

Raising Oral Health Awareness Among Nephrology Nurses

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Introduction

According to the National Kidney Foundation, 26 million Americans have chronic kidney disease (CKD).¹ Given the prevalence of conditions such as diabetes and hypertension, it is estimated that an additional 20 million people are at an increased risk for developing CKD.¹ Research suggests chronic kidney disease can give rise to a wide spectrum of oral manifestations affecting the hard or soft tissues of the mouth.^{2,3} Likewise, periodontitis may contribute to the burden of systemic inflammation in these patients.^{3,4} Unfortunately, patients with CKD and their health care providers are often unaware of the oral complications of the disease, as well as the multiple systems that can be affected. The complexity of care for patients with CKD reinforces the need for collaboration between health care providers. The purpose of this study was to raise oral health awareness by providing educational seminars to health care providers, specifically nephrology nurses.

Abstract

Purpose: The complexity of care for patients with chronic kidney disease (CKD) reinforces the need for collaboration between health care providers. The purpose of this study was to raise oral health awareness by providing educational seminars to health care providers, specifically nephrology nurses.

Methods: Educational seminars entitled "Oral Health and Chronic Kidney Disease" were delivered by calibrated dental hygiene educators to nurses in 3 different regions in the United States. The nurse participants (n=106) were given randomly assigned pre- and post-tests, assessing their knowledge of oral health and its relation to CKD.

Results: Pre-tests revealed that nurses had little knowledge of oral health and its relation to CKD. Regardless of questionnaire order, a significant increase of knowledge was observed for both groups (p-value≤0.015), increasing from 61 to 76% on average.

Conclusion: Incorporating interdisciplinary education increases nurses' knowledge and may lead to greater quality of life outcomes and improved overall health in patients with CKD.

Keywords: kidney disease, interdisciplinary collaboration, nurses' oral health awareness

This study supports the NDHRA priority area, **Clinical Dental Hygiene Care:** Develop and test interventions to reduce the incidence of oral disease in special at-risk populations (diabetics, tobacco users, cardiac patients and genetically

Review of the Literature

The prevalence of CKD has heightened the medical profession's awareness of this serious and growing problem in the United States. Systemic complications associated with CKD include cardiovascular (hypertension, congestive heart failure and pericarditis),^{1,5,6} gastrointestinal (anorexia, nausea, vomiting, generalized gastroenteritis, peptic ulcer disease, stomatitis and candidiasis),^{1,6-8} neuromuscular, hematologic and dermatologic systems.^{1,7,8} In 2005, Protor et al reviewed current literature surrounding oral and dental aspects of renal disease and reported conditions that are important for nephrology and dental professionals to know.² The most significant findings are discussed below.

Gingival Enlargement

Gingival enlargement, secondary to drug therapy, is the most reported oral manifestation of renal disease.⁹⁻¹⁶ Gingival enlargement can be induced by cyclosporine and/or calcium channel blockers. Cyclosporine is an immunosuppressant used in organ transplant recipients and has numerous side effects, such as gingival overgrowth.¹⁷ Regular clinical monitoring of cyclosporine-related gingival enlargement is essential, since squamous cell carcinoma and Kaposi's sarcoma have been reported within such gingival lesions.¹⁰

Oral Biofilms

Studies have indicated that the oral hygiene of hemodialysis patients is worse than that of the general population.^{7,18,19} Greater calculus formation, gingivitis, caries, atrophy of the alveolar bone, pathologic mobility proportional to bone resorption and tooth loss have been observed.²⁰ Pocket formation and necrotic teeth found under crowns, bridges and fillings have also been found in patients with CKD. In a study of 45 hemodialysis patients, all had some form of periodontal disease and oral debris, and 64% had severe gingivitis and a higher-than-normal score for the DMFT (decayed, missing and filled teeth) index.²¹

Xerostomia

Symptoms of xerostomia can arise in many individuals receiving hemodialysis, due to restricted fluid intake, as well as side effects of drug therapy.^{1,2} This predisposes the patient to dental caries, gingival inflammation and difficulties with speech. In addition, xerostomia may lead to infections such as candidiasis and acute suppurative sialadenitis.¹⁷

Mucosal Lesions

A wide range of oral mucosal lesions has been described in individuals receiving dialysis and allografts, particularly white patches and/or ulcerations. Uremic stomatitis may manifest as white, red or grey areas of the oral mucosa. Oral mucosal macules and nodules of unknown etiology have been described in 14% of individuals receiving hemodialysis.^{1,2} In addition, the oral mucosa in patients with anemia may appear pale.^{1,2}

Malodor

Uremic patients may have an ammonia-like oral odor. In some instances, CKD can give rise to altered taste sensation. These patients report a metallic taste or the sensation of an enlarged tongue. Because of their immunocompromised state, hemodialysis patients and allograft recipients have increased susceptibility to candidal infections, such as pseudomembranous, erythematous and chronic atrophic candidosis.^{1,2,18,22}

Osseous and Dental Changes

A wide range of osseous changes of the jaw accompany chronic renal disease. These reflect a variety of defects of calcium metabolism due to increased parathyroid activity. The most classically described osseous change is the triad composed of the loss of lamina dura, demineralized bone and lo-

calized radiolucent jaw lesions, such as giant cell granuloma or Brown tumor.² Delayed eruption of permanent teeth has been reported in children with CKD. Narrowing of the pulp chamber of teeth of adults with CKD can also occur. Non-carious tooth loss is more prevalent in individuals with CKD than in the general population.²

Nutritional Deficiencies

Oral symptoms related to vitamin and mineral deficiencies are common in patients with CKD. Manifestations may include cheilosis of the lips from vitamin B deficiency, bleeding gums, tooth loss, gingivitis from vitamin C deficiency and pale lips/tongue. Iron deficiency may manifest orally as a bald tongue, scarlet tongue, atrophied tongue and filiform atrophy. Other possible oral manifestations from nutritional deficiency may include extra oral dermatitis, lichenification around the mouth, peeling of the lips and poor taste acuity.^{1,2,22}

Periodontal Disease

Diseases showing low-grade inflammation, such as diabetes and hypertension, are commonly associated with CKD.¹ Several studies hypothesize that chronic periodontal inflammation may contribute to the chronic systemic inflammatory burden associated with CKD.^{4,23-25} There is evidence to support a mechanistic link among inflammation, atherosclerosis and CKD. Inflammatory biomarkers, such as C-reactive protein and interleukin-6, have been shown to be elevated in CKD.^{4,23-27} Several studies have suggested that untreated dental infection in immunosuppressed individuals could potentially contribute to morbidity and transplant rejection.⁷ A United States population-based study (n=11,955) suggested the importance of considering multiple risk-factors, including periodontal status, because this improves the identification of individuals at high risk for CKD, and may ultimately reduce its burden.⁴ Further research is needed to evaluate the causal inferences regarding the role of periodontal pathogen burden and its contribution to systemic inflammatory burden of CKD.

Interdisciplinary Collaboration

Given the potential for poor oral health to increase risk for systemic disease, it is extremely important that the medical and dental communities be knowledgeable with regard to the oral-systemic relationship so that health care services can be delivered collaboratively. Numerous studies have assessed medical and other health care professionals' knowledge, attitudes and practices with regard to oral health. The majority of these studies have

identified an existing gap in knowledge and practices among medical providers with regard to oral diseases. Quijano et al found that internal medicine trainees had inadequate knowledge regarding periodontal disease and were generally uncomfortable with performing a simple periodontal examination.²⁸ Southern found that, among the nurses surveyed (n=100), their knowledge of oral health status, signs and symptoms of oral disease was inadequate.²⁹ Lewis et al studied pediatricians' attitudes and practices related to the oral health of children 0 to 3 years old and found that only 54% of surveyed pediatricians reported examining the teeth of more than half of their 0 to 3 year old patients. The most common barrier to participation in oral health-related activities in their practices was lack of training, as less than 25% had received oral health education in medical school, residency or continuing education.³⁰ Results from additional studies assessing pediatricians' knowledge and current practices related to oral health have found that further training is needed to enhance confidence, expertise and knowledge of preventive screening and referral.³¹⁻³⁴

Several studies point to an increased awareness of the oral-systemic relationship among medical providers, but suggest limited incorporation of dental care into clinical medical practice. Wilder et al surveyed obstetricians and found that most were knowledgeable of the potential role of periodontal disease as a pregnancy risk factor but did not look into their patients' mouths at initial prenatal examinations.³⁵ A study by Shenoy et al found that the gynecologists' knowledge was high regarding the oral manifestations of periodontal disease, but knowledge was low regarding periodontal disease as a risk factor for pre-term low birth weight babies.³⁶ Reed et al assessed the oral cancer knowledge and experience of medical students in an academic setting and found that students did not receive adequate exposure to oral cancer prevention and detection practices.³⁷ Andersson et al found that, although nurses were aware of the impact of oral health in old age, their attitude was that this was a matter for dentistry.³⁸ Canto et al found that family physicians were aware of the major risk factors for oral cancer when taking a medical history, but less than 24% provided an oral cancer examination to patients 40 years of age and over.³⁹

In order to build the relationships that are integral to implementing collaborative health care services, educational interventions have been used to increase awareness of chronic diseases among health care providers. Overwhelmingly, the literature supports that even brief educational interventions can enhance health provider knowledge. Educational sessions have been found to improve knowledge

and attitudes in the areas of breast cancer assessment,⁴⁰ chronic pain,⁴¹ pediatric mental health management,⁴² awareness and use of geriatric service⁴³ and prescription standards.⁴⁴ A dental hygiene education program for nursing staff increased nurses' knowledge and self-confidence with regard to the provision of oral care to nursing home residents.⁴⁵ Small group workshops taught by medical and dental educators led to an increase in oral knowledge for medical students.⁴⁶

Methods and Materials

The subjects of this study were nurses who work with renal patients at the University of Minnesota hospitals (n=106). The nurses were invited to attend an educational seminar entitled Oral Health and Chronic Kidney Disease, held at the University of Minnesota, School of Nursing. Participation was voluntary and subjects could opt out of the study by choosing not to complete the questionnaires. No demographic data was asked in order to protect anonymity and participant confidentiality. Informed consent was obtained after explaining the purpose of the seminar and the purpose of the questionnaires.

Three dental hygiene educators presented a single, 2 hour educational seminar to renal nurses in 3 university settings: Virginia Commonwealth University, the University of Minnesota and the University of New Mexico. The educators calibrated by collectively researching literature for the creation of uniform seminar content and delivering the information to participants in a lecture format using identical Microsoft Power Point presentations.

To assess the effectiveness of the educational seminars, a single questionnaire was administered to participants as a pre- and post-test. Because the pre- and post-test were the same, data collected from 2 of the initial sites, the University New Mexico and Virginia Commonwealth University, were discarded because the pre-test could prompt participants to pay attention to particular information, and thereby show an effectiveness effect. For the third site, the University of Minnesota, this shortcoming was addressed by creating 2 questionnaires, A and B, and by administering them at random as pre- and post-tests to eliminate a learning effect from taking 1 questionnaire twice. Only these subjects from the third site are evaluated here. Each questionnaire consisted of 10 multiple-choice questions and were color-coded and sequentially numbered for identification and comparison of the pre- and post-surveys. The subjects (n=106) were given randomly assigned pre- and post-tests that assessed their knowledge of oral health and its re-

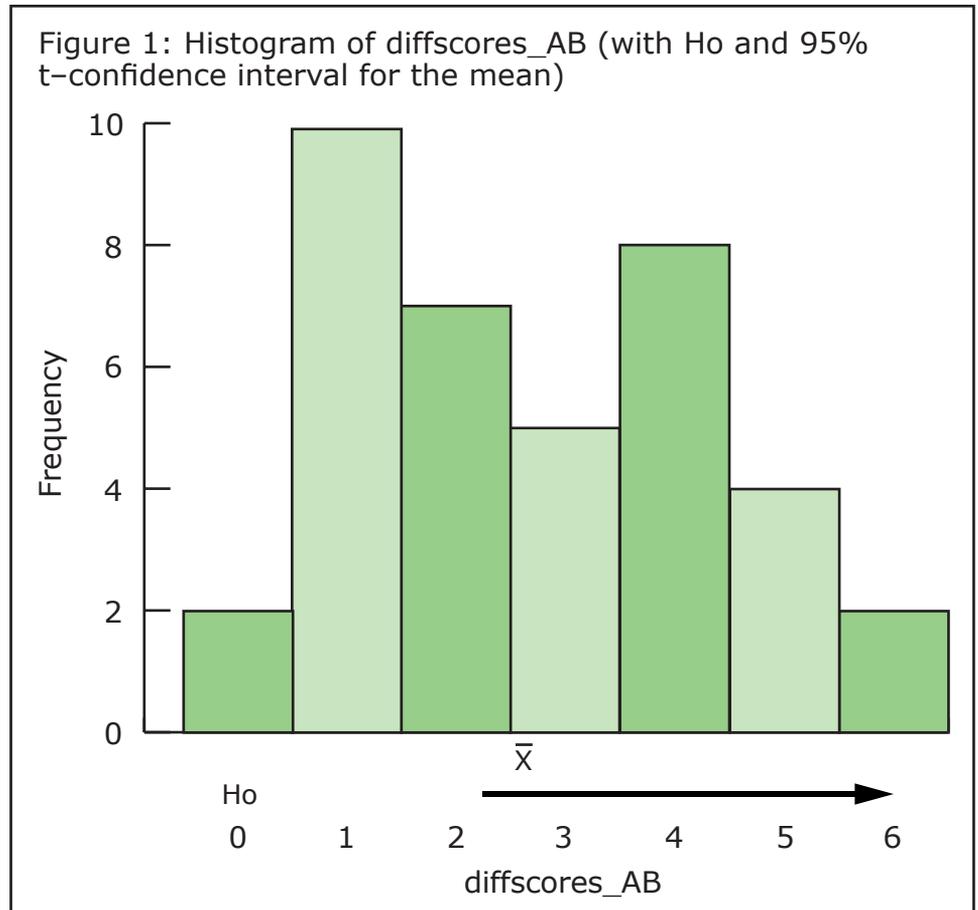
lation to CKD. Scores for the pre- and post-questionnaire were tallied and the score of the pre- was subtracted from the score of the post- so that a positive difference reflected an increase in knowledge. A natural consequence of this design is that 2 groups emerge, those who were assigned the A in the pre-, designated by AB, and those taking B in the pre-, designated by BA. The central hypothesis of the study was that the educational seminar would increase nurses' knowledge of oral manifestations of CKD. The null hypothesis states that there would be no difference between the pre- and post-test.

A 2 sample paired t-test was first performed to indicate whether there is a questionnaire order effect. Separate 1 sample paired t-tests were then performed to indicate whether the increase for each group was significant. Five participants failed to take at least 1 questionnaire, which were excluded from analysis. Questions left blank (only a few among all questionnaires) were considered incorrect. The University of Minnesota Institutional Review Board approved this study as exempted research.

Results

The estimated questionnaire effect was that the AB group had an average improvement of 2.21 more than the BA group, a significant difference with a 2 sample t-test (p -value<0.0005). Therefore, it is important to account for this effect in the individual group improvements. The individual improvements for each group were significant. Figure 1 and 2 shows the distribution of score differences for the AB and BA groups, respectively, with the point labeled HO reflecting the null hypothesis of no improvement. Group AB increased an average of 2.71 (p -value<0.0005), and group BA increased an average of 0.50 (p -value=0.015). Therefore, a significant increase in knowledge was gained. Pre-tests revealed that nurses lacked an understanding of oral health and it's relation to CKD, but understood more after the seminar. Regardless of questionnaire order, a significant increase of knowledge was observed for both groups (p -value \leq 0.015), increasing from 61 to 76% on average.

Figure 1: Histogram of diffscores_AB (with Ho and 95% t-confidence interval for the mean)



Discussion

As the prevalence of CKD continues to escalate in the United States, dental professionals will see an unprecedented number of patients with CKD and end stage renal disease. Because oral health is a critical component of overall general health, it is critical that the nephrology team be aware of the oral complications that CKD and its treatment can cause. Additionally, nephrology nurses need to be aware that periodontal disease and other oral infections may compromise organ transplant. An understanding of these issues may assist renal nurses in recognizing early oral manifestations, providing basic patient education and, when necessary, making referrals to address these concerns. Likewise, the dental professional must understand the basic pathologic process involved in the management of patients with CKD.

Based on the results of this study, it is recommended that educational institutions initiate curriculum innovations that provide the foundational abilities necessary to support an interprofessional approach to health care. The focus of interdisciplinary collaboration in patient treatment should be on promoting mutual understanding, trust and respect, increasing effective communication

and recognizing the importance of self, peer and team assessment among health care professionals. Supporting evidence in the literature suggests that interdisciplinary seminars and/or other educational strategies similar to the one in this study can improve oral health knowledge among health care professionals. However, instructional efforts to increase providers' dental knowledge and opinions of the importance of oral diseases must include components that address self-efficacy in translating knowledge into clinical practice. In addition, more research is needed to evaluate means to sustaining the knowledge gained in educational seminars and whether educational interventions are efficacious in translating knowledge to practice.

Although inconclusive, there is a growing body of research supporting disease processes related to the oral systemic health link. CKD provides a good example of how a systemic condition can affect oral health and why further research in this area is needed. To improve patient outcomes, a collaborative plan between dental and renal professionals must be established. Dental hygienists, nurses, dieticians and nephrologists are ideal candidates to begin working together for the improved health of patients with renal disease.

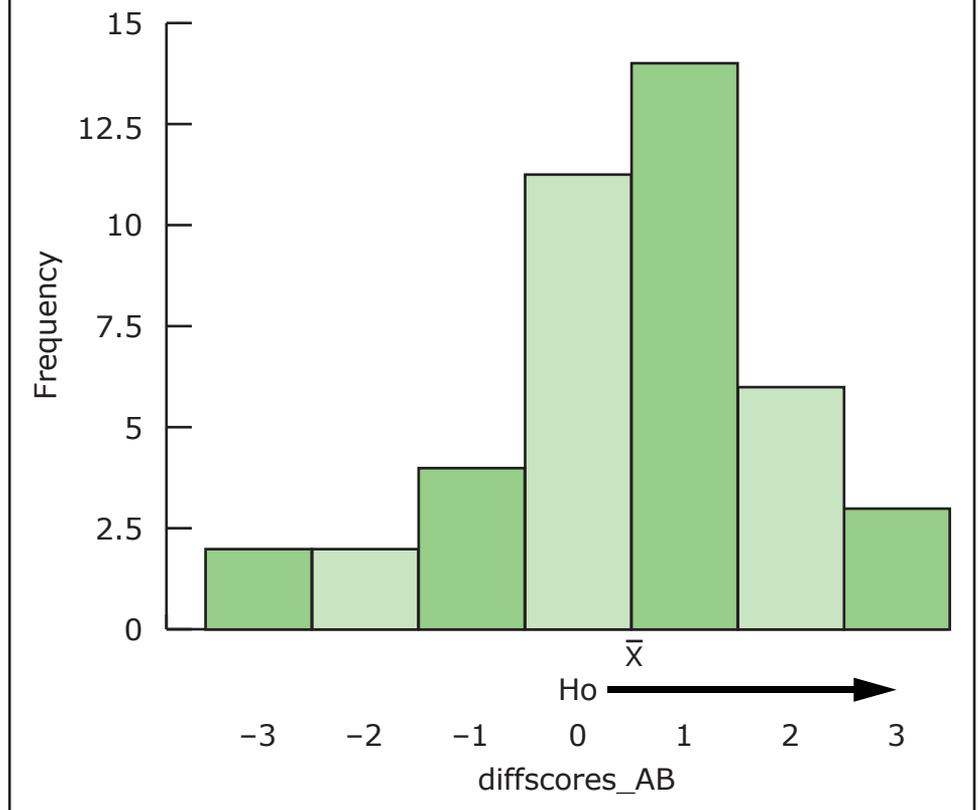
Conclusion

The evidence supports that an educational intervention increases nurses' knowledge of oral health and CKD. As evidence-based practice evolves in nephrology and dentistry, a structured means of communication between these 2 disciplines must be established. CKD provides an example of the

link between oral and general health. Raising oral awareness among nephrology nurses can potentially lead to greater quality of life outcomes and improved overall health in patients with CKD. It is recommended that educational interventions designed to promote interdisciplinary collaboration continue in order to benefit patients with oral-systemic health-associated conditions.

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Figure 2: Histogram of diffscores_AB (with Ho and 95% t-confidence interval for the mean)



References

1. Kidney and urologic diseases statistics for the United States. National Kidney and Urologic Diseases Information Clearinghouse [Internet]. [cited 2007 May 30]. Available from: <http://kidney.niddk.nih.gov/kudiseases/pubs/kustats/index.htm>
2. Proctor R, Kumar N, Stein A, Moles D, Porter S. Oral and dental aspects of chronic renal failure. *J Dent Res*. 2005;84(3):199–208.
3. Thomas CA, Trolinger M. Oral health and chronic kidney disease: building a bridge between the dental and renal communities. *Grand Rounds in Oral-Systemic Medicine*. 2007;2(3):45–53A.
4. Fisher MA, Taylor GW. A prediction model for chronic kidney disease includes periodontal disease. *J Periodontol*. 2009;80(1):16–23.
5. Foley RN. Phosphorus comes of age as a cardiovascular risk factor. *Arch Intern Med*. 2007;167(9):873–874.
6. Hostetter TH. Chronic kidney disease predicts cardiovascular disease. *N Engl J Med*. 2004;351(13):1344–1346.
7. Klassen JT, Krasko BM. The dental health status of dialysis patients. *J Can Dent Assoc*. 2002;68(1):34–38.
8. Little JW, Falace D, Miller C, Rhodus NL, et al. Dental Management of the Medically Compromised Patient. 7th ed. St. Louis: Mosby; 2002. 180–192 p.
9. Ellis JS, Seymour RA, Monkman S, Idle JR. Disposition of nifedipine in plasma and gingival crevicular fluid in relation to drug induced gingival overgrowth. *J Periodontol Res*. 1993;28(5):373–378.
10. Seymour RA, Smith DG. The effect of plaque control programme on the incidence and severity of cyclosporin-induced gingival changes. *J Clin Periodontol*. 1991;18(2):107–110.
11. Colvard MD, Bishop J, Weissman D, Gargiulo AV. Cardizem induced gingival hyperplasia: a report of two cases. *Periodontal Case Rep*. 1986;8(2):67–68.
12. Cucchi G, Giustiniani S, Robustelli F. Gingival hyperplasia caused by verapamil. *G Ital Cardiol*. 1985;15(5):556–557.
13. Hassell TM, Hefti AF. Drug induced gingival overgrowth: old problem, new problem. *Crit Rev Oral Biol Med*. 1991;2(1):103–137.
14. Golden A, Powell DE, Jennings CD. Pathology: understanding human disease. 2nd ed. Baltimore: Williams and Wilkins; 1985. 205–206 p.
15. Rees TD, Levine RA. Systemic drugs as a risk factor for periodontal disease initiation and progression. *Compendium*. 1995;16(1):20,22,26.
16. Seymour RA, Smith DG, Rogers SR. The comparative effects of azathioprine and cyclosporin on some gingival health parameters of renal transplant patients. A longitudinal study. *J Clin Periodontol*. 1987;14(10):610–613.
17. Chialastri SM, Suzuki, JB. Dental implications for the immunocompromised organ transplant patient. *Grand Rounds Oral Sys Med*. 2007;3:36–44.
18. Sharma DC, Pradeep AR. End stage renal disease and its dental management: an overview. *N Y State Dent J*. 2007;73(1):43–47.
19. Levy HM. Dental considerations for the patient receiving dialysis for renal failure. *Spec Care Dentist*. 1988;8(1):34–36.
20. Lócsey L, Alberth M, Mauks G. Dental management of chronic hemodialysis patients. *Int Urol Nephrol*. 1986;118(2):211–213.
21. Naugle K, Darby ML, Bauman DB, Lineberger LT, Powers R. The oral health status of individuals on renal dialysis. *Ann Periodontol*. 1998;3(1):197–205.
22. Bots CP, Poorterman JH, Brand HS, et al. The oral health status of dentate patients with chronic renal failure undergoing dialysis therapy. *Oral Dis*. 2006;12(2):176–180.
23. Stenvinkel P. Inflammation in end-stage renal disease: the hidden enemy. *Nephrology (Carlton)*. 2006;11(1):36–41.
24. Fisher MA, Taylor GW, Papapanou PN, Rahman M, Debanne SM. Clinical and serologic markers of periodontal infection and chronic kidney disease. *J Periodontal Res*. 2008;79(9):1670–1678.

25. Craig RG, Kotanko P. Periodontitis and the end-stage renal disease patient receiving hemodialysis maintenance therapy. *Compend Contin Educ Dent*. 2009;30(8):544–552.
26. Yen JY, Levine RA, Mantadilok V. C-Reactive protein predicts all-cause and cardiovascular mortality in hemodialysis patients. [Am J Kidney Dis](#). 2000;35(3):469–476.
27. Cohen G, Haag-Weber M, Hörl WH. Immune dysfunction in uremia. *Kidney Int Suppl*. 1997;62:579–582.
28. Quijano A, Shah AJ, Schwarcz AI, Lalla E, Ostfeld RJ. Knowledge and orientations of internal medicine trainees toward periodontal disease. *J Periodontol*. 2010;81(3):359–363.
29. Souther H. Oral care in cancer nursing: nurses' knowledge and education. *J Adv Nurs*. 2007;57(6):361–368.
30. Lewis CW, Boulter S, Keels MA, et al. Oral health and pediatricians: results of a national survey. *Acad Pediatr*. 2009;9(6):457–461.
31. Douglass AB, Douglass JM, Krol DM. Educating pediatricians and family physicians in children's oral health. *Acad Pediatr*. 2009;9(6):452–456.
32. Freed GL, Dunham KM, Switalski KE, Jones MD Jr, McGuinness GA; Research Advisory Committee of the American Board of Pediatrics. Recently trained general pediatricians: perspectives on residency training and scope of practice. *Pediatrics*. 2009;123(Suppl 1):S38–S43.
33. Caspary G, Krol DM, Boulter S, Keels MA, Romano-Clarke G. Perceptions of oral health training and attitudes toward performing oral health screenings among graduating pediatric residents. *Pediatrics*. 2008;122(2):e465–e471.
34. Ditto MR, Jones JE, Sanders B, Weddell JA, Jackson R, Tomlin A. Pediatrician's role in children's oral health: an Indiana survey. [Clin Pediatr \(Phila\)](#). 2010;49(1):12–19.
35. Wilder R, Robinson C, Jared HL, Lief S, Boggess K. Obstetricians' knowledge and practice behaviors concerning periodontal health and pre-term delivery and low birth weight. *J Dent Hyg*. 2007;81(4):81.
36. Shenoy RP, Nayak DG, Sequeira PS. Periodontal disease as a risk factor in pre-term low birth weight—an assessment of gynecologists' knowledge: a pilot study. *Indian J Dent Res*. 2009;20(1):13–16.
37. Reed SG, Duffy NG, Walters KC, Day TA. Oral cancer knowledge and experience: a survey of South Carolina medical students in 2002. [J Cancer Educ](#). 2005;20(3):136–142.
38. Andersson K, Nordenram G, Wårdh I, Berglund B. The district nurse's perceptions of elderly patients' oral health: a qualitative interview study. [Acta Odontol Scand](#). 2007;65(3):177–182.
39. Canto MT, Horowitz AM, Drury TF, Goodman HS. Maryland family physicians' knowledge, opinions and practices about oral cancer. [Oral Oncol](#). 2002;38(5):416–424.
40. Gabram SG, Dougherty T, Albain KS, et al. Assessing breast cancer risk and providing treatment recommendations: immediate impact of an educational session. *Breast J*. 2009;15(Suppl 1):S39–S45.
41. Harris JM Jr, Elliott TE, Davis BE, Chabal C, Fulginiti JV, Fine PG. Educating generalist physicians about chronic pain: live experts and online education can provide durable benefits. [Pain Med](#). 2008;9(5):555–563.
42. Kutcher S, Lauria-Horner B, MacLaren C, Bujas-Bobanovic M, Karlovic Z. Short-term educational intervention improves family physician's knowledge of depression. [J Contin Educ Health Prof](#). 2003;23(4):239–243.
43. Carroll JC, Rideout AL, Wilson BJ, et al. Genetic education for primary care providers: improving attitudes, knowledge, and confidence. *Can Fam Physician*. 2009;55(12):e92–e99.
44. Figueiras A, Sastre I, Tato F, et al. One-to-one versus group sessions to improve prescription in primary care: a pragmatic randomized controlled trial. [Med Care](#). 2001;39(2):158–167.
45. Kullberg E, Forsell M, Wedel P, et al. Dental hygiene education for nursing staff. [Geriatr Nurs](#). 2009;30(5):329–333.
46. Silk H, O'Grady Stille S, Baldor R, Joseph E. Implementation of STFM's "Smiles for Life" oral health curriculum in a medical school interclerkship. [Fam Med](#). 2009;41(7):487–491.