, there is a need for interdisciplinary practice in medical-dental settings to improve overall health outcomes.³⁵ It is unclear whether the current dental hygiene curriculum and educational experiences provide the necessary education to support dental hygiene practice for individuals with ESRD in non-traditional settings.

Results from this pilot study suggest that that the respondents from this sample population did not feel knowledgeable or confident in treating individuals with ESRD. The UMN DH curriculum has a two-hour lecture on ESRD in the fall clinical applications course and a graded case-based evaluation. This topic is embedded in the program and was not part of the study. However, the respondents expressed lack of knowledge and confidence merits further examination. While the Commission on Dental Accreditation (CODA) Standards do not specify inclusion of ESRD in the curriculum, Standards 2-8d and 2-12 encompass language that can be applied to individuals with ESRD.³⁶ The intent of Standard 2-8d is to prepare students as an integral member of the health care team.³⁶ Individuals with ESRD need the support of a comprehensive health care team to be knowledgeable of potential side effects and manifestations indicating disease progression.³⁷ The intent of Standard 12-2 is for a wide scope of patient experiences.³⁶ Given the relationships between periodontitis, diabetes, and ESRD, it is critical

that students have the knowledge and confidence in the prevention of conditions leading to CKD and the management of ESRD.^{18-20,22} Although the participants in this pilot study did not feel confident in caring for individuals with ESRD, they understood the importance of this complex chronic illness and displayed positive attitudes toward learning more about ESRD in order to become a more competent and well-rounded oral health care professional. This lack of confidence supports the need for further study.

Respondent attitudes towards learning more about ESRD and their general agreement that DHs and DH/DTs are critical members of the ESRD health care team and should be employed in hospital-based settings, may have been due to clinical experiences in the UMN program. Dental hygiene and DH/DT students participate in rotations at the UMN hospital as part of health care teams. Students have the opportunity to provide oral assessments and assessments for a wide range of individuals including those receiving dialysis for ESRD. These clinical rotations may have influenced the results of this pilot study and should be analyzed further in a larger scale investigation.

Dental hygiene education programs interested in providing their students with experiences in caring for individuals with ESRD, could seek out partnerships with local hospitals, clinics, and dialysis centers. Oral Health in America 2021: Making a Case for Curricular Change, supports the provision of

Table IV. Knowledge-based items (n=25)

Question*	True n (%)	False n (%)	Don't know n (%)
General Knowledge of ESRD			
ESRD is defined by glomerular filtration rate (GFR) less than 15ml/min	7 (28.0)	1 (4.0)	17 (68.0)
Diabetes can make hemodialysis treatment difficult due to damage of the blood vessels	15 (60.0)	—	10 (40.0)
The most common cause of death in ESRD patients is a cardiovascular accident	7 (28.0)	5 (20.0)	13 (52.0)
Hypertension and diabetes are the most common causes of ESRD	10 (40.0)	2 (8.0)	13 (52.0)
Treatment & Management			
Dialysis treatment is a method of filtering waste products and toxins from the blood used in patients with ESRD	21 (84.0)	—	4 (16.0)
Two types of dialysis treatment are hemodialysis and peritoneal dialysis	16 (64.0)	—	9 (36.0)
Hemodialysis is NOT a time-consuming medical treatment	1 (4.0)	18 (72.0)	6 (24.0)
Patients with ESRD should avoid the use of NSAIDs	17 (68.0)	—	8 (32.0)
Oral Manifestations			
An orange pallor of the mucosa is commonly present in patients with ESRD	8 (32.0)	2 (8.0)	15 (60.0)
Xerostomia is seen in patients with ESRD	18 (72.0)	1 (4.0)	6 (24.0)
Metallic taste of ammonia-like odor can be present in patients with ESRD	15 (60.0)	—	10 (40.0)
Petechiae and gingival bleeding can be seen in patients with ESRD	16 (64.0)	1 (4.0)	8 (32.0)
Oral candidiasis is more common in patients with ESRD on immunosuppressive medications	17 (68.0)	—	8 (32.0)
Dental Hygiene Care			
Dental hygienists/therapists should take blood pressure in the arm that provides hemodialysis access	2 (8.0)	11 (44.0)	12 (48.0)
Prophylactic antibiotics are not required for routine dental hygiene treatment for patients with ESRD	9 (36.0)	6 (24.0)	10 (40.0)
Systemic fluoride supplements are contraindicated in patients with ESRD	3 (12.0)	7 (28.0)	15 (60.0)
ESRD patients who use heparin for dialysis can receive elective dental cleanings the same day as dialysis treatment	1 (4.0)	14 (56.0)	10 (40.0)
Periodontal inflammation may be more severe for patients with ESRD	18 (72.0)	—	7 (28.0)

*Correct responses to the questions are highlighted.

experiences in alternative dental care delivery sites for interprofessional management of health conditions such as ESRD.³⁵ Dental-medical teams are needed to increase access to care for individual with chronic conditions to improve health outcomes.³⁵

Knowledge scores from the CKD-SMKT were low in the categories of general knowledge of ESRD and dental hygiene care modifications for individuals with ESRD. This may have been due to the specific nature of some of the items such as the glomerular filtration rate in ESRD and the contraindication of systemic fluoride treatments in patients with ESRD. Of greater concern was less than half (40%) correctly identified diabetes and hypertension as the most common causes of ESRD. This may indicate the need to place greater emphasis on the health impacts of poorly controlled diabetes and hypertension. Participants recognized that periodontal inflammation may be more severe in individuals with ESRD, they were uncertain regarding the need for antibiotic premedication for dental hygiene care appointments. While the participants in this pilot study received a two-hour lecture and case-based evaluations on ESRD, they may not have retained the information, or it could have been challenging to bridge classroom content to clinical applications. One approach to prepare students to care for individuals with ESRD and other chronic health conditions would be to develop an Objective Structured Clinical Examination (OSCE) utilizing a standardized patient. Use of an OSCE could be an ideal method for assessing the application of knowledge to clinical skills, and prepare students to manage patients with chronic conditions.³⁵

This pilot study had limitations including the small sample size and low response rate which limited the statistical analysis of the data. However, this pilot study assessed the knowledge, attitudes, and perceptions of future oral healthcare providers on ESRD, a growing health concern. The use of an investigator designed survey needs to be further developed and validated for future use on a larger sample. Future studies should be expanded to include knowledge, attitudes and perceptions towards hypertension, diabetes and CKD as they relate to the prevention of ESRD.

CONCLUSION

Participants in this pilot study felt that ESRD was an important health condition that needed to be managed but they lacked knowledge and confidence for treating this population.

Results of this pilot study indicate that using a validated instrument on a national sample is feasible to determine the knowledge, attitudes and perceptions of dental hygiene students regarding ESRD. Future research should include knowledge and awareness of hypertension, diabetes, and the role that management of chronic kidney disease plays in the prevention of ESRD.

DISCLOSURE

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