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Statement of Purpose

The Journal of Dental Hygiene is the refereed, scientific publication of the American Dental Hygienists' Association. The JDH promotes the pub-lication of original research related to the profession, education, and practice of dental hygiene and supports the development and dissemination of a dental hygiene body of knowledge through scientific inquiry in basic, applied and clinical research.

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Features

Guest Editorial

Supporting Our Communities of Scholars

Catherine K. Draper, RDH, MS
Managing Editor, JDH

Recently, I was invited to speak to the incoming class of graduate learners enrolled in the Master of Science in dental hygiene program at the University of California San Francisco. This cohort of learners were just beginning their scholarly journey and I was there to share the National Dental Hygiene Research Agenda (NDHRA) of the American Dental Hygienists' Association (ADHA), a fairly weighty topic for the second day of class! However, the invitation gave me time to reflect on the role that research plays in the lives of all dental hygienists, no matter where we are in our education or career. The word research often elicits the image of someone in a white lab coat tucked away at the end of a long corridor, far removed from the real world. Clinicians are often unaware of the ongoing and meticulous efforts of their dental hygienist research colleagues and the role that their work plays in building the foundation for our profession. In my new role as managing editor for the *Journal of Dental Hygiene*, I have developed a much deeper appreciation for the role that ADHA plays in supporting the research that will ultimately advance the dental hygiene profession.

As with many things in life, it is often the work that is done behind the scenes, frequently without a lot of fanfare, that makes an impact extending far beyond its boundaries. ADHA has had a long-standing commitment to support the growth of the unique body of knowledge that defines us as a profession and contributes to the ongoing development of our scholarly discipline. ADHA has defined the discipline of dental hygiene, as the art and science of preventive oral health care that includes the management of behaviors to prevent oral disease and promote health.[1] Reflecting back on our beginnings as preventive care providers for school children and the words of Dr. Alfred C. Fones, that a dental hygienist must "regard herself as the channel through which dentistry's knowledge of mouth hygiene is to be disseminated," [2] we have faced many challenges in establishing our own discipline. It would not be until the first conference on dental hygiene research was held at the University of Manitoba in Canada in 1982, followed by subsequent ADHA conferences on the evolving roles of dental hygienists and the adoption of the first NDHRA by the ADHA House of Delegates in 1994,[2] that the foundation would be laid for growing our unique body of knowledge. The NDHRA continues to evolve the direction for dental hygiene researchers and promote the activities of the profession through revisions in 2001, 2007 and most recently in 2016.[3]

Getting back to my recent presentation, it gave me pause to consider the approach I would take with these newly initiated graduate learners. What was their exposure to research and the supporting role that our professional association has played in this ongoing process? Did they think that the two existed in separate silos? What was their view of the ADHA? Was it just another association of dental hygienists calling out for members or was there deeper significance. After all, only about one third of the program directors in my state even hold membership in ADHA and I wondered how this influenced their perceptions. I also wanted to know how they viewed themselves as members of our profession and future leaders. As their professor, Liz Couch RDH, MS, explained in her opening day lecture, our conceptual models, or lenses, shapes how we view our actions in dental hygiene. How had their entry level-education experiences shaped their broader personal identity as dental hygienists? Did they view dental hygiene as an occupation or a profession?

As educators, we often forget about the importance of the lens that we view all things related to our profession. The focus of entry-level dental hygiene education can often become requirement driven for clinical competency and the ongoing role of research to support clinical decisions and ultimately improved oral and systemic health for the public can often be lost. Similarly, the role of membership in our professional association and ADHA's direct support for the countless intangible benefits of research, health policy and advocacy are often lost when providing students with the lists of discounts and tangible member benefits.

These graduate learners were truly on the threshold of discovering of their scholarly identity and their potential for advancing the profession with the support of a much larger community of mentors and peers focused on lifelong scholarship and development; exactly the vision first articulated by UCSF's first program director, the late Margaret Walsh, RDH, EdD.[4] Clarifying the role that ADHA plays in supporting their new community of scholars was an opportunity to change their conceptual model of our professional association. Viewing what happens behind the scenes to support the growth of the dental hygiene discipline through the lens of a scholar has the potential to change the perceived role that professional associations play. As the communities of dental hygiene scholars continues to grow in graduate programs across the country, ADHA has unique opportunities to support them through the *Journal of Dental Hygiene.* I am honored to be a part of this process.

References

1. American Dental Hygienists' Association. Policy manual. ADHA framework for theory development. [Internet]. Chicago (IL); American Dental Hygienists' Association 2016 [cited 2017 Jul 15] Available from: http://www.adha.org/resources-docs/7614_Policy_Manual.pdf

2. Cobban SJ, Edington EM, Compton SM An argument for dental hygiene to develop as a discipline. Int J Dent Hyg 2007 Feb; 5:13-21

3. American Dental Hygienists' Association. National dental hygiene research agenda. [Internet]. Chicago (IL); American Dental Hygienists' Association 2016 [cited 2017 Jul 15] Available from: http://www.adha.org/resources-docs/7111_National_Dental_Hygiene_Research_Agenda.pdf

4. Walsh MM, Ortega E. Developing a scholarly identity and building a community of scholars. J Dent Hyg. 2013 Jan;87 Suppl 1:23-8.

Exploring Interprofessional Relationships Between Dental Hygienists and Health Professionals in Rural Canadian Communities

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Abstract

Purpose: For most Canadians living in rural communities, limited access to dental care can negatively impact oral and general health. This narrative, tertiary review of the literature explores the outcomes of interprofessional relationships between dental hygienists and other health professionals on individuals residing in rural communities in Canada. Themes addressed include: implementing interprofessional education experiences in entry-to-practice health programs, interprofessional dynamics in primary health care teams, health perceptions in rural communities, and barriers and enablers to interprofessional relationships.

Conclusion: Findings from this review suggest that the development of interprofessional relationships between health care professionals is complex and dynamic. Interprofessional collaboration should first be implemented at the educational level to help develop trust and understanding of each profession's role in health care. Alternative models of health care delivery, such as interprofessional collaborative practice, have the potential to reduce overall health care costs and improve access of comprehensive health care services to Canadians residing in rural communities.

Keywords: interprofessional collaboration, interprofessional education, dental hygienists, oral health, access to care, rural populations

This manuscript addresses the NDHRA priority area: **Population level: Access to care** (interventions).

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Introduction

For the approximately 28% of Canadians residing in rural settings, and a dentist-population ratio 3.5 times lower in rural versus urban areas, limited access to dental care impacts oral health and can contribute to concerns for overall health and wellness.[1,2] Several factors are taken into consideration in identifying Canadian rural communities. A rural community is most commonly defined by its geographic area; situated outside of an urban center with fewer than 1,000 residents and a population density of fewer than 400 people per square kilometer.[3] In other words, rurality reflects smaller populations lacking access to the full range of services and infrastructure due to distance and isolation.[4] In times of increasingly complex health care issues including economic challenges, escalating health care costs and limited access to physicians; alternative models of health care delivery such as interprofessional collaborative practice have the potential to improve access to comprehensive health care services, thereby reducing the inequality between urban and rural health care access.[1,5,6] Interprofessional relationships encourage collaboration, communication, and teamwork from multiple health care professional backgrounds to provide comprehensive health care strategies in order to treat the needs of clients.[6,7] Interdisciplinary collaboration further promotes the abilities of professionals to solve problems collectively and supports working together towards a common goal thus diminishing the many common challenges faced by health care systems globally.[6,7]

Western health care commonly utilizes an approach in which the individual is compartmentalized into body parts and disease entities, and by interventions recommended by uniquely educated health care professionals.[8,9] This approach reduces effective collaboration between professionals and contributes to a limited understanding of each other's roles and responsibilities within a health care team.[8-10] Bowes and colleagues state that a multifaceted, coordinated strategy is more effective in reaching a broader range of individuals than the traditional approach where oral health care is seen as independent and outside of mainstream health.[10] An interdisciplinary approach to care that includes the sharing of information and expertise between primary care providers and other health care professionals will enhance the quality of

oral and general health care for Canadians living in rural communities.[10]

Rural settings may not have been able to support the development and maintenance of interprofessional skills due to a lack of resources, large travel distances, and scarcity of hospitals. However, given the link between oral and systemic health, dental hygienists are well positioned to play a pivotal role in collaborating with existing health care providers by incorporating the oral health perspective while exploring the wide range of opportunities to work within rural communities. Such collaboration has the potential to foster increased oral health education and awareness, post-natal education to new mothers, dietary counseling, fluoride clinics, oral cancer screening, smoking cessation, the provision of referral information, and other beneficial services. Referrals from dental hygienists to other health care providers can facilitate the integration of dental hygiene services into the client's total health care plan.[11] It is also noteworthy that increased client satisfaction has been documented when interprofessional collaboration has been maximized.[12]

The purpose of this tertiary literature review is to assess the benefits of interprofessional collaboration between dental hygienists and other health care providers in rural Canadian communities. The need to improve access to health care, including dental care, for rural communities is evident, and research suggests that interprofessional collaboration in health care can positively influence access and practice outcomes.[1]

Methods

A tertiary research review was conducted using the PubMed, CINAHL, Education Source, and Google Scholar search databases with a refined search of peer-reviewed literature published between 1997 and 2015. The following search terms were used: interprofessional role in Canada; oral care; health care; rural communities; education; limitations of dental hygiene in rural Canada; dental or dental hygiene access and rural comminutes; dentist; nurse practitioner; registered nurse/midwife; dietitian; occupational therapist; pharmacist; physiotherapist; physician; physician assistant; physician; and health professional. Sixteen research studies, including exploratory case studies, comparative case studies, randomized controlled trials, longitudinal and retrospective cohort studies, and cross-sectional studies using qualitative, quantitative and mixed method designs were included. Additionally, two literature reviews and two editorials were reviewed. Excluded from this review were articles not published in English.

Discussion

Themes associated with interprofessional collaboration

Interprofessional Education in Entry-to-Practice Health Programs

Interprofessional education (IPE) in post secondary institutions is gaining recognition as it can bring forth collaboration, communication and teamwork necessary to develop a comprehensive health care plan to manage oral and systemic health care needs in clients.[7,12-15] IPE is defined by the World Health Organization (WHO) as students from two or more professions learning about, from, and with each other to enable effective collaboration and improve health outcomes.[6] A growing body of evidence demonstrates the benefits of IPE within entry-to-practice health professional programs.[16] Post-secondary institutions are committed to graduating health professionals who have the ability to work collaboratively as members of an integrated health care team but many educational programs continue to deliver curricula in discipline-specific silos.[16,17] The underlying premise behind IPE is that if health professionals learn together then they will be better prepared to work together towards improving health outcomes.[16,17]

Multiple prominent organizations and accrediting bodies advocate for IPE. The Commission on Dental Accreditation of Canada stipulates that interprofessional collaboration experiences must be provided for students in all dental hygiene programs.[18] The Health Council of Canada has also included a recommendation that each university health program offer IPE to reflect the vision of interprofessional collaborative practice within health care teams and organizations.[20] Research demonstrates that as health workers move through the system, interprofessional learning experiences offer students the necessary skills to become part of a collaborative, practice-ready, health workforce.[6]

In its Framework for Action on Interprofessional Education and Collaborative Practice (2010), the WHO proclaims a worldwide shortage of approximately four million health care workers and calls for an upscaling of health care workforce production through innovative approaches to teaching in developed countries.[19] The WHO acknowledges the need to strengthen health care systems around the world by encouraging a rapid improvement in educational approaches involving interprofessional collaboration.[19] Furthermore, the WHO recognizes interprofessional collaboration to be one of the most promising solutions to transforming health care in order to build a more flexible health workforce that is able to maximize limited resources and improve access to care.[19] In 2008, the WHO conducted a global environmental scan of health educational programs to assess institutional practices involving

IPE.[19] The scan included 396 institutions across 42 countries.[19] Results demonstrated that IPE occurs in numerous countries and involves various health science and human service professions.[19] Oral health professionals, however, were notably absent from the scan results.[16,19]

Research specifically on IPE and dental hygiene is scarce; however, Navickis and Mathieson conducted a recent national survey assessing dental hygiene students' perceptions of interprofessional collaboration across dental hygiene associate degree programs in the United States.[17] Their findings concluded that dental hygiene students have positive attitudes towards IPE and collaborative practice and that participation in IPE may better prepare dental hygienists to provide quality patient care.[17] There is an absence of similar studies assessing IPE perceptions and outcomes in dental hygiene programs in Canada. However, Kanji and colleagues published a model of IPE being utilized in the University of British Columbia's Dental Hygiene Degree Program and concluded that further research aimed at assessing outcomes and collaborative practice behaviors are needed.[16]

Rosenfield, et al, found that the initial perceptions of students in relation to their first experiences in health professional education programs felt that IPE had both value and merit for their professional education.[13] Research suggests that IPE should employ more small-group sessions as opposed to large-group sessions, be less reliant on lecture based learning, become a regular longitudinal part of undergraduate education, and be well integrated into existing curricula.[13,14] In addition, IPE helps with understanding health professionals, offers multiple viewpoints and perspectives, provides review of one's own ideas, increases awareness of one's own specialty, endorses holistic care, supports knowledge of social resources, and encourages communication, group discussion, and sharing.[12] The study offers insight to educators for enhancing the design and implementation of IPE initiatives as well as facilitates the long-term sustainability of IPE.[12-15]

Interprofessional dynamics in primary health care teams and dental hygiene

Interprofessional dynamics in primary health care teams is associated with the roles constructed within interprofessional health care teams as health care professionals often overlook the value of teamwork.[6,15,19,21] Interprofessional collaboration occurs when members of an interprofessional team, each with unique skills, work together to solve problems, provide services, and achieve optimal outcomes for clients and their families.[15,19,21,22] MacNaughton, et al, examined the various types of role boundaries, influences on role construction, and the implications for professionals and clients.[8] The research suggests that concrete strategies and protocols are needed as a lack of formal structure is cited as the major reason for ineffectiveness as well as frequent staff turnover.[15,19,21] Four distinct attributes facilitate collaboration among health care professionals; *accessibility* - being present and willing to help a teammate, *trust* - believing that another person will act in the client's best interest, *value* - to each other's experience, skill, knowledge and perspective, and *leadership* - a strong leader creates and bolsters the shared vision of the organization, motivates team members towards high performance, and provides concrete examples for behaviors within the team.[19] Furthermore, results demonstrate that autonomy may be an important element in how the interprofessional team functions; empowering team members to develop autonomy can enhance collaborative interactions as well as lessen the workloads of teams.[15] When health care professionals work together, an interprofessional approach to care is associated with improved outcomes including greater client care, shorter duration of treatment, and overall reduced costs of care.[19] As such, effective interprofessional collaboration promotes positive client outcomes and can benefit the health care system.[19]

The assertion that oral health professionals can be significant interdisciplinary collaborators in the delivery of public health services was acknowledged in the 2005 Pan-Canadian Framework for Public Health Human Resources Planning when dental hygiene was listed as one of twelve regulated professions along with public health nurses, medical microbiologists, speech-language pathologists, and dietitians.[23] The Framework for Public Health Human Resources Planning was designed to help facilitate the enhancement of partnerships between government and stakeholders and it emphasized that through collaborative planning, all jurisdictions in Canada will have access to a knowledgeable workforce to meet public health needs while reducing health and social disparities.[23] Dental hygiene was identified as one of the professions that can make a significant contribution to achieving this vision.[23]

Health perception in rural communities

Contextual factors such as underprovided public services and the unequal distribution of health services may contribute to the negative health perception in rural communities.[1] Individuals living in rural areas often have a positive image about residing in a rural location and do not see rurality as a threat to their oral health, although research suggests that rural culture is actually considered a health threat.[1,6] Transportation, or lack there of, is one of the primary barriers to accessing oral health care, particularly for the elderly and those with physical disabilities.[1] Rural residents indicate that they have fewer resources and longer wait times than people living in cities and also feel somewhat isolated from dental professionals.[1] A lack of accessible information and limited educational programs focusing on oral health further contributes to the deficiency.[1] The research not only highlights

the need for better education surrounding oral health in rural communities, but also supports the importance of proactive, collaborative, multifaceted approaches in communities and interprofessional approaches to health care.[1] Oral health disease, unmet dental care needs, and lower utilization of dental care are more prevalent in populations whose access is compromised by geographic location.[24] Research demonstrates that collaboration between dental hygienists and public health nurses in rural communities can generate a moderate decrease in the mean number of decayed, missing, filled, and treated teeth as well as increase disease prevention in underserved populations.[24,25] Between the two professions, collaborative counseling sessions about child development, in-home education, fluoride supplements, tooth brushing demonstration, breastfeeding education, and dentally healthy diets can be provided and have been found to be successful education strategies for young mothers and their infants.[24,25]

Barriers and enablers to interprofessional relationships

Professional factors that impede interprofessional collaboration include workload and time constraints.[22] More specifically, workforce limitations, not valuing the team or other health professionals, and absence or fragmentation of services can inhibit successful interprofessional collaboration.[22] As Parker et al state, "health professionals working in rural settings are likely to provide a broader range of services, work longer hours, operate without adequate locum coverage, have restricted access to specialists expertise, and have limited access to professional support networks."[22] Additional challenges include limited access to professional development, lack of supervision and peer support, and minimal opportunity for interprofessional team work.[4] The quality of interprofessional collaboration is remiss when professionals do not know or understand one another's roles, and when others are not considerate of or communicate effectively with other team members.[6,13,22] As a result, defined roles and responsibilities are needed within a safe environment that will encourage open communication.[6,13,22] The conceptual hierarchy among professions must be deconstructed and the knowledge of all professionals should be valued and considered.[6] Recognizing the values of each profession reiterates the importance of understanding one another's professional roles and responsibilities.[6,7,13] In order to safely provide sufficient care as an interprofessional team member, knowledge of collaborating professionals' scope of practice needs to be instilled at the ground level, through IPE.[6,7,13]

Rural health services face challenges in recruiting and retraining adequate numbers of health professionals for various reasons, though most notably due to a feeling of isolation.[22] Collaboration between professionals has been shown to improve retention of health professionals in rural communities because it encourages a sense of community and synergy within the team.[1,22] This sense of community emphasizes the importance of creating a common vision for successful collaboration.[1,4,22]

Lastly, a lack of funding to support interprofessional relationships in rural communities significantly impacts the potential for development of public health initiatives, without which the development of interprofessional activities will not be possible.[4,22] Increased funding will allow for further development of sustainable models of care centered around interdisciplinary approaches to health care, increase the number of public health positions, and provide for additional medical equipment and other educational resources for health care professionals.[26]

Gaps in the research and future recommendations

Health care is beginning to recognize the benefits of interprofessional collaboration, not only to clients' overall health but also in its ability to reach rural communities and reduce health care costs.[4] Further studies are needed to evaluate if the suggestions provided to improve interprofessional relationships, beginning with educational models (small-group sessions, a reduction in lecture-based learning, integration of IPE as a consistent component of undergraduate education), do in fact improve students' knowledge and values regarding interprofessional collaboration.[13,14] These findings underscore the need for further research of interprofessional curricula, to shift the research agenda beyond evaluation of classroom-based interventions and towards linking IPE with changes in collective care behaviour.[13,14,27] Despite international support for IPE there remains a paucity of systematic evidence of its effectiveness and associated practice outcomes.[28] The question remains whether students who experience curricula with embedded IPE are able to practice more interprofessionally post-graduation. A 2015 report from the Institute of Medicine contained recommendations for further study on IPE which included the need to commit resources to a series of well-designed studies to demonstrate the association between IPE and collaborative practice behaviour.[29] Furthermore, attention needs to be given to informal learning (ongoing education cultivated outside of the standard learning process) to create innovative strategies and appropriate conditions for enhancing and incorporating informal learning in the workplace.[12]

There is a scarcity of research on the oral health status of rural populations in Canada.[1] Squillace suggests that improved systematic collection of data from dental hygienists in public health settings would provide evidence that may affect public oral health policies and encourage further funding and

research.[24] Such data sets include frequency of visits to a dental professional, subsequent use of prevention and restorative services, and the corresponding age of the client to these visits.[24]

Future research can focus on the development of sustainable models of rural interprofessional relationships and the mechanisms that drive successful interprofessional relationships in rural communities, including strategies involving dental professionals.[22] Although there is research surrounding interprofessional relationships within the dental profession, current research has not explored the outcome of dental professionals integrating within other health professional communities and the contributing factors that can improve health care with the added expertise of the oral health care professional. A greater understanding of the barriers and possible solutions for interprofessional relationships between dental and other health care professions is essential to adequately demonstrate the outcomes of interprofessional relationships between dental hygienists and other health professionals on Canadian rural communities and on rural communities at large.

Conclusion

To achieve interprofessional collaboration there is a need for cultural change, trust, respect, and sharing of information and communication across professions.[22] The development of interprofessional relationships between health care professionals is a complex dynamic and this relationship needs to begin with IPE at the entry-to-practice educational program level to develop trust and understanding of one another's role in health care.[7,13] Alternative models of health care delivery, such as interprofessional collaboration, have the potential to improve access of comprehensive oral health and health care services to rural communities therefore reducing the inequality between urban and rural health care access.[1,5] Research demonstrates that collaboration between dental hygienists and public health nurses increases overall health and disease prevention in underserved populations.[24,25] Collaborative interprofessional partnerships may provide all jurisdictions in Canada with better access to a knowledgeable public health workforce to meet public health needs and reduce health and social disparities.[23] Dental hygiene has been identified as one of the professions that can have a meaningful role in achieving this vision.[23-25] More research is needed to identify effective strategies to provide oral health care to underserved communities and to recognize the complex relationship between collaboration and autonomy to further understand the implications of interprofessional collaboration for professionals and clients.[1,15]

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References

1. Emami E, Wootton J, Galarneau C, et al. Oral health and access to dental care: A qualitative exploration in rural Quebec. Can J of Rural Med. 2014 Spring;19(2):63-70.

2. Database of Population: Urban and Rural [Internet]. Ottawa (ON): Statistics Canada: Government of Canada. 2011 [cited 2016 May 23]. Available from: http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/demo62a-eng.htm

3. Database of Data and Definitions [Internet]. Ottawa (ON): Statistics Canada: Government of Canada. 2015 [cited 2016 Jun 5]. Available from: http://www.statcan.gc.ca/pub/21-006-x/2008008/section/s2-eng.htm

4. Paliadelis PS, Parmenter G, Parker V, et al. The challenges confronting clinicians in rural acute care settings: a participatory research project. Rural Remote Health. 2012 Jun 29;12(2):2017-30.

5. Worster A, Sardo A, Sarco A, et al. Understanding the role of nurse practitioners in Canada. Can J of Rural Med. 2005 Spring;10(2):89-94.

6. World Health Organization. Interprofessional collaborative practice in primary health care: Nursing and midwifery perspectives. Human Resources for Health Observer. 2013 Sept;13:1-24.

7. Vanderbilt A, Isringhausen K, Bonwell P. Interprofessional education: the inclusion of dental hygiene in health care within the United States - a call to action. Adv Med Educ Pract. 2013 Oct 29;4:227-29.

8. MacNaughton K, Chreim S, Bourgeault IL. Role construction and boundaries in interprofessional primary health care teams: a qualitative study. BMC Health Serv Res. 2013 Nov 24;13(1):486-99.

9. Costa D, Barg F, Asch D, et al. Facilitators of an interprofessional approach to care in medical and mixed medical/surgical ICUs: a multicenter qualitative study. Res Nurs Health. 2014 Jul 3;37(4):326-35.

10. Bowes D, McConnell H, Van der Horst M. Case report: interprofessional collaboration – a nursing-dental hygiene experience. Can J Dent Hyg. 2010 Sept;44(5):217-20.

11. College of Dental Hygienists of British Columbia. Referrals by dental hygienists [Internet]. Victoria (BC): College of Dental Hygienists of British Columbia; 2005 - 2013 [cited 2016 Mar 28]. Available from: http://www.cdhbc.com/Practice-Resources/Interpretation-Guidelines/Referrals-by-Dental-Hygienists.aspx

12. Maeno, T., Takayashiki, A., Tokie, A., et al. Japanese students' perception of their learning from an interprofessional education program: a qualitative study. Int of Med Edu. 2013 Jan 1;4(1):9-17.

13. Rosenfield D, Oandasan I, Reeves S. Perceptions versus reality: a qualitative study of students' expectations and experiences of interprofessional education. Med Educ. 2011 Apr 12;45(5):471-77.

14. Olson R, Klupp N, Astell-Burt TE. Reimagining health professional socialization: an interactions study or interprofessional education. Health Sociology Rev. 2016 Sept 6;25(1):92-107.

15. Wilbur K, Kelly I. Interprofessional impressions among nursing and pharmacy students: a qualitative study to inform interprofessional education initiatives. BMC Med Edu. 2015 Mar 19;15(1):53-60.

16. Kanji Z, Lin D, Krekowski C Interprofessional education and collaborative practice. Can J Dent Hyg. 2017 Feb;51(1):42-8.

17. Navickis MA, Mathieson K. U.S. dental hygiene students' perceptions of interprofessional collaboration. J Dent Educ. 2016 Sept 1;80(9):1041-8.

18. Commission on Dental Accreditation of Canada. Accreditation requirements for dental hygiene programs [Internet]. Ottawa (ON): Commission on Dental Accreditation of Canada; 2001 - 2015 [cited 2016 Dec 10]. Available from: https://www.cda-adc.ca/cdacweb/en/accreditation_requirements/dental_hygiene/

19. World Health Organization. Framework for action on interprofessional education and collaborative practice. Health Prof Networks, Nurs Midwife Human Res Health. 2010;12-17.

20. Health Council of Canada. Primary health care: a background paper to accompany health care renewal in Canada, accelerating change [Internet]. Toronto (ON): Health Council of Canada; 2005 [cited 2016 May 29]. Available from: http://www.healthcouncilcanada.ca/tree/2.44-BkgrdPrimaryCareENG.pdf

21. Zwarenstein, M., Reeves, S., Russell, A., et al. Structuring communication relationships for interprofessional teamwork (SCRIPT): a cluster randomized controlled trial. Trials. 2007 Sept 18;8(1):23-37.

22. Parker V, McNeil K, Higgins I, et al. How health professionals conceive and construct interprofessional practice in rural settings: a qualitative study. BMC Health Serv Res. 2013 Dec 1;13(1):500-11.

23. Joint task Group on Public Health Human Resources. Building the public health workforce for the 21st century [Internet]. Ottawa (ON): Government of Canada; 2005 [cited 2016 May 29]. Available from: http://publications.gc.ca/collections/collection_2008/phac-aspc/HP5-12-2005E.pdf

24. Squillace J. Study of a rural practice dental hygienist in a public health setting: analysis of an administrative dataset. J of Health Care Poor Underserved. 2012 May;23(2):739-51.

25. Harrison R, White L. A community-based approach to infant and child health promotion in British Columbia first nations communities. Can J of Comm Dent. 1997 May;12(1):7-14.

26. Gittell JH, Godfrey M, Thistlethwaite J. Interprofessional collaborative practice and relational coordination: improving healthcare through relationships. J of Interprof Care. 2013 May; 27(3):210-3.

27. Costanza ME. Measuring the impact of interprofessional education on collaborative practice and patient outcomes. J Interprof Educ Pract. 2015 Jun 1;1(2):34-5.

28. Lapkin S, Levett-Jones T, Gilligan C. A systematic review of the effectiveness of interprofessional education in health professional programs. Nurse Educ Today. 2013 Feb;33(2):90-102.

29. Cox M, Cuff P, Brandt B, et al. Measuring the impact of interprofessional education on collaborative practice and patient outcomes. J Interprof Care. 2016 Feb;30(1):1-3.

Experiences of the Kansas Extended Care Permit Providers: A descriptive study

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Abstract

Purpose: A total of 40 states to date have expanded the role of dental hygienists with the goal of improving access to basic oral health services for underserved populations. In Kansas, legislative changes have resulted in the Extended Care Permit (ECP) designation. The purpose of this study is to describe the experiences of registered dental hygienists in Kansas holding ECP certificates (ECP RDH) as of July of 2014.

Methods: Secondary data analysis was performed utilizing data collected from a survey conducted in 2014 by Oral Health Kansas. All registered ECP RDH's were sent the 32-item survey via Survey Monkey®. Descriptive statistical analyses consisted of frequency distributions, and measures of central tendency. Inferential analyses using t-tests and ANOVA were conducted to compare groups.

Results: A total of 73 responses were received from the (n= 176) surveys that were e-mailed for a 41% response rate. Of the clinicians who responded, 80%, worked at least part-time and in school settings. The most consistent barriers to providing care were the inability to directly bill insurance (52%), financial sustainability (42%) and physical requirements (42%). Follow-up tests found significant differencs between clinician groups when examining barriers.

Conclusion: Although the ECP legislation appears to be expanding access to care for citizens in Kansas, significant barriers still exist in making this a viable model for oral healthcare delivery.

Keywords: dental hygienist, underserved, access to care, Extended Care Permit, barriers to care, health disparities

This manuscript supports the NDHRA priority area, **Population level: Access to care** (interventions).

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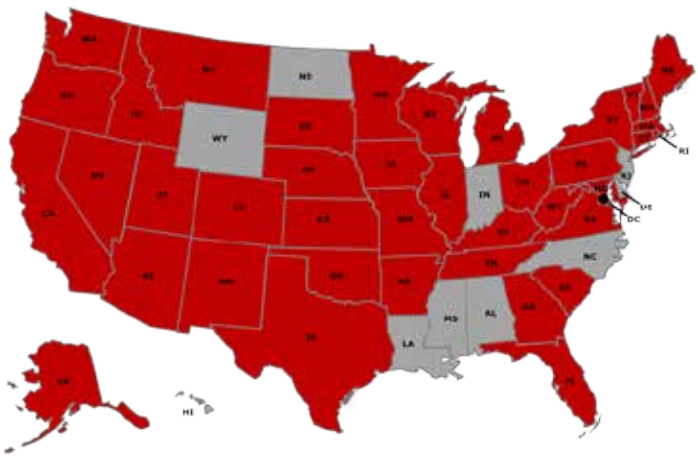
Introduction

Former Surgeon General Richard H. Carmona released "A National Call to Action to Promote Oral Health" in 2003.[1] This *Call to Action* was designed to further the May 2000 report "Oral Health in America: A Report of the Surgeon General".[2] *Call to Action* had three major goals: promote oral health, improve quality of life, and eliminate oral health disparities. As of 2016, dental providers, healthcare workers and legislators across the United States continue to work toward accomplishing these goals.

Healthy People 2020 highlights that individuals with less access to preventive dental services have greater rates of oral diseases.[3] Individuals without the means, or employer-subsidized benefits, often find themselves in a position of severely limited options for affordable oral care. Direct access to oral care from dental hygienists is one method to combat this problem. Currently, 40 states, including Kansas, have legislated variations on direct access for the practice of dental hygiene. Figure 1.[4-5]

Figure 1. Direct Access State Map, American Dental Hygienists' Association[5]



*Red areas denote direct access states

A 2015 report of the U.S. Department of Health and Human Services (USDHHS) outlining the national and state-level predictions for dentists and dental hygienists noted that all 50 states, in addition to the District of Columbia, are expected to experience a shortfall of dentists; while the number of dental hygienists is expected to outpace the number of patients in need of hygiene services.[6] Dentist shortfall areas as of March 2016 in the state of Kansas are shown in Figure 2.[7] The USDHHS report suggested considering the use of dental hygienists, an existing member of the dental team, to minimize the impact of anticipated dentist shortages.[6]

Figure 2. Dental Healthcare Provider Shortfall Areas in Kansas[7]

Dental Practice Models Impact on Access to Oral Healthcare

It has been argued that the structure of a typical dental office contributes to reduced access to care.[8-10] Kitchener and Mertz describe the typical model of practice to be a clinic or dental office where dentists and their team members provide a full range of services to patients presenting for care on an autonomous basis. In addressing the issues of access to care for the underserved and unserved, one successful practice model is the safety net clinic, which provides access for all segments of the population regardless of their socioeconomic status.[11] Safety net settings can be defined as public clinics, hospitals and community health clinics.[12] Federally Qualified Healthcare Centers or FQHCs are a common type of safety net setting.

Alternative practice settings for dental hygienists have also been utilized to expand access to care. In 2012, a case study was conducted in the state of California to examine the experiences of registered dental hygienists practicing in alternative practice (RDHAP).[9] California RDHAPs were found to practice primarily in non-fixed settings such as community facilities, residential assisted living facilities, private residences and school-based settings.[9] A subsequent study examining the development of the RDHAP in California concluded that while RDHAP providers serve populations with high levels of need, extreme difficulties in accessing those populations via both traditional and alternative practice models still exist.[10] Key among the findings were difficulties with payer acknowledgement on the part of Medicare and insurers and Medicaid requirements that continuied to exacerbate access to care barriers.

Alternative Practice Roles in Dental Hygiene

State-specific legislation has created a wide range of roles for dental hygienists to pursue, as well as a variety of specific education and licensure requirements, in order to increase access to care for all individuals. From 2008 to 2014 there was a 32% increase in the number of states adding legislation to expand the dental hygiene scope of practice as a means of improving access to care.[13] Examples of states expanding of the scope of practice include Colorado where dental hygienists are permitted to practice independently as well as own and operate their own practice without any additional licensure requirements and Oregon where the Expanded Practice Permit Dental Hygienist (EPPDH) model allows dental hygienists to provide care to limited access populations without the supervision of a dentist.[14, 15]

Many other states have come up with unique solutions when it comes to alternative practice models for dental hygienists. Notable among these is the mid-level provider role for dental hygienists with legislation that has passed in Minnesota, Maine and Vermont establishing dental hygiene based, oral care provider models. To date, much summary research has highlighted not only the disparity of access to care issues but also the significant variations scope of practice legislation for dental hygienists.[16]

Kansas Extended Care Permit Program

Specific to Kansas, the so-called "Dental Hub" program evaluations from 2007 – 2011 demonstrated increases in access to care on both geographic and socioeconomic levels through the utilization of a centrally located safety net "hub" clinic offering full-service dental care and combined with remote public health facilities, or "spokes", for preventive and screening level care.[17] Individuals living in remote areas or having limited financial resources were able to receive care through this model. Participants noted the program became significantly more sustainable with the creation of the Kansas Extended Care Permit (ECP) program, as the "spoke" clinics were primarily staffed and run by Kansas ECP dental hygienists.

Development and legislation of the Kansas ECP role for dental hygienists has been a key component to the state's approach to addressing the disparities in access to care. Currently Kansas has three levels of the Extended Care Permit program; Extended Care Permit I (ECP I), Extended Care Permit II (ECP II), and Extended Care Permit III (ECP III).[18] (Table I)

Preliminary studies of the Kansas ECP dental hygienist, completed in 2010, demonstrated that this legislation enabled providers to reach previously unserved or underserved populations.[19] Qualitative analysis resulted in the emergence of an "entrepreneurial spirit" theme associated with ECP providers willing to work outside of the traditional practice model, learn new skills required to provide ECP services, and tackle a variety of barriers in order to increase access to oral healthcare services.[19]

Brotzman-Myers et al. conducted a follow up quantitative study in 2012 to examine the perceptions of all registered ECP dental hygienists in the state of Kansas.[20] A majority of the respondents (92%)

Table I. ECP I, II & III Descriptions

	ECP I – 2003*	ECP II – 2007*	ECP III – 2012*
Permit Requirements	• ≥ 1200 clinical hours, or dental hygiene instruction ≥ 2 years in the previous 3 years • Current CPR Certification • Dentist sponsor with signed agreement • Current professional liability insurance coverage	• ≥ 1600 clinical hours, or dental hygiene instruction of ≥ 2 years in the previous 3 years • 6 additional training hour, specific to care of special needs patients • ≥ 3 hours CE in area of special needs every licensure cycle • Current CPR Certification • Dentist sponsor with signed agreement • Current professional liability insurance coverage	• ≥ 2000 clinical hours, or dental hygiene instruction ≥ 3 years in the previous 4 years • 18 additional hours in Kansas Dental Board approved course • ≥ 3 hours CE in area of expanded scope of practice every licensure cycle • Current CPR Certification • Dentist sponsor with signed agreement • Current professional liability insurance coverage
Scope of Practice	• Children birth through grade 12 eligible for early childhood and other government assistance programs. • Prophylaxis • Fluoride application • Patient Education • Assessment	• = ECP I • Persons with developmental disabilities. • Persons 65+ in community or government housing or living in home with an HCBS waiver.	• = ECP I & ECP II • Identify decay, remove with hand instrument and place temporary filling, glass ionomer or other palliative material • Denture adjustments and soft relines • Smooth sharp tooth with slow speed handpiece • Simple extractions of deciduous teeth with "Class 4 Mobility" • Administer local block and infiltration anesthesia • Administer N2O2 (General Supervision)

Source: Kansas Board of Dental Examiners[18]
*Legislation passed

believed that the ECP provides greater access to oral healthcare. ECP providers reported utilizing their permits in a variety of settings including schools, Head Start centers, safety net facilities, and nursing homes. Barriers faced by providers in fully utilizing their ECP permits included difficulties with facility administrators (39%), obtaining start up financing (22%), limited workspace access (14%), and finding a sponsoring dentist (12%). Of the 60 ECP respondents completing the survey, ECPs were shown to be providing oral healthcare services in 58 out of 105 counties in Kansas, with a significant number designated as health professional shortage areas.[20]

A 2015 study of the Kansas school-based oral health program, Miles of Smiles (MOS), utilizing care provided by an ECP hygienist provider in partnership with the University of Missouri Kansas City (UMKC) School of Dentistry, demonstrated that children who had contact with the ECP hygienist had significantly reduced rates of decay, increased provision of restorative treatment and a decreased urgency for dental restorative needs.[21]

While the Kansas extended care permit dental hygienist does not parallel health provider models such as advanced practice nurses requiring a masters and doctorate level education, it does provide an intermediate step for expanding access to care. It is instructive to know that legislation for a mid-level provider has been introduced every year since 2011 in Kansas with continued opposition from organized dentistry. Similar to other health professions, the proposed Kansas mid-level legislation calls for dental hygienists to complete graduate level education as one of the requirements for mid-level provider status .

As Kansas continues to pursue alternative methods to improve access to care, ongoing research must be done to evaluate how the existing ECP workforce model impacts access to oral healthcare. To that end, Kansas's oral health coalition, Oral Health Kansas (OHK), developed a survey for Kansas ECP hygienists to gain insight into the ECP program. Data were collected in the summer of 2014 to determine the impact of all ECP dental hygienists (Levels I, II and III) in increasing access to oral healthcare services in the state. The purpose of this study is to describe the experiences of registered dental hygienists in Kansas holding ECP certificates (ECP RDH) as of July of 2014.

Methods and Materials

Secondary data analysis was performed utilizing data collected from a survey conducted in 2014 by Oral Health Kansas upon receipt of approval from the University of Missouri-Kansas City, Institutional Review Board (#15-332) .

Subjects

The target population for this study consisted of all dental hygienists in Kansas holding an Extended Care Permit at the time of the survey administration (n=176). The electronic survey was launched on

Table II. Demographics of ECP Provider Respondents

Highest Degree Obtained	**n=72**	**%**
Associates	35	49%
Bachelor's	28	39%
Master's	6	8%
Other	3	4%
Year Received RDH License	**n=73**	
1970-1979	10	14%
1980-1989	14	19%
1990-1999	11	15%
2000-2009	31	42%
2010-current	7	10%
Years in Practice	**n=73**	
3-10 years	27	37%
11-20 years	21	29%
21-30 years	11	15%
31-44 years	14	19%
Currently Employed	**n=73**	
Yes	68	93%
No	5	7%
Year Received ECP I	**n=33**	
2003-2006	8	24%
2007-2010	11	33%
2011-2013	14	42%
Year Received ECP II	**n=37**	
2007-2008	13	35%
2009-2011	11	30%
2012-2014	13	35%
Year Received ECP III	**n=17**	
2013	14	82%
2014	3	18%
ECP Current	**n=73**	
Yes	62	85%
No	5	7%
No Response	6	8%

June 16, 2014 and closed on July 5, 2014. A total of 176 surveys were e-mailed and a response rate of 41% (n=73) was obtained. Demographics of the study participants are found in Table II.

Survey Instrument

The 32-item survey developed by Oral Health Kansas (OHK) was delivered via an online format using Survey Monkey®. The survey employed a combination of response formats from a menu of Likert scales, multiple allowable answers, and open-ended written comments. Questions pertained to demographics and employment statistics, motivation for attaining and using an extended care permit, and barriers to practice. Content validity was ensured through experts employed by OHK with knowledge and involvement in the Kansas ECP dating back to the initial legislative process in 2003.

Statistical Analysis

Quantitative data analysis was performed. Descriptive data analyses consisted of frequency distributions and percentages. Inferential data analysis consisted of the conduct of independent-samples *t* tests and analysis of variance (ANOVA) to examine group differences.

Results

The majority of the OHK survey respondents reported obtaining an associate degree in dental hygiene between 2000-2009. Thirty-seven percent reported being in practice 3-10 years, and twenty-nine percent 11-20 years. Ninety-three percent reported being currently employed and the majority of ECP dental hygiene respondents (85%) reported maintaining a current ECP status. (Table II)

The survey also examined how many days per week respondents worked in specific settings. The largest number of respondents reporting full-time work (n=12), 5 days/week, were found to be working in an FQHC setting. The second largest practice setting is the traditional privately owned solo/group practice setting (Table III).

For this study, only half (n=37) of the respondents reported actively providing ECP services, and of those, 69% provide ECP services on a limited, part-time basis. Community settings with the greatest number of ECP dental hygienists currently providing care are school-based programs (n=58), followed by skilled nursing centers (n=14), and senior-focused housing and health departments (n=24). Senior–focused housing has experienced the greatest increase over time in the use of the ECP dental hygienist. While hospital settings and Indian reservations were also included in the survey, none of the respondents reported providing services in either of these settings (Table IV).

Besides workplace settings, the ECP clinicians were asked to report on the specific populations currently or previously receiving ECP services. Currently, the respondents provide the greatest concentration of ECP services to school aged children with the greatest increase over time occurring in populations of children with special needs and services to elders (Table V).

The ECP clinicians were asked to identify barriers to rendering ECP care to patients. Fifty-two percent of respondents identified the inability to direct bill private insurance as an ongoing barrier to providing ECP services. Specifically, the inability to directly bill Medicaid was identified as a barrier by 41% of respondents. Roughly half of respondents, 47%, identified consent for care as a current barrier. Similar response rates were noted for financial viability (44%), physical requirements (42%), and inadequate patient numbers (38%). However, more than half of the respondents believed these issues were no longer a barrier to care. (Table VI).

An independent-samples *t*-test comparing perceived total barriers (dependent variable) between ECP hygienists working in private practice and FQHC practice settings (grouping variable) found a significant difference between the means of the two groups ($t(47) = 2.287$, $p<.05$). Dental hygienists in FQHC

Table III. Employed/Number of Days Per Week x Workplace Setting

Currently Employed	Yes	No				
	68 (93%)	5 (7%)				
Workplace Setting Currently Using ECP	**<1**	**1**	**2**	**3**	**4**	**5**
FQHC	3		1	3	7	12
Solo Practice	3	2	5	3	7	2
Private Practice - Group	2	1	1	2	6	
NON-FQHC		1	1	1	3	5
Health Department	2		1		2	1
School District		1	3	1		
Community College			2		2	1
Head Start	4		1			
University	1					

Table IV. Reported Community Settings

Years Actively Providing ECP Services in a Community Setting	n=37	
1-3 Years	16	43%
4-6 Years	11	30%
7+ Years	10	27%
Days Per Month Providing ECP Care	**n=39**	
Limited Part Time (1 - 12 days)	27	69%
Full Time (17-20 days)	5	13%
Part Time (13-16 days)	4	10%
No response	1	3%

Community Settings ECP Used In (n=74)	Previous	Current	% Increase
School	9 (12%)	28 (38%)	211%
Head Start	7 (9%)	23 (31%)	228%
Other Preschools	2 (3%)	7 (26%)	250%
Skilled Nursing Center	4 (5%)	14 (19%)	250%
Senior-Focused Housing	1 (1%)	12 (16%)	1100%
Health Department	5 (7%)	12 (16%)	140%
Developmental Center	2 (3%)	5 (7%)	150%
Senior Center	1 (1%)	3 (4%)	200%
Homeless Shelter	1 (1%)	1 (1%)	0%

settings perceived fewer barriers (m=2.05, sd=2.4) than dental hygienists in private practice settings (m=4.04, sd=3.46). An independent-samples *t*-test was conducted to compare perceived total barriers (dependent variable) between ECP hygienists who reported interest in applying for the next level of ECP and those with no interest in applying for the next level of ECP (grouping variable). There were no significant differences between groups [t(59) = .866, p>.05]. Dental hygienists planning to apply for the next level ECP reported greater perceived barriers (m=4.71, sd=3.29) than those not planning to apply (m=3.83, sd=3.37). These results show that the perception of barriers to providing ECP care did not impact the decision to pursue the next level of ECP.

A one-way analysis of variance was conducted to evaluate the relationship between years in clinical practice (3-10 years, 11-20 years, 21-30 years, ≥31 years) and perceived total barriers encountered by the ECP dental hygienist. A significant difference was found [F(3,69)=5.99, p<.05]. Post hoc comparisons using the Scheffe's method indicated that the mean score for the clinicians practicing 3-10 years (m=1.96, sd=2.38) was significantly different than that of the clinicians practicing 21-30 years (m=2.50, sd=3.82). This confirmed the impression that clinicians reporting 31+ years of practice perceived greater barriers in the provision of ECP services.

Discussion

The purpose of this research was to describe the experiences of dental hygienists holding an Extended Care Permit in the state of Kansas by performing secondary analysis of the results of an OHK survey administered in the summer of 2014. ECP I legislation was passed in 2003 and data show a steady increase of dental hygienists seeking an ECP I from 2003 to 2014. ECP II legislation, designed to expand the scope of populations served, was passed in 2007 with the number awarded each year remaining relatively stable from 2007-2014. Conversely, ECP III legislation was passed in 2012 to include minimal restorative dentistry procedures such as decay removal using hand instrumentation and placing of a temporary restoration, however there was a sharp decline in in the number of dental hygienists seeking an ECP III from year one to year two (Table II). It is important to note that the various permits, ECP I, II and III, are not contingent on a progressive order. The legislation enacted in Kansas does not require the dental hygienist to obtain an ECP I, prior to being eligible to apply for the ECP II, or ECP III.

Results from this study show that the vast majority of the survey respondents (93%) are currently employed and the workplace setting where the ECP is most often working a five day week (full-time) is in the FQHC setting. The community setting receiving the highest percentage of ECP services during the period of data collection in 2014, were schools and Head Start settings. These findings contrast with previous research highlighting the entrepreneurial interests of ECP clinicians, who reported working independently in community settings beyond schools, such as senior-focused housing.[19] When considering the labor, delay in reimbursement, and added expenses related to billing through a partner dentist (Table VI) these factors may contribute to the study findings showing that ECP dental hygienists are working more frequently in FQHC practice settings versus more autonomous practice settings. It is possible,

given the physical demands, reporting requirements, and various billing challenges, that ECP RDHs turn more often to FQHCs or other safety net settings as places of employment to meet their personal needs. Because the legislation in Kansas does not currently support direct billing by the ECP RDH, costs associated with the delivery of ECP services could easily become overwhelming to ECP RDHs attempting to practice independently. In addition, the burden of self-reliant transportation of persons and equipment to a variety of locations, associated with a mobile dental hygiene practice, can be excessive. The long-term financial sustainability of a solo hygiene practice utilizing an ECP RDH in partnership with a dentist may also be an issue, which is consistent with Siruta's findings from 2013.[22]

Table V. Populations Previously and Currently Receiving ECP Services

Populations Receiving ECP Services (n=74)	Previous	Current	% Increase
Preschool children (ages 3-5)	3 (4%)	30 (41%)	900%
Grade-school Children (ages 6-12)	3 (4%)	30 (41%)	900%
Teenagers (13-19)	3 (4%)	27 (36%)	800%
Infants/Toddlers	4 (5%)	22 (30%)	450%
Elders (65+)	2 (3%)	22 (30%)	1000%
Children with special needs (birth - 19)	1 (1%)	21 (28%)	2000%
Adults with special needs (20-65)	2 (3%)	18 (24%)	800%
Pregnant Women (all ages)	4 (5%)	24 (32%)	500%
Adults (ages 20-65)	5 (7%)	15 (20%)	200%

Table VI. Respondents' Beliefs About Barriers to Care

	n	Not A Barrier	No Longer A Barrier	Still A Barrier
Inability to Direct Bill Private Insurance	56	45%	4%	52%
Obtaining Consent	55	51%	2%	47%
Financial Viability	57	53%	4%	44%
Physical Requirements	59	46%	12%	42%
Inability to Direct Bill Medicaid	56	50%	9%	41%
Inadequate Patient Numbers	56	57%	5%	38%
Sustaining Site Commitment	57	58%	7%	35%
Finding Site Space	57	60%	9%	32%
Lack of Portable Equipment	55	62%	9%	29%
Lack of Knowledge to Establish Sites	55	71%	9%	20%
Working in Isolation	57	83%	2%	16%
DDS Approval of Allowable Services	58	83%	3%	14%
Finding/Keeping Sponsoring DDS	57	86%	4%	11%
Finding Enough CEU for Renewal	59	83%	7%	10%
Completing Application with KDB	59	97%	0%	3%
Acquiring Enough Experience	59	93%	5%	2%

A previous example of a successful program reliant on external support is the Miles of Smiles (MOS) program. MOS worked in partnership with the University of Missouri-Kansas City (UMKC) School of Dentistry which contributed substantial supportive resources and infastructure. Possible reasons why ECP providers rely on safety-net settings, such as FQHC's, may be income stability and the ease of compensation for services provided. Further research is needed in this area to identify and strategize how to negate potential barriers.

Growth in care provided to both young and older adults was revealed although the greatest net growth was identified in senior-focused housing populations. This may correspond with the establishment of the ECP II and III which allowed for increases in age ranges, clinical settings and complexity of care. However, the data still revealed that these groups received care in significantly lower percentages than youth populations. This provides another area of future research to examine the progression of these trends.

Survey respondents reported a wide range of years in clinical practice. Clinicians earlier in their careers, 3-10 years, perceived significantly fewer barriers than those practicing 21-30 years. More research is needed to further investigate the relationship between perceived barriers and years of practice. Among theories to explore, include whether educational programs may be providing newer graduates with improved arwareness and preparation to work in alternative practice settings or utilizing expanded scopes of practice.

The significant decrease in the numbers of ECP III permits issued during the first and second years of its availability should be further investigated. Possible causes could include greater acclimation to independent practice settings and the associated perceptions of barriers to providing ECP care in independent or alternative settings. The present study did not find a significant relationship between the ECP RDH's desire to apply for the next level of ECP permit and perceived barriers to care. Future long-term studies should follow how the ECP III is being used to address access to oral healthcare.

Limitations of this study have been identified. The ECP program is specific to Kansas and describing the Kansas ECP experiences may not have direct implications on clinicians in other states with different practice legislation. However, the results of this study may be useful when evaluating outcomes of changes in scope of practice legislation, particularly in Kansas. Other limitiations include the lack of participation in the development and delivery of the original survey, and the inherent nature of self-reported data to bias.

Conclusion

The results of this research suggest that souces of improved access to care include a variety of FQHC's, other safety net settings, senior-focused housing, and private practices utilizing ECP dental hygienists. Even though the ECP model is not available in all states, the use of similar training and practice models can not only be effective, as in Kansas, but in other states with similar access to care issues and provider shortages. One of the greatest barriers to improved access to care is still the lack of direct compensation for allied dental providers which impacts providers as well as patients. It may be unrealistic to consider providing care without means of efficient reimbursement for services rendered. Additional legislation would be required to minimize the obstacles preventing programs from optimally functioning to improve access to care.

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References

1. National Center for Chronic Disease Prevention and Health Promotion: Division of Oral Health. A national call to action to promote oral health [Internet]. 2003 Jun [Updated 2013 Jul 10; cited 2016 Mar 6].

2. U.S. Department of Health and Human Services. Oral health in America: A report of the surgeon general—executive summary. Rockville, MD: U.S. Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health; c2000. 332 p.

3. Healthy People 2020 [Internet]. Washington DC: US Department of Health and Human Services: Oral Health Disparities. c2014 [Updated 2016 Mar 4; cited 2016 Mar 6]. Available from: https://www.healthypeople.gov/2020/about/foundation-health-measures/Disparities

4. American Dental Hygienists' Association: Direct access chart [Internet]. Chicago: American Dental Hygienists' Association Scope of Practice Facts; 2016 Apr [cited 2016 Apr 23]. Available from: http://www.adha.org/resources-docs/7513_Direct_Access_to_Care_from_DH.pdf

5. American Dental Hygienists' Association: Map of direct access states [Internet]. Chicago: American Dental Hygienists' Association Scope of Practice Facts; 2017 Jan[cited 2017 Jan 23]. Available from: http://www.adha.org/resources-docs/7524_Current_Direct_Access_Map.pdf

6. U.S. Department of Health and Human Services, Health Resources and Services Administration, National Center for Health Workforce Analysis. National and State-Level Projections of Dentists and Dental Hygienists in the U.S., 2012-2025. Rockville, Maryland; c2015 Feb. 16 p.

7. US Department of Health and Human Services Data Warehouse [Internet]. Health Resources and Services Administration: Health professional shortage areas (HPSA) by state and county. c2015 May 29 [Updated 2015 Jul 1; cited 2016 Mar 6] Available from: [Kansas, all counties, Dental] http://hpsafind.hrsa.gov/

8. Institute of Medicine (US) Committee on the Future of Dental Education. Dental Education at the Crossroads: Challenges and Change [Internet]. Field MJ, editor. Washington (DC): National Academies Press (US); 1995 [cited 2016 Dec 18]. (The National Academies Collection: Reports funded by National Institutes of Health).

9. Kitchener M, Mertz E. Professional projects and institutional change in healthcare: The case of American dentistry. Social Science & Medicine [Internet]. 2012 Feb 1 [cited 2016 Mar 6];74(3):372–80. Available from: http://www.sciencedirect.com/science/article/pii/S0277953610007288

10. Mertz E, Glassman P. Alternative practice dental hygiene in California: past, present, and future. J Calif Dent Assoc. 2011 [cited 2016 Mar 6]. Jan;39(1):37-46.

11. U.S. Department of Health and Human Services, Health Resources and Services Administration [Internet]. Integration of oral health and primary care practice. c2014 Feb [cited 2016 Mar 6]. Available from: http://www.hrsa.gov/publichealth/clinical/oralhealth/primarycare/integrationoforalhealth.pdf

12. Institute of Medicine (US) Committee on the Changing Market, Managed Care, and the Future Viability of Safety Net Providers. Americas's health care safety net: intact but endangered [Internet]. in Lewin M, Altman S, editors. Washington (DC): National Academies Press (US); 2000 [cited 2016 Dec 18]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK224523/

13. Jahn C. Maximizing the potential of dental hygiene with the dental hygiene process of care. Access. 2015 Jun 1; 29(6), 4, 24-25.

14. Colorado Dental Board: Laws, rules and policies [Internet]. Denver: Colorado Department of Regulatory Agencies; 2016 May 5. [cited 2016 Jul 11];[page11]. Available from: https://drive.google.com/file/d/0B-K5DhxXxJZbOUFWejJVSTFyN3c/view?pref=2&pli=1

15. Bell K, Coplen A. Evaluating the impact of expanded practice dental hygienists in Oregon: an outcomes assessment. J Dent Hyg. 2015 Feb; 89(1): 17-25.

16. Naughton D. Expanding oral care opportunities: Direct access care provided by dental hygienists in the United States. J Evid Based Dent Pract. 2014 Jun; 14 Suppl: 171-182.e1

17. Wellever A, University of Kansas Medical Center [Internet]. Evaluation of the dental hub program. 2012 May [cited 2016 Jul 6]. Available from: http://www.kamuonline.org/wp-content/uploads/2013/04/Evaluation-of-the-Dental-Hub-Program-by-Anthony-Wellever.pdf

18. Kansas Dental Practices Act [Internet]. [cited 2016 Jul 12]. Available from: https://www.dental.ks.gov/laws/kansas-dental-practices-act

19. Delinger J, Gadbury-Amyot C, Villalpando T et al. A qualitative study of extended care permit dental hygienists in Kansas. J Dent Hyg. 2014 Jun; 88(3): 160-172.

20. Brotzman-Myers J, Gadbury-Amyot C, VanNess C et al. Perceptions of Kansas extended care permit dental hygienists' impact on dental care. J Dent Hyg. 2014 Dec; 88(6): 364-372.

21. Simmer-Beck M, Walker M, Gadbury-Amyot C, et al. Effectiveness of an alternative dental workforce model on the oral health of low-income children in a school-based setting. Am J Public Health. 2015 Sep; 105(9): 1763-1769.

22. Siruta K, Simmer-Beck M, Ahmed A, et al. Extending oral health care services to underserved children through a school-based collaboration: Part 3 - a cost analysis. J Dent Hyg. 2013 Oct; 87(5): 289-298.

Perceptions of Program Directors and Educators Regarding the Adequacy of Oral Health Education in Nursing Assistant Curricula

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Abstract

Purpose: National data indicate that the oral health status of the aging population in long term care facilities (LTCF) is poor in the majority of cases. Nursing assistants are considered to be the primary caregivers of oral health care to elders residing in LTCF's. The aim of this research was to explore the perspectives among nursing educators and program directors on the adequacy of oral health education in nursing assistant curricula.

Methods: This exploratory, cross-sectional study utilized a web-based questionnaire adapted, with permission, from a prior study conducted in 2009. The 17- question survey regarding the adequacy of oral health education, was e-mailed to 253 nursing educators and program directors in 71 locations in the New England area with an explanation of the study and a link to SurveyMonkey®.

Results: Of the 253 surveys e-mailed, 100 surveys (n=100) were returned giving an overall response rate of 40%. Fourteen respondents (n=14) indicated that their program did not include oral health education in their curriculum and were excluded from the study. The remaining 86 participants (program directors n=26 and educators n=60) indicated that oral health education was included in their nursing assistant curricula. Respondents who reported spending more time on both didactic ($P<0.001$) and clinical instruction in oral health ($P<0.001$) were more likely to agree that the oral health care education provided in their program was adequate ($P<0.001$).

Conclusion: The results indicate that the perception of nursing educators and program directors is that the level of oral health education within the nursing assistant curricula is adequate in preparing students with the skills and knowledge needed to provide oral health care to patients.

Keywords: eldercare, long term care facilities, oral health, nursing education, nursing assistants

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Introduction

In today's society, many people are living longer and retaining more of their natural teeth than previous generations.[1,2] According to the United States Census Bureau, the older adult population will more than double by the year 2050, to 80 million; meaning as many as 1 in 5 Americans would be considered to be elderly.[3] It is expected during the time period between 2030 and 2050; the growth of the elder population will average 2.8 % annually.[3] As people live longer, the prevalence of disease becomes greater; many develop chronic illnesses and conditions including cardiovascular disease, arthritis, diabetes, osteoporosis, dementia, oral disease and associated dental problems.[3,4] They also can become increasingly dependent on others for help in performing tasks and activities required for daily living, resulting in the need for institutionalized housing.[3] As caregivers in these facilities are charged with aiding the residents with their activities of daily living, one area of increasing concern is the oral health of the residents.[4,5]

Literature suggests there is an association between oral health and overall health.[6-11] This association is most significant in the older adult population residing in institutionalized Long-term Care Facilities (LTCF) due to the increased incidence and prevalence of oral disease.[12] Poor oral health affects one's quality of life in areas of speech, digestion, nutrition, social interaction, and overall well-being.[13] Adequate oral hygiene practices play a significant role in the maintenance of good oral health.[11] The preservation of oral health is a vital component in the maintenance of the overall health of the elders in LTCF.

The oral health and oral hygiene practices among the aging population in LTCF has been described as poor and neglected.[6,14,15] In 2009, the Massachusetts Department of Public Health's Office of Oral Health conducted a state wide oral health assessment among high risk elder populations, age 60 and older, in 20 state subsidized meal sites and 21 LTCF.[16] The study participants were assessed in a variety of oral health areas.[16] The two most significant oral disease indicators for participants in LTCF were gingivitis, reported at 75% and untreated decay, reported at 59%. Although the report further stated there have been many advances in oral health for the elder population, it concluded many older adults in Massachusetts experience poor oral health status due to unmet oral health needs.[16]

Licensed nursing assistants (LNA) or certified nursing assistants (CNA) are considered primary caregivers and the providers of oral care in most LTCF. While many tasks can be challenging for the nursing assistants to provide, oral care seems to be the one that is most frequently neglected.[9,17] Health care providers at the LTCF generally do not view oral health as a priority.[10,13] In many instances, even the most basic oral care, tooth brushing, is not provided.[13,18] Several studies examining the inadequacy of oral care provided to elders in LTCF's identified a number of barriers including workload, inadequate time to perform tasks, unpleasant activity, uncooperative residents, and lack of knowledge and education as reasons for nursing assistants poor performance.[7,9,17] Knowledge and education regarding oral health are crucial factors in establishing a nursing staff that is confident and comfortable with their responsibilities.[19] The influence of on-site, oral health training sessions in the LTCF has been studied; however, the impact of such training programs has been shown to be short lived in duration and not sustainable for the long term.[11,17,19]

Two studies identified that education in oral disease, oral health, and dental hygiene as major barriers in providing adequate oral care to residents in institutionalized settings, such as LTCF.[8,19] In the United States, nursing assistant curriculum is regulated by the Code of Federal Regulations (CFR) 42, Part 483.[20] This regulation specifies that nursing assistants must be trained in "grooming- including mouth care" but is not detailed as to exactly what training must be included for mouth care.[20] While nursing assisting curricula must adhere to the federal regulations, each state's Board of Nursing (BON) ultimately approves the individual nursing assistant program curriculum using the standards for nursing skills approved by the Accreditation Commission of Education in Nursing (ACEN) and the Commission on Collegiate Nursing Education (CCNE) as a guide.[21,22] Accreditation standards for nursing curricula require the inclusion of integration of preventive health promotion strategies, including oral health screenings; however, nursing assistant curricula includes very little in oral health education.[12,21] With increasing evidenced- based research identifying the link between oral health and overall health, nursing assistant program curricula should be modified to include a more comprehensive oral health education component.[19,23,24] Incorporating evidenced-based oral health education and best practices within nursing assistant curricula will further the understanding of the importance of oral health care for the older adult population and extend beyond the actual process of how it should be performed.[7,8,12,19] Closing the gap regarding the adequacy of oral health education among nursing assistants is an area that requires further attention and has the potential of eliminating lack of education as a barrier to providing adequate oral health care.[5,8,19,25] The aim of this study was to explore the perception among the nursing educators and nursing assistant programs directors on the adequacy of oral health education in the nursing assistant curricula.

Methods and Materials

A convenience sample of 253 program directors and nursing educators of nursing assistant programs located in the New England geographical region of the northeastern United States (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont) was solicited for study participation between February 1, 2015 and February 28, 2015. Inclusion criteria were being a program director or educator of a nursing assistant program in New England. Exclusion criteria were participants representing nursing assistant programs lacking an oral health component in their curriculum. Potential participants were contacted from email addresses obtained on websites of educational institutions and facilities with nursing assistant programs located in New England. The email invitation provided information about the study and included an electronic link to the survey instrument using SurveyMonkey®. Follow-up emails were sent detailing the same information during the second, third and final week of the survey. This study received approval from the Massachusetts College of Pharmacy and Health Sciences (MCPHS) University Institutional Review Board.

Survey Instrument

The survey instrument was modified, with permission, from a 2009 study by Samson, et al.[26] Content validity was established by a panel of five experts.[27] The 17-item questionnaire was subsequently piloted with one program director and three nursing assistant program educators from New England for clarity and comprehension.

The questionnaire included demographic questions about the role and professional background of the participant; characteristics of the oral health education program including the inclusion of oral health in the curriculum, number of didactic and clinical hours spent on oral health education, types of clinical

experiences, evaluation of students' knowledge and type of educational institution. Three open-ended questions regarding educational materials used, instructor/student ratio during clinical instruction and recommendations for improvement of the oral health component of the nursing assistant curricula were added to the end of the survey.

Survey responses to categorical questions were enumerated using frequency percentiles and summary statistics. Differences in select categorical question responses across position type (program director; nursing educator) were assessed via ANOVA and Fisher's Exact Test.[28,29] Associations between select categorical questions and Likert scale questions were assessed using Fisher's Exact Test and Nonparametric Spearman Rank Correlation Tests.[29,30] All statistical tests were performed at an alpha threshold of 0.05. All statistical analyses were performed in STATA® statistics/data analysis software version 11.2.

Results

Of the 100 participants who completed the online questionnaire, 40% response rate; 14 (n=14) indicated their nursing assistant program did not include an oral health care component as part of the curriculum and were therefore excluded from the analysis. The remaining 86 participants, included educators (n=60) and program directors (n=26). The most common academic/professional designation was a Registered Nurse (RN) for program directors (61%) and a Bachelor of Science in Nursing (BSN) for educators (45%). (Figure 1)

Overall, the characteristics of the oral health education programs were comparable between program directors and educators without any statistically significant differences. (Table I) Sixty percent of participants indicated that oral health objectives were outlined in their program, with 81% reporting that oral health education was provided in both didactic and clinical settings. The greatest number of respondents (38%) reported spending 1 to 2 hours for the didactic portion and clinical portion of their oral health program. Ten percent reported spending more than three hours on the didactic portion and while 14% reported spending more than three hours on the clinical portion. Eighty-six percent of the respondents reported that their students received feedback during clinical instruction. With regards to student evaluations of oral health knowledge, 77% utilize both written and clinical evaluations in their program, 1% reported written only and 9% reported clinical only. Regarding the educational materials utilized, 92% use a nursing assistant textbook, 8% utilize videos/DVD's, 6.7% incorporate online resources and 6.7% use no specific materials.

Clinical instructional methods varied among the participants, but the most common method between program directors and educators was brushing on patients, (educators 75%; program directors 92%), second was the use of foam swabs on patients, (educators 73%; program directors 84%), and lastly was denture cleaning (educators 73%; program directors 80%). (Figure 2) Approximately 10% of both program directors and educators reported

Figure 1. Professional Background of Participants

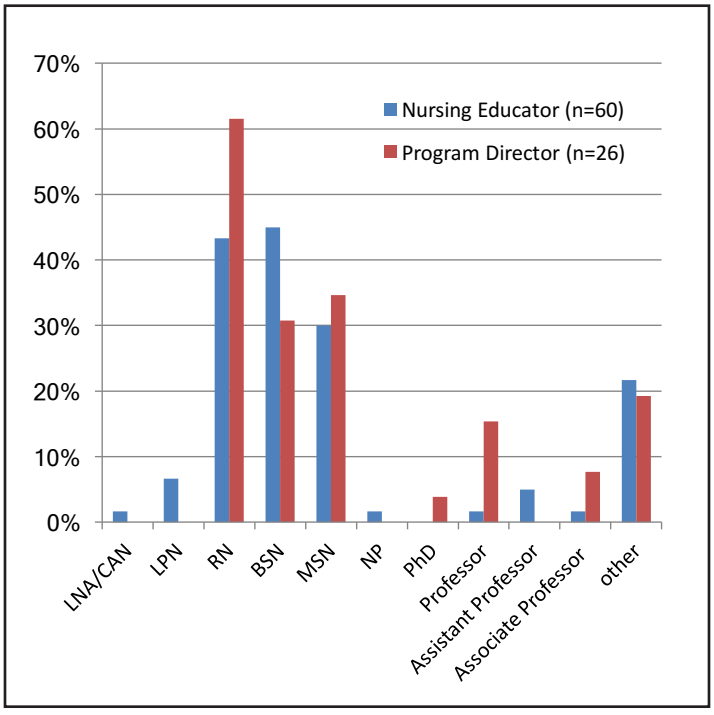


Figure 2. Oral Hygiene Clinical Practice Experiences

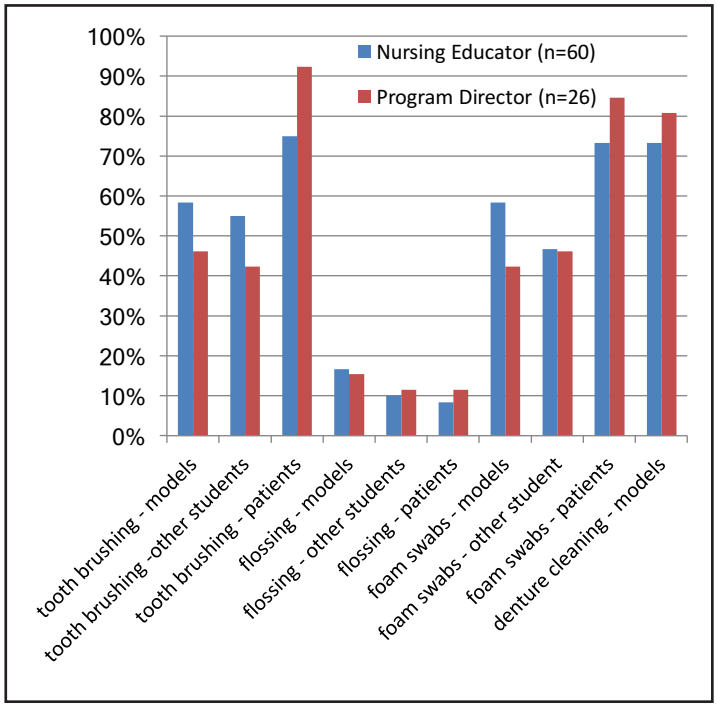


Table I. Characteristics of Oral Health Education Programs

	Total Survey Population (n = 86)	Program Directors (n = 26)	Nursing Educators (n = 60)	*p-value*
Oral Health (OH) education given during:				0.47
didactic only	1 (1%)	0 (0%)	1 (0%)	
clinical only	4 (5%)	0 (0%)	4 (7%)	
both didactic & clinical	70 (81%)	24 (92%)	46 (77%)	
missing	11 (13%)	2 (8%)	9 (15%)	
Hours of classroom instruction on OH education offered during program				0.98
less than 1 hour	22 (26%)	8 (31%)	14 (23%)	
1-2 hours	29 (34%)	10 (38%)	19 (32%)	
2-3 hours	12 (14%)	3 (12%)	9 (15%)	
3 hours or more	9 (10%)	2 (8%)	7 (12%)	
not sure)	3 (3%)	1 (4%)	2 (3%)	
missing	11 (13%)	2 (8%)	9 (15%)	
Hours of clinical instruction on OH education offered during program				0.92
less than 1 hour	15 (17%)	5 (19%)	10 (17%)	
1-2 hours	33 (38%)	11 (42%)	22 (37%)	
2-3 hours	10 (12%)	4 (15%)	6 (10%)	
3 hours or more	12 (14%)	3 (12%)	9 (15%)	
not sure	5 (6%)	1 (4%)	4 (7%)	
missing	11 (13%)	2 (8%)	9 (15%)	
OH care goals and objectives outlined in program/syllabus	52 (60%)	17 (35%)	35 (58%)	0.74
missing	11 (13%)	2 (8%)	9 (15%)	
Student/Instructor ratio, mean	8.9 (2.2)	8.5 (1.8)	9.1 (2.4)	0.26
Students receive feedback during clinical practice	74 (86%)	24 (92%)	50 (83%)	0.64
Student's OH knowledge evaluated by:				0.41
written evaulation	1 (1%)	1 (4%)	0 (0%)	
clinical evaluation	8 (9%)	2 (8%)	6 (10%)	
written and clinical evaluation	66 (77%)	21 (81%)	45 (75%)	
missing	11 (13%)	2 (8%)	9 (15%)	
Education Institution type				0.39
Community College	19 (22%)	9 (35%)	10 (17%)	
Technical College	2 (2%)	0 (0%)	2 (3%)	
Nursing Home	1 (1%)	0 (0%)	1 (2%)	
Private Facility	8 (9%)	1 (4%)	7 (12%)	
Other	45 (52%)	14 (54%)	31 (52%)	
Missing	11 (13%)	2 (8%)	9 (15%)	

*p-values for continuous variables via ANOVA; p-values for categorical variables via Fisher's Exact Test

providing students instruction on flossing, either on models, patients, or other students. In general, the didactic focus was on the oral health of the geriatric population at large, (educators 71%; program directors 77%). Specific emphasis on the oral health of the institutionalized elder population was less frequent with 48% of educators and 65% of program directors reporting providing specific instruction focused on elders living in LTCF. (Figure 3)

Questions regarding the adequacy and importance of oral health education in the nursing assistant program had some differences between the two groups. Participants who reported their programs outlined oral health care goals and objectives in their syllabi were more likely to agree (educators $P<0.0001$; program directors $P<0.001$) with the statements "The oral health education offered is adequate in providing graduating students with sufficient skills in providing oral health care to their patients", and "Oral health care is an important part of the nursing assistant program." Additionally, participants who were more likely to agree their programs were adequate, also reported more hours of classroom instruction ($P<0.001$) and more hours of clinical instruction ($P<0.001$) devoted to oral health education. Overall, both educators (54%) and program directors (57%) strongly agreed that oral health is an important part of their nursing assistant program; however, only 18% of educators and 15% of program directors strongly agreed that the oral health education was adequate. (Table I and Figure 4)

As a follow-up question to the above two statements, participants were asked if they had any recommendations for improvement to the oral health education in their curricula, 66% had recommendations including the following: 32% recommended more time, hours and/or practice; 13% recommended the curricula include education on the oral-systemic health connection; 2.7% recommended instruction with either dentists or dental hygienists, and 4% were unsure.

Discussion

This study explored perceptions among program directors and educators regarding the adequacy of oral health education of nursing assistant programs in New England. Current literature describes the oral health condition of the institutionalized elder population as poor.[6,15] A number of reasons have been identified as contributing factors to poor oral health including the current state of oral health of older adults, barriers to care, and lack of adequate oral health education in nursing assistant curricula.[4,6-8,15,17,19,25] Professional care is most often absent in LTCF.[6,11] While emergency services and annual exams may be performed by a dentist, routine daily care is the responsibility of

Figure 3. Oral Health Populations: Educational Focus

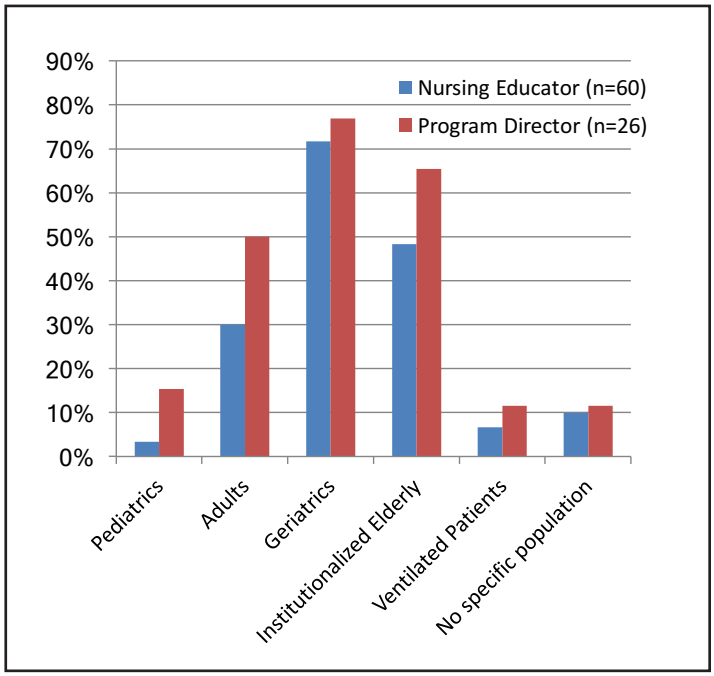
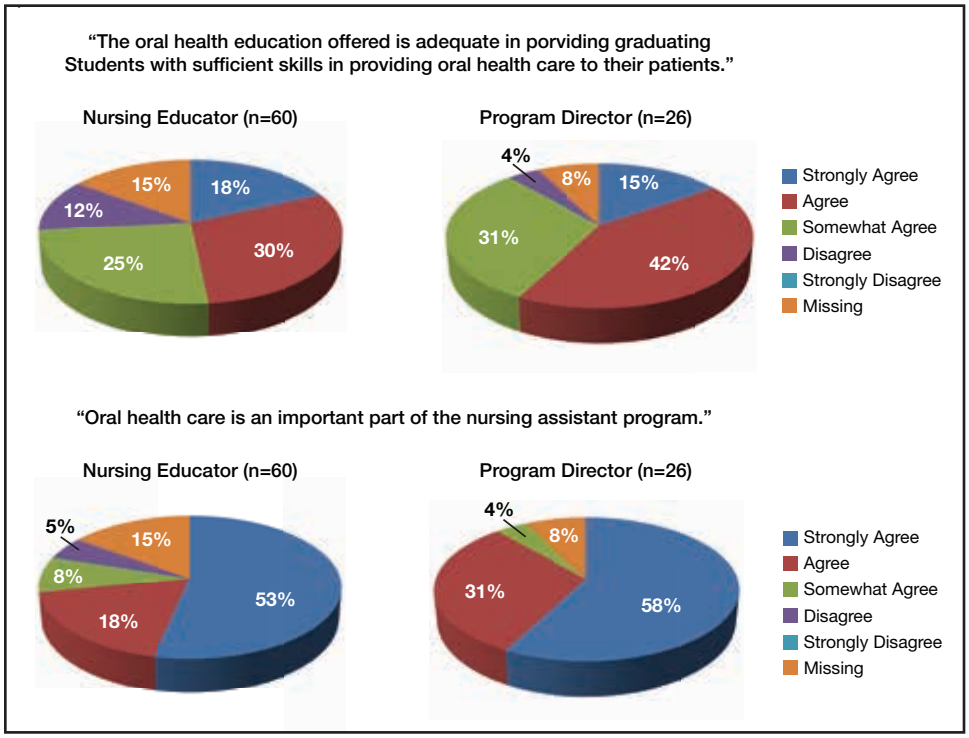


Figure 4. Perceptions of Adequacy and Importance of Oral Health Education



the primary caregivers, nursing assistants, at the institutionalized setting or LTCF.[9,17,20] Oral health care education provided during nursing assistant training is minimal and has been self-identified by the nursing assistant caregivers as a major barrier to providing adequate oral health care.[6,8,11,31] The findings of this study highlight the minimal time spent on oral health education with only 34% of the participants reporting 1-2 hours of didactic instruction and 38% reporting 1-2 hours of clinical instruction. Even more concerning is the data from programs providing minimal oral health education with 26% reporting less than one hour of didactic instruction and 17% less than one hour of clinical instruction. Furthermore, 14% of the participants reported that oral health education is not included in the program at all. Only 10% of the programs provided more than three hours of didactic instruction and 14% had over three hours of clinical instruction. These results appear to differ to the 2009 Norwegian study by Samson, et al., where two-thirds of the participating schools reported providing three or more hours of oral health care training.[26] It is worth noting the professionals providing LTCF oral health care in Norway were registered nurses, social educators, auxiliary nurses or care workers.[26] The minimum, entry-level education requirements for care workers is two years, with registered nurses, social educators and auxiliary nurses completing three years.[26]

In any curriculum, it is important to specify educational objectives for both students and educators to allow for proper instruction and learning.[32] This study demonstrated that only 60% include oral health care education objectives in their syllabi. While most of the participants noted the use of a nursing assistant textbook and some the use of instructional videos, several noted there were no specific educational materials used for oral health education.

Inadequate training and education have previously been identified as barriers to care by the caregivers, however, this study showed that the perception of program directors and educators of nursing assistant programs is in contrast.[9,17] Overall, while 50% of the educators and program directors felt that oral health education is an important part of the nursing assistant curricula, less than 20% strongly agreed that the education received was adequate.

A review of the various types of educational facility/institutions the participants were affiliated with shows that community colleges represented 25.3%, technical colleges 2.7%, private facilities 1.3% and nursing homes 10.7%, while 60% of the remaining participants responded to the "other" category. Of those in the "other" category, 40 of the respondents reported being affiliated with a technical high school. These findings suggest a large majority of the students in those programs are between the age of 16-18. In many instances, this adolescent population may have unmet oral health needs of their own which further supports the importance of an adequate oral health education component in the nursing assistant curriculum.[33,34] Educating this student demographic with an emphasis on the importance of oral health, plays a vital role in teaching the necessary skills for the provision of adequate oral health care to the elder population.

As the dental hygiene profession continues to evolve and progress, the findings of this study further support the need for interprofessional collaboration among healthcare providers for the betterment of oral health. As the integration of Certified Public Health Dental Hygienists (CPHDH) increases, the implications of this study further support the need for LTCF to allow for the CPHDH position on a full-time basis. In addition, dental hygiene educators teaching at institutions offering a CPHDH curricula would benefit from incorporating these statistics to signify what types of oral health education, didactic and clinical, is being taught in nursing assistant programs.

Limitations of this study included the absence of a demographic question regarding the particular state in which the participant's program was located and a question regarding the total number of required hours for the participant's nursing assistant program. Also, results from the New England states may not necessarily reflect areas outside of this region. Furthermore, this study had a relatively low (40%) response rate so these results cannot be generalized to represent the total population of program directors and educators of nursing assistant programs. Lastly, the responses to the questions using the Likert-type scale may have produced vague data due to the interpretation the response may have elicited.

Conclusion

While the data collected regarding the total number of hours spent on didactic and clinical oral health education appears to indicate that there is room for improvement in these areas, the perception of the program directors and educators is that the amount of time currently provided for oral health education is adequate in nursing assistant curricula. Based on the individual recommendations of the study participants, continuing efforts to increase the length of time spent on oral health education and incorporating evidenced-based information for educating students on oral-systemic health connections, will create the foundation for increased knowledge and awareness of the importance of oral health for the institutionalized elder population. Future research should include assessing the nursing assistants' perception on the adequacy of the oral health care education received during their training, as well as their recommendations for improvement. Moreover, in-depth explorations of the perceptions regarding the value of oral health among nursing assistants, program directors and nursing educators would provide unique perspectives in identifying

specific areas of development needed to update the nursing assistant curriculum standards and provide solutions to improve oral health outcomes among the elder population in Long-term Care Facilities.

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References

1. Matthews DC, Clovis JB, Brillant MG, et al. Oral health status of long-term care residents-a vulnerable population. J Can Dent Assoc [Internet]. 2012 Feb 13 [cited 2013 Oct 17];78:c3.Available from http://www.jcda.ca/article/c3

2. Samson H, Strand G, Haugejorden O. Change in oral health status among the institutionalized Norwegian elderly over a period of 16 years. Acta Odon Scan. 2009 Jul 02;66(6):368-73.

3. United States Census Bureau [Internet] Maryland: U.S. Department of Commerce;c1992-2017. Sixty-Five Plus in the United States;1995 May [cited 11/17/2013];Available from https://www.census.gov/population/socdemo/statbriefs/agebrief.html

4. Chalmers JM, Robinson J, Nankivell N. The practical oral care video - evaluation of a dental awareness month initiative. Aust Dent J. 2005 Jun;50(2):75-80.

5. Frenkel H, Harvey I, Needs K. Oral health care education and its effect on caregivers' knowledge and attitudes: a randomized controlled trial. Community Dent Oral Epidemiol. 2002 Apr; 30(2):91-100.

6. Adachi M, Ishihara K, Abe S, et al. Effect of professional oral health care on the elderly living in nursing homes. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2002 Aug;94(2):191-5.

7. De Visschere L, de Baat C, De Meyer L, et al. The integration of oral health care into day-to-day care in nursing homes: a qualitative study. Gerodontology. 2013 Jun 20;32(2):115-22

8. Forsell M, Sjogren P, Kullberg E, et al. Attitudes and perceptions towards oral hygiene tasks among geriatric nursing home staff. Int J Dent Hyg. 2011 Aug;9(3):199-203.

9. Sloane PD, Zimmerman S, Chen X, et al. Effect of a person-centered mouth care intervention on care processes and outcomes in three nursing homes. J Am Geriatr Soc. 2013 Jul;61(7):1158-63.

10. Talwar M, Malik G. Oral health considerations for the elderly-problems and management strategies. Indian J Dent. 2013 Sep;4(3):145-51.

11. Weening-Verbree L, Huisman-de Waal G, et al. Oral health care in older people in long term care facilities: A systematic review of implementation strategies. Int J Nurs Stud. 2013 Apr;50(4):569-82.

12. Haumschild MS, Haumschild RJ. The importance of oral health in long-term care. J Am Med Dir Assoc. 2009 Nov;10(9):667-71.

13. Pino A, Moser M, Nathe C. Status of oral healthcare in long-term care facilities. Int J Dent Hyg. 2003 Aug;1(3):169-73.

14. MacEntee MI. Muted dental voices on interprofessional healthcare teams. J Dent. 2011 Dec;39 Suppl 2:S34-40.

15. Le P, Dempster L, Limeback H, et al. Improving residents' oral health through staff education in nursing homes. Spec Care Dentist. 2012 Nov-Dec;32(6):242-50.

16. Office of Oral Health. The commonwealth's high-risk senior population-results and recommendations from a 2009 statewide oral health assessment [Internet] Boston (MA): Massachusetts Department of Public Health; 2010 [cited 2013 Oct 17]. 5-51. Available from http://www.mass.gov/eohhs/docs/dph/com-health/oral-health/senior-oral-health-assessment-report.pdf

17. Coleman P, Watson NM. Oral care provided by certified nursing assistants in nursing homes. J Am Geriatr Soc. 2006 Jan;54(1):138-43.

18. Ahluwalia K. Oral health care for the elderly: More than just dentures. Am J Public Health. 2004 May;94(5):698.

19. Kullberg E, Sjogren P, Forsell M, et al. Dental hygiene education for nursing staff in a nursing home for older people. J Adv Nurs. 2010 Jun;66(6):1273-9.

20. Code of Federal Regulations. Requirements for states and long term care facilities [Internet] Washington,DC: United States Government Publishing Office; 2015 [cited 2015 Apr 08]. Available from https://www.ecfr.gov/cgi-bin/text-idx?SID=86852c921d909a4c5d86aeed403bd6db&mc=true&tpl=/ecfrbrowse/Title42/42cfr483_main_02.tpl

21. American Association of Colleges of Nursing. CCNE standards and professional nursing guidelines [Internet] Washington,DC: Commission on Collegiate Nursing Education; 2013 [cited 2013 Nov 17]. Available from http://www.aacn.nche.edu/ccne-accreditation/standards-procedures-resources/baccalaureate-graduate/standards.

22. Resources for Nursing Programs [Internet]. Atlanta (GA); Accreditation Commission for Education in Nursing;c2013-2017. ACEN Accreditation Manual; 2013 [cited 2015 Apr 08][about 2 screens]. Available from http://www.acenursing.org/resources-for-nursing-programs

23. Seymour GJ. Good oral health is essential for good general health: The oral–systemic connection. Clin Micrbiol Infect. 2007 Oct;13(S4):1-2.

24. Rautemaa R, Lauhio A, Cullinan MP, et al. Oral infections and systemic disease—an emerging problem in medicine. Clin Micrbiol Infect. 2007 Nov;13(11):1041-7.

25. Coleman P. Opportunities for nursing-dental collaboration: Addressing oral health needs among the elderly. Nurs Outlook. 2005 Jan-Feb;53(1):33-9.

26. Samson H, Iversen MM, Strand GV. Oral care training in the basic education of care professionals. Gerodontology. 2010 Jun;27(2):121-8.

27. Polit DF, Beck CT, Owen SV. Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. Res Nurs Health. 2007 Aug;30(4):459-67

28. Freedman DA. Statistical models: Theory and practice. 1st ed. Cambridge: University Press, 2005.

29. Fisher RA. On the interpretation of x2 from contingency tables, and the calculation of P. J of Roy Stat Soc. 1922 Jan;85(1):87-94.

30. Fieller, EC, Hartley, HO, et al. Tests for rank correlation coefficients I. Biometrika. 1957 Dec;44(3/4):470-81.

31. Forsell M, Kullberg E, Hoogstraate J, et al. An evidence-based oral hygiene education program for nursing staff. Nurse Educ Prac. 2011 Jul;11(4):256-9.

32. Diamond R. Designing and assessing courses and curricula, a practical guide. 3rd ed. San Fransisco: Jossey-Bass;c2008. Chapter 13. Clarifying instructional goals and learning outcomes;147-9.

33. Centers for Disease Control and Prevention [Internet]. Atlanta: U.S. Department of Health and Human Services;c2017 Children's Oral Health. 2016 [cited 2016 Sept 6][about 2 screens] Available from https://www.cdc.gov/oralhealth/basics/childrens-oral-health/index.html

34. Dodd VJ, Logan H, Brown CD, et al. Perceptions of oral health, preventive care, and care-seeking behaviors among rural adolescents. J Sch Health. 2014 Dec;84(12):802-9.

Perceptions of Dental Hygienists and Dentists about Preventing Early Childhood Caries: A Qualitative Study

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Abstract

Purpose: The objective of this qualitative pilot study was to gain an in-depth understanding of dental hygienists and dentists perspectives regarding children's oral health and what needs to be done to prevent early childhood caries (ECC), the most frequent chronic disease of childhood.

Methods: A skilled facilitator conducted four focus groups and four phone interviews with 20 dental hygienists and 17 dentists practicing in a variety of locations within the state of Maryland. The interview guide was based on results from previous state-wide surveys of dental hygienists and dentists. Sessions were recorded, transcribed, and reviewed by the PI and facilitator. Qualitative content analysis was used to identify and manually code themes.

Results: Focus groups and interviews provided rich and insightful information for strategies to help solve the ECC problem in Maryland, which supplemented the earlier quantitative mail survey data. Three key themes emerged: challenges to preventing ECC among low-income families; necessary educational methods and practices; and, the need for inter-professional collaboration. Discussions focused on issues related to educating parents with low oral health literacy about how to prevent ECC and the value of including non-dental health care providers, such as pediatricians and school nurses, in the caries prevention process.

Conclusions: Current approaches to educating low-income adults about caries prevention are insufficient to prevent ECC and dental care providers cannot accomplish this goal alone. Ensuring that all dental care providers have a science-based understanding of caries prevention is critical. Integrating science-based oral health preventive care into medical and nursing undergraduate programs could increase providers' knowledge and confidence towards incorporating oral health into patient care plans; improve the oral health literacy of providers and patients; and improve patient oral health outcomes.

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Introduction

Dental caries is a persistent public health problem, particularly among low-income children in the United States.[1-2] While national data has demonstrated an overall decrease in caries prevalence among children aged 2 to 11 years since the 1970s,[1] more recent data shows a gradual increase in caries among children, aged 2 to 5 years, since the late 1980s.[3] The National Health and Nutrition Examination Survey (NHANES) reveals that non-poor, preschool-aged children overall, experience caries at a lower rate than their lower income counterparts. However, when this population demographic is affected by dental caries, their disease experience is similar to their lower income counterparts,[4] and often goes untreated at the same rate.[5] As of the 1999-2004 NHANES, the rate of untreated decay among children 2 to 5 years of age, was 28%.[3] In contrast to the national data, Vargas found an overall untreated decay prevalence of 52% among children enrolled in Head Start in the state of Maryland.[6]

In general, dental caries is a preventable disease process.[7] However, when preventive regimens are not applied and the disease goes untreated, extensively decayed teeth of very young children are not easily restored in a dental office. Subsequent treatment for these cases often occurs under general anesthesia in a hospital or hospital-like setting. In 2012, Maryland spent $1,396,652 on dental-procedure related general anesthesia for its Medicaid population, with nearly 60% ($830,603) of that on children under 6 years of age – the population most susceptible to caries and least likely to receive preventive dental services.[8-11] The 2014 Annual Early and Periodic Screening, Diagnostic, and Treatment (EPSDT) Participation Report for Medicare and Medicaid in Maryland reflects the lack of preventive dental services

showing that of the 234,981 children 0-5 eligible for services, nearly 62% did not receive any preventive dental services.[11] Despite recommendations by both the American Academy of Pediatrics (AAP) and the American Academy of Pediatric Dentistry (AAPD) that children establish a dental home and receive preventive services by age one, children 0-5 years continue to have low rates of preventive care.[12-14]

Over 70 years of research have demonstrated the use of fluorides is the most effective means for preventing or arresting caries. Translation of these research findings into practice for health care providers in general remains a challenge as evidenced by the ongoing pervasive dental disease, and a lack of knowledge about effective preventive methods among dental and other health providers. Surveys conducted among oral health providers in Maryland reflect this lack of understanding and use.[15-18] Maryland dental hygienists reported not fully understanding the most current recommendations and research about caries etiology and prevention.[15] For example, a majority of dental hygienists knew incipient carious lesions can be remineralized (91.7%) and it is desirable to use professionally applied fluorides for all children in areas without fluoridated water (90.3%). However, less than one third of the respondents knew that removal of plaque is more valuable for maintaining gingival health than for preventing caries(31%) and that dilute, frequently administered fluorides are more effective in caries prevention than more concentrated, less frequently administered fluorides (29.1%).[15] Similarly, Maryland dentists reported only moderate knowledge and use of caries preventive regimens with their patients.[16] The purpose of this current study was to complement data from state surveys conducted in the state of Maryland and gain more in-depth understanding of dentists and dental hygienists perspectives regarding children's oral health and what needs to be done to prevent early childhood caries (ECC).

Methods

This qualitative pilot study used focus groups and one-on-one interviews of practicing dental hygienists and dentists in 2011. Twenty dental hygienists and 17 dentists (11 general, 6 pediatric) participated in the study. A semi structured interview guide (open ended questions) was developed by the Principal Investigator (PI) and the focus group facilitator based on results from previous, Maryland, state-wide surveys of dental hygienists and dentists. Topics included provider's strategies for prevention of dental caries, specifically their thoughts on the use of fluorides, approaches to educating their patients and use of non-dental, care providers in caries prevention. This study was approved by the University of Maryland, College Park, Institutional Review Board.

The focus groups were held at a professional focus group facility centrally located in the state and separate focus groups were held for dental hygienists and dentists. Three dental hygienists from the Eastern Shore were interviewed by phone and one dentist was interviewed in person, so that geographic area of the state was represented in the study. The same skilled facilitator moderated the focus groups and 4 interviews. All participants, those in focus groups and those interviewed by phone or in person, were asked the same questions. Prior to each session participants were screened for inclusion criteria – providers must accept Medicaid patients and be from diverse locations within the state. Consent was obtained prior to each focus group (written) and interview (verbal). The focus groups lasted about 90 minutes; the phone interviews about 60 minutes.

Data analysis consisted of several steps. Following each focus session or interview, the strengths and weaknesses of the encounter were discussed. The focus group and interview recordings were transcribed and reviewed by the facilitator and PI to ensure descriptive validity. To help ensure interpretive validity, about 10 minutes before each session ended the PI supplied the moderator with additional questions or unclear points to be proved before each session ended. The facilitator combined additional notes taken by a study team member during the sessions to prepare a summary used to identify themes and quotes relevant to the study objectives. A qualitative content analysis was used to manually code the themes. The PI and facilitator discussed agreed on the resultant 3 themes. Further, PI and facilitator concluded the data from the two focus groups and phone interviews for each professional group could be combined.

Results

The study results are presented by the following themes: challenges to preventing ECC, educational methods and practices, the need for inter-professional collaboration.

Theme 1 – Challenges to Preventing ECC

Patient Challenges

Both provider groups independently discussed the many challenges faced by their low-income patients, especially those with low oral health literacy, limited resources, the young age of many parents, lack of transportation and language and cultural barriers. They discussed the difficulty of getting patients to understand the importance of oral health and its relationship to overall health, and making oral health a priority. The majority of discussion focused on the range of oral health topics that parents need to know, but also included what parents do not know or understand well, or do consistently. Dentists cited perceptions among patients that decay, "just runs in families," rather than that bacteria play a role in tooth decay and can be transmitted from caregiver

to child. One dentist noted while heredity may make one more susceptible to oral health problems, "bad teeth don't run in families. What runs in families is not seeing the dentist." Dentists in one group agreed that many parents know very little other than "brush twice a day" only because it is featured in toothpaste advertising. One dentist stated, "parents know that you need antibiotics for tooth infections and Tylenol for oral pain – but they do not know that painful oral infections are avoidable."

Several providers mentioned that many parents did not understand that tooth decay is preventable and that baby teeth should not need to be extracted. One dental hygienist shared her experiences with, "People don't know that cavities are preventable and there's a way not to get them…pregnant mothers… have no idea that you're supposed to brush the baby teeth…it's crazy, but the word's not out." Another dental hygienist added, "Sometimes parents just don't believe that it's [decay] preventable. Some parents want to help and do whatever they can, but sometimes they don't really think that they can help it that their child just gets cavities, 'cause they're prone to getting cavities'…" Another theme identified by a dental hygienist in this discussion was that parents often assume that if they do not see a problem in their child's mouth that there are no problems. There is a lack of understanding of the decay process and the absence of a problem means that the child is fine.

Another misunderstanding mentioned by participants is the recommended age for a child's first visit to a dentist. Many of the participants said parents are not bringing their child in as early as they should and fewer than *20% actually do so.* Some children who actually present to the dental practice by age one, already have ECC while some parents only come to the dentist when they notice a brown spot because they want to know what it is. At the same time, dentists pointed out that the AAPD only recently changed the recommendation for the first dental visit to age one and that this change is not common knowledge even within the dental community. Several of the participants noted that in some Maryland counties, oral exams are required for Head Start or kindergarten admission, so parents mistakenly believe that this is the age that dental visits need to start. One dentist commented that "a lot of people have this misconception that [care should start] at age three, but by age three, children already have a lot of cavities. It's rampant. So, at age one, you establish the things we're talking about. Yes, this child is too young to be brushing their own teeth. You need to brush their teeth." Both dentists and dental hygienists mentioned that parents did not make dental care a priority. One dentist stated that "the problem is getting the parents' mindset changed that this is a priority" while both groups noted that they have had to resort to telling parents that they would contact child protective services if appointments for treatment of advanced decay were missed.

Providers discussed challenges posed by limited resources which make serving healthy foods, supervising consistent brushing and keeping to health care appointments difficult, even when dental problems are apparent. Additional challenges come from increased sugar in food products and marketing messages that promote unhealthy foods even from well-intentioned programs like Women, Infants, and Children Supplemental Nutrition Program (WIC), whose recommendation for juice was meant to discourage soda consumption. Teaching patients how to make good choices was cited as an ongoing issue. Another perspective to the problem came from a dentist who shared, "I agree that the challenge is educating the parents, but I think it's also not just educating them about oral health but about nutrition and the changes in many of the products that are in the market today [including knowing] the amount of sugar that's in one can of soda."

Other barriers mentioned were lack of or minimal dental coverage for adults resulting in inadequate contact with dental hygienists and dentists and messages about the importance of oral health and how best to care for babies' and children's oral health. One dentist explains one aspect of the problem with the following comment: "Many parents in the Medicaid population don't have dental coverage – so that presents a problem in getting them to take care of their [own] teeth. If they don't have health insurance, they will not… take care of their own children's teeth until there is a crisis."

Finally, a major challenge that emerged from the session discussions was the reluctance of parents to be firm with their children about brushing. One dentist told a story about a mother who brought her child in at age three, and the dentist found the child's teeth covered with heavy plaque. The parent blamed the child for brushing poorly and tried to tell the dentist that the child wouldn't "let" her (the mom) brush the child's teeth. A hygienist reported that "the parent is like, 'He won't let me brush his teeth…' and, 'He wants to eat candy all day.' [I ask the parent] 'Well, who buys the candy? ... [and tell them] you have to make him brush at night.'" A dentist noted, "One of the most common things when I go through brushing and nutrition…they'll respond with, 'Well, I tell them to brush all the time… [or] 'I told you not to eat candy'… They often have this disconnect where it's not up to the kids to make the decision themselves."

Provider Challenges

Oral health care providers discussed several challenges related to the use of fluoride to prevent ECC as well as the value of inter-professional collaboration. Perspectives on fluoride and understanding of recommendations for fluoride use varied

among the participants. There was some confusion among several of the dental hygienists and dentists about best practices regarding drinking tap water, risks for fluorosis, and systemic versus topical fluoride. For example, some providers mentioned that systemic use of fluoride has raised concerns over whether there is too much fluoride exposure, but they also emphasized how important it is to ask patients about the source of their water to be able to advise them about fluoride supplements (drops and tablets). One hygienist stated that the dentist she works with no longer prescribes dietary fluoride supplements. Additionally, quite a few of the participants practicing in urban areas had not heard of Nursery® Water, a purified bottled water product, available with and without added fluoride, that is used for mixing infant formula. These practitioners were unaware of any bottled water product with an optimum fluoride level; thus, they were not recommending their use.

Two dentists in the focus groups had concerns about fluoridated water. One dentist reported she just learned from a continuing education course that some well water may have excess fluoride and was not recommending its use, however she also acknowledged that she is far more concerned about cavities than fluorosis. Another dentist stated that they personally do not drink tap water and felt strongly that tap water should not be encouraged as a source of fluoride because they felt that fluoride from toothpaste was sufficient. This dentist shared, "I don't encourage them to drink tap water… if you're using toothpaste, brushing twice a day, and we're using fluoride varnish to clean (sic) your teeth…I think we're actually getting more than enough fluoride to prevent tooth decay…If you use fluoride toothpaste twice a day, you're getting the dosage of fluoride you're supposed to get anyway."

Some of the dentists practicing in urban areas seemed surprised to learn that many parents reported they never drink tap water, regardless of whether one resides in the city or in more rural areas of Maryland. With the exception of two dentists, the majority of dentists in the focus groups were encouraging parents to understand the importance of tap water as a source of fluoride. Dental hygienists and dentists also noted that most parents do not know very much about fluoride, and that some even believed fluoride to be poisonous. One dentist commented, "People look up on the Internet that fluoride is poison. You could kill somebody with fluoride.' What [parents] don't understand is that it's in such a minute amount [in the water], they don't understand the studies and they don't understand what fluoride does."

Theme 2 – Dentists' and Dental Hygienists' Approaches to Patient Education

Dental hygienists and dentists discussed their approaches to educating their patients. They spoke about the importance of using clear or plain language so parents can understand and use the information. They shared examples of techniques used to be respectful while communicating the importance of dental disease. Many participants said that their entire staff (dentists, dental hygienists, dental assistants, interpreters and bilingual staff) is involved in patient education. Although dentists stated that they deliver some patient education, the dental hygienists were more involved, often taking the lead role in all types of settings. One dental hygienist shared a common

Table I. Perceptions Regarding the Role of Pediatricians in Preventing ECC

"I think working along with the pediatrician is very important. Everyone takes their child to see the doctor before they go to the dentist. I think if we can get [pediatricians] and educate them on the importance of what we need in the dental field, then maybe that will help so they will reinforce it." (dental hygienist)
"Pediatricians: [should] refer every patient to a dentist. I have a pediatrician next door to my office and every patient gets referred to a dentist." (dentist)
"A lot of times when pediatricians do the examination, they look at the whole body, look in the mouth, and look right past the lips to the throat. They don't look at the oral cavity. They don't see tooth decay…I think we need to get, in terms of policy, the physician to be more engaged when they're doing an examination… of the oral cavity." (dentist)
"[I wish] pediatricians [would] tell parents to see a dentist by age one; given diet instruction, encourage parents to follow through treatment, and tell them: 'Leaving cavities untreated could be fatal. Caries is a disease.'" (dentist)
"Pediatricians [should stress]: that oral health is just as important as overall health; seeing a dentist as early as the first tooth is important (or even before); nutrition is important—what are they putting in the bottle, feeding, etc.; brushing and routine care; habits—pacifier, thumb-sucking; developing a relationship with local dentists, clinics to educate each other concerning children's health." (dentist)
"If pediatricians could simply stress the importance of their patients seeing their dentist/hygienist regularly (every 6 months). And at every appointment, ask when their last visit to the dentist was. If they constantly inquire about visits to the dentist, parents will realize the importance of going." (dentist)

perspective: "The hygienist sees and has a relationship with the patient that's a little bit closer than the dentist's. Even though the dentist comes in and does the exams, the patient sort of relates to and talks to the hygienist a little more freely than they do to the doctor. When the doctor comes in, usually the [patients] clam up or don't say as much as they say to the dental assistant or to us."

Other educational techniques used were demonstrations to show patients how to brush teeth and using disclosing solution to show children and parents where they missed plaque. For young children, a gigantic model of teeth was used for demonstrating how to brush. One dentist shared that, "one of the things that has worked for my populations is the new popular, disclosing solution." Another dentist followed up that the disclosing solution instructional aid "allows parents to do some of that checking, because the kids will be playing around with it… [The parents can say], 'Your teeth are still purple. Go back in there and brush all the purple off.' That's very effective."

Theme 3 – Need for Inter-professional Collaboration

With regard to inter-professional collaboration, several participants commented about the value of involving pediatricians in ECC prevention. Most participants agreed with a dentist who stated that "the need to have a better collaboration with pediatricians will help build or express the need for dental exams. Better communication skills with the parents so you are not only informative, but encouraging at the same time." Expanded statements on the role of pediatri-cians in preventing ECC are presented in Table I.

Others reported having pediatricians who regularly refer children to their practices. One dentist shared that she and her colleagues go to pediatricians' offices to give lunchtime talks about oral health care, particularly to help the pediatric practices understand the importance of children being seen by a dentist and having a dental home by age one. This is earlier than the commonly-held belief that the recommended age for first dental visits is several years beyond age one. Several participants

Table II.
Suggestions for Inter-professional Collaboration

"Some of the best results we find are when we bring someone else in and collaborate with them. The best example: school nurses…We can go do a fluoride varnish and screening on all these kids…then we're gone. It is the school nurse that has to call every single parent that has an urgent referral and call them again….it's a really good follow-up collaborative effort with a non-dental person…School nurses are my favorite people to get involved with." (dentist)

"I think one of the areas [where] we can have the most effective assistance is in the schools with school nurses, because they have more access to children, in terms of children who experience tooth decay, or experience toothache pain…there are school nurses assigned to almost every school."

"School nurses – they get to see cavities first in low socio-economic patients because a lot of these patients never see a doctor." (dentist)

"When the kids go to school, they have to be immunized. Why can't there be something about them having to have their oral health checked out as well, every six months? Why can't we mandate that they get their teeth checked before they go to school….and on up to sixth grade or high school?" (dental hygienist)

"School nurses…—I mean, they can make or break your program, too. I've worked with the local dentist a little bit, too, and he had a great school nurse who was all into it and really gets it, and those kids are getting in, they're getting their sealants done. If you have a school nurse who's harried and feels like she's so busy or whatever and it's just another thing she has to do, then they're just not into it and they don't really want to schedule it ..." (dental hygienist)

"We used to be part of prenatal classes and grandparent prenatal classes as well. We used to do a lot more public health and then everybody became so clinically oriented in the public health programs and it seems to be coming back around again where there's a lot more outreach and a lot more collaboration with school health and things like that to try and initiate it again." (dental hygienist)

"It would be great in the hospitals… How about someone coming in and teach you how to take care of [the baby's gums]—I mean they teach you how to give your baby a bath… they do all [the] things that are in your new parent packets." (dental hygienist)

"If you go down the list of [foods approved by WIC], there are very few that are going to be non-cariogenic—one of the biggest ones being the juices that they push very, very hard. It's kind of like talking to a stone wall when you try to talk to the people at WIC that some of the problems are actually being caused by what they're allowing the children to have." (dental hygienist)

stated that this misunderstanding was common amongst ***all*** health care providers, including oral health care, with one dentist commenting that it was prevalent to hear age three and one dental hygienist stated that the recommended age for first dental visits is around age two.

Participants were sympathetic to the limitations pediatricians have with "maybe fifteen minutes per patient," and emphasized the importance of health care providers other than pediatricians–family physicians, obstetricians, and school nurses–taking a role in teaching parents about oral health.

Some of the participants called for simply expanding the channels by which information could be distributed to parents, such as through hospitals providing prenatal classes with parents and grandparents or with WIC through nutritional messages. Selected quotes relating to inter-professional efforts are presented in Table II.

Discussion

Results from this qualitative study of dental hygienists and dentists are consistent with our findings from focus groups with Maryland adults. Our previous study found that adults have an insufficient understanding of what causes tooth decay and how to prevent it.[19] Furthermore, these groups did not understand the role of fluorides in preventing tooth decay; were confused about juice and its impact on their child's teeth; and most did not drink tap water or give it to their children; rather, they used bottled water.[19] Similarly, the oral health care providers in the current study emphasized what was not understood or practiced by parents when caring for their child's oral health including adequate oral hygiene, the role of fluorides in preventing ECC, limiting consumption of sweets, and the lack of understanding that decay is preventable. Findings from the current study also reinforced results from state and national surveys indicating that adults have a low level of understanding about how to prevent tooth decay.[20-21]

Concordant with previous studies of Maryland oral health care providers,[15-16] participants in this study generally supported using fluorides. However, not all participants agreed with the fluoridated water recommendation or supporting statements about its effectiveness, even in light of the evidence. Two dentists outright stated they "wouldn't recommend" and "don't encourage" consumption of tap water in optimally fluoridated communities with one stating the fluoride from toothpaste and from the "fluoride varnish [we use] to clean your teeth" is enough, and another citing potability concerns related to the municipal water system's aging infrastructure. This lack of consensus among dentists regarding the safety and efficacy of community water fluoridation serves to confuse the public. The most current AAPD clinical practice guidelines describe fluoridated water as "the most equitable and cost-effective method of delivering fluoride to all members of all communities."[22] The guideline recommendations, however, do not make it clear that the consumption of fluoridated water should be encouraged as the primary source of fluoride for anyone connected to a fluoridated water system and that the protective and restorative effect of fluoride occurs from frequent low-level exposures.

Novel findings from this study are related to dental hygienists' and dentists' perceptions of how to reduce ECC and increase oral health literacy among their patients. Participants emphasized the need for earlier intervention by health care providers outside of dentistry, such as pediatricians and family practice physicians, since these health care providers tend to see families for well-care visits long before those families typically establish a dental home. Frequent encounters with these trusted health care providers provide early health education opportunities that dentists and dental hygienists do not typically have. Furthermore, in many states physicians or their staff can be trained to administer and receive reimbursement for early interventions such as fluoride varnish on deciduous teeth,[23] and can write prescriptions for dietary fluoride supplements for children living in areas not served by fluoridated municipal water systems.

Dental hygienists and dentists also emphasized the importance of using specific communication techniques to help patients understand the health guidance they receive. These techniques include using plain language and simple sentences when talking with patients; the use of models to demonstrate to parents and children how to properly brush teeth; using disclosing solution to show parents and children how well they brushed their teeth; confirmation of the patient's understanding of the communicated information; and, continually reinforcing messages.

One limitation of this study is the number of dental hygienists and dentists who participated in the focus groups or interviews. Due to limited resources, only two focus groups or interviews were conducted with each professional group. Nonetheless, little new information emerged from the respective second sessions. Also, while all participants met the selection criteria, this was essentially a convenience sample. This limitation is mitigated to some extent in that no additional information was gained, which may suggest data saturation. Overall, these results serve as a reminder that both dental and dental hygiene education programs need to ensure that their graduates are well versed in the caries disease process along with prevention strategies and that practitioners must stay informed of current professional guidelines for pediatric oral care. Results from this study, in addition to other study results, will help direct educational interventions for health care providers and low-income adults.

Conclusion

Focus groups and interviews with dental hygienists and dentists provided insightful suggestions for future strategies to help solve the prevailing ECC problem in the state of Maryland. Results from this and previous studies, suggest that traditional approaches to educating at-risk families and caregivers about preventing ECC are insufficient to mitigate the disease burden experienced by this population. It is critical that all oral and health care providers have a science-based understanding of caries prevention. Integrating science-based oral health promotion and disease prevention into medical and nursing education programs could increase providers' knowledge and confidence towards including oral health in patient care plans. If increased numbers of health care providers including obstetricians, pediatricians, family physicians and nurses, provided guidance on how to maintain good oral health and prevent ECC, the prevalence of ECC could decrease, especially among those who are low-income or lack a dental home. Additionally, incorporating communication skills training as a part of professional education, would assist all health care providers in better assessing their patients' levels of understanding of health and disease conditions and the behaviors that promote health. Lastly, equally as important as professional training, is the need for more innovative educational interventions to reach individuals, especially those with low-education, to help them understand their role in preventing ECC.

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References

1. Capurro DA, Iafolla T, Kingman A, et al. Trends in income-related inequality in untreated caries among children in the United States: findings from NHANES I, NHANES III, and NHANES 1999–2004. Community Dent Oral Epidemiol. 2015 Dec;43(6):500-10.
2. Tinanoff N, Reisine S. Update on early childhood caries since the surgeon general's report. Acad Pediatr. 2009 Nov-Dec;9(6):396-403.
3. Dye BA, Tan S, Smith V, et al. Trends in oral health status: United States, 1988-1994 and 1999-2004. Vital Health Stat 11. 2007 Apr;(248):1-92.
4. Vargas CM, Crall JJ, Schneider DA. Socio-demographic distribution of pediatric dental caries: NHANES III, 1988–1994. J Am Dent Assoc. 1998 Sep;129(9):1229-38.
5. Tinanoff N, Kanellis MJ, Vargas CM. Current understanding of the epidemiology, mechanisms, and prevention of dental caries in preschool children. Pediatr Dent. 2002 Nov-Dec; 24(6):543-51.
6. Vargas CM, Monajemy N, Khurana P, et al. Oral health status of preschool children attending Head Start in Maryland, 2000. Pediatr Dent. 2002 May-Jun;24(3):257-63.
7. U.S. Department of Health and Human Services. Oral health in America: a report of the surgeon general. Rockville (MD): U.S. Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health; c2000. 308 p.
8. US Centers for Medicare and Medicaid Services (CMS). State of Maryland Medicaid dental program review [Internet]. Baltimore (MD): CMS [2010 Oct; cited 2016 May 5]. Available from: http://mchoralhealth.org/PDFs/CMSReview_MD.pdf.
9. Maryland Department of Health & Mental Hygiene (DHMH). Report on pediatric restorative dental surgery and analysis of rates for anesthesia services [Internet]. Baltimore (MD): DHMH [2013; cited 2016 May 5]. Available from: https://mmcp.dhmh.maryland.gov/Documents/pediatricdentalJCRfinal9-13.pdf.
10. Griffin SO, Barker LK, Wei L, Li C, et al. Use of dental care and effective preventive services in preventing tooth decay among US children and adolescents—Medical Expenditure Panel Survey, United States, 2003–2009 and National Health and Nutrition Examination Survey, United States, 2005–2010. MMWR CDC Surveillance Summaries Suppl. 2014 Sep 12; 63(02):54-60.
11. Centers for Medicare and Medicaid. Annual EPSDT participation report – Fiscal Year 2014 – State: Maryland [Internet]. Baltimore (MD); Centers for Medicare and Medicaid; 2015 Sep 29 [cited 2016 Apr 4]; Available from: www.medicaid.gov/medicaid-chip-program-information/by-topics/benefits/ downloads/ fy-2014-epsdt-data.zip.

12. American Academy of Pediatric Dentistry. Guideline on periodicity of examination, preventive dental services, anticipatory guidance/counseling, and oral treatment for infants, children, and adolescents. Pediatr Dent. 2013 Sep-Oct;35(5):E148-56.

13. American Academy on Pediatric Dentistry Council on Clinical Affairs. Policy on the dental home. Pediatr Dent. 2008-2009;30(7 Suppl):22-3.

14. Hale KJ. Oral health risk assessment timing and establishment of the dental home. Pediatrics. 2003 May;111(5):1113-16.

15. Clovis JB, Horowitz AM, Kleinman DV, et al. Maryland dental hygienists' knowledge, opinions and practices regarding dental caries prevention and early detection. J Dent Hyg. 2012 Fall;86(4):292-305.

16. Matsuo G, Horowitz AM, Beck KH, et al. What Maryland dentists know and do about preventing dental caries in children. J Theory Pract Dent Public Health [Internet]. 2015 Dec 2 [cited 2016 May 5];2(3&4). Available from: http://www.sharmilachatterjee.com/ojs-2.3.8/index.php/JTPDPH/article/view/177.

17. Weatherspoon DJ, Horowitz AM, Kleinman DV. Maryland physicians' knowledge, opinions, and practices related to dental caries etiology and prevention in children. Pediatr Dent. 2016 Jan-Feb;38(1):61-7.

18. Koo LW, Horowitz AM, Radice SD, et al. Nurse practitioners' use of communication techniques: Results of a Maryland oral health literacy survey. PloS One [Internet]. 2016 Jan 14; [cited 2016 May 5];11(1): e0146545. Available from: http://doi.org/10.1371/journal.pone.0146545.

19. Horowitz AM, Kleinman DV, Child W, et al. Perspectives of Maryland adults regarding caries prevention. Am J Public Health. 2015 May;105(5):e58-64.

20. Horowitz AM, Kleinman DV, Wang MQ. What Maryland adults with young children know and do about preventing dental caries. Am J Public Health. 2013 Jun;103(6):e69-76.

21. Delta Dental. Oral health knowledge gap contributes to children's issues [Internet]. Oakbrook (IL): Delta Dental; 2009 Sep 14 [cited 2016 May 5]. Available from: https://www.deltadental.com/Public/NewsMedia/NewsReleaseOralHealthKnowledgeGapIssues092009.jsp.

22. American Academy of Pediatric Dentistry. 2016-17 Definitions, oral health policies, and clinical practice guidelines, guideline on fluoride therapy [Internet]. Chicago(IL): American Academy of Pediatric Dentistry; c2002-2017. [cited 2016 May6; updated 2017 June 8]. Available from: http://www.aapd.org/media/Policies_Guidelines/G_FluorideTherapy1.pdf.

23. Clark MB, Slayton RL, Segura A, et al. Fluoride use in caries prevention in the primary care setting. Pediatrics. 2014 Sep; 134(3):626-33.

Health Literacy Approaches to Improving Communication between Dental Hygienists and Patients for HPV-Related Oral Cancer Prevention

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Abstract

Purpose: Human Papillomavirus (HPV) has been identified as a causal agent for oropharyngeal cancers, suggesting a new role for dental hygienists in HPV-related cancer prevention strategies. Health literacy assessment is an approach that can be used to understand providers' informational assets and needs for educating and discussing HPV prevention with patients. This study aimed to understand dental hygienists' level of health literacy regarding HPV-related oropharyngeal cancers.

Methods: Four focus group sessions with dental hygienists (n=48) were conducted at a national conference. The constant comparison method, with a priori codes for health literacy competencies (i.e., access/understand/appraise/apply), was utilized for this qualitative study.

Results: Participants mentioned a variety of modes (e.g., magazines, journals) for accessing HPV-information; however, descriptions of understanding HPV and its relationship to oropharyngeal cancer varied. Participants considered patients' personal characteristics, the dental practice environment, and professional factors to appraise HPV-related information. Additionally, participants self-described themselves as being "prevention specialists." These factors influenced how dental hygienists applied primary and secondary prevention of HPV-related care issues with their patients (e.g., education and oral-cancer screenings).

Conclusions: Dental hygienists recognized the importance of HPV and oropharyngeal cancer prevention efforts, including oral-cancer screenings and promotion of the HPV vaccine. The study findings identified opportunities for intervention focusing on primary prevention.

Key words: Health literacy, health education, oral cancer, HPV+ oropharyngeal cancer, cancer prevention

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Introduction

Identification of the Human Papillomavirus (HPV) as a causal agent for oropharyngeal cancers has prompted public health interests. The oral HPV infection prevalence among U.S. adults was estimated to be 6.9% in 2009-2010.[1] Moreover, approximately 72% of oropharyngeal cancers are associated with HPV and 62% are attributed to HPV types 16 and 18.[2,3] As a result, it is estimated that approximately 11,000 oropharyngeal cancers each year in the U.S. are attributed to HPV. From 2008 to 2012, oropharyngeal cancers were the second most common HPV-associated cancer in the U.S.[4] Furthermore, evidence indicates that HPV-related oropharyngeal cancer rates are increasing and expected to surpass rates of HPV-related cervical cancer in the U.S. by 2020.[5] The HPV vaccine is a primary prevention activity related to HPV and cancer. This vaccine, although not currently approved for the prevention of oropharyngeal cancer, is now recommended for routine vaccination of children between the ages of 11-to-12. It is also recommended for "catch-up" vaccination for females 13-to-26 years old, and for males 13-to-21 years old and 22-to-26 years old for "high-risk" populations.[3,6]

The American Dental Association advises dental providers "to educate themselves and their patients about the relationship between HPV and oropharyngeal cancer."[7] Given the evolving role of oral health care providers in the prevention of HPV and HPV-related oropharyngeal cancers[8,9], an assessment of oral health care providers' current knowledge and communication skills is needed. One framework to assist this investigation is health literacy, which is

the skill-based process of *accessing, understanding, appraising* and *applying* health information to make informed health decisions.[10] Health literacy is not just knowledge regarding a topic; rather, it is the skills required to gather information, process it, and use it. Previous research has suggested that "health literacy is not just about individual patients, but also includes *healthcare providers* and other decision makers."[11] Furthermore, system-level factors can influence healthcare providers' health literacy and decision-making. Thus, understanding and promoting the HPV-related health literacy of dental providers as *agents and recipients* of health literacy,[12] can ultimately impact the health literacy of patients as well.

Dental hygienists, with their historical focus on prevention through the services they provide including screening examinations, preventive treatments and oral health education, are a unique group of oral health care providers. Dental hygienists can be part of the next group of health care providers involved in HPV-related cancer prevention programs and because of their training, have a unique position as educators and prevention specialists; however, little is known about dental hygienists' HPV-related health literacy levels. The purpose of this qualitative study was to explore dental hygienists' HPV-related health literacy as a means to inform the development of interventions promoting their unique ability to communicate HPV-related information to patients.

Methods and Materials

This study sample included dental hygienists licensed in the United States (U.S.) who were recruited via email to take part in focus groups conducted during a national dental hygiene conference in July 2015. Inclusion criteria included the following: (1) possess a current U.S. dental hygiene license; (2) be a graduate of an accredited dental hygiene program; (3) be in practice for more than one year; and, (4) be 21 years of age or older. The University of South Florida Institutional Review Board approved this study.

Focus groups[13] were used to explore dental hygienists' HPV-related health literacy. As such, the focus group guide was based on the following health literacy competencies as described by Sørensen and colleagues (2012): access; understand; appraise; and apply.[10] Focus group questions addressed areas regarding HPV knowledge, sources of information, information usage, and barriers and facilitators to HPV discussion related to patients, practice and their profession. (Table I) The focus group guide was reviewed for content validity by an expert panel composed of a dental hygienist, a dentist, and researchers with expertise in health literacy and HPV.

Each focus group was conducted with a trained moderator and a note-taker. Written informed consent was obtained from participants. A brief survey was administered to gather information on demographics (e.g., years in practice, gender, race/ethnicity, age). Each participant received a $100 gift card. All focus groups (N=4) were audio-recorded and transcribed verbatim. Focus groups lasted an average of 85 minutes.

When conducting focus groups, it is recommended to plan for three to four groups of similar composition, and to add more groups until saturation is reached.[13] For this study, participants were recruited and focus groups were scheduled several months prior through the conference administrators; therefore, adding additional focus groups was not possible.

A codebook based on the focus group guide and health literacy competencies was created *a priori*. Using constant comparison methods, two researchers independently coded all the transcripts and met to discuss the coding process with areas of disagreement resolved by discussion.[13,14] Data were entered into Atlas-ti version 6.2, and analyzed using the health literacy framework whereby general themes (i.e., competencies) emerged. Additional findings were also noted that may not have been reported across all groups, but describe the variability of participants' perceptions. Exemplary quotes were selected for each theme or sub-theme found for these data. Three quotes were selected per theme, and two researchers came to consensus of the most representative quotations for data presentation.

Results

All participants (n=48) across the four focus groups were female, the majority Caucasian, and had an average of 20 years of experience. (Table II) The health literacy skills based processes for making informed health decisions are presented according to each category.

Access

Participants were asked about sources from which they obtained information regarding HPV and HPV-related cancers. Participants mentioned a variety of sources where they get their information, including scholarly journals, continuing education courses, and during dental hygiene education. Dental hygienists who had been in practice longer reported they had not received information about HPV and HPV-related cancers during their training. Exemplary quotes are presented in Table III.

Participants in two focus groups mentioned using two well-known oral health advocacy websites as a source of information on both oral cancer and oral cancer screening. Similarly, other websites were mentioned in at least one focus group, including the websites of both the American Dental Hygienists' Association and the Centers for Disease Control and Prevention. Other sources of information about HPV and HPV-related cancers that were less frequently discussed included the local news reports, magazines, social media and blogs, public service

Table I. Health Literacy Competencies and Sample Focus Group Guide Questions

Health Literacy Competency	Definition[a]	Sample Focus Group Guide Questions
Access	The ability to seek and obtain health information.	Where do you get your information about HPV-related cancers?
Understand	The ability to comprehend the health information that is accessed through varied sources.	Tell me what you currently know about HPV.
Appraise	The ability to evaluate information before deciding if and how to use it.	Are there certain things about your [patients/practice/profession] that would make it easy to talk about HPV with your patients? What would make it difficult?
Apply	The ability to communicate and use the information to improve health.	How do you use this information in your practice?

[a] Definitions based on Sørensen et al.'s model[10]

announcements, the participant's personal medical doctors, and peers/colleagues. Participants in two of the focus groups mentioned the media coverage of the actor Michael Douglas' revelation regarding his HPV-related oral cancer.

Understand

Dental hygienists were asked what they knew about HPV and the HPV vaccine. Participants discussed three thematic areas of understanding between HPV and oral cancer including: HPV infection, oral cancer and the connection to HPV, and knowledge of the HPV vaccine. (Table III).

HPV infection. Regarding understanding HPV and the association to oral cancer, the majority of participants accurately described HPV as a sexually transmitted infection, oral sex as a mode of transmission, and the different strains of HPV. However, results revealed misunderstanding among participants about HPV treatment and cure, and the specific strains associated with oral cancer.

Oral cancer and the connection to HPV. Participants in all focus groups discussed the connection of the virus with oropharyngeal cancers. These discussions included the increased rates of HPV among young people who have less "traditional" risk factors (e.g., alcohol and tobacco use). Discussion in one group surrounded the perception that HPV-related cancers are more easily treated than "traditional" oral cancers attributable to smoking and alcohol.

Dental hygienists also discussed signs and symptoms associated with HPV-related oral cancers. Although participants accurately described that HPV lesions typically present farther back in the throat, making visual inspection difficult, the majority of participants in all groups reported a lack of knowledge in describing lesion appearance, triage, or referral sources.

The HPV vaccine. Whereas the existence of a vaccine to prevent HPV infection was acknowledged, participants in only three groups correctly identified that the vaccine is available for both males and females (participants in one group said the vaccine was approved only for females). Additionally, although it was not identified as a theme, two participants incorrectly reported the virus' ability to "mutate", impacting the vaccine's ability to prevent HPV-related cancers.

Appraise

The appraisal process comprised a complex set of interrelated factors that dental hygienists consider prior to applying HPV-related information during discussions with patients. These factors were categorized into three broad levels: patient, practice, and professional. (Table III)

Patient factors. Overall, dental hygienists mentioned that talking about sensitive topics depends on the individual patient. Patients' age was the most common factor mentioned across all focus groups. Both younger and older age made it difficult for dental hygienists to engage in HPV-related communication. When referring to older patients, dental hygienists believed that the age difference tended to be a barrier for communication because older patients perceived the dental hygienist as inexperienced. Additionally, some dental hygienists felt uncomfortable engaging in "the sex talk" with older patients, while others felt that older patients need more education.

When dental hygienists referred to younger patients, their concerns were related to adolescents who they perceived as sexually active. Participants noted that discussing HPV-related oral cancer prevention with parents of underage patients raised two different concerns. First, parents of patients that they saw in clinic may believe that a discussion of

Table II. Demographic Characteristics of the Participants

Characteristics	n	Percentage
Gender		
Female	48	100
Race		
White	43	90
Black	2	4
Asian	1	2
Other	2	4
Hispanic		
Yes	1	2
No	47	98
Practice Type		
Private	29	61
Public	15	31
Combination	2	4
No Response	2	4
	Mean	**SD**
Age	45.7	12.0
Years in Practice	20.7	13.1

any topic related to sexuality should be off-limits. Second, dental hygienists who work in school-based settings typically do not have contact with parents where they could engage in these types of conversations.

Another patient factor was specific risk status of the patient. For example, participants reported it was easier to talk about HPV and oral sex with people living with HIV, men who have sex with men, and homeless patients because dental hygienists perceived that these populations are concerned and interested in the information.

Other patient factors that hindered HPV-related communication include the conservative or religious background of the patient, some patients' unwillingness to pay for some dental services, and language differences between the dental hygienist and the patient. However, dental hygienists also mentioned that there are patients that want to talk and establish a provider-patient relationship with them, thus making it easier for them to engage in HPV-related or sensitive topic conversations.

Practice factors. Practice factors discussed in the focus groups represent characteristics of the work environment that affect the dental hygienist's ability to discuss HPV-related oropharyngeal cancer with patients, including: the dentist control of the office, characteristics of the dentist, and the physical setting of the office. Overall, participants in all groups mentioned the influence of the dentist in the practice and the need for their support.

In many cases, dental hygienists mentioned that the dentist is in control of the office, and this may have an impact on the discussion of HPV with their patients. For example, as one hygienist who had had been in a dental practice for 10 years stated, "… *it depends on your boss too, and the protocol, how the office runs*."

Another factor influencing the information discussed with patients is the age of the dentist, which may impact the information provided within the practice setting. Dental hygienists mentioned that young dentists more often support hygienists in educating their patients on HPV and performing oral cancer exams.

Another practice factor that may negatively influence discussion of HPV and HPV-related cancer with patients is a lack of privacy within the office setting. Participants in two focus groups mentioned the open layout of the office creating a situation where patients can overhear conversations. As a result, the lack of privacy, which they perceived as a patient's concern, is a barrier to discussing sensitive topics.

Professional factors. Professional factors are those that relate to the dental hygiene profession in general. The discussion centered on improving perceptions of the dental hygiene profession and the need to be recognized as experts in oral healthcare. This conversation included the public's perceptions of the hygienist's role as a "cleaning lady" (mentioned in three groups) or a "mouth janitor" (mentioned in one focus group), and not being viewed as a healthcare professional.

Additionally, an unsolicited finding noted from these conversations is that of dental hygienists' self-described role as "prevention specialists." Across all four focus groups, dental hygienists discussed their role in the dental profession as that of prevention. The role includes a range of prevention behaviors, patient education, and secondary prevention of oropharyngeal cancers through oral cancer screenings.

Apply

Participants reported they used the information gathered from information sources with their patients. However, as noted above, most felt uncomfortable talking to their patients about the link between oral cancer, HPV, and sexual behaviors. This resulted in most participants not engaging in conversations with their patients to discuss HPV, HPV-related cancers, or HPV vaccine information. The few participants who did discuss this with their patients were more likely to do so during an oral cancer screening. During one of the focus group discussions, participants expressed they would be willing to talk and encourage HPV vaccination because it is related to prevention.

Table III. Exemplary Quotes from Dental Hygienist Participants

Health Literacy Competency	Sub-theme	Exemplary Quotes
Access		"I learned it in school cause it wasn't that long ago for me." – 4 Years/Practice "For me it was continuing education, I'll never forget the first time I saw it up there, that it was the number one cause of oral cancer in males under the age of 39 and under. It really spoke to me." – 20 Years/Practice Moderator: "When you say magazines, you're talking about, like, practice journals?" Participant: "Yeah, professional journals-publications, yeah." Moderator: "Such as?" Participant: "Well, ADHA, you get a free subscription to Access magazine, and then there's RDH magazine, there's Dimensions of Dental Hygiene. Journal of Dental Hygiene." – 15 Years/Practice
Understand	HPV infection	"…but in a normal immune system, you're going to pass it within a year and you won't have it any more until you get re-infected..." – 7 Years/Practice "My thought is, I'm not as well versed in HPV as I should be." - 31 Years/Practice "And I heard it once-I've only heard it once, about the association between periodontal disease and HPV. Not that one or the other is-but, you know, if you have an opening, it's an open sore, your gums are bleeding all the time, and then you come in contact with the virus, your body's much more likely to take it in than, you know, just like your skin. If you have a nice barrier and there's no problems, you have more protection, more immunity." – 7 Years/Practice
	Oral cancer and connection to HPV	"What they believe is the cancers caused by HPV 16-18 are more curable than traditional oral cancers, that risk factors are smoking, drinking." – 34 Years/Practice "…you are actually starting to find it in younger people who participate in oral sex rather than having vaginal sex, because they don't feel like that's having sex when they do that, there's a whole new range of people that you're looking at possibly having the virus….also, not just the older adults where you've typically seen the oral cancer, the smokers and the different things like that. It's a whole new population affected by this." – 34 Years/Practice "When I was studying to give a talk in the product presentation this morning, I was surprised to learn that the advances they've made in a five-year cure rate in oral cancer aren't due to the advances we've made in surgery or radiation or chemo; it's because the - what they believe is the cancer is caused by HPV 16 18 are more curable than traditional oral cancers. … just a different ideology." – 35 Years/Practice
	Knowledge of the HPV vaccine	"I know that the CDC [Centers for Disease Control and Prevention] recommends, vaccination and that Healthy People 2020 has a set goal of how many teens both male and female are supposed to be vaccinated, and I don't know what the vaccination estimate is, how much percent of between such and such age male and females they want to have vaccinated by 2020, but we're nowhere near it." – 8 Years/Practice "I believe that there's a vaccine that they recommend for young women, and I'm just hearing a little bit about the oropharyngeal cancer connection." – 20 Years/Practice "The vaccine is also being recommended for teen males now, and basically there's a lot of strains of HPV, and they're mutating." – 34 Years/Practice
Appraise	Patient factors	"… definitely an age barrier exists, especially where I was practicing at the time, most of them were like old Italian men whose wives never set foot out of the kitchen, they didn't want to hear some girl tell them that they potentially could have cancer, where it would come from or anything like that. They were just there to get in and get out, they didn't want to hear anything else. That always makes me feel uncomfortable too." – 29 Years/Practice "I see kids in the school system, I don't have access to their parents who would be my primary person I would be having the conversation with, maybe about the vaccine or about being aware that their children may be sexually active earlier than they thought." – 5 Years/Practice "If their gums were bleeding, because they want to know, because they don't want to do certain things, but-it's a completely different population, but that makes it really easy, because they already have a disease that's an STD…"– 7 Years/Practice
	Practice factors	"From my experience, the dentist pretty much tells us what he wants done. That's how it is in my reality." – 10 Years/Practice "That's a big key, because dentists, especially the older generation, they absolutely may not be okay with this being addressed in their practice." – 10 Years/Practice "I think one of the biggest barriers is that we don't have rooms with closed doors to initiate these conversations like they do in a medical office." – 20 Years/Practice
	Professional factors	"We're thought of as tooth cleaners. We're not thought of as healthcare providers." - 31 Years/Practice "Talking to the hygienists here, this is like the group that cares about educating themselves and moving the profession forward, it's all - this is a generalization - but it's all the people that are not here that need to buy into the "we are preventative specialists." 5 Years/Practice "I think that it's getting us out to the general public and making them come to us and recognizing us as experts in our field." – 6 Years/Practice
Apply		"During the oral cancer screening at the beginning, that gives me the opportunity - rather than to be silent or "what did you do this weekend?" - it's more of an opportunity to talk about what I'm looking for, what I might find, what we found in the past, risk factors and what to look out for in case they see something at home." - 4 Years/Practice "If you look at [website], she says, when you go to get your teeth cleaned, it's really not about getting your teeth cleaned, it's getting the oral cancer exam. After I read that, I thought, "She is so right!" Speed up on the polish, man; who cares? The plaque's coming back in 12 hours." - 30 Years/Practice "I don't necessarily go into specific risk factors as much unless they ask. Sometimes they'll be like, "Oh, I don't smoke" or "I don't do this" … that's when I'll say, "Well, there are other things that could cause it," but I don't always go into all the specific risk factors for it." - 8 Years/Practice

Participants felt confident doing the secondary prevention behavior of oral cancer screenings and were willing to take the time to educate their patients about HPV risks factors and overall health related information. Some even provided suggestions about what to do and say while screening for oral cancer (Table III).

All groups discussed the necessity of the oral cancer screening at dental visits and suggested that this prevention behavior is of a higher importance than "cleaning teeth." Additionally, many mentioned the need to change patients' perceptions of the hygiene visit to focus on the oral cancer exam rather than just a dental cleaning.

Some dental hygienists reported questions from patients as to why they had never had an oral cancer exam performed before and why it was necessary. Dental hygienists stated that they used this opportunity to educate the patient on the exam's importance, how it was performed, and general risk factors for oral cancer, without discussing specific risks.

Discussion

The results from this study present a baseline description of the current health literacy of dental hygienists in relation to HPV. As dental hygienists are among providers who can be both *agents and recipients* of health literacy, these focus groups helped to better understand the current health literacy process. Overall, dental hygienists reported mixed experiences when accessing, understanding, appraising, and applying information about HPV prevention with their patients.

Participants accessed HPV-related information from a variety of sources. When discussing the information received during their training, length of time in practice impacted the amount of HPV information they received during their program. With virtually every state requiring graduation from an accredited dental hygiene program and completion of a national written examination for licensure,[15,16] interventions to improve access to HPV-related information should be incorporated into the dental hygiene curricula of the more than 300 accredited hygiene programs across the country.[17] Employment of dental hygienists is expected to increase by almost 20% in the next ten years, and the number of dental hygiene education programs is expected to increase to meet those needs.[17] Including access to information about emerging oral health topics in curricula is crucial. Additionally, there is an opportunity to include the topic of HPV prevention in regional, state, and national boards. For dental hygienists currently in practice, approaches to increase the level of HPV health literacy might be best facilitated through professional journals or continuing education courses, as these lectures have been shown to significantly increase knowledge of prevention-related topics.[18]

Overall, dental hygienists reported a mix of correct and incorrect knowledge about HPV and HPV-related cancers. Traditionally, oropharyngeal cancers have been associated with smoking and alcohol; however, it is now understood that HPV is an emerging causal factor in oropharyngeal cancer. Dental hygienists possess the baseline knowledge of oral cancers and they clearly expressed a desire to learn more and have accurate information before they begin to educate their patients. These findings complement a study conducted among Maryland dental hygienists, which identified a lack of awareness of oral cancer rates and an interest in additional training in this area.[19] This presents an opportunity to increase dental hygienists' knowledge by including information on HPV and risk factors through the common sources mentioned previously.

Dental hygienists reported appraising multiple interrelated factors prior to discussing HPV-related information with patients. Commonly mentioned factors included the sensitive nature of the topic and characteristics of the patient (e.g., age). Again, participants reported they would greatly benefit from additional skills and training on beginning the discussion with patients. To meet this need, education should be provided in a variety of modalities, including personalized techniques to meet the needs of individual patients, materials to improve communication skills and HPV-related health literacy,[20] and passive materials to educate patients on HPV (e.g., videos in waiting room, pamphlets). Such materials are available through the Centers for Disease Control and Prevention website and provide education on HPV, cancer prevention, and sexually transmitted infections. Additionally, other professional development options to improve self-efficacy for communication may include techniques such as motivational interviewing and active listening.

One emerging finding from this study is that dental hygienists are self-described as being "prevention specialists. "This finding was salient and unsolicited across all focus groups. Currently, few dental hygienists are applying their HPV-related knowledge with patients; however, they consistently reported performing oral cancer screenings to detect oropharyngeal cancer. As self-perceived "prevention specialists," a crucial role within the dental hygiene profession, the ideal standard of care would involve the combination of educating patients about HPV and the HPV vaccine (i.e., primordial/primary prevention), and oral cancer screenings (i.e., secondary prevention).

Moreover, this view aligns with the professional identity of dental hygienists and presents an opportunity to build upon this perception by the inclusion of HPV-related education. Dental hygienists view themselves as having a professional focus on prevention and currently possess a skill-set as well as a relationship with their patients that facilitates patient education. The discussion of HPV and recommend-ation

of the HPV vaccine as primary prevention would directly integrate into this perceived role. Previous research has suggested that dental hygienists should seek to increase their scope of practice,[21] and that the role of dental hygienists is evolving,[22,23] both of which present an opportunity to incorporate discussion of the HPV vaccine with their patients. Both dentists and dental hygienists report positive attitudes toward expanding the scope of practice.[24] To facilitate this additional role, educational opportunities should be developed. More specifically, the development of targeted patient messages, continuing education opportunities, and dissemination of information on this topic could support dental hygienists in their role as "prevention specialists" as it is applied to HPV prevention.

Currently dental hygienists have a focus on primary prevention and providing preventive procedures, such as dental sealants and the application of fluorides. There is potential to include HPV information and the HPV vaccine within the education provided to their patients. Linking their perceived role as prevention specialists with the HPV vaccine is crucial, as dental hygienists may not conceptualize the ways in which the HPV vaccine fits in with their role. Similar practice behaviors, such as tobacco cessation counseling and oral cancer screenings, have been shown to increase among dental hygienists after they have received education about the topics.[18] By increasing the dental hygienists' knowledge base in various types of primary prevention, they may recognize that incorporating the HPV vaccine into their patient visits adds to the prevention opportunities. While the vaccine is not currently part of their current prevention behaviors, dental hygienists view themselves as "prevention specialists"; therefore, future studies should evaluate how dental hygienists view the role of "prevention specialist" as it relates to describing the benefits of and recommending the HPV vaccine to their patients.

The findings from this study describe the ways in which dental hygienists currently process HPV-related information in their practice. In the process of health literacy, dental hygienists report that they clearly have a role in HPV prevention, but there are issues throughout this process that impact the implementation of this role into practice. The access points that dental hygienists discussed for information should provide more clear and practical information about HPV vaccination. There are opportunities to further develop and expand the meaning of prevention within the dental hygiene profession by broadening the number of topics that fall under the scope of prevention.

This study had several limitations. First, the study sample was derived from convenience sampling at a national dental hygiene conference. This may introduce sampling bias as persons attending the conference may be more likely to receive novel information regarding this topic. Moreover, this sample was homogenous, as the majority were Caucasian, all were women, with an average of 20 years in practice. Thus, additional research is needed to expand the generalizability of these findings to more diverse populations of dental hygienists. Given that these data were collected in a focus group, there is the possibility for social desirability bias influencing responses to questions in this group environment. Finally, while data saturation was reached for major health literacy themes, not all findings were consistent across all focus groups. Nonetheless, this formative study elicited both emerging themes and specific, unsolicited responses that propel the need for greater exploration of this complex topic.

Conclusions

Health literacy is a useful framework that can be used for patients as well as health care providers to understand HPV, a complex, emerging public health issue. Dental hygienists view prevention of HPV-related oropharyngeal cancer through screening and vaccine recommendation as being consistent with their professional perception of being prevention specialists. However, important practice and professional barriers (e.g., lack of self-efficacy, training and resources) among this population of oral healthcare providers remain. Public health efforts should facilitate opportunities for health literacy interventions among dental hygienists, with the ultimate goal of preventing HPV-related cancers morbidity and mortality.

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Conflict of Interest

Ellen Daley has served on the U.S. HPV Vaccine Advisory Board for Merck Pharmaceuticals. All other authors have no conflict of interest to report.

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References

1. Gillison ML, Broutian T, Pickard RK, et al. Prevalence of oral HPV infection in the United States, 2009-2010. JAMA. 2012 Feb; 307(7):693-703.

2. Steinau M, Saraiya M, Goodman MT, et al. Human papillomavirus prevalence in oropharyngeal cancer before vaccine introduction, United States. Emerg Infect Dis. 2014 May;20(5)822-828.

3. Markowitz LE, Dunne EF, Saraiya M, et al. Human papillomavirus vaccination: recommendations of the advisory committee on immunization practices (ACIP). MMWR Recomm Rep. 2014 Aug;63(RR-05):1-30.

4. Viens LI, Henley SJ, Watson M, et al. Human papillomavirus – associated cancers – United States, 2008 – 2012. MMWR Morb Mortal Wkly Rep. 2016 Aug;65(26)661-6.

5. Chaturvedi AK, Engels EA, Pfeiffer Rm, et al. Human papillomavirus and rising incidence in the United States. J Clin Oncol. 2011 Oct;29(32):4294-301.

6. Petrosky E, Boccihi Jr JA, Hariri S, et al. Use of 9-valent human papillomavirus (HPV) vaccine: updated HPV vaccination recommendations of the advisory committee on immunization practices. MMWR Morb Mortal Wkly Rep. 2015 Mar;64(11)300-4.

7. American Dental Association Council on Scientific Affairs. Statement on human papillomavirus and cancers of the oral cavity and oropharynx [Internet]. Chicago (IL): American Dental Association; 2012 Nov [cited 2013 May 22]. Available from: http://www.ada.org/1749.aspx.

8. Daley E, DeBate R, Dodd V, et al. Exploring awareness, attitudes, and perceived role among oral health providers regarding HPV-related oral cancers. J Public Health Dent. 2011 Spring;71(2):136-42.

9. Daley EM, Vamos CA, Thompson EL, et al. Are dentists and dental hygienists the next line of prevention against HPV-related cancers? [abstract]. Paper presented at: Oral health section. 144th American Public Health Association Conference; 2016 Nov; Denver, CO.

10. Sørensen K, Van den Broucke S, Fullam J, et al. Health literacy and public health: a systematic review and integration of definitions and models. BMC Public Health. 2012 Jan;12(1):80.

11. Horowitz AM, Kleinman DV. Oral health literacy: The new imperative to better oral health. Dent Clin North Am. 2008 Apr;52(2):333-44.

12. Vamos CA. Applying a health literacy lens to preventative children's oral health programming. Umwelt und Gesundheit. 2011;4:30-4.

13. Kreuger Ra, Casey MA. Focus groups: A practical guide for applied research. 5th ed. USA. SAGE Publications; 2015.

14. Morrison-Beedy D, Cote-Arsenault D, Feinstein NF. Maximizing results with focus groups: Moderator and analysis issues. Appl Nurs Res. 2001 Feb;14(1):48-53.

15. American Dental Hygienists' Association. Education & Careers: Licensure [Internet]. Chicago (IL): American Dental Hygienist Association; c2012-2017. [cited 2016 December 12]. Available from: http://www.adha.org/licensure.

16. American Dental Hygienists' Association. Standards for Clinical Dental Hygiene Practice [Internet]. Chicago (IL): American Dental Hygienist Association; 2016 [cited 2016 December 12]. Available from: https://www.adha.org/resources-docs/2016-Revised-Standards-for-Clinical-Dental-Hygiene-Practice.pdf.

17. Bureau of Labor Statistics, U.S. Department of Labor. Occupational outlook handbook, 2016-17 edition, dental hygienists [Internet]. Washington (DC): U.S. Bureau of Labor Statistics; 2016 [updated 2015 December 17; cited 2016 December 12]. Available from: http://www.bls.gov/ooh/healthcare/dental-hygienists.htm.

18. Walsh MM, Rankin KV, Silverman S. Influence of continuing education on dental hygienists' knowledge and behavior related to oral cancer screening and tobacco cessation. J Dent Hyg. 2013 Apr;87(2):95-105.

19. Horowitz AM, Siriphant P, Canto MT, Child WL. Maryland dental hygienists' views of oral cancer prevention and early detection. J Dent Hyg. 2002 Summer;76(3):186-92.

20. Horowitz AM, Clovis JC, Wang MQ, Kleinman DV. Use of recommended communication techniques by Maryland dental hygienists. J Am Dent Hyg. 2013 Aug 1;87(4):212-23.

21. Rock LD, Takach EA, Laronde DM. Oral cancer screening: Dental hygienists' responsibility, scope of practice, and referral pathway. Can J Dent Hyg. 2014 Feb;48(1):42-6.

22. McComas MJ, Inglehart MR. Dental, dental hygiene, and graduate students' and faculty perspectives on dental hygienists' professional role and the potential contribution of a peer teaching program. J Dent Educ. 2016 Sept;80(9):1049-61.

23. Boyd L. Educating dental hygienists to meet future health care need and roles of the profession. J Dent Educ. 2016 Sept;80(9):1031-2.

24. Reinders JJ, Krijnen WP, Onclin P, et al. Attitudes among dentists and dental hygienists towards extended scope and independent practice of dental hygienists. Int Dent J. 2017 Feb;67(1):46-58.

The Effect of Magnification Loupes on Dental Hygienists' Posture while Exploring

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Abstract

Purpose: The purpose of this study was to determine the effects of dental magnification loupes on posture during instrumentation.

Methods: A convenience sample of 27 right-handed dental hygienists, with no prior history of injuries or disabilities of the head, neck, or trunk region, enrolled in the study. Baseline posture calibration was taken and tri-axial accelerometers were placed on four locations of the head and trunk (occipital region of head; cervical vertebrae C5; thoracic vertebrae T5; lumbar vertebrae L1) to measure acceleration and the orientation of the body to gravity. Participants were randomly assigned to wear self-supplied magnification loupes during either the first or second half of the session. Dental chair mounted typodonts, prepared with artificial calculus, were used to represent a simulated oral environment. Participants were asked to explore all areas of the mouth using an ODU 11/12 explorer. Mean accelerations of the three axes were used to compute average forward/backward (AP) and side to side (ML) tilt of each accelerometer recorded during the instrumentation sessions. An end-user opinion survey was completed by each participant at the conclusion of the session.

Results: No statistically significant differences in posture were revealed between the sessions with the participants wearing their loupes and not wearing loupes. However, data from the end-user survey indicate that 74% of all the participants strongly agreed that magnification loupes made exploring easier and 67% strongly agreed that they felt that magnification loupes improved their posture.

Conclusion: While the majority of participants perceived that their magnification loupes enhanced their posture and made exploring easier, data from this study provided little evidence to suggest that wearing loupes leads to improved body orientation. Future research needs to examine the declination angle of ergonomic loupes and its relationship to neck and trunk flexion.

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Introduction

The physical stress of clinical practice is an occupational risk factor for developing musculoskeletal disorders (MSDs) in dental hygienists. MSDs are common in professions requiring fine repetitive movements and prolonged static positions. The incidence of MSDs is a well-documented concern in the dental profession and attests to work-related trauma often exerted on the practitioner.[1-12] More specifically, upper extremity MSDs occur frequently in dental professionals, with approximately 68% of dental hygienists reporting neck and upper back pain.[2,13] While it is generally agreed that the operator's muscles should be balanced and relaxed while providing treatment, practitioners frequently report difficulties in maintaining a neutral body position. Continuous operator positioning outside of neutral body posture creates physical stresses which ultimately threaten work productivity, career longevity, and the overall health of the clinician. Researchers have been challenged with determining exact musculoskeletal etiologies and appropriate preventive strategies to reduce MSDs in dental hygienists.[14] Various strategies including neutral body positioning, the use of magnification loupes, and improved work pacing have been suggested to minimize risk factors associated with MSDs.[14]

Dental loupes are designed to enhance visual acuity by magnifying the working area and have been hypothesized to promote a neutral body position when fitted correctly based on proper working distance and declination angles.[15-21] It is also imperative to seek professional guidance when purchasing loupes in order to ensure optimal ergonomic benefits. Rucker et al. developed a stepwise approach for determining optimal working posture and declination angle.[22] This

approach includes measurements for proper working distance, depth of field, frame weight and size and optical declination angle. While all of these measurements are all important for optimal ergonomics, it is the declination angle that is most critical. An improper declination angle will force the clinician to tip their head and eyes forward and downward in order to see the work area; thereby increasing the risk of strain to musculature of the head, neck and shoulders.[22] While properly fitted, magnification loupes have been associated with improved posture, there is limited quantitative research to support this assumption. Previous studies on dental magnification loupes have been limited to subjective assessments of posture.[15,16] Branson et al. examined the posture of dental hygiene students wearing loupes while performing periodontal probing, using the Posture Assessment Instrument (PAI). This instrument utilized raters and video to assess subjects' posture. Evaluators/raters examined ten components of the body's posture over a period of five minutes and, using established criteria, rated the posture in one of three categories; acceptable, compromised, and harmful. Each subject was given a final score representing the posture impact over the five-minute time frame, with higher scores representing greater deviation from ideal posture.[15] Maillet et al. repeated this protocol utilizing a modified version of the PAI, scoring different categories of posture while performing the more complex task of instrumentation (scaling). The results of both studies found improved posture with the use of magnification loupes.[15,16]

Previous studies have focused on the subjective posture measurement of the participants have not taken into consideration the style and fit of the magnification loupes. However, it is possible to measure posture quantitatively through the use of an accelerometer. The accelerometer is a device that is sensitive to accelerations in three perpendicular areas, including the force of gravity which acts vertically toward the ground. If the three axes are approximately aligned with the anteroposterior axis (AP: front to back), mediolateral axis (ML: left side to right side) and vertical axis (VT: head to toe) of the body, the mean value of each axis can be used to estimate the orientation of the accelerometer axes relative to gravity. From these measures, the average anteroposterior (AP: forward/backward) and the mediolateral (ML: side to side) angles can be determined. The aim of this study was to objectively assess the effect of magnification loupes on AP and ML posture during simulated instrumentation sessions on typodonts involving full-mouth exploration.

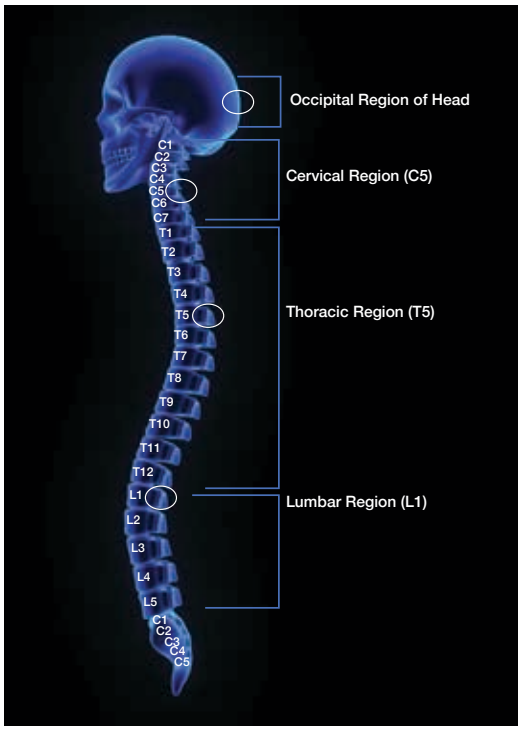
Materials and Methods

A convenience sample of 27 (n=27) right-handed, licensed dental hygienists (26 female and 1 male) enrolled in the study. Participants were recruited via Internet and informational flyers and were pre-screened over the phone to ensure that they met the inclusion criteria of being a right-handed, licensed dental hygienist who owned magnification loupes and had no previous history of MSDs, disabilities or injuries of the right wrist, forearm, shoulder, neck, upper or lower back. The Institutional Review Board of Old Dominion University approved this study and informed consent was obtained from each participant. Fifty-dollar incentive gift cards were given at the end of the study sessions. Participants ranged in age from 20 years to over 50 and the number of years in clinical dental hygiene practice ranged from 1 to 20 years. The participants provided their own magnification loupes from range of manufacturers. The use of headlights was excluded from the study. A baseline standing posture was recorded with the participant maintaining their back against a flat wall, prior to beginning the session.

Accelerometers

Placement points for the triaxial accelerometer sensors were as follows: occipital pole of the head, cervical vertebrae 5 (C5), thoracic vertebrae 5 (T5), and lumber vertebrae 1 (L1). A schematic of the sensor placement is illustrated in Figure 1. Prior to placement of vertebra sensors, each participant's skin was wiped with an alcohol pad and sensors were attached with double sided tape. A "swim cap" fitted with an accelerometer sensor was used to quantify measurements of head movement. Average accelerations in the three axes (AP, ML, VT) were used to compute the mean anteroposterior (AP: forward/backward) and mediolateral (ML: side to side) angles during each trial. To ensure standardization, a one minute warm-up period was given to each subject to adjust to the equipment.

Figure 1. Accelerometer Placement Guide



Experimental Session

Typodonts (Columbia Dentoform Corp™, Long Island, NY) were prepared with artificial calculus (Paradigm

Dental,™ Escondido, CA) and mounted to dental chairs for the simulated clinical environment. A pilot test was conducted to establish a baseline for sufficient amount of time for each individual to complete full mouth exploring. Participants were supplied with an ODU 11/12 explorer (HuFriedy,™ Chicago, IL) and were randomly assigned to begin the exploring session either with or without their magnification loupes. Each participant received an identical narration of instructions before starting each treatment sequence. Participants were instructed to explore all four quadrants of the typodont starting with the distobuccal surface of the first tooth in the upper right quadrant, using their normal instrumentation technique, for up to five minutes. A new typodont was supplied to the participants when they switched from using loupes to not loupes and vice versa.

At the end of the session, participants were asked to complete an end-user, post opinion survey on Survey Monkey.™ The survey consisted of demographic information (age, gender years of clinical experience), and two questions related to using magnification loupes: "Overall, do you feel that wearing magnification loupes made it easier to explore in all areas of the mouth?" and "Overall, do you feel that wearing magnification loupes improved your posture during exploring in all areas of the mouth?" Responses were scored on a Likert type scale (5-strongly agree to 1-strongly disagree). All procedures were completed in one session lasting approximately 1.5 hours.

Data Collection

Delsys Trigno System and EMGworks Software (Natick, Massachusetts) was used to collect the data obtained from each accelerometer. Prior to analysis, data was down sampled from 150 Hz to 50 Hz. Data were subsequently filtered using a fourth order Butterworth filter with a 20 Hz cutoff. The accelerometers were sensitive to the orientation to gravity, so that an axis aligned with vertical recorded an acceleration of 1g (acceleration due to gravity). If the sensor was tilted from vertical, then each axis would measure a proportion of 1g directly dependent on the angle of alignment. The average acceleration in each axis was computed for each trial. Using basic trigonometry, the average angle of the device in the AP (APangle) and ML (MLangle) planes was computed.[23,24] Baseline postures were recorded for calibration purposes. The average angles from the calibration trial were subtracted from the AP angle and ML angle to provide the angle of tilt from the neutral position. Negative angles indicate forward AP angle or left side ML angle.

Statistical Analysis

Separate paired samples t-tests (loupes vs. no loupes) were used to assess for differences in each dependent variable: APangle (forward/backward tilt relative to gravity), MLangle (side to side tilt relative to gravity) for each of the four sensors (head, C5, T5, L1). Chi-square was used to analyze survey question results. All statistical analyses were performed using SPSS 21 statistical software with the level of significance set at $p < 0.05$.

Table I. APangle and MLangle: Descriptive Statistics for Each Dependent Variable Measured with and without Loupes*

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1				
L_AP1ang	-35.462	25	9.862	1.972
NL_AP1ang	-35.963	25	10.719	2.144
Pair 2				
L_ML1ang	.530	25	6.068	1.214
NL_ML1ang	.589	25	6.478	1.296
Pair 3				
L_AP2ang	-31.537	25	10.647	2.129
NL_AP2ang	-34.542	25	15.330	3.066
Pair 4				
L_ML2ang	.781	25	6.345	1.270
NL_ML2ang	1.529	25	6.558	1.312
Pair 5				
L_AP3ang	-18.989	25	6.276	1.255
NL_AP3ang	-19.518	25	6.820	1.364
Pair 6				
L_ML3ang	.719	25	3.551	.710
NL_ML3ang	1.064	25	3.946	.789
Pair 7				
L_AP4ang	-6.413	25	6.246	1.429
NL_AP4ang	-6.479	25	6.305	1.261
Pair 8				
L_ML4ang	.721	25	2.730	.546
NL_ML4ang	.788	25	3.526	.705

*Key

AP- Forward/backward
ML- Side to side
L- Loupes
NL- No loupes
Ang-Tilt

Results

Twenty-seven licensed dental hygienists (26 female and 1 male) enrolled in the study, however, data from two participants proved to be unusable due to corruption

of their data files. resulting in a final sample population of 25 (N=25). Years of clinical dental hygiene practice ranged from 1 to 5 years (n=15), 6 to 10 years (n=7), 11 to 15 years (n=3), 16 to 20 years (n=1), and 21 years and over (n=1). Participant ages ranged from 20-29 (n=13), 30-39 (n=9), 40-49 (n=4), and over 50 (n=1).

The mean and standard deviation for AP and MLangles at each accelerometer location are shown in Table I. Accelerometer at the occipital pole of the head, revealed no statistically significant difference in APangle while wearing magnification loupes (M=-35.46, SD=9.86); t(24)=.385, *p*=.703 when compared to not wearing loupes (M=-35.96, SD=10.72).

Results for the MLangle at the occipital pole also revealed no statistically significant difference between loupes (M=.53, SD=6.06); t(24)=.084, *p* =.934 and not wearing loupes (M=.59, SD=6.48). The APangle for the accelerometer placed at C5 approached the level of significance, but revealed no statistically significant difference in mean postural angle while wearing loupes (M=-31.54, SD=10.65); t(24)= 1.789, *p*=.086, compared to not wearing loupes (M=-34.54, SD=15.33). Additionally, there was no statistically significant difference in the MLangle at C5 while wearing loupes (M=.78, SD=6.35); t(24)=.76, *p*=2.31, compared to not wearing loupes (M=1.53, SD=6.53). At T5, the accelerometer revealed no statistically significant difference in the APangle between wearing loupes (M=-18.99, SD=6.28); t(24)=.812, *p*=.425, and no loupes (M=-19.52, SD=6.82). Furthermore, there was no statistically significant difference in the MLangle while wearing loupes (M=.72, SD=3.55); t(24)=.659, *p*=.516, compared to not wearing loupes (M=1.06, SD=3.95). Lastly, the L1 accelerometer, revealed no statistically significant difference in APangle between wearing loupes (M=-6.41, SD=6.25); t(24)=.174, *p*=.863, and no loupes (M=-6.48, SD=6.31). There was also no statistically significant difference in the MLangle while wearing loupes (M=.72, SD=2.73); t(24)= .130, *p*=.897 as compared to not wearing loupes (M=.79, SD=3.53). (Table I and Figure 2, 3).

A post opinion, self-report survey was completed to assess overall opinions of using magnification loupes. Results revealed that 74% of the participants *strongly agreed* that magnification loupes made it easier to explore, 22% agreed, and 4% were neutral. No participants disagreed or strongly disagreed

Figure 2. Means and Standard Error Bars for AP Angle with and without Loupes at the Four Sensor Locations

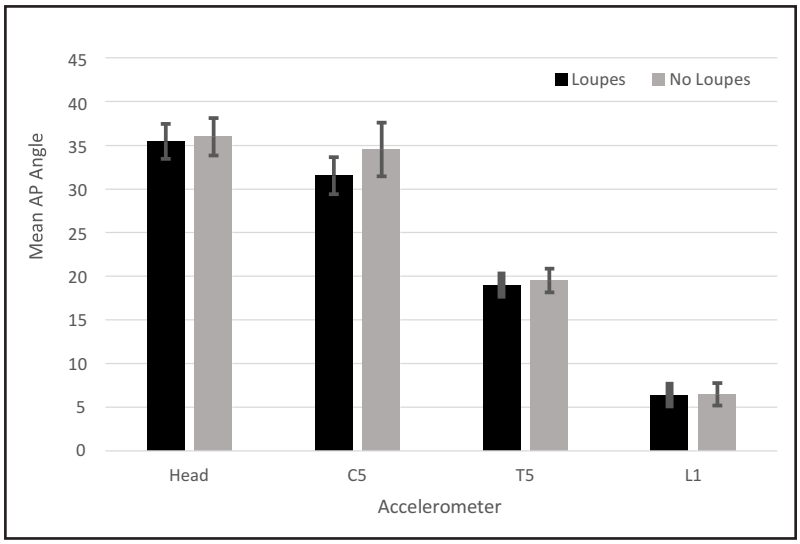
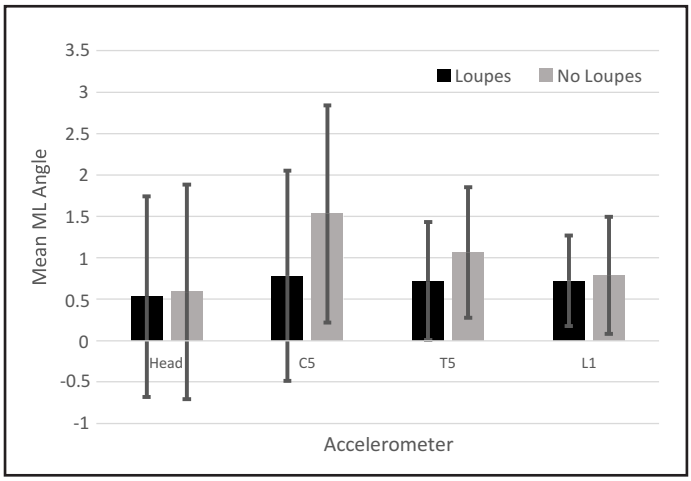


Figure 3. Means and Standard Error Bars for ML Angle Measured with and without Loupes



with this statement. Chi-square analysis revealed there was a statistically significant difference between the frequencies of the ratings, $\chi^2(2) = 21.56$, $p=.00$. Results also demonstrated that 67% of participants *strongly agreed* that wearing magnification loupes improved their posture, while 26% agreed, and 7% were neutral. Again, none of the participants disagreed or strongly disagreed with this statement, and chi-square analysis revealed there was a statistically significant difference between the frequencies of the ratings, $\chi^2(2)=14.89$, $p=.00$. Therefore, the majority of participants tended to strongly agree that loupes not only improved their posture, but also made it easier to explore in all areas of the mouth.

Discussion

Musculoskeletal disorders occur at a high rate in dental hygienists and continue to negatively impact overall well-being.[1-12] While ergonomically neutral postures help to

minimize the movements attributed to MSDs, the very nature of a limited working field, static posture and fine movements, places high workloads on the neck and trunk. Dental magnification loupes may offer a means for improved ergonomic posture. Loupes, when properly fitted for working distance and declination angle, are designed to reduce the need to lean forward at the head, neck, and waist to give a magnified view of oral structures, thereby potentially minimizing the risk of developing work-related MSDs. Research related to posture and magnification loupes typically used subjective measures such as video and observer/raters to assess posture. At the time of this writing, the researchers were unaware of any other studies using accelerometers to quantitatively measure the difference in posture when wearing magnification loupes as compared to not wearing loupes.

Findings from this study demonstrated no statistically significant differences related to AP and MLangle which suggests that wearing loupes had little effect on posture when performing instrumentation used in exploring. The angle findings at the head and neck (APangle) showed adopted positions far from recommended ergonomic guidelines while wearing and not wearing loupes. Adopted positions were significantly different from the participants' baseline neutral body positions for the head, (C5 and T5) recorded while participants were not wearing loupes. Interestingly, these deviations were very similar to the recordings made when participants were wearing loupes. In order to retain a neutral neck position, research states the head tilt from side to side and forward to back should be between 0-20°.[25,26] In both experimental conditions, participant mean APangles were well out of this range for the head and C5, indicating that on average participants flexed their neck outside of the recommended range. Trunk flexion is also recommended to remain within the neutral 0-20° range.[25,26] In both conditions, the average APangle at T5 was close to the maximum recommended value. With the mean and standard deviation exceeding 20°, it is clear that many participants flexed their trunks more than recommended. Data from this study suggests that whether wearing loupes or not, participants flexed their body far from the neutral position, resulting in less than optimal ergonomics. It is important to note that these findings were limited to a group of 25 dental hygienists who used self-supplied loupes in a wide range of styles and from a variety of manufacturers. The researchers did not evaluate the individually owned loupes for fit and declination angle. It remains possible that properly fitted loupes with an appropriate declination angle could reduce forward lean of the neck and trunk. This aspect of magnification loupes should be examined in future research.

Prevalence of neck MSDs are exceptionally high especially in the dental hygiene profession, sometimes as high as 84%.[5,6,7,12,13,27] Dental hygienists, despite ergonomic education and training, are not following the accepted recommendations to reduce MSDs, especially in the neck area. Furthermore, previous studies have indicated positive changes toward improved posture with the use of magnification loupes, however the quantitative results of this study could not support these findings.

The APangle and MLangle results shown in Table I suggest that loupes do not affect posture of the neck and trunk, and that dental hygienists tend to flex their neck outside of the recommended range whether wearing loupes or not. These findings demonstrate minimal posture benefit when using magnification loupes. Regardless of whether or not magnification loupes improved posture during the present experiment, results of the survey show that more than half of all participants (74%) strongly agreed that they felt wearing magnification loupes made it easier to explore in all areas of the mouth. More than half of all participants (67%) strongly agreed that wearing magnification loupes improved their posture during exploring, however the data does not support this perception. The results from this quantitative study provide no evidence that wearing loupes leads to changes in body orientation and demonstrated that dental hygienists were operating far from optimal ergonomic positioning with and without the use of magnification loupes, potentially leading to MSDs.

Several limitations may have influenced the findings of this research. Researchers did not record the type, fit or style of participant loupes. Loupes used by the participants may or may not have been fitted ergonomically i.e. measured for: proper working distance, depth of field, frame weight and size, and optical declination angle. If these factors had been evaluated, different results might have been obtained. Future studies should examine the use of ergonomically fitted loupes with steep declination angles and/or vertically adjustable flip-up loupes. Participants were not allowed to use the headlight mounted to their dental magnification loupes during the experiment which could have revealed differences related to posture. Dental hygienists were recruited using a convenience sample, rather than a random sample from the population. Only dental hygienists using magnification loupes were recruited for this study, it is possible that the introduction of magnification loupes could improve posture in this population when compared with individuals who do not typically use magnification loupes. Considering that the majority of this sample (n=15) was limited to novice dental hygienists practicing from 1 to 5 years, future research should consider comparing dental hygienists with varying levels of work experience. This study assessed posture while wearing magnification loupes during exploring, further studies should look into visual acuity, performance of dental related tasks and detection of pathology, calculus and caries. Future studies should also examine the use of dental

loupes while performing other tasks such as hand scaling and periodontal debridement performed with ultrasonic instruments.

Conclusion

It remains possible that appropriately adjusted loupes can reduce neck and trunk flexion. However, while the majority of the participants in this study felt that magnification loupes helped improve their posture (67%) and that wearing loupes made it easier to explore all areas of the mouth (74%); these perceptions do not match the quantitative measurements of this study.

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References

1. Hayes MJ, Taylor JA, Smith DR. Predictors of work-related musculoskeletal disorders among dental hygienists. Int J Dent Hyg.2012 Nov 1;10:265-269.

2. Hayes MJ, Cockrell D, Smith DR. A systematic review of musculoskeletal disorders among dental professionals. Int J Dent Hyg. 2009 Aug 1;7(3):159-165.

3. Yamalik N. Musculoskeletal disorders (MSDs) and dental practice part 2. Risk factors for dentistry, magnitude of the problem, prevention, and dental ergonomics. Int Dent J. 2007 Feb 1;57(1):45-54.

4. Hayes MJ, Osmotherly PG, Taylor JA, et al. The effect of wearing loupes on upper extremity musculoskeletal disorders among dental hygienists. Int J Dent Hyg. 2014 Aug 1;12(3):174-179.

5. Morse T, Bruneau H, Dussetschleger J. Musculoskeletal disorders of the neck and shoulder in dental hygienists and dental hygiene students. J Dent Hyg. 2007 Jan 1;81(1):10-10.

6. Hayes MJ, Smith DR, Cockrell D. Prevalence and correlates of musculoskeletal disorders among Australian dental hygiene students. Int J Dent Hyg. 2009 Aug 1;7:176-181.

7. Leggat PA, Smith DR. Musculoskeletal disorders self reported by dentists in Queensland, Australia. Aus Dent J. 2006 Dec 1;51(4):324-327.

8. Hayes MJ, Osmotherly PG, Taylor JA, et al. The effect of loupes on neck pain and disability among dental hygienists. Work. 2016 Jan 1:1-8.

9. Hayes MJ, Taylor JA, Smith DR. Introducing loupes to clinical practice: dental hygienists experiences and opinions. Int J of Dent Hyg. 2015 Feb 1;14(3):226-230.

10. Branson BG, Black MA, Simmer-Beck M. Changes in posture: A case study of a dental hygienist's use of magnification loupes. Work. 2010 Jan 1;35(4):467-476.

11. Åkesson I, Balogh I, Hansson GÅ. Physical workload in neck, shoulders and wrists/hands in dental hygienists during a work-day. Appl Ergon. 2012 Jul 31;43(4):803-811.

12. Hayes MJ, Smith DR, and Taylor JA. Musculoskeletal disorders and symptom severity among Australian dental hygienists. BMC Res Notes. 2013 Jul 4;6(1):1-5.

13. Anton D, Rosecrance J, Merlino L, Cook T. Prevalence of musculoskeletal symptoms and carpal tunnel syndrome among dental hygienists. Am J Ind Med. 2002 Sep 1;42(3):248-257.

14. Hayes MJ, Smith DR, Taylor JA. Musculoskeletal disorders in a 3 year longitudinal cohort of dental hygiene students. J Dent Hyg. 2014 Feb 1;88(1):36-41.

15. Branson BG, Bray KK, Gadbury-Amyot C, et al. Effect of magnification lenses on student operator posture. J Dent Educ. 2004 Mar 1;68(3):384-389.

16. Maillet JP, Millar AM, Burke JM, et al. Effect of magnification loupes on dental hygiene student posture. J Dent Educ. 2008 Jan 1;72(1):33-44.

17. Chang BJ. Ergonomic benefits of surgical telescopes: selection guidelines. J Calif Dent Assoc. 2008 Feb;30(2):161-169.

18. Sunell S, Rucker L. Surgical magnification in dental hygiene practice. Int J Dent Hyg. 2004 Feb 1;2(1):26-35.

19. Maggio MP, Villegas H, Blatz MB. The effect of magnification loupes on the performance of preclinical dental students. Quintessence Int. 2011 Jan 1;42(1):45-55.

20. Gilmour A, James T. Magnifying loupes in modern dental practice: an update. Dental update. 2010 Nov;37:633-636.

21. Syme SE, Fried JL, Strassler HE. Enhanced visualization using magnification systems. J Dent Hyg. 1997 Fall;71(5):202-206.

22. Rucker LM, Beattie C. Declination angle and its role in selecting surgical telescopes. J Am Dent Assoc. 1999 Jul 1;130(7):1096.

23. Moe-Nilssen R. A new method for evaluating motor control in gait under real-life environmental conditions. Part 1: The instrument. Clin Biomech. 1998 Jun 1;13(4):320-327.

24. Moe-Nilssen, R. A new method for evaluating motor control in gait under real-life environmental conditions. Part 2: Gait analysis. Clin Biomech. 1998 Jun 1;13(4):328-335.

25. Ariëns GA, Bongers PM, Douwes M, et al. Are neck flexion, neck rotation, and sitting at work risk factors for neck pain? Results of a prospective cohort study. J Occup Environ Med. 2001Mar 1;58(3):200-207.

26. Nield-Gehrig JS. Fundamentals of Periodontal Instrumentation & Advanced Root Instrumentation. 7th ed. Baltimore, MD: Lippincott Williams & Wilkins; 2012. 10-12 p.

27. Shenkar O, Mann J, Shevach A, et al. Prevalence and risk factors of upper extremity cumulative trauma disorder in dental hygienists. Work. 1998 Jan 1;11:263-275.

Perceptions of Registered Dental Hygienists in Alternative Practice Regarding Silver Diamine Fluoride

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Abstract

Purpose: Silver diamine fluoride (SDF) is an inexpensive, non-invasive, antimicrobial liquid used to treat carious lesions and decrease sensitivity. The purpose of this study was to assess the perceptions of registered dental hygienists in alternative practice (RDHAP) regarding the use of SDF to treat dental caries.

Methods: A 16-item survey designed to evaluate RDHAP's familiarity and perceptions of SDF was electronically distributed to 222 RDHAPs practicing in the state of California. A survey research software program collected and tabulated responses, calculated response frequencies for each survey item, and determined statistical relationships among variables, using cross tabulation analysis.

Results: The response rate was 46% (n=103). Over half the respondents, 54%, were unfamiliar with SDF. After describing SDF's properties and uses, 78% of respondents agreed that applying SDF to treat dental caries would be within the scope of practice of a RDHAP. Respondents agreed that patients or parents of patients would be interested in using SDF because it provides an alternative to removing tooth structure with a dental drill in order to place restorative material (82%), less expensive than restorative treatment (82%), applied like a varnish and time efficient (86%), and utilized without local anesthesia (91%). Over 56% of the respondents agreed that many patients or guardians of patients would object to the permanent black staining of the carious lesion treated with SDF. The respondents' employment/practice settings were related statistically ($p<0.01$) to their agreement that SDF is within the RDHAP scope of practice and their disagreement the question that patients would not accept SDF treatment due to the black staining ($p=0.03$). Eighty-eight percent of the respondents felt that the advantages of SDF outweigh the disadvantages for their patient populations.

Conclusions: SDF would be a useful therapeutic agent for the treatment of dental caries for RDHAP practitioners treating underserved populations.

Keywords: alternative practice, registered dental hygienist in alternative practice, dental caries, silver diamine fluoride, preventive products, special needs patients

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Introduction

The traditional method of treating dental decay in the United States (U.S.) has been restorative dental treatment, which can be expensive, time consuming, and difficult to access for many patient populations.[1-4] Silver diamine fluoride (SDF) is an inexpensive, non-invasive, antimicrobial liquid used in several countries to treat carious lesions and decrease sensitivity.[1] As of April 2014, a 38% SDF was cleared for marketing as a Class II medical device by the U.S. Food and Drug Administration (FDA) for the treatment of dentinal hypersensitivity.[1,5] Marketed as Advantage Arrest™ (Elevate Oral Care LLC, West Palm Beach, FL), SDF has been used in the U.S. (off-label), for the arrest of carious lesions.[1,4,5] In October of 2016, the FDA granted the designation of breakthrough therapy to Advantage Arrest 38% SDF as a treatment for arresting dental caries in children and adults.[6] This designation is designed to expedite the development and review of drugs that address a serious medical need and is based on preliminary clinical evidence indicating that the drug may demonstrate significant improvement over current therapies.

Previous studies on SDF have focused primarily on its clinical efficacy.[2,7-10] Using SDF at 38% concentration has been highly effective in the arrest and prevention of carious lesions.[1-12] SDF contains silver ions that act as antimicrobial and bactericidal agents within lesions by destroying bacterial membranes, denaturing proteins, and inhibiting DNA replication.[1,13] The fluoride ions in SDF help create

fluorapatite, a more acid-resistant enamel which can prevent further demineralization of tooth structure.[14] Applying SDF to occlusal, facial, and lingual surfaces has been shown to be successful in arresting caries in multiple clinical trials,[1,2,7-10] and its application to interproximal surfaces is currently being studied.[1,8] While a single application of SDF appears insufficient for sustained effects, annual and semi-annual re-applications have been shown to be highly successful.[1] Furthermore, SDF application is cost effective; one 8mL bottle of Advantage Arrest™, costing approximately $129, is sufficient to treat 1,600 carious lesions. The widespread use of SDF is limited by the fact that it stains the carious lesion black, and sometimes causes a temporary metallic taste.[1,2,7-12,15-17] Acceptability of the black staining has been studied in two recent studies.[2,18] Chu et al. demonstrated that parents of Chinese preschool children expressed no significant changes in their satisfaction with their child's appearance following treatment with SDF.[2] In an initial report of parental response to a scenario of a large cavity on their child's baby molar, parents' decisions regarding SDF treatment were influenced by their child's behavior and gender, the location of the tooth to be treated, and the use of local anesthesia.[18] SDF treatment can be a promising strategy to manage dental caries in young children and those who have special needs.[2] Geriatric patients with high anxiety or special needs and other patient populations could also benefit significantly from its application.[4,19-22]

The incidence of oral disease is disproportionately greater for lower-income and rural populations, racial and ethnic minorities, medically compromised or disabled populations and young children.[23] In California, the licensure category of registered dental hygienists in alternative practice (RDHAPs) was created to help care for the substantial percentage of the population lacking access to dental care.[23,24] RDHAPs receive specialized training and a specific license to treat patients with limited access by delivering dental hygiene care in the residences of patients that are homebound, at schools, residential facilities, community institutions, and other dental health professional shortage areas.[22] RDHAPs are most likely to use SDF as they are authorized to provide preventive oral health services without direct supervision in these community-based settings.[23,25]

Although the clinical efficacy of SDF has been extensively studied,[17] SDF is relatively new to the field of dentistry in the U.S. Consequently, the level of knowledge possessed by RDHAPs in California regarding SDF treatments is not known. The purpose of this study was to assess the perceptions of RDHAPs regarding the use of SDF to treat dental caries.

Methods and Materials

This cross-sectional study was approved by the Institutional Review Board of the University of California, San Francisco (UCSF). The target population consisted of dental hygienists licensed as RDHAPs in the state of California. RDHAP email addresses were acquired from various Internet sources, i.e., publically available lists available from the Dental Hygiene Committee of California (DHCC), California Dental Hygienists' Association (CDHA), and LinkedIn. All RDHAPs with known email addresses were included in the invitation to participate in the electronic survey.

A 16-item survey instrument was created to assess the perceptions of RDHAPs regarding treatment of caries with SDF. To assess the respondent's familiarity with SDF, 8 response options were offered ranging from "never heard of product" to "use product frequently." A brief description of SDF's characteristics followed this item, for the benefit of respondents not familiar with SDF: SDF is an inexpensive, non-invasive clear antimicrobial varnish that can be applied with a micro-brush; SDF contains a fluoride concentration of 5%, which is twice the amount of fluoride present in 5% sodium fluoride varnish (2.26%); and the area treated with SDF hardens and turns black. The 12 subsequent questions, regarding the respondents' perceptions, used the 5-point Likert scale, ranging from strongly agree to strongly disagree. The survey was created and distributed using Qualtrics™ (Provo, UT), a survey research program.

The survey was pre-tested on a convenience sample consisting of 8 dental hygienists in the Master of Science in Dental Hygiene program at UCSF, 2 dentists currently studying SDF at UCSF, and 2 practicing RDHAPs, in order to assess survey acceptability and feasibility. Survey modifications were made based on feedback.

A request to participate in the survey was distributed electronically to the respondents describing the purpose of the study, in addition to providing instructions for giving informed consent and a link to the survey instrument. Accessing the survey indicated the participant's consent. Follow-up email messages were sent to non-respondents at 3, 6 and 8 weeks following the initial distribution to encourage participation.

Qualtrics™ tabulated the responses and calculated the response frequency for each survey item. Cross tabulation analysis determined the significant relationships between respondents' employment/practice settings and their responses regarding perceptions of SDF, as well as between respondents' responses regarding their perceptions.

Results

Respondent's demographic information and level of familiarity with SDF

Of the 222 potential respondents, 103 completed the online survey (n=103), resulting in a response rate of 46%. One hundred and nineteen respondents

stated that they worked in private practice and/or a community or public health clinical care settings (Table I). Ninety-two percent of the respondents had received their RDHAP licensure between 2003 and 2013 "or later." The time frames that the RDHAPs received their licences were similarly distributed over the ranges of years that were delineated in the survey, 2003-2007 (31%), 2008-2012 (32%), and 2013 "or later" (29%) as shown in Table II. Fifty-four percent of the respondents were unfamiliar with SDF as a caries therapeutic agent with 32% reporting that they had never heard of SDF and 22% stating that they were not sure what the SDF product was used for. (Table III)

Respondents' perceptions regarding SDF as a caries therapeutic agent

Seventy-eight percent of the respondents agreed that the application of SDF was within the RDHAP scope of practice. (Table IV) Respondents' agreement that the use of SDF was within the RDHAP scope of practice was statistically related to their type of employment/practice setting ($p<0.01$). Almost all respondents agreed that SDF treatment could enhance the oral health of patients in RDHAP specialty areas and patient groups in low-income communities, challenging pediatric patients, geriatric patients, and those with high anxiety or other special needs.

The majority of respondents agreed that many patients or their parents would be interested in SDF for the reasons expressed in the survey displayed in Table V. Ninety-one percent of the respondents agreed with the statement, "Patients (or the parents of patients) would be interested in SDF because it does not require the use of local anesthesia." A small number of respondents disagreed with statements describing the advantages of SDF. Fifty-six percent of the respondents agreed that many patients or their parents would not accept treatment of dental caries with SDF due to the permanent black staining of the carious lesion. This perception was significantly related ($p=0.03$) to their employment/practice settings. (Table V)

Overall, 88% of respondents perceived that the advantages of SDF outweighed the disadvantages for the patients that they were accustomed to treating in their RDHAP practice settings. The statistical relationship of this statement to other responses is summarized in Table VI. Most respondents agreed that they "would like to use SDF to arrest active carious lesions" in their patients (91%) and that they "want to offer the option of SDF so that [their] patients receive the best dental care" (93%).

Table I. Current setting of employment/practice of respondents, by percentage and number of respondents

Current setting of employment/ practice* (N=87)	Respondents % (n)
Clinic care:	
Private practice	58 (49)
Community or public health	82 (70)
Education:	
Oral health for school children	14 (12)
Dental professional education program	21 (18)
Administration:	
Educational institution	4 (3)
Public health organization	2 (2)
Government organization	0
Non-Profit organization	2 (2)
Not practicing	2 (2)
None of the above	1 (1)

*Participants selected as many as applied

Table II. Professional background of respondents, by percentage and number of respondents

Professional background	Respondents % (n)
Year of RDHAP licensure (N=87)	
1998-2002	8 (7)
2003-2007	31 (27)
2008-2012	32 (28)
2013 or later	29 (25)
Years of practice as an RDHAP (N=86)	
Less than 1	12 (10)
1-3	27 (23)
4-6	21 (18)
7-10	26 (22)
Over 10	15 (13)

Percentages may not equal 100% due to rounding

Discussion

This study assessed the perceptions of RDHAPs regarding the use of SDF to treat dental caries. Treating carious lesions with SDF is especially useful in situations where dental resources are limited and treatment can be carried out by dental auxiliaries;[26] situations in which RDHAPs typically practice. The majority of respondents agreed that the application of SDF to treat dental caries is within the RDHAP's

scope of practice. These respondents are in agreement with the California law allowing RDHAPs to apply topical therapeutic agents for the control of dental caries without direct supervision. [25,27] The phrase, "without direct supervision," allows for RHDAPS to practice in specified settings including the residences of the homebound, nursing homes, hospitals, residential care facilities, dental health professional shortage areas, and other public health settings.[23,25]

Table III. RDHAP familiarity with SDF, by percentage and number of respondents

Familiarity (N=100)	Respondents % (n)
Never heard of SDF	32 (32)
Heard of SDF but not sure what it is used for	22 (22)
Aware of what SDF is used for	43 (43)
Observed SDF being used	1 (1)
Used SDF once	0
Used SDF a few times	0
Use SDF occasionally	1 (1)
Use SDF frequently	1 (1)

Percentage may not equal 100% due to rounding

Table IV. Perceptions of respondents regarding the use of SDF within the RDHAP scope of practice, by percentage and number of respondents

	Respondents' level of agreement % (n)				
Survey items	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
The application of SDF is within the RDHAP scope of practice (N=89)	52 (46)	26 (23)	19 (17)	3(3)	0
SDF treatment could enhance the oral health of my patients in RDHAP specialty areas (N=89)	80 (71)	16 (14)	4 (4)	0	0
SDF treatment could enhance the oral health of patient groups including: low income communities, challenging pediatric patients, geriatric patients and patients with high anxiety or other special needs (N=87)	76 (66)	20 (17)	5 (4)	0	0

Percentage may not equal 100% due to rounding

Most of the respondents, who agreed that "the application of SDF is within the RDHAP scope of practice", also reported that they were currently practicing in community or public health settings. These respondents most likely viewed their scope of practice in terms of the activities and needs required by the patients in the settings in which they practice. Practicing in community/public health settings may have provided these respondents experiences that enhanced their comfort working in an environment with limited resources and supervision while serving patients with extensive dental needs. Because the RDHAP may be the only oral health care provider these patients see,[23,26] the RDHAP may be more accustomed to the greater demands and expectations of extended dental services.

Approximately one quarter of the respondents did not believe that the application of SDF to treat dental caries was within the RDHAP scope of practice. These respondents may have disagreed based on the survey's use of the phrase "to treat dental caries." They may have viewed the treatment of dental caries as the sole responsibility of the designated supervising dentist. Also, many dental hygienists including RDHAPs may see their role as preventive rather than treatment-based. In addition,the description of SDF's application technique, "can be applied with a micro-brush", may have required additional clarification, for example, that the excavation of soft dentin is not needed because SDF will react with the tooth surface and create a layer of silver protein that resists bacterial acids and promotes the formation of hydroxyapatite and fluorapatite.[15,17] Some

respondents raised concerns about the legal ambiguity regarding the use of SDF "off-label" to treat dental caries. They may not have been aware that off-label use of approved pharmaceuticals is common, and these drugs frequently have medical evidence supporting their "off label" use.[28] As a Class II medical device, regulatory controls are required to provide assurance of the device's safety and effectiveness.[28] Similar to SDF, sodium fluoride varnish has been cleared by the FDA for treatment of dentinal hypersensitivity,[29] although it is widely used to prevent dental caries.[16] Since the time this survey was conducted in 2015, SDF has been granted the designation of Breakthrough Therapy as a treatment for arresting dental caries in children and adults by the FDA.[6]

The majority of respondents agreed that patients or their parents would be interested in SDF for a number of reasons. First, it is an alternative to removing tooth structure by drilling to place restorative material. Avoiding dental procedures involving use of a drill could substantially alleviate the angst associated with a dental visit for many patients. Secondly, SDF is applied like a varnish on top of the carious lesion, thus, it does not require the use of local anesthesia. Fear and stress frequently prevents people from visiting the dentist and is attributed to a variety of factors, including the sound of the dentist's drill and the thought of the needle to administer local anesthesia.[30,31] The greatest percentage of respondents strongly agreed that fear of the injection for local anesthesia is a major contributor to dental anxiety. Furthermore, the application procedure of SDF, like that of other topical agents and varnishes, considerably reduces the amount of time required for a dental visit to treat caries.[19,20] Lastly, the potential cost of a dental visit can create a barrier for the patient to avoid dental appointments and treatment;[31] however in contrast,

Table V. Perceptions of respondents regarding the advantages and disadvantages of SDF, by percentage and number of respondents (N=89)

	Respondents' level of agreement % (n)				
Survey items	**Strongly Agree**	**Agree**	**Neither Agree nor Disagree**	**Disagree**	**Strongly Disagree**
Advantages Many patients (or parents of patients) would be interested in SDF because:					
It is an alternative to removing tooth structure by a dental drill in order to place restorative material	46 (41)	36 (32)	12 (11)	6 (5)	0
It is less expensive than restorative treatment	57 (51)	25 (22)	15 (13)	3 (3)	0
It is applied like a varnish and therefore time efficient	60 (53)	26 (23)	12 (11)	2 (2)	0
It does not require the use of local anesthesia	70 (62)	21 (19)	8 (7)	1 (1)	0
Disadvantages					
Many patients (or parents of patients) would not accept treatment of dental caries with SDF due to the permanent black staining of the carious lesion	12 (11)	44 (39)	27 (24)	16 (14)	1 (1)
Clinicians would not want to use SDF because of the potential permanent staining to clothes and counter tops/ floors if spilled	4 (4)	9 (8)	30 (27)	43 (38)	13 (12)
The advantages of SDF outweigh the disadvantages to the patients I am accustomed to treating as an RDHAP	70 (62)	18 (16)	11 (10)	1 (1)	0

Percentage may not equal 100% due to rounding

Table VI. Relationships between the responses to the survey item "advantages of SDF outweigh the disadvantages" and responses to other survey items:

Survey Items	P Value
Many patients (or parents of patients) would be interested in SDF because:	
• It is an alternative to removing tooth structure by a dental drill in order to place restorative material	<0.01
• It is less expensive than restorative treatment	<0.01
• It is applied like a varnish and therefore time efficient	<0.01
• It does not require the use of local anesthesia	<0.01
I want to offer the option of SDF so that my patients receive the best dental care	<0.01

SDF is very cost effective. Currently sold for approximately $129.00 per bottle (8mL), one drop of SDF (25µL) is sufficient to treat five teeth.[1] Therefore SDF may be a viable option for patients faced with the problem of limited financial resources.[10,21]

Over half of the respondents agreed that many patients would not accept the treatment of dental caries with SDF due to the permanent black staining of the carious lesion. This may be an assumption by respondents who feel that patients are biased by the media, marketing the importance of esthetic appearance. However, based the studies of Chu, et al. and Tesoriero, et al., this may not be true, especially in all cultures. In Chu's study parents of Chinese preschool children expressed no change in satisfaction with their children's teeth and appearance following SDF treatment.[2] While these results from a Chinese culture may not be directly related to Western norms, Tesoriero's study was conducted in New York where most of the parents were comfortable with SDF treatment on a posterior tooth but not on an anterior tooth.[18]

The greatest number of "disagree" responses to the statement, "Many patients (or parents of patients) would not accept treatment of dental caries with SDF due to the permanent black staining of the carious lesion" were from respondents who were currently practicing in community or public health settings. This may be because the RDHAPs working in these settings may be regularly treating patients whose primary concern is having teeth free of painful carious lesions. Teeth with black stains due to SDF may not be a contraindication for them.

The majority of respondents agreed that the advantages of SDF, including its low cost, efficiency of treatment, and the fact that it does not require the use of local anesthesia, outweighed the disadvantage of the black staining for their patient populations. Moreover, the nature of the application procedure facilitates its use by dental auxiliaries, such as RDHAPs.[26] Consequently, the respondents in this study would like to use SDF to arrest active carious lesions in their patients and to offer the option of SDF so that their patients can receive optimal dental care.

The finding that approximately half of the respondents were unfamiliar with SDF as a caries therapeutic agent was not surprising since SDF was not available in the United States until 2015.[1] However, due to SDF's substantial benefits, the issue of lack of knowledge should be addressed. Opportunities need to be promoted to educate all oral health care providers of the advantages/disadvantages of the application of this medicament. It is recommended that dental hygiene educational programs at all levels—entry-level to advanced degree--provide both didactic information and clinical experiences. More continuing education programs with similar didactic and clinical components are also recommended. Education should not be limited to oral health care providers, but include other health care providers, especially pediatricians and nurses.

One limitation in generalizing these results to a broader population is that the subjects of this study were RDHAPs. This category of dental hygienist is somewhat unique to California, although many other states allow dental hygienists to practice in specific settings with less supervision.[32] Furthermore the 46% response rate may suggest a response bias. RDHAPs who were not familiar with SDF may not have been interested in completing the survey. Ten of the 11 respondents, who did not continue the survey after the item probing familiarity, indicated that they were not familiar with SDF. Another limitation may be the use of the term, "private practice," which may have been ambiguous in terms of their current setting of employment/practice. Respondents owning RDHAP practices may consider "RDHAP private practice" as referring to something other than what is commonly known as a "private practice" in the field of dentistry. It might have been prudent to define private practice as being associated with a supervising dentist, a requirement for RDHAPs in California. The option to type in an answer allowed for clarification of respondents' interpretations.

Conclusion:

The clinical application of SDF has been shown to be effective in arresting carious lesions, however its use depends upon the oral health care providers' familiarity with the product and their perceptions of its benefits

to their patient population. This study surveyed RDHAPs, dental hygienists who are licensed to treat underserved patients in a variety of settings in California. Approximately half of the respondents were unfamiliar with SDF, which emphasizes the need for the properties of SDF to be addressed in dental hygiene educational programs and continuing education courses. After being informed of the application process and SDF's clinical efficacy, most respondents agreed that the use of SDF was within their scope of practice. These respondents felt that their patients or the parents of their patients would be interested in this treatment due to its advantages, including not requiring local anesthesia and the removal of tooth structure, its low cost and reduced treatment time. According to the respondents, these advantages outweighed the disadvantage of permanent black staining of the carious lesion, and they were interested in offering the option of SDF as a means of delivering optimal dental care.

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References:

1. Horst JA, Ellenikiotis H, Milgrom PM, UCSF Silver Caries Arrest Committee. UCSF protocol for caries arrest using silver diamine fluoride: rationale, indications and consent. J Calif Dent Assoc. 2016 Jan;44 (1):17-28.

2. Chu CH, Lo ECM, Lin HC. Effectiveness of silver diamine fluoride and sodium fluoride varnish in arresting dentin caries in Chinese pre-school children. J Dent Res. 2002 Nov;81(11):767-770.

3. Sharma G, Puranik MP, Sowmya KR. Approaches to arresting dental caries: An update. J Clin Diagn Res. 2015 May;9(5):8-11.

4. Alcorn M, Johnson T. New addition to the caries armamentarium. Dimensions Dent Hyg. 2015 Jul;13(7):24-27.

5. U.S. Food and Drug Administration. Diamine Silver Fluoride Dental [Internet]. Silver Spring(MD): U.S.Food and Drug Administration; 2017[cited 2017 Jan 16] Available from: https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfPCD/classification.cfm?ID=1332

6. Wilson TG. Silver diamine fluoride receives new FDA designation. Decisions in Dentistry. 2016 Nov;2(12):10.

7. Yee R, Holmgren C, Mulder J, et al. Efficacy of silver diamine fluoride for arresting caries treatment. J Dent Res. 2009 Jul;88 (7):644-7.

8. Mattos-Silveira J, Floriano I, Ferreira F, et al. Children's discomfort may vary among different treatments for initial approximal caries lesions: preliminary randomized controlled clinical trial. Int J Clin Pediatr Dent. 2015 Jul;(25):300-4.

9. Zhi QH, Lo ECM, Lin HC. Randomized clinical trial on effectiveness of silver diamine fluoride and glass ionomer in arresting dentine caries in pre-school children. J Dent. 2012 Nov;40(11):962-7.

10. Tan HP, Lo ECM, Dyson JE, et al. A randomized trial on root caries prevention in elders. J Dent Res. 2010;89(10):1086-1090.

11. Dos Santos VE Jr, de Vasconcelos FM, Ribeiro AG, et al. Paradigm shift in the effective treatment of caries in schoolchildren at risk. Int J Dent. 2012 Feb;62(1): 47-51.

12. Targino AG, Flores MA, dos Santos VE Jr, et al. An innovative approach to treating dental decay in children. A new anti-caries agent. J Mater Sci Mater Med. 2014 Aug;25(8):2041-7.

13. Mei ML, Li QL, Chu CH, et al. The inhibitory effects of silver diamine fluoride at different concentrations on matrix metalloproteinases. Dent Mater. 2012 Aug;28(8):903-8.

14. Featherstone JD. The continuum of dental caries – evidence for a dynamic disease process. J Dent Res. 2004;83 Spec Iss C:C39-42.

15. Yamaga R, Nishino M, Yoshida S, et al. Diamine silver fluoride and its clinical application. J Osaka Univ Dent Sch. 1972 Sep;12:1-20.

16. Newburn E. Topical fluorides in caries prevention management: A North American perspective. J Dent Educ. 2001Oct; 65(10):1078-83.

17. Gao SS, Zhao IS, Duangthip D, et al. Clinical trials of silver diamine fluoride in arresting caries among children: a systematic review. JDR Clin Trans Res. 2016 May;1(3):1-10.

18. Tesoriero J, Lee A. Parental acceptance of silver diamine fluoride. Paper presented at: American Academy of Pediatric Dentistry Annual Session; 2016 May 26-29; San Antonio, TX.

19. Quock RL, Patel SA, Falcao FA, et al. Is a drill-less dental filling possible? Med Hypotheses. 2011Sep;77(3):315-17.

20. Clarkson BH, Exterkate RA. Non-invasive dentistry: A dream or reality? Caries Res. 2015; Suppl 1:11-17.

21. Zhang W, McGrath C, Lo EC, et al. Silver diamine fluoride and education to prevent and arrest root caries among community-dwelling elders. Caries Res. 2013;47(4):284-90.

22. Monse B, Heinrich-Weltzien R, Mulder J, et al. Caries preventive efficacy of silver diamine fluoride (SDF) and ART sealants in a school-based daily fluoride toothbrushing program in the Philippines. BMC Oral Health. 2012; Nov 21;12:52.

23. Mertz E, Glassman P. Alternative practice dental hygiene in California: past, present, and future. J Calif Dent Assoc. 2011 Jan;39(1):37-46.

24. Dyer TA, Robinson PG. The acceptability of care provided by dental auxiliaries; A systematic review. J Am Dent Assoc. 2016 Apr;147(4):244-54.

25. California Dental Hygienists' Association. RDHAP [Internet]. Sacramento (CA): California Dental Hygienists' Association;2015 [cited 2015 Dec 6] Available from: from http://cdha.org/rdhap

26. Craig GG, Powel KR, Price CA. Clinical evaluation of a modified silver fluoride application technique designed to facilitate lesion assessment in outreach programs. BMC Oral Health. 2013 Dec 28;13:73.

27. Dental Hygiene Committee California. Licenses, laws and regulations [Internet]. Sacramento (CA): California Department of Consumer Affairs; 2016 [Cited 2016 April 24] Available from: http://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=BPC&division=2.&title=&part=&chapter=4.&article=9

28. U.S. Food and Drug Administration. Understanding investigational drugs and off label use of approved drugs [Internet]. Silver Spring (MD): U.S. Food and Drug Administration;2016 [cited 2016 Apr 28] Available from: http://www.fda.gov/ForPatients/Other/OffLabel/default.htm

29. U.S. Food and Drug Administration. Fluoride Varnish [Internet]. Silver Spring (MD): U.S. Food and Drug Administration;2017 [cited 2017 Jan 3] Available from: http://www.accessdata.fda.gov/cdrh_docs/pdf3/k031932.pdf

30. Yamada T, Ebisu S, Kuwano S. A questionnaire survey on the effect of the sound of dental drills on the feeling of patients in dental clinics. Acoust Sci Tech. 2006;27(5):305-8.

31. Armfield JM, Ketting M. Predictors of dental avoidance among Australian adults with different levels of dental anxiety. Health Psychol. 2015 Sep;34(9):929-40.

32. American Dental Hygienists Association. Direct Access States [Internet]. Chicago(IL): American Dental Hygienists' Association; 2016 [cited 2017 Jan13] Available from: https://www.adha.org/resources-docs/7513_Direct_Access_to_Care_from_DH.pdf