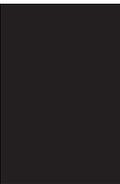


ORAL HEALTH

GUEST EDITORS: TERRY FULMER, RITA A. JABLONSKI, ELIZABETH MERTZ,
MARY GEORGE, AND STEFANIE RUSSELL





Oral Health

Nursing Research and Practice

Oral Health

Guest Editors: Terry Fulmer, Rita A. Jablonski, Elizabeth Mertz,
Mary George, and Stefanie Russell



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Editorial

Oral Health

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The Institute of Medicine Report called for a greater role for nurses within the context of oral health in two recent publications, *Advancing Oral Health in America* (2011) and *Improving Access to Oral Health Care for Vulnerable and Underserved Populations* (2011). Nurses provide care for many vulnerable persons, including frail and functionally dependent older adults, persons with disabilities, and persons with intellectual and developmental disabilities. These persons are the least likely to receive necessary, health-sustaining dental care (which is distinct from mouth care). The mouth, or more accurately, plaque, serves as a reservoir for bacteria and pathogens. The link between mouth care, oral health, and systemic health is well documented; infections such as pneumonia have been linked to poor oral health. Nurses, therefore, need to reframe mouth care as oral infection control and infection control more broadly. They can provide the preventive measures that are crucial to minimizing systemic infections. Nurses in all settings can potentially provide mouth care, conduct oral health assessments, educate patients about best mouth care practices, and make dental referrals. Yet, nurses are often hesitant to do anything beyond basic oral hygiene and, even in this area, often fail to provide mouth care based on best practices. There are many reasons for this hesitancy as noted by the authors of the ten papers published in this special issue. The problems, and their solutions, can be approached from three perspectives: nursing education, practice, and research.

The root of the problem begins in basic nursing education. R. A. Jablonski asserts that nurses lack knowledge regarding basic mouth care, especially as this care pertains

to older adults. In her paper, she describes the overall quality and quantity of oral hygiene content in seven major nursing fundamentals textbooks. She concludes that much of the information is incomplete, erroneous, or outdated. While R. A. Jablonski poses one plausible explanation for knowledge deficits regarding mouth care, three authors provide potential solutions. M. C. Dolce observes that nursing faculty are often ill-prepared for teaching content related to oral health, oral health assessments, and best practices in oral systemic health. She introduces the *Smiles for Life: A National Oral Health Curriculum* as a starting place for nursing faculty to develop their own competencies and to transmit them to their students. M. C. Dolce et al. present the *Oral Health Nursing Education and Practice* program, a national initiative whose goal is to create a nursing educational infrastructure. J. E. Hahn et al. offer an exemplar for introducing oral health content and skills pertinent to the care of elders and persons with disabilities into graduate nursing education. From the evaluation data reported in their papers, J. E. Hahn et al.'s strategy shows promise.

Education, as noted earlier, is only one problematic area when examining why nurses must take ownership of oral health and hygiene. Three of the papers in this special issue address clinical issues pertinent to oral health. K. Fisher provides an overview of best oral hygiene and dental care for persons with intellectual and developmental disabilities—a group that is at high risk for poor oral health, and ultimately, poor systemic health. M. E. McNally et al. discuss how to integrate oral care practices into organizational policy and practice in long-term care facilities in Canada. T. Fulmer and P. Cabrera argue that the primary care visit provides

an optimum opportunity for the clinician to provide oral health assessment and screening. They note that while nurse practitioners are able to apply fluoride varnish to children under 19 years of age, no data exist describing this practice among nurse practitioners.

The dissemination of research findings that inform education and practice provides the final tier towards moving nurses into accepting responsibility for the oral health and hygiene of their patients. M. R. Frazelle and C. L. Munro describe the state of the science as it pertains to toothbrush contamination. They note that existing research provides little direction in the area of toothbrush contamination or disinfection, which explains in part the lack of evidence-based nursing guidelines for toothbrush storage and decontamination. N. VanDevanter et al. offer an interesting perspective from patients regarding HIV screening during dental visits as part of nursing-dental collaboration. The patients were positive about being tested as part of the dental examination, citing knowledge of HIV status and convenience of testing as two major benefits. Finally, S. Williamson et al. compared 27 cytokines in plasma samples, passive drool samples, and filter paper samples from 50 subjects. They found that relationships were dependent upon the specific biomarker. This research can help inform future studies and clinical practices related to cytokine measurement, especially those cytokines implicated in illnesses with oral system associations.

We hope that this special issue provides the catalyst to help nurses take ownership of their role in health promotion as it pertains to oral health. Mouth care and oral hygiene are more than an activity of daily living; they are imperative to safe and quality care.

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Research Article

The Primary Care Visit: What Else Could Be Happening?

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The Institute of Medicine Report called for a greater role for nurses within the context of oral health in two recent publications, *Advancing Oral Health in America* (2011) and *Improving Access to Oral Health Care for Vulnerable and Underserved Populations* (2011). Nurses provide care for many vulnerable persons, including frail and functionally dependent older adults, persons with disabilities, and persons with intellectual and developmental disabilities. These persons are the least likely to receive necessary, health-sustaining dental care (which is distinct from mouth care). The mouth, or more accurately, plaque, serves as a reservoir for bacteria and pathogens. The link between mouth care, oral health, and systemic health is well-documented; infections such as pneumonia have been linked to poor oral health. Nurses, therefore, need to reframe mouth care as oral infection control and infection control more broadly. The can provide the preventive measure that are crucial to minimizing systemic infections. Nurses in all settings can potentially provide mouth care, conduct oral health assessments, educate patients about best mouth care practices, and make dental referrals. Yet, nurses are often hesitant to do anything beyond basic oral hygiene—and even in this area, often fail to provide mouth care based on best practices.

1. Introduction

The year 2011 was a banner year for oral health reports; the Institute of Medicine published two key reports entitled “*Advancing Oral Health in America*” [1] which outlined the seriousness of poor oral health and lack of access in the oral health care system in America. The second report was entitled “*Improving Access to Oral Health Care for Vulnerable and Underserved Populations*” [2]. The first report was written to describe the aims of oral health as integral to the overall health of the population beyond just dental conditions. It was also a call to arms not only for those in the professional dental community but also for all health care professionals who have interactions with patients. In any given health care encounter, clinicians and in particular nurses have the opportunity to screen for oral cancer, tooth decay, and gum disease and consider any necessary health care referrals as well as provide health education on the role of fluorides, sealants, nutrition, and oral health. Further, the report described how oral diseases can affect other health conditions. There is clear evidence related to the oral-systemic connection and how oral disease can lead to poor

health outcomes such as premature birth and cardiac valve disease. The report has seven key recommendations.

- (1) The secretary of HHS should give the leaders of the new oral health initiative (NOHI) the authority and resources needed to successfully integrate oral health into the planning, programming, policies, and research that occurs across all HHS programs and agencies.
- (2) All relevant HHS agencies should promote and monitor the use of evidence-based preventative services in oral health, (both the clinical and community based) and counseling across the lifespan.
- (3) All relevant HHS agencies should undertake oral health literacy and education efforts aimed at individuals and communities and health care professionals.
- (4) HHS should invest in workforce innovation to improve oral health.
- (5) CMS should explore new delivery and payment models for Medicare and Medicaid and CHIP to improve

access, quality, and coverage of oral health care across the lifespan.

- (6) HHS should place a high priority on efforts to improve open, actionable, and timely information to advance science and improve oral health through research.
- (7) To evaluate the NOHI the leaders of the NOHI should convene an annual public meeting of the agency heads to report on the progress of the NOHI [1].

This report, commissioned in 2009 by the United States Department of Health and Human Services, asked the Institute of Medicine to convene a panel to think about strategies for oral health. We have long known that our oral health system is challenged when it comes to access and that many people who encounter a dental visit may, unfortunately, receive less than a comprehensive health assessment while there. The important distinction in the “*Advancing Oral Health in America*” report is that oral health is different from dental health. This change of term reminds all of us that oral health can be addressed by nurses, physicians, social workers, pharmacists, and other allied health professionals who come in contact with patients [1]. By simply asking questions about the patient’s oral health, an important difference can be made in the screening and triage of those in need of better oral health care.

2. Background and Context

There are numerous reports and ample data to document the need for better access and higher-quality oral health care in America. The Department of Health and Human Services (DHHS) has conducted a number of surveys through the CDC and its National Health and Nutrition Examination Survey (NHANES), in which data are gathered from a sample of the civilian US population for the purpose of better understanding how health and nutrition impact health status outcomes. In 2007, the National Center for Health Statistics (NCHS) compared two reports from NHANES (NHANES III, 1988–1994, and NHANES, 1990–2004), on the dental health of the public. Dye and colleagues have reported optimistic data because in older adults, dental health, specifically edentulism, and periodontitis have improved and the number of dental caries in adolescents decreased from 68% to 59% [3]. According to NHANES data, the dental health of the general adolescent and adult population has improved with a decreased prevalence of dental caries and periodontal disease, likely due to the impact of fluoridation [4]. Only a subset of the adult population, consisting of Mexican-American and non-Hispanic Black men, showed a decrease in oral and dental health in their self-reports, which could be associated with socioeconomic factors. Further, *treatment* of dental decay increased in most ethnic and racial groups, except for non-Hispanic black persons and youths living at or over 200% of the federal poverty level [3]. The IOM report, however, documents a discouragingly high percentage of adults, including older adults who present with untreated dental caries at the time of examination. Finally

and alarmingly, there has been an 18–20% reported increase in dental caries in preschool children [1].

Oral health includes dental health and conditions such as cleft palate (1 in 1,000 live births), neoplasms, and neuromuscular or joint disorders of the oral region. Oral cancer has decreased over the past decade, presumably because of a reduction in the use of alcohol and tobacco; however, there is a high mortality because most oral cancers are diagnosed in advanced stages, especially in African Americans, who have a 5-year survival rate of 42% compared to a 63% in whites [1]. In the latest SEER Cancer Statistics Review, oral cancer is among the top 15 cancers [5].

Chevarley has estimated that approximately 1 in 10 persons in the US noninstitutionalized population (approximately 30 million persons) was not able to get or had a delay in accessing needed dental care. Specifically, approximately 5.5 percent of the population was unable to access dental care when needed [6]. The alarming death of Deamonte Driver, a 12-year-old who died in 2007 due to a lack of access to dental care, was a shocking wakeup call for all health care professionals [7].

3. The Primary Care Visit: What Else Could Be Happening?

Every primary care visit is an opportunity to provide oral health assessment and care. In the United States, primary care is provided by several categories of health care practitioners including nurse practitioners, family physicians, physician assistants, general internists, pediatricians, and geriatricians. Further, registered nurses, health educators, and medical assistants are an important part of the healthcare workforce who can bring to bear their own knowledge and skills to oral health assessment and care. Private practices, hospital outpatient departments, community health centers, and integrated care systems are all setting for oral health intervention and the mandate to do so is growing [8].

For example, in 2007 there were 88.9 million visits to hospital outpatient departments (OPDs) in the United States and each encounter, an opportunity for an oral health examination, with 54.7% of those visits to primary care providers [9]. Black or African-American persons (58.4 visits per 100 persons) had higher OPD visit rates. What if each of them received an oral health exam?

4. Incentives and Barriers to the Primary Care Oral Examination

“If you want to provide dental care, go to dental school.” This sentiment is a major barrier to oral health screening for those who are committed to the specialty model of health care. All providers are increasingly under pressure to show productivity in the workplace and argue that the oral examination is not in their scope of practice. Further, there is a concern that the requisite knowledge and skills for the oral health examination are not well understood. Nursing and medical licensing exams require knowledge of oral health, but few medical or nursing schools include oral health in their curriculum

[10]. There is an opportunity to fundamentally reconceptualize healthcare delivery practice patterns and interprofessional collaboration as a bidirectional relationship between oral health care and physical health care to improve patient outcomes and access [11, 12]. In 2008, the American Association of Medical Colleges added oral health in their learning objectives but much is to be done before oral health examinations are a standard practice [2]. Only 50% of pediatricians receive oral health training during residency and report a lack of training as a barrier to incorporating oral health in their practices [13]. There are 3.1 million nurses and over 140,000 nurse practitioners in the United States [14] and few have received adequate education related to oral health assessment. While the majority received some instruction related to oral hygiene, few nurses place a high priority on mouth care in the practice setting [11, 15]. In 2006, family medicine residencies included oral health as a requirement; however, only three-quarters of residency directors were aware of this requirement, and in 2006, only two-thirds of the programs were including oral health in the curriculum. These deficiencies in physician training on oral health lead not only to a lack of diagnosis of oral conditions but also to a low rate of referrals to dentists, as 23% of internal medicine residents reported never having referred a patient to the dentist [2].

Educational competencies for nurse practitioners, physicians, and dentists have a great deal in common with opportunities to capitalize on practice expectations. Competencies and learning objectives in the different educational programs overlap. This can be used to promote synergies between educators in the different programs, enriching students' education with knowledge of another discipline which can be incorporated in their future professional practice in benefit of patients [10].

In 2007, the National Hospital Ambulatory Medical Care Survey reported that 55.3% of OPD visits were to a provider other than the patient's primary care provider. It also reported that established patients (those with previous visits to the OPD clinic) made 82.9% of OPD visits and that only 43.1% of visits by these patients were to their primary care provider. The lack in continuity of patients to a constant primary care provider (PCP) may add to the minimization of oral health during examination [9].

It has been described that when used at least twice a year, fluoride varnish reduces dental decay by 38%. In some states, Medicaid reimburses physicians and nurse practitioners \$18.18 per visit to apply fluoride varnish 3 times a year to children under 19 years of age [16]. Furthermore, Quiñonez et al. reported that the application of fluoride varnish improves clinical outcomes by 1.52 cavity-free months at a cost of US\$7.18 for each cavity-free month gained per child and US\$203 for each treatment. These authors have concluded that the use of fluoride varnish in the medical setting is effective in reducing early childhood caries in low-income populations [17]. This is an extremely important data point and adds power to the argument that all of us need to practice oral health assessment and intervention. Despite the evidence that only four percent of pediatricians regularly apply fluoride varnish, there are no data for nurse practitioners [13].

5. Barriers to Changing Primary Care Practice Related to Oral Health

There are substantial barriers to changing primary care practice related to oral health. Lack of practitioner confidence, minimal education during formal training, time constraints during the visit, and an absence of referral strategies after examination except in locations where there are dental schools all lead to lack of access and underserved populations. The two recent IOM reports provide specific recommendations that must be addressed and nurse practitioners and physicians are a powerful voice in addressing our current shortfalls in practice [1, 2]. With the looming retirement of the dental workforce [18] there is an urgency to implement some of the creative strategies that are now in pilot phase (Dolce, in press). Our professional practice associations (AMA, ANA) can do much to move the agenda forward by giving voice to the inadequacies of our current educational and payment systems as they relate to oral health.

References

- [1] IOM, *Advancing Oral Health in America*, The National Academies Press, Washington, DC, USA, 2011.
- [2] IOM and NRC, *Improving Access to Oral Health Care for Vulnerable and Underserved Populations*, The National Academies Press, Washington, DC, USA, 2011.
- [3] B. A. Dye, S. Tan, V. Smith et al., "Trends in oral health status: United States, 1988–1994 and 1999–2004," *Vital and Health Statistics. Series 11*, no. 248, pp. 1–92, 2007.
- [4] CDC, "National Health and Nutrition Examination Survey, Questionnaires, Datasets, and Related Documentation," 2011, <http://www.cdc.gov/nchs/nhanes/nhanes-questionnaires.htm>.
- [5] S. F. Altekruse, M. Kosary, N. Krapcho et al., *SEER Cancer Statistics Review, 1975–2007*, National Cancer Institute, Bethesda, Md, USA, 2010.
- [6] F. M. Chevarley, "Percentage of Persons Unable to Get or Delayed in Getting Needed Medical Care, Dental Care, or Prescription Medicines: United States, 2007," *Agency for Healthcare, Research and Quality*, vol. 282, Statistical Brief, 2010.
- [7] M. Otto, *For Want of a Dentist*, The Washington Post, 2007.
- [8] T. Bodenheimer and H. H. Pham, "Primary care: current problems and proposed solutions," *Health Affairs*, vol. 29, no. 5, pp. 799–805, 2010.
- [9] E. Hing, M. J. Hall, and J. Xu, "National Hospital Ambulatory Medical Care Survey: 2006 outpatient department summary," *National Health Statistics Reports*, no. 4, pp. 1–31, 2008.
- [10] A. I. Spielman, T. Fulmer, E. S. Eisenberg, and M. C. Alfano, "Dentistry, nursing, and medicine: a comparison of core competencies," *Journal of Dental Education*, vol. 69, no. 11, pp. 1257–1271, 2005.
- [11] J. Haber, S. Strasser, M. Lloyd et al., "The oral-systemic connection in primary care," *Nurse Practitioner*, vol. 34, no. 3, pp. 43–48, 2009.
- [12] W. E. Mouradian, J. H. Berg, and M. J. Somerman, "Addressing disparities through dental-medical collaborations—part 1. The role of cultural competency in health disparities: training of primary care medical practitioners in children's oral health," *Journal of Dental Education*, vol. 67, no. 8, pp. 860–868, 2003.
- [13] C. W. Lewis, S. Boulter, M. A. Keels et al., "Oral health and pediatricians: results of a National Survey," *Academic Pediatrics*, vol. 9, no. 6, pp. 457–461, 2009.

- [14] ANA, "About ANA," 2011, <http://www.nursingworld.org/FunctionalMenuCategories/AboutANA>.
- [15] D. A. Clemmens and A. R. Kerr, "Improving oral health in women: nurses' call to action," *The American Journal of Maternal/Child Nursing*, vol. 33, no. 1, pp. 10–14, 2008.
- [16] C. W. Lewis, D. C. Grossman, P. K. Domoto, and R. A. Deyo, "The role of the pediatrician in the oral health of children: a national survey," *Pediatrics*, vol. 106, no. 6, article E84, 2000.
- [17] R. B. Quiñonez, S. C. Stearns, B. S. Talekar, R. G. Rozier, and S. M. Downs, "Simulating cost-effectiveness of fluoride varnish during well-child visits for medicaid-enrolled children," *Archives of Pediatrics and Adolescent Medicine*, vol. 160, no. 2, pp. 164–170, 2006.
- [18] IOM, *Retooling for an Aging America: Building the Health Care Workforce*, The National Academies Press, Washington, DC, USA, 2008.

Research Article

Oral Health Nursing Education and Practice Program

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Millions of Americans have unmet oral healthcare needs and profound oral health disparities persist in vulnerable and underserved populations, especially poor children, older adults, and racial and ethnic minorities. Nurses can play a significant role in improving the quality of oral health including access to care with appropriate education and training. The purpose of this paper is to describe New York University College of Nursing's response to this challenge. The *Oral Health Nursing Education and Practice* (OHNEP) program is a national initiative aimed at preparing a nursing workforce with the competencies to prioritize oral disease prevention and health promotion, provide evidence-based oral healthcare in a variety of practice settings, and collaborate in interprofessional teams across the healthcare system. The overarching goal of this national initiative is to create an educational infrastructure for the nursing profession that advances nursing's contribution to reducing oral health disparities across the lifespan.

1. Introduction

Over a decade ago, the United States (US) Surgeon General's landmark report, *Oral Health in America*, profiled the poor oral health status of the nation as a "silent epidemic" and linked oral health to overall health and well-being [1]. While overall improvements in oral health have been reported in the US population, millions of Americans have unmet needs related to oral health and profound oral health disparities persist in vulnerable and underserved populations, especially poor children, older adults, and racial and ethnic minorities [1–3]. For example, today, dental caries (tooth decay), an infectious and highly preventable disease, remains a common chronic disease across the life cycle and disproportionately impacts vulnerable and underserved groups [3].

One of the many barriers to quality oral healthcare includes a lack of attention to oral health by nondental health care professionals (e.g., nurses, pharmacists, physicians, physician assistants) [1–3]. For example, oral health has not been a high priority for nurses in practice [4]. Another barrier is the inadequate education of nondental health care professionals in basic oral health [3]. To address these challenges, the Committee on Oral Health Access to Services recommended the development of a core set of oral health

competencies and curricula for nondental health care professionals to enhance their role in oral health promotion and disease prevention [3]. In response to this recommendation, nursing programs will need to prepare graduates with core competencies to identify risk for oral disease, conduct oral examinations, provide oral health information, connect oral health information with diet and lifestyle counseling, and make referrals to dental professionals [3]. There are over 3 million licensed registered nurses including approximately 140,000 nurse practitioners (NP) in the US health care workforce [5]. With adequate education and training in oral health, the nurse workforce has the potential to have a major impact on improving access and quality of oral health care.

New York University (NYU) College of Nursing is strategically engaged with NYU College of Dentistry in an innovative organizational partnership to advance an interprofessional model for health professions oral-systemic education and practice. The purpose of this paper is to describe the NYU College of Nursing's program on *Oral Health Nursing Education and Practice* (OHNEP), an outgrowth of the NYU College of Nursing and College of Dentistry academic partnership and interprofessional collaborations with colleagues in Pediatrics and Family Medicine. The OHNEP program is a national initiative aimed at preparing the nurse workforce

with the competencies to prioritize oral disease prevention and health promotion, provide evidence-based oral health care in a variety of practice settings, and collaborate in inter-professional teams across the health care system to improve access to care and reduce oral health disparities.

2. Materials and Methods

2.1. Setting the Stage. The NYU College of Nursing proposed to develop and demonstrate the impact of a replicable model for implementing and disseminating a comprehensive oral health curriculum in nursing programs and integrate oral health best practices in nurse-managed primary care settings throughout the United States. Several landmark reports published in 2011 set the stage for NYU College of Nursing's program to enhance nursing's role in reducing the burden of oral disease in America. These reports, *Advancing Oral Health in America* [2], *Improving Access to Oral Health Care for Vulnerable and Underserved Populations* [3], *National Prevention Strategy: America's Plan for Better Health and Wellness* [6], and *Core Competencies for Interprofessional Collaborative Practice* [7], underscored the centrality of the nursing profession in improving oral health outcomes, nurses' role in health promotion and prevention, and the importance of interprofessional education and collaborative practice in improving oral health. In 2011, NYU College of Nursing launched a national initiative, *Oral Health Nursing Education and Practice* (OHNEP), funded by DentaQuest Foundation, Washington Dental Service Foundation, and Connecticut Health Foundation. *Oral Health Nursing Education and Practice* is a constituent of the National Interprofessional Initiative on Oral Health (NIIOH), a consortium of clinicians and funders whose mission is to engage primary care clinicians to partner with dental professionals in providing oral health preventive services and to eliminate dental disease.

2.2. Program Aims. The overarching goal of this national initiative is to create an infrastructure for the nursing profession that advances nursing's contribution in reducing oral health disparities across the lifespan. The OHNEP initiative focuses on the development of a replicable model for integrating oral health in nursing curricula and implementing and disseminating oral health best practices in nurse-managed primary care settings. The specific aims of the OHNEP initiative are to

- (1) engage national nursing stakeholders representing licensure, accreditation, certification, education, practice, and policy in advancing an action plan and recommendations that will support oral health nursing education, clinical practice, and policy changes,
- (2) implement a strategy for developing oral health competencies in undergraduate and graduate nursing programs,
- (3) implement a strategy for integrating best practices in oral health care in registered nurse (RN) and advanced practice nurse (APRN) clinical settings,

- (4) disseminate these strategies nationally including nursing programs, healthcare organizations, nurse managed primary care settings, and professional nursing organizations.

2.3. Program Approach

2.3.1. Aim 1. Engaging stakeholders and creating a shared vision are critical underpinnings of the program approach. To further this aim, in May 2011 a National Invitational Nursing Summit was convened in Washington, DC, to launch the OHNEP initiative. Over 35 representatives from 25 national nursing and professional organizations responsible for licensure, accreditation, certification, education, practice, and policy participated in the Summit. Summit participants were engaged in discussions about nursing's role in improving oral health and expanding access in the context of interprofessional collaboration. These key nursing stakeholders contributed ideas and strategies for advancing an oral health agenda in nursing.

2.3.2. Aim 2. To achieve this aim a faculty development train-the-trainer approach was designed to enhance nursing curricula and disseminate best practices in oral health. The train-the-trainer workshop, *Oral Health Nursing Education and Best Practices: Enhancing Faculty Capacities*, was specially tailored to assist faculty with integrating oral health into existing courses in the baccalaureate and graduate nursing programs at NYU College of Nursing. The train-the-trainer workshop was approved by NYU College of Nursing's Center for Continuing Education in Nursing, an accredited provider of continuing nursing education by the American Nurses Credentialing Center's Commission. The purpose of the workshop was to provide faculty with teaching-learning resources to facilitate the integration of oral health into didactic, clinical, and simulation learning environments. The *Smiles for Life: A National Oral Health Curriculum* [8] was presented as a comprehensive, interprofessional curriculum for nurse faculty enrichment and competency development in oral health across the lifespan [9]. At the completion of the train-the-trainer workshop, participants were expected to (a) articulate the importance of oral-systemic health and nursing's call to action, (b) discuss interprofessional education and collaborative practice as a framework for improving oral-systemic health outcomes, (c) describe the comprehensive features of Smiles for Life, and (d) implement a variety of teaching-learning strategies that facilitate the development of nurses' oral health competencies and implementation of oral health best practices across the lifespan.

2.3.3. Aim 3. An oral health documentation or chart template was developed to prompt nurse practitioner (NP) providers to adhere to best practices in oral health care. The chart system will prompt NP providers to assess risk factors for oral disease, provide brief intervention, and make appropriate referrals. This new office system will be pilot tested in a nurse-managed primary care setting to assess the

feasibility and preliminary effect on NP adherence to best practices in oral health promotion and disease prevention.

2.3.4. *Aim 4.* Laying the groundwork for an effective dissemination plan required extensive outreach to the executive directors, presidents, and conference planning committees of national nursing organizations. Abstracts for preconference train-the-trainer workshops and concurrent sessions were submitted for consideration at national nursing conferences. The target audiences included nurse faculty, professional development specialists, registered nurses, and advanced practice nurses.

3. Results and Discussion

3.1. *Outcome 1.* A short film, *Expanding Access to Oral Health Care—Nurses Make a Difference* [10], featuring Dr. David Satcher, former US Surgeon General, was produced to vividly depict the burden of oral health in America and NYU College of Nursing's response to the challenge of improving oral health. The purpose of the film was to begin a dialogue and create a shared vision about the role of nurses in improving oral health care and access. The film was first presented at the Summit and was highly acclaimed. Since the Summit, the film has been made widely available on the Internet.

3.2. *Outcome 2.* An outcome of the Summit was the development of a national nursing action plan. The action plan identified short-, mid-, and long-range nursing strategies to advance a national oral health agenda. Priority areas were outlined and included policy, education, practice, interprofessional partnerships, outreach, and communication.

3.3. *Outcome 3.* One of the first priorities identified by key nursing stakeholders was to establish a National Nursing Workgroup on Oral Health. A national call for members was issued and resulted in nominations from nursing education, practice, research, and policy. The National Nursing Workgroup on Oral Health was first convened in December 2011. The Workgroup, comprised of 18 members, serves as an expert advisory committee providing input related to nursing's role in advancing a national oral health agenda.

3.4. *Outcome 4.* To keep local, regional, and national constituents up-to-date regarding OHNEP activities, an electronic newsletter, *Oral Health Matters*, was developed for nurses and other health professionals. The inaugural issue was released in Fall 2011 and has been widely disseminated through print media and the Internet.

3.5. *Outcome 5.* The Smiles for Life (<http://www.smilesforlifeoralhealth.org/>) curriculum [8] was promoted as a comprehensive oral health resource for competency development and integrated into faculty development train-the-trainer workshops. The curriculum consists of eight individual courses: (1) The Relationship of Oral to Systemic Health, (2) Child Oral Health, (3) Adult Oral Health, (4) Acute Dental Problems, (5) Oral Health and the Pregnant Patient, (6)

Fluoride Varnish, (7) The Oral Examination, and (8) Geriatric Oral Health. The NYU College of Nursing's Center for Continuing Education in Nursing, accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation, approved the Smiles for Life curriculum. Each individual course was approved for 1.0 contact hour and was made available free to individual users.

The Geriatric Oral Health course was the most recent addition to the curriculum. Prior to the launch of the geriatric course in October 2011, a member of the NYU College of Nursing faculty with specialization as an adult and geriatric nurse practitioner conducted an expert review of the content. The OHNEP project director was invited to serve on the National Association of School Nurses National Oral Health Expert Panel and provided consultation related to the implementation of Smiles for Life curriculum for the professional development of school nurses. To date, the OHNEP initiative including Smiles for Life curriculum has received organizational board recognition from the American Association of Colleges of Nursing, National League for Nursing, National Organization of Nurse Practitioner Faculties, National Association of Pediatric Nurse Practitioners, Association of Faculties of Pediatric Nurse Practitioners, and Gerontological Advanced Practice Nurses Association.

3.6. *Outcome 6.* The train-the-trainer workshop was piloted at NYU College of Nursing for faculty teaching in the baccalaureate and graduate programs. Four workshops were conducted in the Fall 2011 semester. A total of 24 faculty members and 6 students enrolled in the Master's of Science nursing education program completed the workshop. At the end of the workshop, blank index cards were distributed to the participants. The participants were instructed to identify and indicate on the card at least two teaching-learning strategies or resources that they planned to implement in their curriculum as an outcome of the workshop. Participants completed a program evaluation providing feedback on teaching effectiveness and achievement of learning outcomes. Using a five-point likert rating scale ranging from "strongly disagree" to "strongly agree," participants were asked to rate the following outcomes: (1) I am able to articulate the importance of oral health and nursing's call to action. (2) I am able to discuss interprofessional education and collaborative practice as a framework for improving oral health outcomes. (3) I am able to describe the comprehensive features of Smiles for Life. (4) I am able to implement a variety of teaching-learning strategies that facilitate integration of oral health nursing education and practice across the lifespan. These data were collected at the end of each train-the-trainer workshop. Evaluation data were analyzed to improve the quality of the workshops in meeting faculty learning needs and expectations. Follow-up surveys with workshop participants are conducted to assess how the training has impacted their courses and curriculum.

3.7. *Next Steps.* The OHNEP initiative will build upon the outcomes achieved in its first year, and focus on the

national dissemination of strategies for developing oral health competencies in undergraduate and graduate nursing education and integrating oral health best practices in RN and APRN clinical settings. The dissemination plan includes the spread of curricular innovations and best practices across nursing programs, healthcare organizations, nurse-managed primary care settings, and professional organizations. Train-the-trainer workshops will be offered to nurse faculty, professional development specialists, and clinicians and will feature the Smiles for Life curriculum as a resource for competency development. Faculty and clinician train-the-trainer sessions to disseminate strategies for enhancing nursing curricula, developing oral health competencies, and implementing best practices will be presented at select national nursing conferences and meetings beginning in 2012. These conferences will include the American Association of Colleges of Nursing, National League for Nursing, National Organization of Nurse Practitioner Faculty, and American Academy of Nurse Practitioners.

The next phase will also focus on the implementation of oral health best practices in nurse-managed primary care settings. A best practice protocol will be first implemented in the NYU College of Nursing Nurse Practitioner Faculty Practice, with expansion into its Mobile Health Van Program and Diabetes Care—Lifestyle Center for Older Adults. The implementation will be evaluated for effectiveness and disseminated nationally. The NYU College of Nursing's OHNEP initiative will continue to demonstrate the capacity to advance interprofessional education and collaborative practice in oral health. Program activities will be planned around aligning leadership, leveraging information technology, and supporting curricular development.

To continue the dialogue and momentum that began at the National Nursing Summit, a nursing leadership colloquium will be convened in 2012. Members of the National Nursing Workgroup on Oral Health, along with other nursing stakeholders, will be invited to participate in a nursing leadership colloquium on oral health. The goals of the colloquium will be to align nursing leaders on key priority areas: licensure, accreditation, certification, education, practice, and policy, and to build consensus about nursing's role in an interprofessional agenda to improve oral health. An expected outcome of the nursing leadership colloquium will be individual and collective ownership of strategic actions that advances a national policy agenda to improve oral health. An initial strategy will be to attain formal recognition and support from the Tri-Council of Nursing.

An important strategy for the dissemination of oral health nursing education and best practices will be the development of a website to serve as the "knowledge center" for faculty development, competency development, and best practices in oral health across the lifespan. The website will provide open access to online curricular resources. The OHNEP website, under the umbrella of NIIOH, will facilitate the dissemination of oral health nursing education and practice resources for nurses and other health professionals, including the Smiles for Life curriculum.

Curricular development awards will be available to nurse faculty and clinicians to support the development,

implementation, and evaluation of oral health instructional resources. Curricular resources will be used for educating nurses in undergraduate- and graduate-level programs and clinical practice settings. The curricular resources will be peer-reviewed, published, and disseminated through the OHNEP website. An example of an oral health instructional resource is the use of a standardized patient case for simulation learning designed to supplement the Smiles for Life curriculum.

4. Conclusion

New York University College of Nursing, leveraging a novel organizational partnership with NYU College of Dentistry, is uniquely positioned to advance innovative models of interprofessional education and collaborative practice that enhance oral health outcomes. The *Oral Health Nursing Education and Practice* initiative has gained tremendous momentum with its focus on faculty and professional development using a train-the-trainer approach. Building on this initial momentum, the next phase will focus on the expansion of professional development train-the-trainer programs nationally and implementation of a strategy for integrating oral health best practices in nurse-managed primary care settings. It is in this context that NYU College of Nursing is poised to develop, implement, and evaluate the effectiveness of strategies that facilitate the dissemination of oral health nursing education and best practices.

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References

- [1] U.S. Department of Health and Human Services, "Oral health in America: a report of the Surgeon General," U.S. Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health, Rockville, Md, USA, 2000, <http://www.surgeongeneral.gov/library/oralhealth/>.
- [2] Institute of Medicine, *Advancing Oral Health in America*, The National Academies Press, Washington, DC, USA, 2011, <http://iom.edu/Reports/2011/Advancing-Oral-Health-in-America.aspx>.
- [3] Institute of Medicine, *Improving Access to Oral Health Care for Vulnerable and Underserved Populations*, The National Academies Press, Washington, DC, USA, 2011, <http://www.iom.edu/Reports/2011/Improving-Access-to-Oral-Health-Care-for-Vulnerable-and-Underserved-Populations.aspx>.
- [4] D. A. Clemmens and A. R. Kerr, "Improving oral health in women: nurses' call to action," *The American Journal of Maternal/Child Nursing*, vol. 33, no. 1, pp. 10–14, 2008.

- [5] U.S. Department of Health and Human Services, *The Registered Nurse Population: Findings from the 2008 National Sample Survey of Registered Nurses*, U.S. Department of Health and Human Services, Health Resources and Services Administration, Washington, DC, USA, 2010.
- [6] U.S. Department of Health and Human Services, *National Prevention Strategy*, U.S. Department of Health and Human Services, Office of the Surgeon General, National Prevention Council, Washington, DC, USA, 2011, <http://www.healthcare.gov/prevention/nphpphc/strategy/index.html#NatPrevStrategy>.
- [7] Interprofessional Education Collaborative Expert Panel, *Core Competencies for Interprofessional Collaborative Practice: Report of an Expert Panel*, Interprofessional Education Collaborative, Washington, DC, USA, 2011.
- [8] A. B. Douglass, R. Maier, M. Deutchman et al., *Smiles for Life: A National Oral Health Curriculum*, 3rd edition, 2010, <http://www.smilesforlifeoralhealth.org/>.
- [9] M. C. Dolce, "Nurse faculty enrichment and competency development in oral-systemic health," *Nursing Research and Practice*, vol. 2012, Article ID 567058, 2012.
- [10] New York University College of Nursing (Producer), *Expanding Access to Oral Health Care—Nurses Make a Difference [DVD]*, 2011, <http://www.youtube.com/watch?v=cW5cMZ6EZEQ>.

Research Article

Nurse Faculty Enrichment and Competency Development in Oral-Systemic Health

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Nurses are positioned to play a significant role in oral health promotion and disease prevention across the life cycle. Oral health has not been a high priority in nursing practice, and educating nurses about oral health has been inadequate particularly regarding the interrelationship between oral health and overall health. The first step for developing a nursing workforce with core competencies in oral health promotion and disease prevention is to prepare nurse faculty with the requisite knowledge, skills, attitudes, and best practices in oral-systemic health. The purpose of this paper is to present *Smiles for Life: A National Oral Health Curriculum* as a knowledge framework that nurse faculty can use for faculty enrichment and competency development in oral health across the life cycle. A variety of teaching-learning strategies and resources are provided to assist nurse faculty with integrating oral-systemic health into existing nursing curricula.

1. Introduction

Nurses are positioned to play a significant role in oral health promotion and disease prevention across the life cycle, and in expanding access to preventive care services especially for vulnerable and underserved populations across health care settings [1–5]. Oral health promotion and preventive care services, such as basic risk assessments, oral health examinations, referrals, counseling, and anticipatory guidance, are well within the scope of professional nursing practice. Recognizing the significance of oral health in achieving overall health and well-being, nurses can empower individuals, families, and communities with oral health information and resources to support healthy choices regarding oral hygiene, diet, tobacco, and alcohol use.

Historically, oral health has not been a high priority in nursing practice [1]. Education and training of nurses about basic oral health and oral-systemic health has been inadequate [5–7]. In 2007, a survey of academic deans and administrators from accredited dental schools in the United States and Canada found that only 2.3% of respondents strongly agreed that nurses and physicians in their health science center or academic campus were well educated about oral-systemic health [8]. The potential role of nurses in

improving oral health outcomes across the life cycle and expanding access is contingent upon enhancing nursing curricula in undergraduate- and graduate-level programs and professional development programs for practicing nurses [1].

The initial step for developing a nursing workforce with core competencies in oral health promotion and disease prevention is to prepare nurse faculty with the requisite knowledge, skills, attitudes, and best practices in oral-systemic health. The purpose of this paper is to present *Smiles for Life: A National Oral Health Curriculum* [9] as a knowledge framework that nurse faculty can use for competency development in oral health across the life cycle. A variety of teaching-learning strategies and resources are provided to assist nurse faculty with integrating oral-systemic health into existing nursing curricula.

2. Materials and Methods

2.1. Smiles for Life: A National Oral Health Curriculum. *Smiles for Life (SFL)* is a comprehensive oral health curriculum developed by a national steering committee of physicians and dentists formed within the Society of Teachers of

Family Medicine, and specially tailored for primary care clinicians and educators [9]. Since its launch in 2006, this online resource (<http://www.smilesforlifeoralhealth.org/>) has been accessed by individual users including physicians, nurses, physician assistants, and dental hygienists [9]. The curriculum has been adapted and implemented in medical schools and residency programs [9, 10]. *Smiles for Life* curriculum has received numerous endorsements from medical and nursing organizations, including American Academy of Family Physicians, American Academy of Pediatrics, Society of Teachers of Family Medicine, American Academy of Physician Assistants, Association of Faculties of Pediatric Nurse Practitioners, National Association of Pediatric Nurse Practitioners, and Gerontological Advanced Practice Nurses Association.

Smiles for Life is an evidence-based curriculum covering oral health across the life cycle. The curriculum is presented in an interactive, web-based format and consists of eight courses: (1) The Relationship of Oral to Systemic Health, (2) Child Oral Health, (3) Adult Oral Health, (4) Acute Dental Problems, (5) Oral Health and the Pregnant Patient, (6) Fluoride Varnish, (7) The Oral Examination, and (8) Geriatric Oral Health. *Smiles for Life* curriculum is approved for continuing nursing education by New York University College of Nursing's Center for Continuing Education in Nursing, an accredited provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation. Each individual course is approved for 1.0 contact hour and is available free to individual users.

2.1.1. Clinicians. Individual clinicians can access the *SFL* curriculum and complete the online courses at their own pace. New users are advised to complete the registration information before launching a course. Each course will take approximately one hour to complete. Clinical cases corresponding to each course are included as optional learning activities. Each case will take approximately 10 minutes to complete. Clinicians are recommended to review the clinical cases before completing the post-assessment. Only registered users will be eligible to complete the post-assessment, obtain a certificate of completion, and receive continuing education credit.

2.1.2. Educators. A special link for educators is located on the *SFL* website homepage. Nurse educators can readily access educational materials for integration into existing nursing curricula and professional development programs. Each individual course is downloadable and includes course description, educational objectives, PowerPoint slides, presenter notes, clinical cases, test questions, instructional videos, and implementation guide. Additional *SFL* resources, described in the next section, are available for integration into clinical teaching and practice settings.

2.1.3. Resources. *Smiles for Life* offers a multitude of educational and practice resources for educators and clinicians. Reference guides such as lab coat "pocket cards" can be

downloaded to assist students and nurses in delivering patient care. For example, the *Adult Oral Health Pocket Card* provides clinicians with evidence-based recommendations for the prevention of periodontal disease (gum disease) and caries (tooth decay), and treatment of xerostomia (dry mouth) in adult patients. Patient education handouts and posters are available in English and other languages, including Spanish, Vietnamese, Cambodian, and Russian. The handouts can be printed and made available to patients, and the posters can be displayed in patient care areas such as waiting and examination rooms. Brief instructional videos are available on the website and can be downloaded into PowerPoint presentations. Instructional videos include lap-to-lap child oral exam, application of fluoride varnish, palpation of the temporomandibular joint, and palpation of the floor of the mouth. The *SFL* website also provides a selected annotated bibliography for clinicians and educators. Oral health topics include (a) engaging primary care medical providers in preventing dental disease, (b) diabetes and oral health, (c) prenatal/perinatal oral health, (d) cardiovascular disease and oral health, (e) seniors and oral health, and (f) other oral systemic health connections. The *SFL* website offers clinicians and educators direct links to peer-reviewed internet sites for oral health information and resources.

3. Results and Discussion

3.1. Knowledge Framework. The *Smiles for Life* curriculum provides a knowledge framework for nurse faculty enrichment and competency development in oral health across the life cycle. Table 1 outlines a strategy for nurse faculty to enhance nursing competencies in the domain of oral-systemic health. This strategy addresses the competency to integrate knowledge of the oral health impact on systemic health into professional nursing practice. Building upon the *SFL* knowledge framework, educational strategies and resources are identified for nurse faculty enrichment. Teaching-learning strategies are described for integration into existing nursing curricula.

3.1.1. Content. The first *SFL* course, *The Relationship of Oral to Systemic Health*, provides nurse faculty and students with a core knowledge base in oral-systemic health interactions. This foundational course addresses the linkage between oral health and systemic health, and discusses the role of clinicians in promoting oral health and preventing oral diseases. At the completion of the first course, nurse faculty and students will be able to (a) discuss the prevalence and sequelae of oral disease, (b) recognize the interrelationships between oral and systemic disease, and (c) highlight the role of professional nurses in promoting oral health. Most learners will take approximately one hour to complete the first course. It is recommended that learners complete the two optional clinical cases included in the oral-systemic health module, review the selected annotated bibliography for references addressing the association between periodontal disease and systemic diseases, and navigate the recommended oral health websites.

TABLE 1: Framework for faculty enrichment and competency development in oral health.

Competency domain	Competency outcome	<i>Smiles for Life</i> curriculum	Faculty enrichment resources	Integrative teaching-learning strategies
Oral-systemic health interactions	Integrate knowledge of oral health impact on systemic health into professional nursing practice	Complete SFL Course 1: <i>The Relationship of Oral to Systemic Health</i>	Read the following references: US Department of Health and Human Services, Office of the Surgeon General (2000). <i>Oral health in America: A report of the surgeon general</i> . Rockville, MD: Author. Retrieved from http://www.surgeongeneral.gov/library/reports/oralhealth/ [11]	Incorporate SFL Course 1 post-assessment questions in didactic teaching using audience response system
		Review optional clinical cases corresponding to oral-systemic health	Institute of Medicine (2011). <i>Advancing oral health in America</i> . Washington, DC: The National Academies Press. Retrieved from http://iom.edu/Reports/2011/Advancing-Oral-Health-in-America.aspx [4]	Assign students to complete SFL Course 1 in preparation for a clinical simulation
Oral-systemic health interactions	Integrate knowledge of oral health impact on systemic health into professional nursing practice	Complete post-assessment and achieve passing score of 80% or higher	Institute of Medicine. (2011). <i>Improving access to oral health care for vulnerable and underserved populations</i> . Washington, DC: The National Academies Press. Retrieved from http://www.iom.edu/Reports/2011/Improving-Access-to-Oral-Health-Care-for-Vulnerable-and-Underserved-Populations.aspx [5]	Incorporate SFL patient education handouts in clinical or simulation experiences
		Review selected annotated oral health bibliography for references addressing associations between periodontal disease and diabetes mellitus, adverse pregnancy outcomes, cardiovascular disease	Navigate the following websites: <i>Healthy People 2020, Oral Health at</i> http://healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=32	Instruct students to use SFL pocket cards as a reference guide during clinical or simulation experiences
	Navigate recommended oral health websites	<i>World Health Organization Global Oral Health Programme at</i> http://www.who.int/oral_health/en/	Select a research article from SFL annotated bibliography and facilitate an evidence-based journal club discussion	

3.1.2. Resources for Faculty Enrichment. The US Surgeon General's landmark report released in 2000, *Oral Health in America*, is a good starting point for understanding the meaning of oral health and the link between oral health and overall health. The report described the mouth as a "mirror" of health and disease and emphasized that oral health encompasses a broader scope than healthy teeth [11]. Over a decade later, the 2011 Institute of Medicine's reports on oral health conveyed a consistent message about the importance of oral health to overall health and well-being, and the imperative to enhance the role of health professionals in oral health promotion and disease prevention [4, 5].

Improving oral health is a national priority and a global challenge. *Healthy People 2020* outlined a national agenda with goals and objectives for improving health for all Americans and identified oral health as one of the leading health indicators [12]. The *Healthy People 2020* website (<http://www.healthypeople.gov/2020/default.aspx>) is an excellent resource for information about the oral health impact on overall health, oral health disparities in the United States, and evidence-based recommendations on oral health. The World Health Organization (WHO) established a strategic *Global Oral Health Programme* focused on developing global policies addressing oral health promotion and disease prevention [13]. The WHO website (http://www.who.int/oral_health/en/) is an important resource for strategies and approaches on oral health promotion and disease prevention. The WHO defined oral health as "a state of being free from chronic mouth and facial pain, oral and throat cancer, oral sores, birth defects such as cleft lip and palate, periodontal (gum) disease, tooth decay and tooth loss, and other diseases and disorders that affect the oral cavity. Risk factors for oral diseases include unhealthy diet, tobacco use, harmful alcohol use, and poor oral hygiene" [14]. This definition is useful in understanding that oral health is more than healthy teeth, oral care is greater than dental care, and oral diseases share the same risk factors as many significant noncommunicable diseases such as cardiovascular disease and cancer.

3.1.3. Integrative Teaching-Learning Strategies. Strategies that actively engage learners and integrate knowledge of oral-systemic health interactions are recommended for teaching nursing students about the oral-systemic health connection. A variety of effective teaching-learning methods can be used to integrate knowledge about oral-systemic health into professional nursing practice, such as clinical case presentations, clinical simulations, and unfolding case studies. Clinical case presentations are effective in illustrating the oral manifestations of systemic diseases or oral-systemic interactions. Clinical case examples may include patients with diabetes mellitus and periodontal disease, eating disorders and oral disease, sexually transmitted diseases including HIV/AIDS and oral manifestations, depression and oral impact of medications, and impact of cancer treatments (radiation and chemotherapy) on oral health. Clinical simulation scenarios can be designed to address the role of professional nurses in the assessment and monitoring of the oral health

impact of systemic conditions and treatments. Case scenarios focused on oral health promotion and disease prevention can include counseling mothers about good oral hygiene during pregnancy, teaching children proper tooth brushing, and providing oral care to patients with disabilities or special needs. Nurse faculty can develop unfolding case studies to correlate patient's oral manifestations of systemic disease and pathophysiology, and to plan and evaluate interventions for an oral-systemic interaction. Unfolding case study examples may include patients with xerostomia related to HIV treatment, poor glycemic control associated with chronic periodontal disease, and poor nutritional status and edentulism. Additional teaching-learning strategies are outlined in Table 1 to assist nurse faculty with integrating knowledge of oral-systemic health into existing nursing curricula.

4. Conclusion

Smiles for Life is a comprehensive oral health curriculum for health professionals and serves as a knowledge framework for nurse faculty enrichment and competency development in oral health across the life cycle. Articulating the importance of oral health to overall general health is essential in promoting oral health and preventing oral disease. Nurse faculty and educators are called to develop a nursing workforce that understands oral-systemic health associations and demonstrates the core competencies of oral health promotion and disease prevention. To attain this goal, strategies and resources are recommended for nurse faculty enrichment. Teaching-learning strategies that actively engage nursing students about the oral-system connection will contribute to the integration of knowledge about oral-systemic interactions into professional nursing practice.

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References

- [1] D. A. Clemmens and A. R. Kerr, "Improving oral health in women: nurses' call to action," *MCN The American Journal of Maternal/Child Nursing*, vol. 33, no. 1, pp. 10–14, 2008.
- [2] J. Haber, S. Strasser, M. Lloyd et al., "The oral-systemic connection in primary care," *The Nurse Practitioner*, vol. 34, no. 3, pp. 43–48, 2009.
- [3] D. Hallas and D. Shelley, "Role of pediatric nurse practitioners in oral health care," *Academic Pediatrics*, vol. 9, no. 6, pp. 462–466, 2009.
- [4] Institute of Medicine, *Advancing oral health in America*, The National Academies Press, Washington, DC, USA,

- 2011, <http://iom.edu/Reports/2011/Advancing-Oral-Health-in-America.aspx>.
- [5] Institute of Medicine, *Improving access to oral health care for vulnerable and underserved populations*, The National Academies Press, Washington, DC, USA, 2011, <http://www.iom.edu/Reports/2011/Improving-Access-to-Oral-Health-Care-for-Vulnerable-and-Underserved-Populations.aspx>.
- [6] C. Hein, D. J. Schönwetter, and A. M. Iacopino, "Inclusion of oral-systemic health in predoctoral/undergraduate curricula of pharmacy, nursing, and medical schools around the world: a preliminary study," *Journal of Dental Education*, vol. 75, no. 9, pp. 1187–1199, 2011.
- [7] K. T. Wooten, J. Lee, H. Jared, K. Boggess, and R. S. Wilder, "Nurse practitioner's and certified nurse midwives' knowledge, opinions and practice behaviors regarding periodontal disease and adverse pregnancy outcomes," *Journal of Dental Hygiene*, vol. 85, no. 2, pp. 122–131, 2011.
- [8] R. S. Wilder, A. M. Iacopino, C. A. Feldman et al., "Periodontal-systemic disease education in U.S. and Canadian dental schools," *Journal of Dental Education*, vol. 73, no. 1, pp. 38–52, 2009.
- [9] M. Deutchman, A. Douglass, and J. Douglass, "Smiles for life: a national oral health curriculum," *Dental Abstracts*, vol. 56, no. 1, pp. 4–6, 2011.
- [10] H. Silk, S. O'Grady Stille, R. Baldor, and E. Joseph, "Implementation of STFM's "Smiles for life" oral health curriculum in a medical school interclerkship," *Family Medicine*, vol. 41, no. 7, pp. 487–491, 2009.
- [11] U.S. Department of Health and Human Services, Office of the Surgeon General, "Oral health in America: A report of the Surgeon General," Rockville, MD, 2000, <http://www.surgeongeneral.gov/library/reports/oralhealth/>.
- [12] U.S. Department of Health and Human Services, "Healthy-People 2020, Oral Health," 2011, <http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=32>.
- [13] P. E. Petersen, "World Health Organization global policy for improvement of oral health—World Health Assembly 2007," *International Dental Journal*, vol. 58, no. 3, pp. 115–121, 2008.
- [14] World Health Organization, "Oral health," Fact Sheet No. 318, 2007, <http://www.who.int/mediacentre/factsheets/fs318/en/>.

Research Article

Comparison of Biomarkers in Blood and Saliva in Healthy Adults

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Researchers measure biomarkers as a reflection of patient health status or intervention outcomes. While blood is generally regarded as the best body fluid for evaluation of systemic processes, substitution of saliva samples for blood would be less invasive and more convenient. The concentration of specific biomarkers may differ between blood and saliva. The objective of this study was to compare multiple biomarkers (27 cytokines) in plasma samples, passive drool saliva samples, and filter paper saliva samples in 50 healthy adults. Demographic data and three samples were obtained from each subject: saliva collected on filter paper over 1 minute, saliva collected by passive drool over 30 seconds, and venous blood (3 mL) collected by venipuncture. Cytokines were assayed using Bio-Rad multiplex suspension array technology. Descriptive statistics and pairwise correlations were used for data analysis. The sample was 52% male and 74% white. Mean age was 26 (range = 19–63 years, sd = 9.7). The most consistent and highest correlations were between the passive drool and filter paper saliva samples, although relationships were dependent on the specific biomarker. Correlations were not robust enough to support substitution of one collection method for another. There was little correlation between the plasma and passive drool saliva samples. Caution should be used in substituting saliva for blood, and relationships differ by biomarker.

1. Introduction

Many clinical research projects evaluate immune components as biomarkers that reflect patient health status or outcomes of interventions. Innate and adaptive immune components are present in the blood and the saliva and are attractive biomarker targets. Blood is generally regarded as the best body fluid for evaluation of systemic processes. However, collection of blood involves potential risks to subjects, including transient discomfort, bruising, infection at the venipuncture site, and anemia (if large volumes are required or if subjects are vulnerable). Blood collection is also less favored in research involving children as well as in other research subjects for whom venous access is difficult (i.e., elderly or critically ill). While passive drool samples are considered the gold standard for analysis of unstimulated saliva, collection and storage of saliva on filter papers is more convenient. Comparisons of cytokines values in saliva samples

obtained by these 2 methods have not been published. This methodologic study compared multiple biomarkers in blood to saliva samples collected in two different ways from human volunteers.

Salivary glands have rich vasculature from which saliva is filtered and processed. Salivary components may originate entirely from the salivary glands or may be derived from the blood by passive diffusion or active transport [1, 2]. In cases where components in saliva are derived from the blood, levels of biochemical and immunological components measured in saliva may reflect blood levels. Substitution of saliva samples for blood in analysis of biomarkers is of considerable interest because collection of saliva is less invasive and does not have any of the risks associated with collection of blood. While there is some information about single biomarkers in saliva (such as cortisol), the correspondence to blood levels varies widely by biomarker, and to date there has been little published regarding how well blood levels of specific cytokines or

other biomarkers are represented in saliva, or how saliva collection technique affects recovery of specific bio-markers [3].

Saliva can be collected and measured as unstimulated whole saliva, unstimulated saliva from specific gland pairs (such as parotid or submandibular-sublingual pairs), or stimulated saliva from specific gland pairs. Unstimulated whole saliva represents the usual, or baseline, saliva present in the oral cavity for the majority of a 24-hour period. Unstimulated whole saliva often correlates to systemic clinical conditions more accurately than stimulated saliva, since materials use to stimulate flow may change salivary composition.

Unstimulated saliva has traditionally been obtained by having the subject seated quietly with his or her head flexed forward and allowing the saliva to passively drip from the mouth to a collection container, or by having the subject gently spit into a collection contain for a specified amount of time. This method of collection is considered the “gold standard” for obtaining many components of saliva [3]. Recently, an alternative method for collection of unstimulated saliva using filter paper placed in the sublingual pocket has been described [4, 5]. Collection of saliva by filter paper has several potential advantages. In contrast to passive drool collection, it does not require active participation of the subject nor upright positioning. Filter paper samples are easy to transport, use less storage space, and can be stored at room temperature.

Immune components can be measured with commercially available immunoassay kits and have historically been measured using enzyme-linked immunosorbent assays (ELISAs). Such immunoassays are exquisitely sensitive and specific. However, ELISAs generally measure a single biomarker, so sample volume requirements increase dramatically if multiple biomarkers are to be measured. This is particularly problematic for blood collections. New multiplex suspension array technology enables the examination of multiple cytokines and other biomarkers simultaneously from the same small volume sample. Multiplex technologies were originally developed for use with blood samples and more recently have been applied to other fluids such as urine or cerebrospinal fluid; there are few reports of multiplex analysis of saliva.

The specific aim of this research was to compare levels of biomarkers (27 specific cytokines) in 3 sample types (plasma, passive drool saliva, and saliva collected on filter paper) using a single time point, within-subjects correlational design of a convenience sample of healthy volunteer adults. This was undertaken to enable us to evaluate which biomarkers could be reliably determined in less invasive salivary samples, thus reducing the necessity of blood collection in future research, and whether filter paper sampling could be substituted for passive drool collection.

2. Methods

2.1. Design. A single time point, within-subjects correlational design was used.

2.2. Setting. All data collection and analysis were conducted at a certified, core laboratory located in a research intensive university.

2.3. Sample. Fifty healthy volunteers were recruited from the medical and academic campuses of a large urban university in the southeastern United States. Inclusion criteria were: age 18 or older and self-identified as healthy. Exclusion criteria were inability to read and understand spoken English (as consent documents and discussion were conducted in English), current pregnancy, or prisoner. Participants were paid a \$10 incentive for their time.

2.4. Procedures. Approval for the study was obtained from the University’s institutional review board. Healthy volunteer subjects were recruited from posted written advertisements placed in public areas on both campuses of the University. Following contact from a potential subject in response to the advertisement, an appointment was made for the individual to come to the laboratory for consent discussion, consent, enrollment, and data collection. Volunteer subjects were asked to avoid eating, drinking, or smoking for one hour prior to appointment time for saliva collection.

Following consent, subjects were asked to complete a short demographic form. Data were collected on additional factors (age, gender, race, ethnicity, and smoking status) in order to provide a comprehensive description of the study sample. Two saliva samples (one filter paper; one passive drool) and a blood sample were collected; collection order was the same for all subjects. For filter paper collection of saliva, Whatman grade 42 filter paper (2.4 cm × 9 cm size) was placed in the sublingual pocket of the participant’s mouth for one minute to permit saturation. After the filter paper was removed from the participant’s mouth, the furthest extent of the fluid migration on the paper was marked; measurements were used to determine the proportional volume of fluid used to elute salivary components from the filter. Papers were air-dried and then single-packaged in plastic bags to prevent cross-contamination of specimens. For passive drool saliva collection, we instructed the subject to briefly (30-second) refrain from swallowing. We then collected saliva accumulated in the mouth from a single expectoration into a sterile disposable test tube. One vacutainer tube of venous blood (approximately 3 mL of blood in a BD Vacutainer tube preserved with 5.4 mg K₂ EDTA) was drawn from the antecubital or other accessible arm vein. Processing of the samples was done following standard laboratory procedures. Blood was centrifuged to obtain plasma, and plasma samples were stored frozen at -70°C until batch assayed. Passive drool saliva samples were stored frozen at -70°C in the collection tube until batch assayed. Filter paper samples were stored at room temperature until assay, and analytes were eluted from the filter paper in preparation for assay, using the method described by Neu and colleagues [5]. When all subjects had been recruited and all samples collected, levels of cytokines in plasma and both saliva samples were determined using a Bio-Plex Suspension Array System (Bio-Rad) with a commercial 27-plex cytokine detection kit according to the manufacturer’s protocol.

The 27-plex assay includes human interleukin (IL)-1 β , IL-1ra (receptor agonist), IL-2, IL-4, IL-5, IL-6, IL-7, IL-8, IL-9, IL-10, IL-12, IL-13, IL-17, eotaxin, basic fibroblast growth hormone (FGF), growth-colony stimulating factor (G-CSF), granulocyte-macrophage colony-stimulating factor (GM-CSF), interferon (IFN)- γ , interferon-inducible protein (IP)-10, monocyte chemotactic protein (MCP)-1, macrophage inflammatory proteins (MIPs)-1 α , MIP-1 β , platelet-derived growth factors (PDGF)-BB, regulated on activation normal T cell expressed and secreted (RANTES), tumor necrosis factor (TNF)- α , and vascular endothelial growth factor (VEGF). These 27 cytokines are bundled together in the commercially available cytokine multiplex assay and are commonly used as a panel in assessment of immune function. The cytokines available in this commercially available bundle reflect both pro- and anti-inflammatory immune response. Assays were performed in a core laboratory, where there was extensive experience with measurement of biomarkers from human samples. The Bio-Plex multiplex suspension array assay combines fluorescent flow cytometry and ELISA technology, providing simultaneous quantitation of each of the 27 analytes being assayed in the sample. The manufacturer reports that the assay accurately measures cytokine values in the range of 1–2,500 pg/mL (well within the required limits of detection for this project), is precise (intra-assay CV < 10%, interassay CV < 15%), and shows less than 1% cross-reactivity among cytokines or with other molecules. Output (electronic file results) from the Bio-Plex assays was transferred to an excel Spreadsheet for data analysis.

2.5. Data Analysis. Data were analyzed using JMP statistical analysis software. Descriptive statistics were calculated, and scatterplots created for each biomarker. The levels of individual biomarkers were compared using a pairwise correlational analysis. Biomarker data were positively skewed as anticipated, and log transformation was performed to permit approximation of a normal distribution of the data required to calculate correlations.

3. Results

Subjects ranged in age from 18 to 63 years with a mean age of 27.1 years (sd = 9.7). The sample was 52% male. The majority of the subjects were white (72%) and non-Hispanic (90%), 6% were African American, 4% were Asian, 2% were Pacific Islander, and 16% identified themselves as more than one race.

Correlations for cytokines among the plasma, passive drool saliva, and filter paper saliva samples are presented in Table 1. Between passive drool and filter paper saliva samples, statistically significant correlations were found among 16 of the 27 tested cytokines, including IL-1 β , IL-1ra, IL-4, IL-7, IL-8, IL-9, IL-10, IL-12, IL-13, IL-15, G-CSF, IFN- γ , IP-10, MCP-1, MIP-1 β , and VEGF. Between plasma and passive drool saliva sample, only 3 cytokines were statistically significantly correlated (IL-6, IFN- γ , and MIP-1 β). No significant correlations were found between cytokine values in plasma samples and filter paper saliva samples.

TABLE 1: Correlations of biomarkers among passive drool saliva, filter paper saliva, and plasma samples.

Biomarker	Passive drool versus filter paper	Filter paper versus plasma	Passive drool versus plasma
IL-1 β	0.63**	0.01	0.12
IL-1RA	0.56**	0.05	0.18
IL-2	0.15	-0.08	0.04
IL-4	0.36*	0.08	-0.18
IL-5	0.17	-0.26	-0.07
IL-6	0.48	0.25	0.31*
IL-7	0.50**	-0.09	0.01
IL-8	0.56**	-0.04	0.17
IL-9	0.53**	0.01	0.23
IL-10	0.52**	0.21	0.28
IL-12	0.62**	0.03	0.26
IL-13	0.37*	0.12	0.12
IL-15	0.43**	-0.03	0.12
IL-17	-0.04	0.05	-0.06
Eotaxin	0.27	0.00	-0.07
Basic FGF	0.01	-0.13	-0.26
G-CSF	0.41**	0.07	0.00
GM-CSF	-0.10	0.13	-0.14
IFN- γ	0.33*	0.13	0.34*
IP-10	0.34*	0.25	-0.01
MCP-1	0.44**	0.12	-0.01
MIP-1 α	0.03	-0.09	-0.10
MIP-1 β	0.53**	0.29	0.34*
PDGF-BB	0.23	-0.17	-0.22
RANTES	0.24	0.32	0.22
VEGF	0.58**	0.01	0.19
TNF- α	0.08	0.19	0.17

* $P < 0.05$; ** $P < 0.01$.

4. Discussion

We undertook this comparison of levels of biomarkers (27 specific cytokines) in 3 sample types (plasma, passive drool saliva, and saliva collected on filter paper) to evaluate which biomarkers in a commercial multiplex panel could be reliably determined in less invasive salivary samples and whether filter paper sampling of saliva could be substituted for passive drool collection. Our data indicate that both the biological fluid and the manner of collection affect measurement of biomarkers. While the greatest associations were between the salivary samples (passive drool and filter paper samples of each biomarker), the relationships varied by biomarker from good correlations to poor correlations. Additionally, although the correlations were statistically significant, no correlation was greater than 0.63, indicating that values obtained from the filter paper were not substitutable for those obtained by passive drool. Passive drool saliva samples were significantly associated with plasma samples for only 3 biomarkers. No significant associations between filter paper saliva and plasma samples were found.

Saliva has been widely analyzed as an indicator of oral health [6–8], and there has been recent interest in use of salivary components as surrogates for systemic biomarkers in blood [9]. This approach has been employed successfully in the case of cortisol [10, 11]. Our data indicate that for some biomarkers, samples collected on filter paper yield different results than passive drool samples. It is likely that some substances bind more tightly to the filter paper and are eluted less efficiently from filter paper; reduced recovery of specific biomarkers from filter paper may account for lack of correlation between passive drool and filter paper samples for several specific biomarkers. The issue of incomplete recovery of selected molecules from matrices used for collection of stimulated saliva (such as cotton wads or cellulose plugs) has been noted in the literature [10, 12, 13].

Blood still remains the best body fluid for evaluation of many biomarkers reflecting systemic processes and substitution should be used with caution.

Moreover, although salivary levels of cortisol may be reflective of systemic levels, other immune biomarkers in saliva, including IL-6, IL-6sr, and C-reactive protein cytokines, have failed to demonstrate significant correlations to paired samples of plasma [14–16].

The oral cavity represents a distinct environmental niche, and immune biomarkers are influenced by processes of local immunity. Recently, investigators have identified cytokine levels in saliva associated with gingivitis [6] and periodontitis [7] which reflect local, rather than systemic, immune responses. Therefore, cytokine levels in saliva cannot be generally employed as surrogate markers for systemic immune response.

It may be possible for future studies to use saliva collection as an alternative to blood when measuring specific biomarkers other than cytokines. However, the appropriateness of substitution varies by analyte, and plasma levels of cytokines tested in our panel were generally not well reflected in either type of salivary sample. Further, feasibility of recovery of saliva using the filter paper method and correlation to passive drool salivary values cannot be assumed and should be verified for every biomarker unless published evidence of substitutability is available.

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References

- [1] J. K. M. Aps and L. C. Martens, "Review: the physiology of saliva and transfer of drugs into saliva," *Forensic Science International*, vol. 150, no. 2-3, pp. 119–131, 2005.
- [2] S. Chiappin, G. Antonelli, R. Gatti, and E. F. De Palo, "Saliva specimen: a new laboratory tool for diagnostic and basic investigation," *Clinica Chimica Acta*, vol. 383, no. 1-2, pp. 30–40, 2007.

- [3] C. L. Munro, M. J. Grap, R. Jablonski, and A. Boyle, "Oral health measurement in nursing research: state of the science," *Biological Research for Nursing*, vol. 8, no. 1, pp. 35–42, 2006.
- [4] S. A. Ameringer, C. L. Munro, and R. K. Elswick, "Assessing agreement between salivary alpha amylase levels collected by passive drool and eluted filter paper in adolescents with cancer," *Oncology Nursing Forum*. In press.
- [5] M. Neu, M. Goldstein, D. Gao, and M. L. Laudenslager, "Salivary cortisol in preterm infants: validation of a simple method for collecting saliva for cortisol determination," *Early Human Development*, vol. 83, no. 1, pp. 47–54, 2007.
- [6] A. Lee, C. B. Ghaname, T. M. Braun et al., "Bacterial and salivary biomarkers predict the gingival inflammatory profile," *Journal of Periodontology*, vol. 83, no. 1, pp. 79–89, 2012.
- [7] W. M. Sexton, Y. Lin, R. J. Kryscio, D. R. Dawson, J. L. Ebersole, and C. S. Miller, "Salivary biomarkers of periodontal disease in response to treatment," *Journal of Clinical Periodontology*, vol. 38, no. 5, pp. 434–441, 2011.
- [8] E. H. Kang, Y. J. Lee, J. Y. Hyon, P. Y. Yun, and Y. W. Song, "Salivary cytokine profiles in primary Sjögren's syndrome differ from those in non-Sjögren's sicca in terms of TNF- α levels and Th-1/Th-2 ratios," *Clinical and Experimental Rheumatology*, vol. 29, no. 6, pp. 970–976, 2011.
- [9] C. S. Miller, J. D. Foley, A. L. Bailey et al., "Current developments in salivary diagnostics," *Biomarkers in Medicine*, vol. 4, no. 1, pp. 171–189, 2010.
- [10] P. Gallagher, M. M. Leitch, A. E. Massey, R. H. McAllister-Williams, and A. H. Young, "Assessing cortisol and dehydroepiandrosterone (DHEA) in saliva: effects of collection method," *Journal of Psychopharmacology*, vol. 20, no. 5, pp. 643–649, 2006.
- [11] E. M. Poll, I. Kreitschmann-Andermahr, Y. Langejuergen et al., "Saliva collection method affects predictability of serum cortisol," *Clinica Chimica Acta*, vol. 382, no. 1-2, pp. 15–19, 2007.
- [12] N. Kamodyová and P. Celec, "Salivary markers of oxidative stress and Salivette collection systems," *Clinical Chemistry and Laboratory Medicine*, vol. 49, no. 11, pp. 1887–1890, 2011.
- [13] L. Strazdins, S. Meyerkort, V. Brent, R. M. D'Souza, D. H. Broom, and J. M. Kyd, "Impact of saliva collection methods on sIgA and cortisol assays and acceptability to participants," *Journal of Immunological Methods*, vol. 307, no. 1-2, pp. 167–171, 2005.
- [14] R. Fernandez-Botran, J. J. Miller, V. E. Burns, and T. L. Newton, "Correlations among inflammatory markers in plasma, saliva and oral mucosal transudate in post-menopausal women with past intimate partner violence," *Brain Behavior and Immunity*, vol. 25, no. 2, pp. 314–321, 2011.
- [15] M. Minetto, A. Rainoldi, M. Gazzoni et al., "Differential responses of serum and salivary interleukin-6 to acute strenuous exercise," *European Journal of Applied Physiology*, vol. 93, no. 5-6, pp. 679–686, 2005.
- [16] E. Sjögren, P. Leanderson, M. Kristenson, and J. Ernerudh, "Interleukin-6 levels in relation to psychosocial factors: studies on serum, saliva, and in vitro production by blood mononuclear cells," *Brain, Behavior, and Immunity*, vol. 20, no. 3, pp. 270–278, 2006.

Research Article

Infusing Oral Health Care into Nursing Curriculum: Addressing Preventive Health in Aging and Disability

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Access to oral health care is essential for promoting and maintaining overall health and well-being, yet oral health disparities exist among vulnerable and underserved populations. While nurses make up the largest portion of the health care work force, educational preparation to address oral health needs of elders and persons with disabilities is limited across nursing curricula. This descriptive study reports on the interdisciplinary development, implementation, and testing of an oral health module that was included and infused into a graduate nursing curriculum in a three-phase plan. Phase 1 includes evaluation of a lecture presented to eight gerontological nurse practitioner (GNP) students. Phase 2 includes evaluation of GNP students' perceptions of learning, skills, and confidence following a one-time 8-hour practicum infused into 80 required practicum hours. The evaluation data show promise in preparing nurse practitioner students to assess and address preventive oral health needs of persons aging with disabilities such that further infusion and inclusion in a course for nurse practitioners across five specialties will be implemented and tested in Phase 3.

1. Introduction/Background

Health disparities for intellectual and developmental disabilities (I/DD) often exist, including poorer health, unmet health needs, and problematic access to primary and preventive health services [1–6] including preventive oral health services and severe oral health disparities. The safety net to offset these disparities in oral health is lacking in a comprehensive system of care [7].

Access to oral health care is essential to promoting and maintaining overall health and well-being, yet only half of the United States population visits a dentist each year. Older adults and disabled individuals uniformly confront access barriers, regardless of their financial resources. The consequences of these disparities in access to oral health care

can be associated with a number of conditions, including malnutrition, infections, diabetes, heart disease, and premature births. For example, periodontal disease is associated with diabetes and its sequelae, including stroke, transient ischemic attack, myocardial infarction, and intermittent claudication [8, 9]. In addition, various side effects of medications increase the risk of oral health disease (e.g., drug-induced xerostomia and gingival hyperplasia).

The surgeon general reports that persons with disabilities (PWDs) have more dental disease, more missing teeth, and more difficulty obtaining dental care than other members of the general population [10]. Annually, 36.5 percent of severely disabled persons 15 years and older report a dental visit, compared with 53.4 percent of those with no disability [11]. Few states cover dental services for adults

under Medicaid, and clinical preventive services are generally lacking for PWD [12]. Even in states with Medicaid coverage, low reimbursement rates and the reluctance of practitioners to accept those rates reduce the availability of care required for treating patients with disabilities [13]. Seniors face similar oral health disparities [14]. Of particular concern for nursing and oral health professionals is the fact that there is increasing evidence of the association of dental disease with general health conditions.

In July 2011, the Institute of Medicine (IOM) released a report, “*Improving access to oral health care for vulnerable and underserved populations*” [14], which examines the scope and consequences of inadequate access to oral health services in the USA. The IOM report supports the creation of a diverse workforce that is competent, compensated, and authorized to serve vulnerable and underserved populations across the life cycle. The report recommends ways to combat the economic, structural, geographic, and cultural factors that prevent access to regular quality care and recommends changes to incorporate oral health care into overall health care. One recommendation includes expanding the oral health work force by training physicians, nurses, and other nondental professionals to recognize risk for oral diseases. The report also suggests changing funding and reimbursement for dental care and adding or changing recommendations to revamp regulatory, educational, and administrative practices [14].

Nurses make up the largest portion of health care persons in the work force today [15]. Nurses, nurse practitioners (NPs), and health educators are far more likely to encounter underserved and vulnerable populations than dental professionals, particularly family health and community nurses [16, 17]. Increasing nurses’ awareness and knowledge about oral health in general can increase nurses’ knowledge and skills in oral health care.

Proper education and tools to assess oral health risk can be used in conjunction with other risk assessments to help guide early detection and prevention of oral disease [18]. Through individual and population-based screenings, nurses and NPs can identify at-risk individuals and assess and manage their oral health needs as well as make referrals to dental professionals when necessary. For example, NP comprehensive assessment led to the referral of 38.6% ($n = 27$) of 70 adults with intellectual and developmental disabilities for oral health counseling, based on identified unmet oral health needs [19]. Having the ability to identify potential health risk factors such as lifestyle, ethnicity, health status, and social determinants associated with oral health status risk, nurses can take an active role in health screening to discover any need for clinical preventive services, including dental preventive services, and can detect health problems for PWD [20]. Therefore, it is essential that these health care providers are familiar with the various risk factors to manage oral care and make appropriate referrals and intervention decisions as recommended by the IOM report.

Attention to oral health, including oral assessment and awareness of the negative consequences due to poor oral care, has been found lacking in nursing curricula [21], especially concerning oral health and elders [22]. In addition, a void

exists in the literature on NP education about oral health and PWD [23], and general education of nurses about health promotion for PWD is deficient. In a national survey of 1,000 basic nursing education programs, over half of the schools reported little curriculum content regarding health promotion for PWD; this was attributed to lack of faculty time, interest, and expertise [24]. Innovative projects led by faculty and others can enhance the integration of new curriculum in nursing programs, including discipline-specific and interdisciplinary training. A small number of programs demonstrate collaboration between nurses and oral health professionals [25, 26] with overlapping competencies related to oral health [18].

Nursing education that combines course work with “hands-on” experience has positively affected the attitudes of nursing students toward PWD [27]. High satisfaction with an educational opportunity that paired dental hygiene students with student nurses was reported by nursing students who completed training and clinical practicum performing oral assessments of school children [28]. An “infusion” or integration approach to curricular change that embeds new content about disabilities into existing health professional education is gaining attention and can address identified curricula needs.

The specific aim of this project was to develop, test, and integrate an oral health module targeted toward oral health of elders and persons with disabilities into graduate nursing curriculum as a sustained learning activity for NP students. The long-term aim, by increasing NP’s awareness and skills, is to promote health and prevent comorbid conditions among persons with disabilities. We will describe the development, implementation, and evaluation of the oral health module as well as how these activities, in a three-phase process, led to *inclusion and infusion* into existing nursing curriculum for graduate NP students (see Table 1 for activities according to phases).

2. Methods and Materials

2.1. Phase 1: Module Development. An initiative within a Cooperative Agreement with the Centers for Disease Control and the California Department of Public Health provided funds to develop curriculum and training materials for nursing students and other health care professionals. The California Department of Public Health, Safe and Active Communities Branch (SACB), Living Healthy with a Disability Program was awarded funding for “*Module E: Training of Professionals and Paraprofessionals*,” and UCLA was funded for a curricular project, entitled “*Disability Inclusion and Infusion in Nursing Education*.” The overall aim was to increase knowledge, skill, and confidence of nursing faculty, nursing students, oral health professionals, and other allied health care professionals in implementing effective health promotion and wellness strategies and interventions to promote health and prevent development of secondary conditions experienced by PWD. The University of California Los Angeles (UCLA) subcontracted with the Pacific Center for Special Care at the University of the Pacific School of

TABLE 1: Overview of phases of development, testing and integration of an oral health module for nurse practitioner students serving persons aging with disabilities.

(a) Phase 1: curriculum development and testing

Project phase Activities		Methods	Participants	Data and response rate	Outcomes of activities
Module development and testing	Development of oral health forms and evaluation methods Identification of resources (for elders and PWDs)	Curriculum development with collaboration of dental and nursing faculty/staff and project director	Dental faculty/staff (2) Nursing faculty (1) Project Director (1)		Resource list Lecture evaluation tool Oral health forms (3) Practicum evaluation tool
	2-hour didactic lecture with oral health screening demonstration and GNP student return demonstration and post intervention evaluation	Educational intervention with postlecture evaluation	Nurse faculty member (1) Dental faculty member (1) GNP students (8)	Lecture Evaluation Tool GNP students <i>N</i> = 8 62.5%	High level of reported student satisfaction with module and learning of content
	Practicum site coordination Collation of educational and screening packets Recruitment of faculty and students		Nursing faculty member (1) Clinical nursing faculty (1)		Agency established as clinical practicum site Established an annual health fair conducted by NP students

PWDs: persons with disabilities; GNP: gerontological nurse practitioner.

(b) Phase 2: module integration (clinical section)

Project phase Activities		Methods	Participants	Data and response rate	Outcomes of activities
Infusion and inclusion into one clinical section	Integration of oral health content and resources in GNP clinical practicum section Practicum held at Geriatric Health Fair with oral and multidimensional health screenings for elders with I/DD	Practicum educational intervention with postlecture evaluation for GNP students and for elders with I/DD who attended the health fair	Clinical nursing faculty (1) Agency staff liaison (1) GNP students (23) PWDs (45)	Practicum evaluation by GNP students <i>N</i> = 23 79.3% <i>Elders with I/DD</i> <i>N</i> = 45 49.1%	Favorable ratings by GNP students on learning, improvement in confidence and skills and satisfaction with materials, tools, and practicum Favorable satisfaction ratings by elders with disabilities on help and visit by nurse, materials and learning about health

GNP: gerontological nurse practitioner; I/DD: intellectual and/or developmental disabilities.

(c) Phase 3: module integration (nursing program)

Project phase Activities		Methods	Participants	Data and response rate	Outcomes of activities
Integration into one NP course in graduate nursing program ^a	Integration of oral health module (lecture, practicum, and evaluation tools) into one course for all NP students in graduate nursing program activities	Educational intervention: 2-hour lecture by dental faculty, 12 required oral health screenings and preventive oral health plans per each NP student in practicum, and pre/postevaluation	Dental faculty member (1) Nursing faculty/Course coordinator (1) Nursing clinical faculty (7) ^c NP students (90) Clients (practicum) = ~1080	Forthcoming in next academic quarter	Learner gain based on pre/posttest Learner satisfaction, confidence and skill development

NP: nurse practitioner.

^aCourse is inclusive of NP students in acute care, adult/gerontology, family, adult/occupational health, and oncology graduate master's NP program. ^bAll NP students in program except for pediatric NP students. ^cOne clinical faculty member per section of twelve students.

Dentistry to develop oral health components. The curricular project was approved by the UCLA School of Nursing's faculty curriculum committee, the UCLA Institutional Review Board (IRB), and the Committee for the Protection of Human Subjects (CPHS), which is the IRB for the California Health and Human Services Agency.

One nursing faculty member from UCLA School of Nursing, two dental faculty and dental staff from the University of the Pacific School of Dentistry, and the project manager from the California funding agency developed the oral health module via monthly teleconferences. The module has three main components, a didactic lecture, a clinical practicum, and an evaluation component. The components are outlined in Table 2.

2.2. Phase 1: Oral Health Lecture. A dental faculty from UCLA School of Dentistry and a UCLA School of Nursing (SON) faculty worked in collaboration. The dental faculty member conducted a 120-minute lecture on oral health and elders that included a demonstration on how to conduct an oral health screening; students performed a return-demonstration using other students as patients. Students received written materials on oral health care for elders and oral health for PWD, and dental and SON faculty reviewed content, respectively. For a list of content covered in the lecture, see Table 3. The lecture was provided to eight gerontology nurse practitioner (GNP) students during their first year master's level gerontological nursing theory course. The SON faculty member coordinated a satisfaction evaluation questionnaire at the end of the lecture.

2.3. Phase 1: Module Practicum Forms. The practicum consisted of three forms for GNP students to use during the practicum. A description of the three forms follows.

The Dental Assessment for the Nondentist was developed originally for case managers and nondental laypeople. Essentially, this form provides an instruction sheet to guide assessment using a series of questions and decision-making based on two protocols. The first protocol guides the decision for dental follow-up as routine, emergent, or urgent. The second protocol guides the decision about recommendations for help or accommodations for the PWD on oral preventive education and if oral health training is indicated for a caregiver. The second form, the *Oral Health-Screening Exam Results*, provides a document to record oral health assessment results and possible treatment needs. This includes a checklist to note recommendations for oral health providers based on the client's abilities to engage in the oral health assessment. The third form was the *Oral Health Prevention Plan*, which is used to record a preventive oral health plan encompassing, as needed, documentation of physical skills, a behavioral plan, special aids, denture care, other preventive actions (e.g., fluoride rinse, and record of dental visits, location), and special considerations for follow-up. A copy of these forms can be found in Supplementary Material available online at doi:10.1155/2012/157874.

2.4. Phase 1: Identification of Clinical Practicum Site. In Phase 1, we collaborated with a local case management/service coordination agency for persons with intellectual and developmental disabilities to arrange the contractual paperwork to establish this agency as a nursing clinical practicum site. The nursing faculty member had pilot tested a multidimensional health screening using screening tools commonly administered in a comprehensive geriatric assessment that have been pilot tested with adults with I/DD [19]. A social worker or service coordinator recruited persons aging with lifelong developmental disabilities to attend the health fair.

2.5. Phase 2: Module Integration. In Phase 2, we began the first infusion of the oral health module into nursing curricula. We infused the oral health practicum into the existing multidimensional health screening held for persons aging with I/DD at the local case management agency located within five miles of the school. The first practicum occurred with a cohort of first-year GNP students who had attended the lecture. The oral health module was included in the clinical practicum activities of this GNP clinical group during a clinical theory/practicum course offered during their second year.

A SON GNP clinical faculty member at the health fair supervised the cohorts of GNP students. At each fair, two students formed a team to interview and assess one client. Following the screening, each client and/or caregiver received education on pertinent health issues. Arrangements were facilitated for clients with immediate health concerns, with either a health care provider or, if needed, at the local hospital emergency department. The enthusiasm of the agency about this combined oral health and multidimensional health-screening fair led to a yearly event called a Geriatric Health Screening Fair. Thus, this full-day (8-hour) practicum for GNP students was held as a part of a health fair for the geriatric client with developmental disabilities. GNP students received 8 hours of credit toward the 80 clinical hours required in this second year course.

Over the course of Phase 2, 29 GNP students and 53 clients took part in four Geriatric Health Fairs (practica) from 2008 to 2011. Each GNP student received the resource information packets on oral health care and geriatric screening for elders and PWDs prior to the practicum. Each year, prior to the practicum, the SON GNP faculty member provided and reviewed guidelines for conducting an oral health assessment and using the three forms. At this point in the program, GNP students had been taught and had practiced basic oral health assessment. The comprehensive health-screening packet included geriatric screening tools as well as forms for the oral health screening practicum to allow for an experience with a comprehensive multidimensional screening.

2.6. Phase 2: Module Practicum Evaluation. We developed two practicum evaluation tools. The practicum included an evaluation questionnaire for the GNP students and a tool tailored for persons with intellectual and developmental disabilities. The evaluation tool for GNP students includes

TABLE 2: Components of oral health module.

(i) Classroom lecture
(a) Taught with collaboration of nursing and dental faculty
(b) Didactic lecture with photos
(c) Demonstration of oral screening by dental faculty member
(d) Return demonstration by students
(e) Packet of resource materials on oral health for elders and PWDs
(ii) Practicum with persons aging with disabilities
(a) Packet of resource and teaching materials shared with students
(b) Forms for use in practicum
(1) Dental assessment for the nondentist
(1a) Assessment instruction sheet and protocols to guide recommendations
(2) Oral health-screening exam results
(2a) An oral health assessment form to record findings, treatment needs, and recommendations for oral health
(3) Oral health prevention plan
(3a) Identifies plan for overcoming obstacles to dental health
(iii) Module evaluation
(a) Lecture evaluation
(1) Likert-type scale survey with open-ended questions
(2) Rating of learning and improved confidence and skills
(b) Practicum evaluation
(1) For nursing students
(2) For persons with disabilities

Likert-type scale questions using a 5-item scale as well as some open-ended questions. The tool for persons with I/DD uses a 4-item Likert Scale with smiley faces to assess their level of satisfaction from “highly satisfied (pleased)” to “not at all satisfied” in four areas: materials received, accommodations, health education, and visit with the nurse.

3. Results

Data were collected between 2008 and 2011. The lecture was given to eight first-year master’s level gerontological NP students in 2008. Only one set of lecture evaluation data is available as, subsequently, the stand-alone lecture was replaced with integrated content within the SON clinical faculty member’s clinical conferences with the students as the practicum was infused into this clinical section’s activities.

3.1. Participants. The GNP students who attended the lecture were first-year graduate nursing students specializing in adult/gerontological nursing. The GNP students, who attended the practicum, were in their second year. The 53 persons with I/DD who volunteered to attend the health fair were adult clients of a local service coordination agency. Most of the clients were aged 55 and older. Each client met the criteria as having a “developmental disability” according to the state of California’s definition. The majority had some level of intellectual disability in the moderate or mild range and were ambulatory and able to communicate in words. However, etiologies and diagnoses associated with having a developmental disability were unknown and not collected as data.

3.2. Lecture Evaluation. The oral health module lecture evaluation had a 62.5% response rate from the eight GNP students who attended the lecture. The lecture was well received with 100% agreement on a rating of “5” or “liked a lot” on all of the items. There was 100% student agreement on learner gain at the highest rating (5: an abundance of information) for topics: preventive oral health care and the role of the advanced practice nurse (APN) in providing preventive oral health care for elders and for persons with disabilities. See Table 4 for mean levels of reported GNP student satisfaction and their estimates of learner gain.

3.3. Practicum Evaluation: GNP Students. A total of 23 GNP students filled out an evaluation at the completion of the oral health practicum (held between 2008 and 2011). The survey response rate is 79.3%. In terms of overall satisfaction with the practicum, 100% expressed “good” to “excellent” satisfaction. Over 70% rated “good” to “excellent” having improved confidence (72.8%) and skills (77.3%) in working with PWD. Additionally, overall satisfaction with the oral health component of the practicum was 72.9% (see Table 5 for mean ratings).

Anecdotal comments by GNP students showed the value of the experience and the desire of NP students to have this content in their coursework (see Table 6 for anecdotal NP student comments arranged by theme). Comments from GNP students suggesting improvements were related to wanting to have more time for the practicum or having more educational lecture materials about PWD prior to the practicum.

TABLE 3: Curricular outline of lecture content on oral health of elders and persons with intellectual and developmental disabilities.

(a)

Elders^a

- Oral health screening
- Oral health screening procedures
- Age-associated changes
- Non-age related conditions
 - Oral cancer
 - Xerostomia
 - Tooth decay/loss
 - Periodontal disease
 - Immune-related disease
- Recognizing common oral health conditions for elders
(with photos and descriptions)
(e.g., candida, keratosis, “hairy leukoplasia” squamous cell carcinoma, ulcers, nicotine stomatitis)
- Oral health prevention
 - Need for immediate dental treatment
- Oral hygiene
- Denture fit and denture care

^aThe lecture content outline on elders is from the lecture presented by S. Spackman to gerontological nurse practitioner students. The lecture has elements from curricular content developed by J. Bauer and S. Spackman for the program in Geriatric Dentistry at UCLA School of Dentistry, Los Angeles, USA.

(b)

Persons with intellectual and developmental disabilities^b

- Definitions of disability
- Demographics and oral health disparities among persons with I/DD
- Conditions associated with developmental disabilities
(e.g., intellectual disability, Down syndrome, cerebral palsy, Fragile X syndrome)
- Common oral health conditions
(e.g., cheilitis, xerostomia, malocclusion)
- Other oral health concerns
(e.g., bruxism, pica, GERD, pocketing food)
- Review of oral health assessment and preventive oral health education and practice
- Urgent, emergent, routine follow-up
- Positioning, accommodations, and adaptive equipment
- Consideration of fears or anxiety related to oral care
- Roles and teaching of caregivers

^bThe lecture content outline about oral health and persons with intellectual and developmental disabilities was developed from a number of resources including *Developmental Disabilities and Oral Health: Strategies for Providing Oral Care to People With Developmental Disabilities—Practical Oral Care for People with Developmental Disabilities Series For Health Professionals*—available at <http://www.nidcr.nih.gov/OralHealth/Topics/DevelopmentalDisabilities/>.

A comment from the SON clinical instructor who supervised the GNP students indicated the ability of students to gain skills in working with elders with disabilities. The clinical experience gave them (*the GNP students*) an eye opening experience and motivation to become an effective negotiator to enhance cooperation with oral exam and oral care, especially with those who would display anxiety leading to minimal cooperation with the oral examination.

3.4. *Practicum Evaluation: Elders with Disabilities.* Evaluation data were collected from 26 older adults seen by

GNP students (49.1% response rate). Seventy-five percent or more reported being satisfied or highly satisfied on four items with the highest ratings for visit with the nurse and the accommodations that were made during the exam (see Figure 1 for rating of satisfaction by persons with I/DD).

Another finding that shows the value of NP students doing the evaluation is that the majority of the individuals with I/DD who were seen by the GNP students during practice were referred for follow-up support for an identified health problem. To give an indication of the ability of nurses to recognize issues and the complexity of health issues of

TABLE 4: Gerontological nurse practitioner evaluation of oral health module lecture ($n = 5$).

Category item	<i>M</i>
<i>Learning content^a</i>	
Preventive oral health care	5
Role of APN in preventive oral health care for elders	5
Role of preventive oral health care for PWDs	5
<i>Satisfaction^b</i>	
Materials on preventive oral health care	5
Overall rating of didactic	5
Overall rating of demonstration	5
Overall rating of return demonstration portion	5

^aBased on Likert scale (1: none to 5: learned an abundance of information).

^bBased on Likert scale (1: not satisfied at all to 5: highly satisfied).

APN: Advanced Practice Nurse; PWDs: persons with disabilities.

TABLE 5: Gerontological nurse practitioner evaluation of practicum using evaluation tool.

Category item	<i>M (SD)</i>
<i>Learning^a</i>	
Conducting a geriatric health screening with PWDs	3.65 (0.94)
Identifying need for preventive education or support	3.48 (0.90)
Identifying need for routine or emergent/urgent follow-up	2.91 (1.16)
<i>Confidence and Skills^b</i>	
Rating of improved confidence	3.18 (0.85)
Rating of improved skills	3.23 (0.81)
<i>Satisfaction^b</i>	
Overall rating of oral health components	3.27 (1.08)
Rating of Dental Assessment for the Nondentist form	3.32 (1.09)
Overall rating of practicum	3.86 (0.77)

^aBased on Likert scale (1: not much to 5: an abundance of information).

^bBased on Likert scale (1: poor to 5: excellent);

PWDs: persons with disabilities.

adults with I/DD, we present the specific findings from one of the health screenings (see Table 7 for the types of referrals made for the 16 individuals who were seen by the GNP students). There were only three clients who had no need for a referral. The referral to a dental provider was the second most frequent type of referral.

4. Discussion

This appears to be the first reported educational intervention study that included infused, integrated, and reinforced oral health content and skills within gerontological curriculum and courses for GNP students. The project that led to the development and testing of an oral health module with didactic and practicum experiences for advanced practice nursing students was integrated into a theory-based gerontology course and a practicum for GNP students.

TABLE 6: Gerontological nurse practitioner anecdotal comments about practicum.

Theme/category	Comments
Oral health	Oral health component was great! (liked) guided assessment
Materials and Setting	(liked) the screening tools, availability of space and instruments
Need for Training	Is often overlooked area in this patient population I enjoyed learning how we can be an advocate for clients, families, and caregivers This was an enlightening experience. Great experience! Wish we had more time here.
Attitude	Excellent clinical rotation and experience. I feel more at ease/comfortable with assessing this population.

TABLE 7: Types of referrals made by gerontological nurse practitioner students following a geriatric and oral health screening in 2008 ($N = 16$).

Referral type	<i>n</i>	%
Primary care provider	6	37.5
Dentist	3	18.8
Physical therapist	3	18.8
Nurse ^a	2	12.5
Ophthalmologist	1	6.3
Psychiatrist	1	6.3
Service coordinator ^a	1	6.3

^aThese personnel were from the service coordination agency.

This allowed for a clinical experience in conducting an overall comprehensive health screening with older adults with disabilities inclusive of oral health. For this eight-hour practicum, the students received credit toward their overall credit hours of clinical time. The majority of GNP students and the majority of PWD perceived the practicum experience as a whole, and specifically on oral health care, very favorably. Educated to provide safe, efficient, patient-centered quality, and equitable care, nurses can promote a comprehensive approach to health care, emphasizing the overall health and wellness of the patient, including oral health. Students were able to identify the need of PWD to get follow-up dental care as well as other health professional follow-up including follow-up nursing services from the case management agency. This opportunity not only provided the opportunity to gain a mastery of NP skills in assessment, communication, planning, and health promotion, but also it gave the nurses experience with both the older adult and the adult with disabilities. This was a logical infusion into content on conducting comprehensive

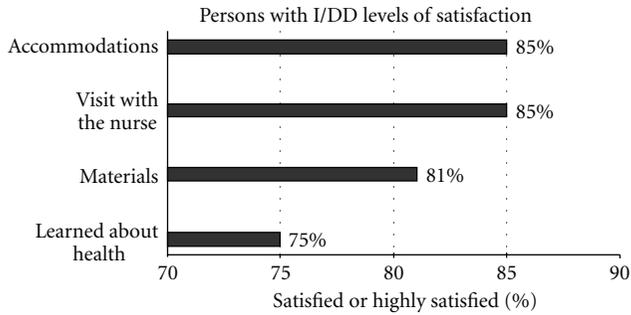


FIGURE 1: Rating of satisfaction by persons with I/DD with geriatric and oral health screening.

geriatric screening to promote health and well-being among elders, in this instance, adults aging with disabilities, who are often underserved.

The literature cites the challenges of integrating new curriculum into existing nursing curricula. Our project mirrors the finding that infusion and inclusion or integration of new content into nursing curricula takes time with a need for ongoing nurturing and support during the integration phase [29], which in this case was over four to five years. In addition, it takes champions. At each of the three phases, one nursing faculty member played a key role in the process. What facilitated this experience was the principle investigator's extensive experience with PWD, the interest of two other nursing faculty members who valued the importance and had willingness to take leadership to infuse and include the module into their courses.

Other positive influences were the funding that gave credibility to the initiative and provided the opportunity for multidisciplinary collaboration among faculty, the endorsement of the curricular project by School nursing faculty, and the willingness of a clinical faculty member to participate and to add and sustain this clinical experience as part of clinical hours for students. Establishing a clinical contract for the agency as a new clinical site facilitated continued student opportunities at this site. We found that the practicum portion of the module has continued annually, in part due to two champions: the first, a faculty member who has taken a group of students each year to a regional center site, and the second, a clinical regional center staff liaison who assures that the event continues through recruitment of interested PWD. These partners are vital in coordinating and continuing this practicum for students.

4.1. Limitations. Limitations of this study are the small numbers of students and the lack of a control group. The student group was targeted to GNP students who were part of only one clinical group of NPs across the nursing program. These limit the generalizability of the findings. We lacked a rigorous assessment of learner gain. A pre/posttest of knowledge, skills, and attitudes would add credibility that the intervention was associated with these gains and will be implemented in the next phase of this project.

Further dissemination and testing are warranted in both undergraduate and graduate nursing programs.

4.2. Future Direction. The next phase of the infusion and inclusion of the oral health module for elders and persons with disabilities will be for a cohort of 90 NP students who will enroll next quarter in a second year NP course that combines classes for theory content and clinical hours. Students will receive all components of the oral health module: 2-hour lecture, practicum with the three oral health forms, and student evaluation tools for lecture and practicum. This phase will add a pre/posttest for evaluation of learner gain. In addition, we will infuse the oral health practicum activities into the ongoing clinical practicum activities at the assigned clinical sites for each student. Each NP student will be required to conduct a minimum of 12 oral health screening assessments as part of their clinical NP practicum at sites where they are assigned (approximately one per week). Students will upload each oral health assessment into an internet-based course management system titled Modular-Object-Oriented Dynamic Learning Environment (Moodle). Oral health assessments and preventive oral health plans for clients seen will be discussed with clinical faculty at each postclinical conference session. Seven clinical faculty members will be involved. This cohort of NP students will include the NP specialty areas of acute care, adult/gerontological, adult/occupational health, family, and oncology nursing. Future research includes long-term follow-up evaluation to evaluate the sustained impact of this educational intervention on the NP's routine use of oral health screening and preventive education in postgraduation practice.

5. Conclusion

This innovative educational intervention study met with success and showed the receptiveness of the students to receiving knowledge and practicing skills in an area of nursing that may get overlooked or not emphasized enough, given its critical nature to health, and the lack of experience, especially to work with clients with disabilities. PWD and elders face oral health disparities. In accordance with the 2010 IOM Future of Nursing report, nurses are poised to help bridge the gap between coverage and access, to coordinate increasingly complex care for a wide range of patients and to fulfill their potential as primary care providers to the full extent of their education and training [30].

Evidence supports that nurses, once better educated and engaged, can provide safe, effective primary care services leading to improved health of the nation in a variety of settings. Utilizing nurses and NPs to their full potential, expanding their knowledge of oral health, we can meet the diverse needs of the public, including the oral health needs of this underserved and vulnerable population. The next steps of this project are to disseminate the Oral Health Module more widely and to evaluate the outcomes of nurses in promoting good oral health among not only PWD, but for all Americans.

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References

- [1] H. Evenhuis, C. M. Henderson, H. Beange, N. Lennox, B. Chicoine, and S. Saxena, "Healthy ageing—adults with intellectual disabilities: physical health issues," *Journal of Applied Research in Intellectual Disabilities*, vol. 14, no. 3, pp. 175–194, 2001.
- [2] M. F. Hayden and S. H. Kim, "Health status, health care utilization patterns, and health care outcomes of persons with intellectual disabilities: a review of the literature," *Policy Research Brief*, vol. 13, no. 1, pp. 1–17, 2002.
- [3] U.S. Public Health Service, "Closing the gap: a national blueprint for improving the health of persons with mental retardation," Report of the Surgeon General's Conference on Health Disparities and Mental Retardation, 2002, <http://www.ncbi.nlm.nih.gov/books/NBK44346/>.
- [4] U.S. Department of Health and Human Services, *Healthy People 2010: Understanding and Improving Health*, U.S. Government Printing Office, Washington, DC, USA, 2nd edition, 2000.
- [5] W. Wei, P. A. Findley, and U. Sambamoorthi, "Disability and receipt of clinical preventive services among women," *Women's Health Issues*, vol. 16, no. 6, pp. 286–296, 2006.
- [6] G. L. Krahn, L. Hammond, and A. Turner, "A cascade of disparities: health and health care access for people with intellectual disabilities," *Mental Retardation and Developmental Disabilities Research Reviews*, vol. 12, no. 1, pp. 70–82, 2006.
- [7] E. Mertz and E. O'Neil, "The growing challenge of providing oral health care services to all Americans," *Health Affairs*, vol. 21, no. 5, pp. 65–77, 2002.
- [8] B. Mealey, "American academy of periodontology position paper on diabetes and periodontal diseases," *Journal of Periodontology*, vol. 71, pp. 664–678, 2000.
- [9] R. Genco, "Diabetes and periodontal disease: current concepts," in *Proceedings of the CDC Conference on Public Health Implications of Chronic Periodontal Infections in Adults*, April 2003.
- [10] U.S. Department of Health and Human Services, *Oral Health in America: A Report of the Surgeon General*, U.S. Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health, Rockville, Md, USA, 2000.
- [11] D. J. Stiefel, *Adults with Disabilities. Dental Care Considerations of Disadvantages and Special Care Populations: Proceedings of the Conference. Held April 18-19, 2001*, U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Division of Medicine and Dentistry, Division of Nursing, Baltimore, Md, USA, 2001.
- [12] S. Horwitz, B. Kerker, P. Owens, and E. Zigler, *The Health Status and Needs of Individuals with Mental Retardation*, Special Olympics, Washington, DC, USA, 2001.
- [13] Oral Health America, *The Disparity Cavity: Filling America's Oral Health Gap*, Oral Health America, Chicago, Ill, USA, 2000.
- [14] Institute of Medicine, *Improving Access to Oral Health Care for Vulnerable and Underserved Populations*, National Academy of Sciences, Washington, DC, USA, 2011.
- [15] Institute of Medicine, *The Future of Nursing: Leading Change, Advancing Health*, vol. The National Academies Press, Washington, DC, USA, 2011.
- [16] A. Fawcett-Henesy, *Community Health Needs Assessment—An Introductory Guide for the Family Health Nurse in Europe—Part 1: A Pack for Practitioners—Part 2: A Pack for Trainers*, World Health Organization Regional Office for Europe, Copenhagen, Denmark, 2001, http://www.euro.who.int/_data/assets/pdf_file/0018/102249/E73494.pdf.
- [17] American Association of Colleges of Nursing (AACN), Nurse Practitioners: The Growing Solution in Health Care Delivery, <http://www.aacn.nche.edu/media-relations/fact-sheets/nurse-practitioners>.
- [18] A. I. Spielman, T. Fulmer, E. S. Eisenberg, and M. C. Alfano, "Dentistry, nursing, and medicine: a comparison of core competencies," *Journal of Dental Education*, vol. 69, no. 11, pp. 1257–1271, 2005.
- [19] J. E. Hahn and H. U. Aronow, "A pilot of a gerontological advanced practice nurse preventive intervention," *Journal of Applied Research in Intellectual Disabilities*, vol. 18, no. 2, pp. 131–142, 2005.
- [20] O. Barr, J. Gilgunn, T. Kane, and G. Moore, "Health screening for people with learning disabilities by a community learning disability nursing service in Northern Ireland," *Journal of Advanced Nursing*, vol. 29, no. 6, pp. 1482–1491, 1999.
- [21] J. A. Jones, T. Fulmer, and T. Wetle, "Oral health content in nursing school curricula," *Gerontology and Geriatrics Education*, vol. 8, no. 3-4, pp. 95–101, 1988.
- [22] E. I. Walid, F. Nasir, and S. Naidoo, "Oral health knowledge, attitudes and behaviour among nursing staff in Lesotho," *Journal of South African Dental Association*, vol. 59, no. 7, pp. 288–292, 2004.
- [23] H. B. Waldman and S. P. Perlman, "Oral health, nurses and patients with developmental disabilities," *International Journal of Nursing in Intellectual & Developmental Disabilities*, vol. 3, no. 1, p. 4, 2007, <http://journal.hsmc.org/ijnidd/articletemplate.asp?id=111>.
- [24] S. C. Smeltzer, M. A. Dolen, G. Robinson-Smith, and V. Zimmerman, "Integration of disability-related content in nursing curricula," *Nursing Education Perspectives*, vol. 26, no. 4, pp. 210–216, 2005.
- [25] M. Kraus, C. Connick, and C. Morgan, "Interdisciplinary partners: nursing and dental hygiene," *The Journal of Nursing Education*, vol. 41, no. 12, pp. 535–536, 2002.
- [26] J. P. Bellack, D. R. Graber, E. H. O'Neil, C. Musham, and C. Lancaster, "Curriculum trends in nurse practitioner programs: current and ideal," *Journal of Professional Nursing*, vol. 15, no. 1, pp. 15–27, 1999.
- [27] T. L. Thompson, K. Emrich, and G. Moore, "The effect of curriculum on the attitudes of nursing students toward disability," *Rehabilitation Nursing: the Official Journal of the Association of Rehabilitation Nurses*, vol. 28, no. 1, pp. 27–30, 2003.

- [28] C. C. Mabry and N. G. Mosca, "Interprofessional educational partnerships in school health for children with special oral health needs," *Journal of Dental Education.*, vol. 70, no. 8, pp. 844–850, 2006.
- [29] L. D. DeSilets, "Evaluating learning activities," *The Journal of Continuing Education in Nursing*, vol. 36, no. 5, pp. 191–192, 2005.
- [30] Committee on the Robert Wood Johnson Foundation Initiative on the Future of Nursing at the Institute of Medicine and Institute of Medicine, *The Future of Nursing: Leading Change, Advancing Health*, The National Academies Press, Atlanta, Ga, USA, 2012.

Review Article

Oral Health and Hygiene Content in Nursing Fundamentals Textbooks

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The purpose of this paper is to describe the quantity and quality of oral hygiene content in a representative sample of before-licensure nursing fundamentals textbooks. Seven textbooks were examined. Quantity was operationalized as the actual page count and percentage of content devoted to oral health and hygiene. Quality of content was operationalized as congruency with best mouth care practices. Best mouth care practices included evidence-based and consensus-based practices as published primarily by the American Dental Association and supported by both published nursing research and review articles specific to mouth care and published dental research and review articles specific to mouth care. Content devoted to oral health and hygiene averaged 0.6%. Although the quality of the content was highly variable, nearly every textbook contained some erroneous or outdated information. The most common areas for inaccuracy included the use of foam sponges for mouth care in dentate persons instead of soft toothbrushes and improper denture removal.

1. Introduction

Oral hygiene is vitally important because oral health is directly related to systemic health [1–3]. Poor oral health results in plaque buildup and inflammation of the gingiva. Plaque harbors pathogens associated with pneumonia [4]. In fact, poor oral hygiene has been linked to ventilator-associated pneumonia across the lifespan [5, 6]. Inflammation of the gingival tissues, either with or without periodontal disease, has been related to adverse outcomes in pregnancy, such as premature-birth and low-birth-weight infants [7]. Other systemic diseases associated with inadequate oral hygiene and resulting poor oral health include diabetes [8–10] and coronary artery disease [11]. Inadequate oral health negatively impacts quality of life and mortality, as well [12].

In 1986, Jones et al. surveyed nursing schools in the New England region to determine the quantity of oral health in both undergraduate and graduate curricula [13]. At the undergraduate level, Jones et al. reported an hour or less of overall oral health content in the entire curricula for 50% of the surveyed schools [13]. Fourteen percent of the undergraduate programs included 2 to 3 hours of oral

health content specific to older adults; the remaining schools reported zero to 1 hour [13]. More recent reports of oral health content in undergraduate/predoctoral nursing, medical, and pharmacy schools show little, if any, improvement. Nearly 60 percent of educators in nursing, medicine, and pharmacology in English-speaking universities around the world currently describe their curricula in oral health as insufficient [14].

In 2009, at the request of the Department of Health and Human Services (DHHS), the Institute of Medicine convened an oral health panel. The panel, The Committee on an Oral Health Initiative, was charged with “assessing the current oral health care system, reviewing the elements of an HHS Oral Health Initiative, and exploring ways to promote the use of preventive oral health interventions and improve oral health literacy [15, page vii]. Members of the committee invited experts to share their experiences and perspectives during public meetings held across the United States. One area that members of the committee explored was the important contributions nondental clinicians make to the prevention, diagnosis, and treatment of oral diseases [15]. The committee-desired information regarding the quantity and quality of oral health content in nursing education

because nurses are responsible for either providing oral hygiene for their patients or supervising and delegating this task to unlicensed personnel [16]. This author was invited to address the committee and discuss the quantity and quality of oral health content in nursing education. In order to substantiate the content of the presentation, a search of nursing fundamentals textbooks was conducted in order to describe both the quantity and quality of oral hygiene content. Thus, the purpose of this paper is to describe the quantity and quality of oral hygiene content in before-licensure nursing fundamentals textbooks.

2. Materials and Methods

2.1. Search Description. The purpose of this search was to obtain a representative sample of nursing fundamental textbooks in order to describe the quantity and quality of oral hygiene content. The Google search engine was used to conduct the textbook search because it interfaced with content found in the Google Book Projects. In 2007, Google and the Committee on Institutional Cooperation (CIC), a consortium of 12 universities, entered into a partnership that would allow Google to convert the millions of books owned by CIC libraries to electronic formats [17]. The goal was to digitize 10 million volumes. Many textbooks were not fully digitized due to copyright restraints, but the titles, table of contents, and other information are available for searching [17]. The search terms “nursing,” “fundamentals,” and “textbook” were used in the search. Only textbooks in English published from 2006 through 2010 were included; when multiple editions were identified, only the most recent edition was included in the sample. The intended audience for the textbooks was before-licensure registered nursing students; textbooks for before-licensure practical nursing students or nursing assistants were excluded. Study guides or companion books to the primary textbooks were excluded. Additionally, the same search terms and criteria were used to search Amazon and Barnes & Noble websites. No additional textbooks were identified. Finally, if a publisher of any nursing textbooks did not appear in these searches (such as SAGE), the website was searched as well. Seven fundamental textbooks were identified using these criteria.

The textbooks were obtained via interlibrary loan. Quantity was operationalized as the actual page count and percentage of content devoted to oral health and hygiene in order to determine the quantity of oral hygiene content. Percentages were obtained by dividing the actual page count by the total pages of content and multiplying by 100. Total page count was determined by the last page of actual content, excluding indices, appendices, glossaries, and bibliographies. Quality of content was operationalized as congruency with best mouth care practices. Best mouth care practices included evidence-based and consensus-based practices as published primarily by the American Dental Association [18, 19] and supported by both published nursing research and review articles specific to mouth care and published dental research and review articles specific to mouth care [5, 6, 16, 20–28]. For example, nurse researchers have demonstrated the efficacy of specific oral health protocols, such as the use of

soft toothbrushes instead of foam swabs for both dentate and edentate persons [27, 29–32]. Chalmers et al. [22] published a comprehensive evidence-based protocol for oral hygiene care targeting older adults with functional and cognitive impairments. Thus, contents in the nursing fundamental textbooks were examined for content congruent with oral hygiene practices tested and endorsed by nurses, dental hygienists, and dentists.

3. Results and Discussion

Seven textbooks meeting the search criteria were obtained and are listed in Table 1. The percentage of oral health and hygiene content ranged from 0.27% [33] to 1.10% [34] with an average of 0.6%. Assessment of the oral cavity ranged from a few sentences [35] to 3.3 pages [34]. The assessment content in three textbooks [33, 35, 36] contained no information about assessing dentures for fit, integrity, or plaque. Potter and Perry [37] and Wilkinson and Van Leuven [34] offered the most complete information pertinent to oral health assessment. Potter and Perry [37] alone clearly articulated the oral-systemic link. This textbook also provided the clearest instructions for oral care with an unconscious or mechanically ventilated patient, for example, instructing the nurse to use an oral airway to keep the mouth of an unconscious or debilitated patient open. Three textbooks suggested using a tongue blade wrapped in gauze, which is not the safest or most comfortable approach [33, 35, 38]. Wilkinson and Van Leuven [34], on the other hand, recommended either the use of a tongue blade wrapped in gauze or a bite block.

One textbook contained no information on how to correctly floss or brush teeth [36] such as brush at a 45 degree angle and use short strokes [19]. The same textbook, however, offered a recipe for toothpaste (2 parts baking soda, one part salt) without referencing the source of this information. The remaining six textbooks provided information on correct brushing techniques. On the other hand, content about flossing was problematic. The American Dental Association [19] recommends using 18 inches of string floss, winding the bulk of the floss around a finger of the nondominant hand, and using the dominant hand to spool the floss and take up the soiled sections as different teeth are flossed. While string floss is acceptable when assisting a cognitively intact patient with mouth care, floss holders and interdental brushes are better choices when providing mouth care to dependent patients or those with cognitive impairments. In fact, the American Dental Association [19] does suggest floss holders and interdental brushes for persons who have difficulty using string floss. Interdental brushes, also called proximal brushes, resemble plastic toothpicks but with spiral shaped brushes on the end. These brushes are also perfect for nurses providing mouth care to fully dependent patients because the brushes allow the nurse to floss if the patient is unable or unwilling to open his or her mouth [40]. Furthermore, the use of interdental brushes prevents bite injuries because the nurses' fingers are not in patients' mouths. In spite of these considerations, the authors of one textbook directed nurses to use string floss,

TABLE 1: Summary of Results.

Bibliographic data	Pages devoted to oral health and hygiene	Total Pages*	Percent of oral health and hygiene content	Significant findings
Craven and Hirnle [35]	4.5	1408	0.32%	<p>(i) Assessment was 0.25 page.</p> <p>(ii) Recommended cleaning dentures with soft-bristled toothbrush “because hard-bristled brushes can produce grooves in dentures” (page 722). Although this sentence is congruent with the American Dental Association guidelines [18, 19], it could be misconstrued as advising against using denture brushes, which tend to have firmer bristles than soft toothbrushes.</p> <p>(iii) Directed nursing student to use string floss, not floss heads or interdental sticks.</p> <p>(iv) Suggested the use of a padded tongue blade oral to keep the mouth of an unconscious patient open.</p> <p>(v) Recommended either a soft toothbrush or foam swabs to brush teeth.</p> <p>(vi) Denture removal incongruent with published dental research.</p>
Delaune and Ladner [36]	8.5 with pictures	1391	0.61%	<p>(i) Oral health assessment content did not address checking dentures for fit, integrity, or plaque.</p> <p>(ii) Recommended the use of foam swabs for “clients with impaired physical mobility or who are unconscious (comatose)” (page 759).</p> <p>(iii) No information on how to correctly floss or brush teeth, although the text provided a recipe for toothpaste: 2 parts salt and 1 part baking soda, no citations for this recipe.</p> <p>(iv) Recommended brushing dentures with toothpaste.</p> <p>(v) Did not direct nurses to brush the gums of edentate patients with soft toothbrushes.</p> <p>(vi) Simultaneously recommended the use of foam sponges with toothpaste or toothbrushes with toothpaste.</p> <p>(vii) Confusing content in the area of flossing. For generic mouth care, solely advised the use of string floss for flossing. For patients who were comatose, directed the use of floss holders BUT also recommended against flossing teeth for patients fully dependent on nurses for care.</p> <p>(viii) Denture removal incongruent with published dental research.</p>
Lynn [38]	10	1042	0.96%	<p>(i) Assessment content focused on the oral cavity (10 lines) but did not address normal versus abnormal findings.</p> <p>(ii) Included content specific to oral hygiene and persons with cognitive impairments consistent with published articles in this area by Chalmers [20–23].</p> <p>(iii) No mention of soft toothbrush, simply “toothbrush.”</p> <p>(iv) For assisting the patient, did recommend flossing, but technique was incorrect—recommended that the nurse use 6 inches of floss. Did recommend “a plastic floss holder” (page 338).</p> <p>(v) Mouthwash is presented as simply a mechanism for “leaving a pleasant taste in the mouth” (page 338) instead as an adjuvant to prevent caries and gingivitis.</p> <p>(vi) Recommended use of a padded tongue blade to prop open the mouth of a “dependent” patient (page 341).</p> <p>(vii) For a dependent patient, recommended use of toothpaste and toothbrush.</p> <p>(viii) For a dependent patient, Remove dentures if present and use a foam swab or gauze-padded tongue blade “moistened with water or dilute mouthwash to gently clean gums, mucous membranes, and tongue.” (page 341).</p> <p>(ix) Denture removal incongruent with published dental research.</p> <p>(x) No direction about need to remove dentures overnight.</p> <p>(xi) Recommended toothpaste to brush dentures.</p>

TABLE 1: Continued.

Bibliographic data	Pages devoted to oral health and hygiene	Total Pages*	Percent of oral health and hygiene content	Significant findings
Potter and Perry [37]	7.5	1408	0.53%	<p>(i) Out of all 7 textbooks, best description of oral health assessment (defined and described caries, periodontal disease, gingivitis; also addressed the components of an oral health assessment such as presence/absence of plaque quality of saliva and integrity of buccal mucosa).</p> <p>(ii) Oral-systemic link clearly articulated.</p> <p>(iii) Recommended brushing 4x/day.</p> <p>(iv) Stated that foam swabs are ineffective and should not be used—but then, in procedure section, recommended foam swabs for unconscious or debilitated patients (page 889) and showed them in pictures.</p> <p>(v) Provided clearest instructions for oral care on an unconscious/mechanically ventilated patient.</p> <p>(vi) Recommended oral airway to keep mouth open for unconscious/debilitated patient.</p> <p>(vii) Foam swabs recommended for patients without teeth.</p> <p>(viii) Best description of oral health assessment, defined and described caries, periodontal disease, gingivitis.</p> <p>(ix) No mention of using toothpaste to clean dentures, but picture on page 891 shows toothpaste being used. (x) Denture removal and insertion directions simplistic too and incongruent with published dental research.</p> <p>(xi) No recommendation to use interdental sticks or floss heads for flossing.</p>
Taylor et al. [33]	4.75	1742	0.27%	<p>(i) The oral health assessment was limited to 3 paragraphs in one health assessment chapter. There was no information on checking dentures for fit, integrity, or plaque. (ii) Provided overall correct mouth care techniques, including tongue brushing.</p> <p>(iii) Gave detailed directions for flossing using string floss; nothing about alternatives.</p> <p>(iv) For dependent patient, advised the use of padded tongue depressor to prop mouth open instead of a bite block.</p> <p>(v) Advised using toothpaste for dentures.</p> <p>(vi) No content on removing dentures from patient's mouth.</p> <p>(vii) Recommended mouth care every 1-2 hours, especially for persons who were not able to take anything by mouth.</p>
Wilkinson and Leuven [39]	4.5	1089	0.41%	<p>(i) Erroneously instructs patients in "Teaching Your Client About Oral Hygiene" to use regular toothpaste when brushing dentures.</p> <p>(ii) Also included a recipe for toothpaste, 1 part baking soda, 2 parts salt.</p> <p>(iii) Did not recommend removing and leaving dentures out overnight.</p>
Wilkinson and Leuven [34]	11.3	1026	1.10%	<p>(i) Included 3.3 pages about assessing the oral cavity; one of the most comprehensive.</p> <p>(ii) Included the use of foam swabs for mouth care, although the authors stated that toothbrushes better remove plaque and debris.</p> <p>(iii) Included content on the use of a floss holder.</p> <p>(iv) Recommended dilute hydrogen peroxide as a mouth wash.</p> <p>(v) Recommended toothpaste for cleaning dentures.</p> <p>(vi) Denture removal incongruent with published dental research. (vii) No indication for leaving dentures out overnight.</p> <p>(viii) For providing mouth care to an unconscious patient, recommended using a bite block or a padded tongue depressor.</p>

instead of floss holders or interdental brushes, when caring for a dependent patient [33]. The use of floss heads was recommended by Lynn [38] and Wilkinson and Van Leuven [34]. No textbooks contained recommendations for the use of interdental brushes. Lynn [38] erroneously advised nurses to use 6 inches of string floss instead of the 18 inches as advised by the American Dental Association [18]. Flossing information provided by DeLaune and Ladner [36] appeared contradictory. In one section of the textbook, nurses were advised to refrain from flossing the teeth of patients who were fully dependent on others for care. In another section, nurses were instructed to use floss holders when flossing the teeth of comatose patients.

Another problematic content area was the use of foam sponges in lieu of soft toothbrushes. Foam sponges do not remove plaque and debris as efficiently or completely as soft toothbrushes. Soft toothbrushes can be safely used for dentate patients, even unconscious ones [27]. In spite of the availability of this information since the mid-seventies [22], the use of foam sponges to provide oral hygiene was endorsed in some of the textbooks. Craven and Hirnle [35] and DeLaune and Ladner [36] advocated the use of a foam sponge to clean the teeth of dependent or unconscious patients. Wilkinson and Van Leuven [34] and Potter and Perry [37] explicitly stated that soft toothbrushes were superior to foam sponges but still recommended their usage.

Regular toothpaste can contain particles that scratch acrylic denture material; the American Dental Association [18] recommends that regular toothpaste be avoided and suggests the use of household dish cleaning liquid for cleaning dentures. The authors of five textbooks promoted the use of toothpaste for denture cleaning [33, 34, 36, 38, 39]. Taylor et al. [33] provided no information on denture removal; the remaining six textbooks recommended the removal of top dentures first, followed by bottom dentures. In the dental and nursing literature, clinicians recommend removing the bottom denture first because it is easier to remove and minimizes bite risk for the caregiver [20, 22, 23]. Dentures also must be removed overnight to avoid damage to gingival surfaces and to prevent the growth of thrush on the hard palate. Yet, this important information was missing from two of the seven textbooks [34, 38].

Only one textbook, Lynn [38], included content about oral hygiene and cognitively impaired older adults, but was vague regarding the best way to address care-resistant behavior. Given the aging of the American population [15, 41], registered nurses will find themselves caring for greater numbers of older adults and, very likely, older adults with cognitive impairments. All seven of the reviewed textbooks directed nurses to refer any dental problems, such as broken and loose teeth or poorly fitting dentures, to a dental professional.

This review was an attempt to systematically describe the quantity and quality of oral hygiene content in a representative sample of before-licensure nursing fundamentals textbooks. A strength of the search strategy was the use of identical search terms within multiple sources, which should have resulted in a representative sample of nursing fundamentals textbooks meeting the inclusion criteria. On

the other hand, there is no primary database from which to identify nursing fundamentals textbooks. In spite of searching in a methodical manner and replicating the search within several sources, there exists the possibility that textbooks meeting the inclusion criteria may have been overlooked. Another limitation of this paper was the use of textbook titles and descriptions, and not the actual textbooks, in order to determine if the textbooks met the inclusion criteria before being obtained via interlibrary loan. It is possible that textbooks meeting the inclusion criteria may have been inadvertently excluded if the available title and description did not fully convey the intended audience or content.

4. Conclusion and Recommendations

In conclusion, the oral health and hygiene content in these seven nursing fundamental textbooks were highly variable in quantity and quality. One challenge faced, by nurse authors writing the chapters and by nurse educators evaluating the content in the textbooks, was the lack of evidence-based guidelines addressing oral health and hygiene. For example, the sole evidence-based guidelines regarding the care and maintenance of dentures became available in 2011 [42]. These guidelines, however, do not provide concrete directives for the length of time dentures should be daily removed “While existing studies provide conflicting results, it is not recommended that dentures should be worn continuously (24 hours per day) in an effort to reduce or minimize denture stomatitis” [42, page S3]. Given the difficulty of obtaining accurate oral health and hygiene information without systematically poring through the dental and nursing literature, nurse educators are encouraged to engage in partnerships with dental professionals, especially those teaching in dental hygiene programs. In one such partnership, for example, dental hygiene faculty and students provided expertise in oral health assessments, while the nursing faculty and students shared their geriatric expertise with the entire team [31]. Nurse educators are also encouraged to incorporate the use of current clinical practice guidelines if the available textbooks do not contain the appropriate oral health content. Finally, it is imperative for nurse researchers involved in oral health and hygiene activities to actively engage in the dissemination of accurate information through publication and presentations. One such venue is the Oral Health Nursing Education & Practice Initiative within the New York University’s College of Nursing at the College of Dentistry. This initiative was launched in April, 2011, and one of its goals includes disseminating best oral care practices to nurse educators [43].

Oral health and hygiene has been an area overlooked in overall nursing education, but the growing body of research linking poor oral health to systemic diseases merits the need for added emphasis on the provision of oral hygiene [1–3]. In clinical practice, registered nurses provide oral hygiene either directly or supervise the provision of oral hygiene by others. Registered nurses who were not taught best mouth care practices may be providing inadequate mouth care as well as inadvertently promoting poor mouth care by unlicensed care personnel, who are dependent upon the knowledge and

direction of registered nurses. It is important, therefore, for registered nurses to use current clinical mouth care practice guidelines.

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References

- [1] M. P. Cullinan, P. J. Ford, and G. J. Seymour, "Periodontal disease and systemic health: current status," *Australian Dental Journal*, vol. 54, supplement 1, pp. S62–S69, 2009.
- [2] P. J. Ford, S. L. Raphael, M. P. Cullinan, A. J. Jenkins, M. J. West, and G. J. Seymour, "Why should a doctor be interested in oral disease?" *Expert Review of Cardiovascular Therapy*, vol. 8, no. 10, pp. 1483–1493, 2010.
- [3] J. R. Gurenlian, "Inflammation: the relationship between oral health and systemic disease," *Dental Assistant*, vol. 78, no. 2, pp. 8–43, 2009.
- [4] A. Azarpazhooh and J. L. Leake, "Systematic review of the association between respiratory diseases and oral health," *Journal of Periodontology*, vol. 77, no. 9, pp. 1465–1482, 2006.
- [5] K. Hutchins, G. Karras, J. Erwin, and K. L. Sullivan, "Ventilator-associated pneumonia and oral care: a successful quality improvement project," *American Journal of Infection Control*, vol. 37, no. 7, pp. 590–597, 2009.
- [6] L. Johnstone, D. Spence, and J. Koziol-McClain, "Oral hygiene care in the pediatric intensive care unit: practice recommendations," *Pediatric Nursing*, vol. 36, no. 2, pp. 85–97, 2010.
- [7] Y. W. Han, "Oral health and adverse pregnancy outcomes—what's next?" *Journal of Dental Research*, vol. 90, no. 3, pp. 289–293, 2011.
- [8] S. Bakhshandeh, H. Murtooma, R. Mofid, M. M. Vehkalahti, and K. Suomalainen, "Periodontal treatment needs of diabetic adults," *Journal of Clinical Periodontology*, vol. 34, no. 1, pp. 53–57, 2007.
- [9] L. N. Borrell and S. P. Joseph, "Periodontal treatment may control glycemic status among diabetic patients," *Journal of Evidence-Based Dental Practice*, vol. 11, no. 2, pp. 92–94, 2011.
- [10] W. J. Teeuw, V. E. A. Gerdes, and B. G. Loos, "Effect of periodontal treatment on glycemic control of diabetic patients: a systematic review and meta-analysis," *Diabetes Care*, vol. 33, no. 2, pp. 421–427, 2010.
- [11] N. Kurihara, Y. Inoue, T. Iwai et al., "Oral bacteria are a possible risk factor for valvular incompetence in primary varicose veins," *European Journal of Vascular and Endovascular Surgery*, vol. 34, no. 1, pp. 102–106, 2007.
- [12] D. M. P. Padilha, J. B. Hilgert, F. N. Hugo, A. J. Bos, and L. Ferrucci, "Number of teeth and mortality risk in the Baltimore Longitudinal Study of Aging," *Journals of Gerontology*, vol. 63, no. 7, pp. 739–744, 2008.
- [13] J. A. Jones, T. Fulmer, and T. Wetle, "Oral health content in nursing school curricula," *Gerontology and Geriatrics Education*, vol. 8, no. 3–4, pp. 95–101, 1988.
- [14] C. Hein, D. J. Schönwetter, and A. M. Iacopino, "Inclusion of oral-systemic health in predoctoral/undergraduate curricula of pharmacy, nursing, and medical schools around the world: a preliminary study," *Journal of Dental Education*, vol. 75, no. 9, pp. 1187–1199, 2011.
- [15] Institute of Medicine, *Advancing Oral Health in America*, The National Academies Press, Washington, DC, USA, 2011.
- [16] A. M. Berry, P. M. Davidson, J. Masters, and K. Rolls, "Systematic literature review of oral hygiene practices for intensive care patients receiving mechanical ventilation," *American Journal of Critical Care*, vol. 16, no. 6, pp. 552–563, 2007.
- [17] Google Book Project at Penn State, <http://www.libraries.psu.edu/psul/googlebooksproject/faq.html>.
- [18] Oral health topics: dentures, <http://www.ada.org/2648.aspx?currentTab=2>.
- [19] Oral Health Topics: Cleaning Your Teeth & Gums, <http://www.ada.org/2624.aspx?currentTab=2>.
- [20] J. Chalmers and A. Pearson, "Oral hygiene care for residents with dementia: a literature review," *Journal of Advanced Nursing*, vol. 52, no. 4, pp. 410–419, 2005.
- [21] J. M. Chalmers and A. Pearson, "A systematic review of oral health assessment by nurses and carers for residents with dementia in residential care facilities," *Special Care in Dentistry*, vol. 25, no. 5, pp. 227–233, 2005.
- [22] J. Chalmers, V. Johnson, J. H. Tang, and M. G. Titler, "Evidence-based protocol: oral hygiene care for functionally dependent and cognitively impaired older adults," *Journal of Gerontological Nursing*, vol. 30, no. 11, pp. 5–12, 2004.
- [23] J. M. Chalmers, "Behavior management and communication strategies for dental professionals when caring for patients with dementia," *Special Care in Dentistry*, vol. 20, no. 4, pp. 147–154, 2000.
- [24] D. A. Clemmens and A. R. Kerr, "Improving oral health in women:nurses' call to action," *The American Journal of Maternal Child Nursing*, vol. 33, no. 1, pp. 10–16, 2008.
- [25] J. A. Fitch, C. L. Munro, C. A. Glass, and J. M. Pellegrini, "Oral care in the adult intensive care unit," *American Journal of Critical Care*, vol. 8, no. 5, pp. 314–318, 1999.
- [26] J. A. Gil-Montoya, A. L. F. de Mello, C. B. Cardenas, and I. G. Lopez, "Oral health protocol for the dependent institutionalized elderly," *Geriatric Nursing*, vol. 27, no. 2, pp. 95–101, 2006.
- [27] M. J. Grap, C. L. Munro, B. Ashtiani, and S. Bryant, "Oral care interventions in critical care: frequency and documentation," *American Journal of Critical Care*, vol. 12, no. 2, pp. 113–118, 2003.
- [28] D. J. Jones, C. L. Munro, M. J. Grap, T. Kitten, and M. Edmond, "Oral care and bacteremia risk in mechanically ventilated adults," *Heart and Lung*, vol. 39, supplement 6, pp. S57–S65, 2010.
- [29] R. A. Jablonski, "Examining oral health in nursing home residents and overcoming mouth care-resistive behaviors," *Annals of Long-Term Care*, vol. 18, no. 1, pp. 21–26, 2010.
- [30] R. A. Jablonski, C. L. Munro, M. J. Grap, C. M. Schubert, M. Ligon, and P. Spigelmyer, "Mouth care in nursing homes: knowledge, beliefs, and practices of nursing assistants," *Geriatric Nursing*, vol. 30, no. 2, pp. 99–107, 2009.
- [31] R. A. Jablonski, T. Swecker, C. Munro, M. J. Grap, and M. Ligon, "Measuring the oral health of nursing home elders," *Clinical Nursing Research*, vol. 18, no. 3, pp. 200–217, 2009.
- [32] C. L. Munro, M. J. Grap, R. Jablonski, and A. Boyle, "Oral health measurement in nursing research: state of the science," *Biological Research for Nursing*, vol. 8, no. 1, pp. 35–42, 2006.
- [33] C. R. Taylor, C. Lillis, P. LeMone, and P. Lynn, *Fundamentals of Nursing: The Art and Science of Nursing Care*, Lippincott Williams & Wilkins, Philadelphia, Pa, USA, 6th edition, 2008.
- [34] J. M. Wilkinson and K. Van Leuven, *Fundamentals of Nursing: Theory, Concepts, & Applications*, vol. 2, FA Davis, Philadelphia, Pa, USA, 2007.

- [35] R. F. Craven and C. J. Hirnle, *Fundamentals of Nursing: Human Health and Function*, Wolters Kluwer Health/Lippincott Williams & Wilkins, Philadelphia, Pa, USA, 6th edition, 2009.
- [36] S. C. Delaune and P. K. Ladner, *Fundamentals of Nursing: Standards and Practice*, Thomson Delmar, New York, NY, USA, 3rd edition, 2006.
- [37] P. A. Potter and A. G. Perry, *Fundamentals of Nursing*, Mosby Elsevier, St. Louis, Mo, USA, 7th edition, 2009.
- [38] P. Lynn, *Taylor's Clinical Nursing Skills: A Nursing Process Approach*, Wolters Kluwer Health/Lippincott Williams & Wilkins, Philadelphia, Pa, USA, 2nd edition, 2008.
- [39] J. M. Wilkinson and K. Van Leuven, *Fundamentals of Nursing: Theory, Concepts, & Applications*, vol. 1, FA Davis, Philadelphia, Pa, USA, 2007.
- [40] R. A. Jablonski, B. Therrien, E. K. Mahoney, A. Kolanowski, M. Gabello, and A. Brock, "An intervention to reduce care-resistant behavior in persons with dementia during oral hygiene: a pilot study," *Special Care in Dentistry*, vol. 31, no. 3, pp. 77–87, 2011.
- [41] Institute of Medicine, *Retooling for an Aging America: Building the Health Care Workforce*, National Academy Press, Washington, DC, USA, 2008.
- [42] D. Felton, L. Cooper, I. Duqum et al., "Evidence-based guidelines for the care and maintenance of complete dentures: a publication of the American college of Prosthodontists," *Journal of Prosthodontics*, vol. 20, supplement 1, pp. S1–S12, 2011.
- [43] NYUCN Launches Oral Health Nursing Education Program, <http://www.nyu.edu/about/news-publications/news/2011/04/26/nyucn-launches-oral-health-nursing-education-and-practice-program.html>.

Research Article

Action Planning for Daily Mouth Care in Long-Term Care: The Brushing Up on Mouth Care Project

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Research focusing on the introduction of daily mouth care programs for dependent older adults in long-term care has met with limited success. There is a need for greater awareness about the importance of oral health, more education for those providing oral care, and organizational structures that provide policy and administrative support for daily mouth care. The purpose of this paper is to describe the establishment of an oral care action plan for long-term care using an interdisciplinary collaborative approach. *Methods.* Elements of a program planning cycle that includes assessment, planning, implementation, and evaluation guided this work and are described in this paper. Findings associated with assessment and planning are detailed. Assessment involved exploration of internal and external factors influencing oral care in long-term care and included document review, focus groups and one-on-one interviews with end-users. The planning phase brought care providers, stakeholders, and researchers together to design a set of actions to integrate oral care into the organizational policy and practice of the research settings. *Findings.* The establishment of a meaningful and productive collaboration was beneficial for developing realistic goals, understanding context and institutional culture, creating actions suitable and applicable for end-users, and laying a foundation for broader networking with relevant stakeholders and health policy makers.

1. Introduction

The last half-century has seen considerable improvements for dental health. Unlike previous generations, more and more older adults are maintaining their natural teeth into old age [1–3]. This is a welcome trend but results in new patterns of disease that become especially significant for those who are frail and who must depend on others for their personal care and hygiene [4–6]. Mouth care is an integral part of personal care yet it is inadequate [4, 6, 7] and given low priority for residents in long-term care [8, 9].

Poor oral hygiene resulting from inadequate mouth care causes considerable morbidity such as mucosal inflammation, caries (tooth decay), and periodontal disease (bone loss

around teeth) [7, 10]. Evidence demonstrating links between dental disease and systemic conditions such as respiratory infections [11, 12], diabetes [13–16], and cardiovascular disease [17] also continues to emerge. Tooth loss, pain, and poorly functioning dentures result in problems chewing [18, 19] which is linked to poor nutrition, low body mass index [20], and involuntary weight loss [21]. Dental diseases and dysfunction impact quality of life are known to diminish the pleasures of eating, speaking and social interactions [12, 22]. Overall, the oral health status of residents in long-term care is poor [7, 10, 23–25] and those with dementia experience even higher rates of oral disease [26].

Oral care for dependent older adults in long-term care is becoming a challenge that is expected to grow in

importance as our population ages [9]. Over the past several decades, research focusing on attitudes and behaviors of care providers; education and oral hygiene intervention programs; and more recently, environmental, organizational, or social influences on the delivery of care is shedding new light on the complexity of factors influencing the ability to provide adequate oral care.

Practical barriers to oral care include a perceived lack of time [27–29], inadequate staffing levels [27, 28], lack of readily available oral care equipment [30, 31], resistant behaviors by patients/residents [27, 28, 30, 31], and high care staff turnover rates that undermine oral care education programs [32, 33]. Social barriers include embarrassment and repulsion, lack of care staff confidence in their knowledge or ability to provide care [28, 34], a perception of oral care as invasive to the dignity and privacy of residents [35, 36] or unwanted by the resident [35], and the perception by nurses that oral care is professionally unrewarding [36]. Factors identified to facilitate care staff's ability and/or willingness to provide oral care include availability of oral health equipment [37], influence of and examples set by people seen as influential leaders [37], education and/or demonstration in oral health care procedures [27, 29, 35, 37], adequate time to provide care [29], and believing that oral health and oral care are important [28, 29].

Research involving staff education-based interventions directed toward improving oral health status of long-term care residents demonstrates conflicting results [38–40]. Some studies have demonstrated a decrease in disease indicators [32, 39] while others did not [40]. A similarly designed comprehensive personal mouth care program introduced in multiple facilities found different effects on oral hygiene practices and health status of residents of the different facilities [41]. In fact, structural variables expected to influence quality of care (e.g., on-site services, routines, and resources) explained very little of the difference between effective and ineffective programs [41, 42]. Rather, effectiveness appeared contingent upon the organizational context within facilities, comprised of both programmatic strategies and the organizational culture that supports or inhibits them [42].

Creating effective strategies to address the issue of oral health in long-term care is further complicated because oral health care has traditionally been peripheral to mainstream health considerations. The lack of interaction between dentistry and other domains of health care has fostered isolation in approaches for managing oral health. This has been recognized as a shortcoming and has resulted in a call for an interdisciplinary and collaborative approach to both research and practice [8, 9]. Our research attempts to address these shortcomings.

The purpose of this paper is to describe the experience of developing a meaningful interdisciplinary collaboration and to highlight the processes used to design a comprehensive set of actions to integrate oral care into organizational policy and practice within three long-term care facilities in rural Nova Scotia on the east coast of Canada. A collaborative approach is advantageous because the synergy created by the blending of perspectives, resources, and skills of various participants [43] enables the group to create something that is

not attainable by single agents [44]. In this study, an interdisciplinary network of researchers and stakeholders were brought together with administrators and front-line care staff to think about the work in creative and practical ways; develop realistic goals; plan and carry out comprehensive interventions that connect multiple programs, services, and sectors; understand and document the impact of its actions; incorporate the perspectives and priorities of stakeholders including the target population; and communicate how actions will address problems [43].

2. Methods

2.1. The Collaboration. A common interest was established between the principal investigator (M. E. McNally) and a senior administrator of three long-term care facilities during a provincial oral health policy workshop. Over the course of a year, multiple face-to-face meetings, telephone, and email consultations were undertaken with administrative staff to: discuss the current level of oral care and associated challenges; develop realistic and practical research objectives; establish a formal commitment to the research; clarify roles and expectations; and establish mutual benefits. Through this process, a formal collaboration was established consisting of an interdisciplinary research team in partnership with Health Service Managers and Nurse Managers of the three facilities (i.e., the “site team”). All members of the collaboration were involved in establishing goals and strategies for the project. The Nurse Managers were further involved as direct liaisons to each of the sites and assisted with recruitment and data collection. To help focus the research goals and ongoing knowledge exchange, the site team identified training and resources as desired outcomes.

2.2. Research Site. Three long-term care facilities were the sites for this research. They are rurally situated within 1 hour of each other and are within 1-2-hour drive of a metropolitan area. The number of residents per site ranged from 25 to 40, which is typical of the majority of long-term care facilities found in rural settings in the region [45]. The three long-term care facilities are administered under the same health district where there is sharing of resources, budgets, and policy. Examining multiple sites within the same organizational structure was undertaken to provide a deeper understanding of how subcultures influence delivery of care at a micro-organizational level [46].

2.3. Study Design. A case study approach was used to explore the individual, organizational, and system factors associated with the integration of oral care in three long-term care settings. The unit of analysis was institutional [47]. The case study method was selected in order to gain a holistic understanding of “how” the development and implementation of actions may be influenced by the cultural systems of action that exist within each setting [48].

This research is consistent with the elements of a program planning cycle that include assessment, planning, implementation, and evaluation [49] of a set of actions to

integrate oral care into both organizational policy and daily personal care practice. This paper describes details associated with the first two phases, assessment and action planning. *Assessment* involved an exploration of the internal and external factors that influence the provision of oral care and oral disease prevention and was undertaken through a document review, focus groups, and one-on-one interviews. The *action-planning* phase brought care providers and stakeholders (government representatives, educators, and dental professionals) together for a workshop to design a set of actions to integrate oral care into organizational policy and practice in each of the settings. The action plan is being *implemented* in each of the settings over a 12-month period and experiences of the health care team (front-line care staff and administrators) explored. The process and outcomes associated with the implementation of actions are being *evaluated* and are providing the basis of recommendations to revise organizational policy and oral care practice. The latter two phases of the project will be described in a subsequent manuscript at their completion.

A systematic analysis of multiple forms of evidence was used to enhance understanding of the context and the people within it [47]. Sources of triangulation [48] of data include multiple perspectives among investigators (i.e., dentistry, nursing, medicine, administration, policy decision-makers), multiple methods (i.e., document analysis, focus groups, interviews, journaling), multiple data sources (i.e., personal care providers, administrators, residents, and families), and multiple settings. It was also recognized that the term “oral care” connotes the broad spectrum of oral health care needs associated with both professional and personal care. This research is primarily concerned with the latter, “daily mouth care”, for frail older adults. However, it was recognized that the scope of this work might also overlap with clinical and policy considerations of professional dentistry and public health. The term “oral care” is therefore used to encompass the broader range of considerations in the research.

2.4. Data Collection

2.4.1. Document Review. Document review was undertaken to provide an organizational and health system context [50]. Members of the collaboration determined the strategy and breadth of the review. Documents were selected on the basis of their topic relevance [51] and included those expected to inform the provision of oral care for long-term care in the region (e.g., job descriptions, clinical guidelines, health assessment tools, accreditation guidelines). Documents were collected directly from the site team, from government, academia, the health services and community college education sectors, and through internet searches of relevant government and education websites. They were individually read, coded, and organized according to four criteria: (1) general health terminology (that may or may not include oral care), (2) oral care (including terms “oral”, “mouth”, and “dental”), (3) foot care, and (4) wound care. References to foot care and wound care were included to provide a basis for comparing oral care to other aspects of care that may be similarly addressed through relevant documents.

Members of the collaboration suggested that it would be useful to examine oral care for consistency with existing and familiar clinical domains that may ultimately provide a useful framework for oral care.

2.4.2. Individual Interviews and Focus Groups. Experiential data were collected using a qualitative approach. This approach is constructivist and interpretivist [52, 53] seeking to distil from personal accounts the experiences and meaning behind oral health care for dependent older adults. Qualitative methods are particularly well suited to finding answers to “what” questions (what are people doing, what does it mean) and “how” questions (how are things done, how is meaning produced) [52]. Ethics approval was obtained from the Nova Scotia Capital District Health Authority (CDHA-RS/2009-033). Members of the site team identified potential participants who were invited by letter and a follow-up telephone call. One-on-one semistructured interviews were held with administrators and health professionals who provide a variety of health services to residents and clients associated with the three facilities. Two focus groups were held in each of the three facilities with (1) personal care providers (i.e., those who provide personal care within their job scope including personal care workers, continuing care assistants, and licensed practical nurses) and (2) residents and family members. Residents who had capacity to provide consent (as determined by the nurse manager) were invited to participate and family members were included to represent experiences of those not able to speak for themselves. One author (K. P. McNeil) facilitated focus groups and interviews.

Semistructured questions for both focus groups and individual interviews were designed to guide and generate discussion to elicit participants’ description of practices associated with the provision of oral care, perceptions of barriers and facilitators to oral care in the care settings, attitudes toward oral health and oral health care, and relevant knowledge of formal oral health policies. Participants were also asked for suggestions that may improve or enhance oral care. This approach allowed for structure but was flexible enough for participants to raise issues not anticipated. Focus groups and interviews were audio-recorded and transcribed. Each verbatim interview underwent open coding to identify thematically group-related phrases and patterns arising from the data [54, 55] using HyperRESEARCH Qualitative Analysis Tool (Version 2.8.2).

2.4.3. Action Planning Workshop. A one-day interdisciplinary oral care action-planning workshop was held at a location central to the research sites. Members of the collaboration established workshop goals and identified invitees to ensure a broad range of relevant expertise and experience. The purpose of the workshop was to design a set of actions that would integrate oral care into organizational policy and personal care practices in each of the three long-term care settings. The two key goals were to: (1) identify and prioritize education, training, tools, and program strategies and (2) establish a detailed plan for implementing, tracking, and evaluating both professional and daily personal mouth care delivery.

The workshop was facilitated by the authors M. E. McNally and K. P. McNeil.

Forty-six invitees were contacted individually by M. E. McNally or K. P. McNeil. The workshop was attended by 34 participants: clinical researchers from dentistry, dental hygiene, nursing, and medicine ($n = 7$); researchers from health promotion and organizational management ($n = 4$); administrators ($n = 5$); nurse managers ($n = 2$); regulated and unregulated front line care staff ($n = 5$); policy makers in the health and continuing care sectors ($n = 3$); representatives of organized dentistry and dental hygiene ($n = 3$); community college educators ($n = 2$); speech language pathologist ($n = 1$); dietician ($n = 1$); as well as a representative from a seniors' government advisory organization. Findings from the document review and experiential data were presented to provide participants with an understanding of context. A review of current best practices [56] and a model of oral health care in long-term care [57] provided an evidence base to inform workshop discussion. Relevant topics identified through the document review, focus groups, and interviews were prioritized by the collaboration for discussion in one-hour breakout sessions and a discussion guide was developed for each topic (Table 1). Each session included 6–8 participants organized to ensure input from a variety of perspectives and disciplines [58].

Responses to the discussion questions were recorded by individual groups and reported back in a plenary session where further input was gathered from the larger group. At the plenary, the group was asked to consider the following: how to best synthesize the information to create a comprehensive "oral care action plan", how to best communicate the action plan to end users, and how to determine the biggest indicators of success over the next 18 months. Findings from the workshop were collated and synthesized into a draft "oral care action plan" for integration at each of the three long-term care sites. Strategies for implementing and evaluating actions were finalized as part of this process. Following the workshop, details of the action plan were prepared into a report and relevant materials circulated to the site team for final approval. The principal investigator and research coordinator met with both managers and front line care staff at each of the sites to ensure that the proposed action plan accommodated circumstances unique to each setting.

3. Results and Discussion

3.1. Document Review. Forty-two internal ($n = 28$) and external ($n = 14$) documents were collected and reviewed. Internal documents included information that was directly applicable to the sites (e.g., mission and values, job descriptions, accreditation standards) and external documents provided information on potentially influential outside factors (e.g., Continuing Care Provincial Policy, Professional Standards of Practice). Overall the document scan revealed a general lack of specific reference to oral health and oral care. Consistent with other findings [42], external documents clearly acknowledged a need for or commitment to whole body health and optimal well-being. However, internal documents reflected more direct activities of practice and referred

to general terms such as "personal care", "assessing all body systems", or "AM/PM care" without the specific mention of oral care. Where oral care was included ($n = 10$), terms such as "mouth/denture care" or "oral care" were used but not described. Overall, the scan revealed negligible references to oral or mouth care as an explicit domain of personal care. There are no government standards with specific reference to mouth or oral care in long-term care. Similar references and level of detail were provided for foot care ($n = 13$). Conversely, the five documents mentioning wound care included details regarding scopes of practice, an interdisciplinary clinic manual, a health services operational report, and a comprehensive manual developed by the provincial government [59]. Details provided for wound care were not surprising given its recognition as specialized care with established best practices for managing wound pathology [60]. This is informative for oral care where the consequences of unchecked oral disease have similar negative implications for health and quality of life.

3.2. Individual Interviews and Focus Groups. Thirteen one-on-one semistructured interviews ranging from 30 to 60 minutes were undertaken with administrators and health professionals who service the three facilities. Participants represented two distinct groups, 5 internal professionals who were involved with the day-to-day care of residents living in long-term care facilities (i.e., long-term care coordinators, nurse managers), and 8 external professionals who provided care to residents but who are not present on a daily basis (i.e., physician, dietitian, physiotherapist, occupational therapist, social worker, nurse practitioner, acute care coordinators). The former group was more involved in addressing and recognizing the needs of residents on a daily basis and their perspectives were very much aligned with those of front-line care staff described hereinafter. External professionals recognized the importance of oral care but generally felt removed from oral care and its implications. Neither group was aware of existing formal policies or supports related to oral care in long-term care. Some concerns raised by external participants centered on relevant health risks for residents. Regarding dysphagia, for example, "...we certainly have concerns about the people pocketing food, going to bed after lunch and that they could choke on that food". Lack of consideration for oral care in routine health assessments undertaken by the various professions was also identified as problematic: "...in a routine screening, I probably wouldn't ask about teeth unless I noticed something and that is probably not a good thing. It is probably something we should be asking about". Both groups acknowledged the importance of daily oral care: "[oral health is important] for overall general health, for nutrition status, for comfort, for self esteem. It's really important for basic health" and advocated for more educational opportunities for care staff: "I think that front line people need more education on oral health. . . I am not sure it is focused enough in the program they take. . . There doesn't seem to be a lot of emphasis on oral health and why it's important in what I see in the people who come here to work". All interviewees were generally aware of difficulties residents have in accessing professional dental services: "For a lot of our people, they find they can't do

TABLE 1: Action planning workshop break-out session guides.

Prioritized discussion topics	Questions for discussion guide
Education/training required to strengthen delivery of care	<i>Who needs to be involved? What should they be doing (i.e., actions/activities)?</i>
Planning and tracking oral care activities	<i>What will be required to make activities possible? How will we measure/keep track of activities?</i>
Special supports to manage residents with dementia	<i>Who will need to be involved in measuring/tracking progress?</i>
Access to professional dental services	<i>How will we know if activities are successful?</i>

anything. If they do have a problem with their dental or oral health, they can't really afford to do anything about it so they tend to leave it".

Focus groups held at each of the three sites included 17 residents and family members ($n = 8, 3, 6$) and 14 front-line personal care providers ($n = 5, 3, 6$). Sessions averaged 90 and 60 minutes, respectively. Residents and family members expressed feedback about availability of mouth care products and good communication between care staff and residents as being important features of mouth care. There was general satisfaction with care provided by personal care staff. Responses to direct questions about daily brushing and denture care met with positive responses by residents: "They are a great bunch of girls". Even with probing questions about daily hygiene care, residents and family members associated mouth care with professional dental care. There was deep concern about a lack of accessibility to professional services. Current residents who did have complaints about their teeth indicated that they would "make do" or "put up" with the discomfort: "I'll put up with my teeth"; "I can't bite with [my dentures] like I used to with some things but I think they'll do me". Access to professional services was limited by residents' mobility and funding issues associated with transportation costs to move residents off-site for professional care, costs that must be borne by residents themselves: "It's really expensive to go to a dentist and get a cap or a filling, or even just to have your dentures fixed because some of the elderly, their dentures are loose and they can't afford a new set of dentures. Like who is going to pay for it?" (Family member). Living in a rural area seemed to further complicate this issue: "It's practically a whole day by the time you get to the dentist's and back again... Very draining. I get there but by the time I get home, I'm dead." (Resident).

Not surprisingly, the most significant input came from front line care staff most involved with the day-to-day care of residents summarized in Table 2. They generally reported that they feel competent to provide mouth care. However, they identified numerous factors that either hindered or helped with carrying out these tasks that are consistent with other reported findings. For instance, although oral care is included in their personal care training, many felt a repulsion and lack of comfort (fear) when providing mouth care [28, 34]. This was intensified when residents exhibit resistant behavior as a result of dementia [28, 34] disability or indifference to the value of mouth care [35]. Participants acknowledged that the proportion of residents and clients with advanced frailty and dementia-related disease is increasing, placing greater demands for providing care [61]. The

number of residents with natural teeth is also increasing and many enter long-term care with very poor oral health [1, 34]. In fact, the oral health status of residents was also seen to be an important factor influencing the quality of care they received especially if poor oral health is accompanied by sensitivity or pain. Constraints of resources and time for completing personal care tasks often leave mouth care low on care staff's list of priorities [31, 34]. Although one of the facilities did have a formal oral care protocol, it was acknowledged that there was little guidance for oral assessments, care planning, and accountability. Along with barriers, key facilitating influences were also identified and are consistent with the earlier findings [28, 34]. The level of residents' functional abilities and a good relationship with their care provider were seen as beneficial. Having a good routine, availability of mouth care products, and sufficient time were also identified as important for facilitating care. With respect to perspectives about education, there was a strong indication that standardized and in-depth oral health education during personal care and nursing training programs would be key to achieving improved and consistent daily oral care. Care staff were generally receptive to "in house" education and training opportunities as well. They suggested that "reminders" and "visuals" (such as those commonly posted for hand-washing) would be useful tools for raising awareness. They were unanimous in expressing a resistance to being monitored daily through check lists saying: "Tick sheets are definitely not the answer". Positive reinforcements, available resources, visual reminders, and education would be more readily accepted by care staff for enhancing mouth care.

Overall these findings provided a unique window into the continuing care environment and direct responsibilities of a range of front-line care staff, managers, and administrators working within the three facilities. This feedback, coupled with findings of the document analysis and input from the collaboration, provided the basis for establishing priorities for the action planning workshop, evaluation of prospective activities arising from the workshop, and planning next steps for introducing an oral care action plan.

3.3. Action Planning Workshop. As described previously, this one-day interdisciplinary workshop was held to develop an oral care action plan to be integrated into organizational policy and practice. Following formal presentations, significant contributions of the workshop were obtained through direct feedback from workshop participants' small group discussions. Topics and guiding questions are outlined in

TABLE 2: Personal care providers narrative findings—barriers, facilitators and education.

	Explanation of theme	Supporting quotes
Barrier themes		
Repulsion/fear	<i>Sometimes care providers are repulsed by certain aspects of oral care such as halitosis, or a resident spitting/coughing on them. Care staff are fearful of providing oral care for a variety of reasons (e.g., drop or break dentures, cause the resident to gag or aspirate, get bitten).</i>	<p>“So I had to clean them; oh it was gross. . . I don’t know how she even handled it but I guess it’d been like that and she had just gotten used to it.”</p> <p>“You have to be careful because if you want to stick your finger in or anything close they can bite you.”</p>
Resident disability/dementia/resistance	<i>Oral care provision is more complicated when a resident is disabled or has dementia. Often residents cannot express themselves when they are confused or suffering from oral pain or discomfort and this may be interpreted as resistant behaviour.</i>	<p>“If you have a [resident with] dementia that might have some of their own teeth and can’t tell you he’s a got a toothache, you know what he’s going to do. . . they’re going to act out. . . They become agitated and they can’t express it.”</p> <p>“Sometimes it’s hard to do oral care with people with dementia because they don’t want you around their mouth; they don’t know exactly what you’re doing.”</p> <p>“I mean somebody who’s got advanced dementia there’s no sense, just work with them and hope for the best.”</p>
Resident attitude/indifference	<i>Often residents appear to not care or are unaware of the importance of oral health. Many residents would not have gone to the dentist for regular check-ups throughout their lives and therefore oral care is not a priority for them.</i>	<p>“People years ago didn’t go to a dentist unless it really bothered them and they had an abscess and then they went to the family doctor and he gave them antibiotics and then he pulled the tooth out.”</p> <p>“A lot of residents just don’t want to be bothered [with oral care]. . . it’s just not something that’s important to them.”</p> <p>“I think he wouldn’t say a word if you didn’t get to his teeth.”</p>
Current oral health status of resident	<i>If a resident comes into a facility with poor oral health, it is more difficult to provide them with adequate oral care, especially if they have sensitivity, discomfort, or pain.</i>	<p>“[Resident Name] has very few teeth and has had over the years very poor mouth care, therefore he’s got infections in his gums and his teeth are rotten.”</p> <p>“Yes it makes you wonder if they have a bad history their whole life of bad mouth care. And that’s why their teeth are so bad, or is this decline just recent, like within the last five years or whatever.”</p>
Lack of time	<i>“Visible” activities (dressing, combing hair, washing, etc.) take priority when there is a time crunch (e.g., in the morning). Staff indicated that if they had more time, oral care would likely get more attention.</i>	<p>“If somebody’s in a hurry. . . It’s a wham, bam, thank you, ma’am, the teeth can be left.”</p> <p>“I think the people that have their own teeth probably don’t get the attention. Now as far as I’m concerned, they need more attention because they have their own teeth, but I think they’re the ones that get neglected because of the fact that it takes longer to do natural teeth than it does dentures.”</p>
Facilitator themes		
Resident ability	<i>It can be helpful when residents are aware of their oral care and remind staff to brush their teeth. Having the resident provide the cue often ensures their teeth will be done.</i>	<p>“We have two [residents] that will actually ask, will you brush my teeth?”</p> <p>“[Name of resident] is very insistent on having her teeth done after breakfast and before she goes to bed and her teeth are done faithfully.”</p>
Resident relationship with care provider	<i>Having a good relationship with a resident can make oral care provision easier. The care provider is familiar with likes/dislikes and routines and the resident is more comfortable around them.</i>	<p>“You know what [the residents] want. . . they sort of trust you. . . they feel, they don’t care if you see them without their teeth [in].”</p>

TABLE 2: Continued.

	Explanation of theme	Supporting quotes
Proper tools and products	<i>Oral care provision is easier when the necessary tools are available and on-hand. Using the proper tools for specific care needs is also important (e.g., denture brushes for dentures, child size toothbrushes for residents with small mouths).</i>	“Having everything there right where you can get it; you know your toothbrush, toothbrushes and things; just having it right close.” “I wish we had those little toothbrushes back... [they] curved like this, so every time you used them it would get right in around their gums and everything else; it brought a lot of stuff out.”
Education themes		
Oral health education	<i>Additional oral health care training may be beneficial for care providers who are currently in the workforce as well as family members or volunteers.</i>	“A lot of these [care providers] have been doing this for 25 years, they never took a course and were just grandfathered in... it’s really hard for you to get across to them that just because you’ve been doing that that way doesn’t mean you were doing it the right way. So a lot of people figure you’re making waves if you say something.” “Sometimes family members need to be educated; and just to be aware of what we’re trying to do like promote good oral care; sometimes they say “If mom or dad won’t open their mouth then don’t make them”. [Then] there’s nothing I can do.”
Education tools	<i>Tools suggested that would be helpful with oral health education and awareness (apart from formal education).</i>	“Well we have hand-washing posters all over the place, why not oral care posters?” “So if there was posters [about oral care] in each of the elders rooms, in their bathrooms, right by their sink then you’re there with the teeth or with the elder, you’re going to read it.” “If this could be one of the subjects that is brought up at every care conference, also, every time we do rounds. Now, rounds is for a wing, a whole wing in general, so if oral care could be brought up then and discussed, just like I said, keep it fresh, keep it going, keep it on everybody’s mind.”
Care provider training programs	<i>Care providers should receive standardized, in-depth training on oral care provision.</i>	“So that’s where the education has to come in—that everybody realizes what oral care is and what it entails.” “It’s always good when we have new young ones coming in because they’re fresh out of the course and they’ve learned from the book the right way; so I always like to see them coming in.”

Table 1. There was some overlap between topics but feedback was collated into the following summaries.

Education/Training Required to Strengthen the Delivery of Daily Oral Care. Education for residents may be important to heighten awareness regarding oral health. Strategies should be fun, with creative delivery. Laminated posters should be placed in residents’ washrooms. These posters would be used as a visual reminder and would include information on the importance of proper oral care, steps outlining proper care, and so on. They should be bright and colorful and include a number of pictures. A “train the trainers” approach would be appropriate to enhance sustainability of the action plan. This would involve training nursing staff or a designate who would take a leadership role in providing ongoing oral health care support for personal care providers and other relevant staff within the facilities.

Planning and Tracking Daily Oral Care Activities (Daily and Professional). There is a need to change the built environment to provide appropriate space for oral health (i.e., designated space for oral care). To adequately plan and track oral care activities within long-term care, specific tools and resources were suggested. (i) Oral health kits should be created for each resident including the necessary tools to complete oral care such as toothbrushes, denture brushes, toothpaste, mouth rinses, and a towel to protect dentures in sink. The products in kits would be individualized depending on resident’s oral care needs. (ii) Care cards should be developed and color coded according to tooth and denture status (i.e., natural teeth, dentures, partial dentures, no teeth) and would facilitate an individualized oral care plan for each resident. Cards could be used by care providers and, if residents go home for visits, by family members. (iii) A tool to enable personal care providers to conduct oral assessments as a part of providing oral care should be developed. The tool would

provide guidance for a visual exam of the mouth and a record of any problems. Care providers would need to be educated on what to look for and recognized as being the “eyes of oral care” within the facility. They need to be involved in decision making about what they will be asked/required to do. (iv) A strategy for including oral care in dysphagia assessment that is performed by the Dysphagia Team should be developed. This would allow for a more formalized system of information sharing. By documenting issues related to oral care, it will increase the likelihood that something will be done about it.

Special Support Needed to Manage Resistant Residents/Residents with Dementia. A multidisciplinary approach to care planning is necessary. There is a need to raise the profile of oral care for these residents and look at preexisting tools, daily report sheets, and white boards to improve communication regarding oral care. Whatever is done, it needs to be practical for frontline workers. Role-playing may help to put care providers in the residents’ shoes.

Access to Professional Dental Services. This is an issue that needs to involve everyone from frontline care staff, senior administration, to government. Funding for service is a key issue. Taking residents to a dentist requires funding for transportation in addition to the cost of service. Bringing a dentist to the residents requires funding for space, equipment, and costs of professional service. Ideally, hygienists could make regular visits to facilities. Oral care could be set up similar to foot care where a mobile unit makes site visits. Some mobile services exist but do not currently travel to the more rural areas. Good communication across silos of continuing care and professional dental services is required to improve resident care and potentially save money in the health care system. The value of professional dental care depends on the personal values of residents and their families. Participants recognized that access to professional dental services was an issue beyond the scope of the workshop and of the three facilities involved in the research.

3.4. Action Plan Implementation. The strategic action plan evolving from the workshop included each of the activities identified for action in the workshop. The plan emphasized targeted education and training for administrators, nursing staff, and daily personal care providers. The plan specified that oral health manuals should be developed for each site. The manuals would include education materials, pamphlets, and prepared forms to guide oral assessment, care planning, and intervention/referral documents, detailed work-plans, required oral hygiene products such as toothbrushes, toothpaste, denture care products, as well as individualized oral health toolkits for residents.

Proposed actions were implemented over a 12-month period. The site team liaison (or an appropriate designate) assumed responsibility for coordinating activities associated with the action plan. The research coordinator visited each of the three research sites at 6-week intervals to review progress, to provide support, and to gather data. Proposed

hands-on education workshops were provided by qualified research team members at the outset of action plan intervention and during regularly scheduled visits. The site team liaison assumed responsibility for overseeing the care and reinforcing the skills with individual care providers as needed. Relevant research team members and the research coordinator provided ongoing support.

3.5. Evaluation of the Oral Care Action Plan. To ensure that proposed methods of collecting data to evaluate the action plan activities were relevant and acceptable, the draft evaluation framework was reviewed and refined by the research team based on feedback at the action-planning workshop (Table 3). According to Thorne et al. [42], success in oral health programs in long-term care is contingent upon effective programmatic strategies (e.g., routine oral hygiene, oral assessment, availability of professional dental services) as well as the organizational culture influencing them (e.g., administrative capacity to support and control a caring environment, the presence of “champions”, organizational values) [42]. Recalling that the unit of analysis for this case study was institutional, the evaluation plan was designed to examine the institutional context and to consider both organizational culture and the programmatic strategies arising from the oral care action plan.

4. Conclusions

This paper highlights a variety of important considerations for developing meaningful collaborative and applied intervention research. A defining feature of the “Brushing Up on Mouth Care” project has been an enduring and positive collaboration with end-users. This has required careful attention to ongoing communication. It has also necessitated that frequent project updates and face-to-face meetings are balanced with ensuring that end-users do not become “burned out”. Prior to the launch of this project, the collaboration (members of both the research and project site teams) invested time in getting to know each other and in coming to a common understanding of where the research should go. These early communications created a level of comfort and familiarity enabling all voices to be heard and respected. At the outset, this led to the development of realistic research goals about what could be achieved. It also laid the groundwork for the exploratory and planning phases of the project.

The document scan, focus groups, and interviews all contributed to our understanding of the institutional context and organizational culture influencing the delivery of mouth care. This directly informed the action plan that followed. The document scan revealed significant gaps in policy, education, and clinical standards available to guide oral care in long-term care. Our understanding of influences on the delivery of oral care was further informed through the workshop group discussions involving a broader stakeholder group. Here, mechanisms for addressing gaps were also identified and have become integrated into considerations for our ongoing work. One specific example has been the uptake of

TABLE 3: Evaluation Framework.

Outcome variables	Data source	Proposed metrics/indicators
Programmatic strategies		
Integration of individualized oral care plan	Focus group and key informant narratives Administrator diary studies Document review (e.g., policy)	Thematic analysis Proportion of residents in whom oral care is discussed during care planning meetings
Oral assessments	Oral care activities records	Summary data
Professional dental care	Oral care activities records	Use of referral systems (e.g., to dentist)
Daily mouth care protocol	Focus group and interview narratives Diary studies Oral care activity records	Thematic analysis Oral care product use
Material indicators of program uptake	Dental supply inventory Dental supply orders	Summary data
Nonmaterial indicators of program uptake (e.g., time allotment formal and informal practices)	Focus group and key informant narratives Diary studies Document review	Thematic analysis
Organizational culture		
Behavior/attitudes of staff toward delivery of oral care	Focus group and key informant narratives AWS Care provider and administrator diary studies	Thematic analysis Mean change in AWS scores
Satisfaction/acceptability of staff/residents/families	Focus group narratives and interviews	Pre/postintervention comparison of themes and patterns
Staff knowledge of oral health	Posteducation knowledge uptake questionnaires	Attendance at orientation and education in-service Pre/posteducation knowledge (scores)
Organizational values	Key informant narratives Document review	Pre/postcomparison of themes and patterns

the “Brushing Up on Mouth Care” action plan by local community colleges responsible for training relevant entry-level care staff. Engagement with government policy makers, directors of care, educators, health administrators, and a broad spectrum of health professionals has also been fruitful in creating awareness about the need for relevant policy as well as guidelines that consider the interdisciplinary nature of this realm of care. Finally, the creation of an oral care action plan that is suitable and applicable to end-users is benefiting both care staff and those who depend on them for care.

References

- [1] D. C. Matthews, J. B. Clovis, M. G. S. Brillant et al., “Oral health status of long-term care residents—a vulnerable population,” *Journal of the Canadian Dental Association*, vol. 78, article c3, 2012.
- [2] P. E. Petersen and T. Yamamoto, “Improving the oral health of older people: the approach of the WHO Global Oral Health Programme,” *Community Dentistry and Oral Epidemiology*, vol. 33, no. 2, pp. 81–92, 2005.
- [3] R. J. Hawkins, “Oral health status and treatment needs of Canadian adults aged 85 years and over,” *Special Care in Dentistry*, vol. 18, no. 4, pp. 164–169, 1998.
- [4] C. C. L. Wyatt, F. H. C. So, P. M. Williams, A. Mithani, C. M. Zed, and E. H. K. Yen, “The development, implementation, utilization and outcomes of a comprehensive dental program for older adults residing in long-term care facilities,” *Journal of the Canadian Dental Association*, vol. 72, no. 5, p. 419, 2006.
- [5] J. Fitzpatrick, “Oral health care needs of dependent older people: responsibilities of nurses and care staff,” *Journal of Advanced Nursing*, vol. 32, no. 6, pp. 1325–1332, 2000.
- [6] M. I. MacEntee, “Oral care for successful aging in long-term care,” *Journal of Public Health Dentistry*, vol. 60, no. 4, pp. 326–329, 2000.
- [7] C. C. Wyatt, “Elderly Canadians residing in long-term care hospitals: part II. Dental caries status,” *Journal of the Canadian Dental Association*, vol. 68, no. 6, pp. 359–363, 2002.
- [8] P. Coleman, “Opportunities for nursing-dental collaboration: addressing oral health needs among the elderly,” *Nursing Outlook*, vol. 53, no. 1, pp. 33–39, 2005.
- [9] M. I. MacEntee, “Missing links in oral health care for frail elderly people,” *Journal of the Canadian Dental Association*, vol. 72, no. 5, pp. 421–425, 2006.
- [10] C. C. Wyatt, “Elderly Canadians residing in long-term care hospitals: part I. Medical and dental status,” *Journal of the Canadian Dental Association*, vol. 68, no. 6, pp. 353–358, 2002.
- [11] S. Awano, T. Ansai, Y. Takata et al., “Oral health and mortality risk from pneumonia in the elderly,” *Journal of Dental Research*, vol. 87, no. 4, pp. 334–339, 2008.

- [12] T. Yoneyama, M. Yoshida, T. Ohruji et al., "Oral care reduces pneumonia in older patients in nursing homes," *Journal of the American Geriatrics Society*, vol. 50, no. 3, pp. 430–433, 2002.
- [13] S. G. Grossi and R. J. Genco, "Periodontal disease and diabetes mellitus: a two-way relationship," *Annals of Periodontology*, vol. 3, no. 1, pp. 51–61, 1998.
- [14] T. Nakajima and K. Yamazaki, "Periodontal disease and risk of atherosclerotic coronary heart disease," *Odontology*, vol. 97, no. 2, pp. 84–91, 2009.
- [15] G. E. Sandberg, H. E. Sundberg, C. A. Fjellstrom, and K. F. Wikblad, "Type 2 diabetes and oral health: a comparison between diabetic and non-diabetic subjects," *Diabetes Research and Clinical Practice*, vol. 50, no. 1, pp. 27–34, 2000.
- [16] J. E. Stewart, K. A. Wager, A. H. Friedlander, and H. H. Zadeh, "The effect of periodontal treatment on glycemic control in patients with type 2 diabetes mellitus," *Journal of Clinical Periodontology*, vol. 28, no. 4, pp. 306–310, 2001.
- [17] K. Joshipura, "The relationship between oral conditions and ischemic stroke and peripheral vascular disease," *The Journal of the American Dental Association*, vol. 133, pp. 235–305, 2002.
- [18] J. M. Chalmers, K. D. Carter, and A. J. Spencer, "Caries incidence and increments in community-living older adults with and without dementia," *Gerodontology*, vol. 19, no. 2, pp. 80–94, 2002.
- [19] D. Kandelman, P. E. Petersen, and H. Ueda, "Oral health, general health, and quality of life in older people," *Special Care in Dentistry*, vol. 28, no. 6, pp. 224–236, 2008.
- [20] P. Mojon, E. Budtz-Jørgensen, and C. H. Rapin, "Relationship between oral health and nutrition in very old people," *Age and Ageing*, vol. 28, no. 5, pp. 463–468, 1999.
- [21] D. H. Sullivan, W. Martin, N. Flaxman, and J. E. Hagen, "Oral health problems and involuntary weight loss in a population of frail elderly," *Journal of the American Geriatrics Society*, vol. 41, no. 7, pp. 725–731, 1993.
- [22] M. I. Macentee, R. Hole, and E. Stolar, "The significance of the mouth in old age," *Social Science and Medicine*, vol. 45, no. 9, pp. 1449–1458, 1997.
- [23] C. C. L. Wyatt, "A 5-year follow-up of older adults residing in long-term care facilities: utilisation of a comprehensive dental programme," *Gerodontology*, vol. 26, no. 4, pp. 282–290, 2009.
- [24] J. Woo, S. C. Ho, A. L. M. Yu, and J. Lau, "An estimate of long-term care needs and identification of risk factors for institutionalization among Hong Kong Chinese aged 70 years and over," *Journals of Gerontology*, vol. 55, no. 2, pp. M64–M69, 2000.
- [25] M. P. Sweeney, C. Williams, C. Kennedy, L. M. D. Macpherson, S. Turner, and J. Bagg, "Oral health care and status of elderly care home residents in Glasgow," *Community Dental Health*, vol. 24, no. 1, pp. 37–42, 2007.
- [26] J. M. Chalmers, K. D. Carter, and A. J. Spencer, "Oral diseases and conditions in community-living older adults with and without dementia," *Special Care in Dentistry*, vol. 23, no. 1, pp. 7–17, 2003.
- [27] B. Hijji, "Trained nurses' knowledge and practice of oral care on three wards in acute care hospital in Abu Dhabi, UAE," *Online Brazilian Journal of Nursing*, vol. 2, no. 3, 2003.
- [28] J. M. Chalmers, S. M. Levy, K. C. Buckwalter, R. L. Ettinger, and P. P. Kambhu, "Factors influencing nurses' aides' provision of oral care for nursing facility residents," *Special Care in Dentistry*, vol. 16, no. 2, pp. 71–79, 1996.
- [29] L. A. Furr, C. J. Binkley, C. McCurren, and R. Carrico, "Factors affecting quality of oral care in intensive care units," *Journal of Advanced Nursing*, vol. 48, no. 5, pp. 454–462, 2004.
- [30] R. A. Jablonski, C. L. Munro, M. J. Grap, C. M. Schubert, M. Ligon, and P. Spigelmyer, "Mouth care in nursing homes: knowledge, beliefs, and practices of nursing assistants," *Geriatric Nursing*, vol. 30, no. 2, pp. 99–107, 2009.
- [31] P. Coleman and N. M. Watson, "Oral care provided by certified nursing assistants in nursing homes," *Journal of the American Geriatrics Society*, vol. 54, no. 1, pp. 138–143, 2006.
- [32] P. Glassman and C. E. Miller, "Effect of preventive dentistry training program for caregivers in community facilities on caregiver and client behavior and client oral hygiene," *The New York State Dental Journal*, vol. 72, no. 2, pp. 38–46, 2006.
- [33] M. E. Kaz and L. Schuchman, "Oral health care attitudes of nursing assistants in long-term care facilities," *Special Care in Dentistry*, vol. 8, no. 5, pp. 228–231, 1988.
- [34] S. Dharamsi, K. Jivani, C. Dean, and C. Wyatt, "Oral care for frail elders: knowledge, attitudes, and practices of long-term care staff," *Journal of Dental Education*, vol. 73, no. 5, pp. 581–588, 2009.
- [35] I. Wårdh, L. Andersson, and S. Sörensen, "Staff attitudes to oral health care. A comparative study of registered nurses, nursing assistants and home care aides," *Gerodontology*, vol. 14, no. 1, pp. 28–32, 1997.
- [36] D. R. Eadie and L. Schou, "An exploratory study of barriers to promoting oral hygiene through carers of elderly people," *Community Dental Health*, vol. 9, no. 4, pp. 343–348, 1992.
- [37] K. Kite, "Changing mouth care practice in intensive care: implications of the clinical setting context," *Intensive and Critical Care Nursing*, vol. 11, no. 4, pp. 203–209, 1995.
- [38] H. Frenkel, I. Harvey, and K. Needs, "Oral health care education and its effect on caregivers' knowledge and attitudes: a randomised controlled trial," *Community Dentistry and Oral Epidemiology*, vol. 30, no. 2, pp. 91–100, 2002.
- [39] H. Frenkel, I. Harvey, and R. G. Newcombe, "Improving oral health in institutionalised elderly people by educating caregivers: a randomised controlled trial," *Community Dentistry and Oral Epidemiology*, vol. 29, no. 4, pp. 289–297, 2001.
- [40] M. I. MacEntee, C. C. L. Wyatt, B. L. Beattie et al., "Provision of mouth-care in long-term care facilities: an educational trial," *Community Dentistry and Oral Epidemiology*, vol. 35, no. 1, pp. 25–34, 2007.
- [41] M. I. MacEntee, "Conflicting priorities: oral health in long-term care," *Special Care in Dentistry*, vol. 19, no. 4, pp. 164–172, 1999.
- [42] S. E. Thorne, A. Kazanjian, and M. I. MacEntee, "Oral health in long-term care the implications of organizational culture," *Journal of Aging Studies*, vol. 15, no. 3, pp. 271–283, 2001.
- [43] R. D. Lasker, E. S. Weiss, and R. Miller, "Partnership synergy: a practical framework for studying and strengthening the collaborative advantage," *Milbank Quarterly*, vol. 79, no. 2, pp. 179–205, 2001.
- [44] V. J. Shannon, "Partnerships: the foundation for future success," *Canadian Journal of Nursing Administration*, vol. 11, no. 3, pp. 61–76, 1998.
- [45] Government of Nova Scotia Continuing Care Branch, "Nursing homes and homes for the aged: accurate bed count as of December, 2011," Department of Health, Nova Scotia, Canada, 2001, http://www.gov.ns.ca/health/ccs/pubs/approved_facilities/Dir_approved_facilities_NH.pdf.
- [46] L. M. Franco, S. Bennett, and R. Kanfer, "Health sector reform and public sector health worker motivation: a conceptual framework," *Social Science and Medicine*, vol. 54, no. 8, pp. 1255–1266, 2002.

- [47] J. E. Gangeness and E. Yurkovich, "Revisiting case study as a nursing research design," *Nurse Researcher*, vol. 13, no. 4, pp. 7–18, 2006.
- [48] R. Yin, *Case Study Research: Design and Methods*, Sage Publications, Thousand Oaks, Calif, USA, 2003.
- [49] C. Braden and N. Herban, *Community Health: A Systems Approach*, Appleton-Century-Crofts, New York, NY, USA, 1976.
- [50] I. Hodder, "The interpretation of documents and material culture," in *Handbook of Qualitative Research*, N. Denzin and Y. Lincoln, Eds., pp. 703–715, Sage Publications, Thousand Oaks, Calif, USA, 2000.
- [51] F. A. Miller and K. Alvarado, "Incorporating documents into qualitative nursing research," *Journal of Nursing Scholarship*, vol. 37, no. 4, pp. 348–353, 2005.
- [52] J. Gubrium and J. Holstein, *The New Language of Qualitative Method*, Oxford University Press, New York, NY, USA, 1997.
- [53] P. Mukerji, *Methodology in Social Research: Dilemmas and Perspectives, Essays in Honour of Ramkrishna Mukerjee*, Sage Publications, Thousand Oaks, Calif, USA, 2003.
- [54] M. Lubrosky, "The identification and analysis of themes and patterns," in *Qualitative Methods in Aging Research*, J. Gubrium and A. Sankar, Eds., pp. 189–210, Sage Publications, Thousand Oaks, Calif, USA, 1994.
- [55] P. Ulin, E. Robinson, and E. Tolley, *Qualitative Methods in Public Health: A Field Guide for Applied Research*, Wiley/Jossey-Bass, San Francisco, Calif, USA, 2004.
- [56] Registered Nurses' Association of Ontario, Oral health: nursing assessment and interventions best practice guidelines, Registered Nurses' Association of Ontario, 2008.
- [57] C. C. L. Wyatt and M. I. MacEntee, *Daily Oral Care for Persons in Residential Care*, Geriatric Dentistry Program Manual, The University of British Columbia, Vancouver, Canada, 2nd edition, 2007.
- [58] A. Delbecq and A. Van de Ven, "A group process model for problem identification and program planning," *Journal of Applied Behavioral Science*, vol. 7, no. 4, pp. 466–492, 1971.
- [59] Government of Nova Scotia, *Evidence Based Wound Management Protocol*, Department of Health—Community Care, Nova Scotia, Canada, 2000.
- [60] F. Gottrup, "Optimizing wound treatment through health care structuring and professional education," *Wound Repair and Regeneration*, vol. 12, no. 2, pp. 129–133, 2004.
- [61] D. P. Rice, H. M. Fillit, W. Max, D. S. Knopman, J. R. Lloyd, and S. Duttagupta, "Prevalence, costs, and treatment of Alzheimer's disease and related dementia: a managed care perspective," *American Journal of Managed Care*, vol. 7, no. 8, pp. 809–818, 2001.

Review Article

Is There Anything to Smile about? A Review of Oral Care for Individuals with Intellectual and Developmental Disabilities

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Individuals with intellectual and developmental disabilities (I/DD) are at risk for dental disease and face substantial challenges in accessing both routine and preventive dental services. In terms of unmet needs it ranks third, following residential services and employment opportunities for this particular group of people. Poorer oral health status negatively impacts overall health and one's quality of life. Factors contributing to this problem include significantly higher rates of dental caries, periodontal disease, poor oral hygiene, low expectations, fear of treatment, and lack of awareness among individuals and carers. Additional factors include problems accessing dental care or denial of services because of inadequate education and clinical training, inappropriate bias, or inadequate levels of compensation to providers. Strategies to improve service delivery include individualized and coordinated care services, education of individuals, carers, and providers, including both classroom and clinical experiences with special needs patients in dental programs.

1. Introduction

In 1961, President John F. Kennedy created this nation's first *President's Panel on Mental Retardation*. Like others with a family member with intellectual and developmental disabilities (I/DD) he was advocating for education, employment, community living, and engagement as well as research into the causes and prevention of I/DD. Ninety-five recommendations were put forth from this panel addressing issues from scientific research, civil rights, normalization, improved community services, and downsizing of institutional facilities [1]. Forty years later, Surgeon General David Satcher called on the experts including those with I/DD and their families, to identify and address the continued and multiple unmet health needs and disparities in health care experienced by individuals with I/DD. In their report titled *Closing the Gap: A National Blueprint to Improve the Health of Persons with Mental Retardation*, the following six goals highlighted the needs to (1) integrate health promotion into community environments of people with mental retardation, (2) increase knowledge and understanding for

health and mental retardation, ensuring that knowledge is made practical and easy to use, (3) improve the quality of health care for people with mental retardation, (4) train health care providers in the care of adults and children with mental retardation, (5) ensure that health care financing produces good health outcomes for adults and children with mental retardation, and (6) increase sources of health care services for adults, adolescents, and children with mental retardation, ensuring that health care is easily accessible for them [2].

Dramatic changes have occurred for individuals with I/DD since President Kennedy's call to action, including increases in life expectancy and shifts from living in institutions to living with family or in small community-based residences versus large state institutions [3, 4]. While some gains have been realized, individuals with I/DD continue to experience significant socioeconomic disadvantages and disparities in health care service delivery [1, 2, 4, 5]. Consequently, individuals with I/DD continue to experience significant unmet medical needs in general and significant unmet dental needs [6, 7] which is the focus of this paper.

2. Defining Intellectual and Developmental Disability

Terminology has changed as well, and intellectual disability is now the preferred term to describe individuals with limitations in intellectual functioning and adaptive behavior [8, 9]. Hopefully this change can lessen the stigma attached to the previous term of *mental retardation*. Intellectual disability is considered a subset of persons who have developmental disabilities, defined as impaired cognitive functioning with onset during the developmental period from birth to age 22 [4]. Developmental disabilities cause functional limitations in three or more areas of life such as self-care, receptive and expressive language, learning, mobility, capacity for independent living, and economic self-sufficiency [4].

3. Prevalence

According to the Centers for Disease Control, a total of 10 million Americans live with a developmental disability [10]. Analysis of data from the National Health Interview Surveys over 12 years (1997–2008), revealed an increase in the prevalence of any developmental disability from 12.84% to 15.04%, and a higher prevalence in boys compared to girls. For the years 2006 to 2008, one in six children reported a developmental disability. The prevalence for any developmental disability was 13.87% in this ongoing nationally representative sample. Attention Deficit Hyperactivity Disorder (6.69%) and autism (0.47%) showed significant and successive increases from 1997 to 2008, which researchers linked to the national campaigns to increase awareness of autism. Collinearity existed between learning disability (7.66%) and intellectual disability (0.71%); thus, learning disabilities were reported as a consequence of the intellectual disability versus a co-occurring condition. The researchers conclude that additional health, educational, and social support services would be needed to address these growing trends [11].

A developmental disability requires a combination of interdisciplinary, generic care, treatment, and coordinated services to meet the individual's needs [12]. Some examples of developmental disabilities include autism, cerebral palsy, Down syndrome, epilepsy, blindness, deafness, and intellectual disability, and each can present with varying symptoms and severity. In addition developmental disabilities are characterized by significant limitations in three or more of the following areas: self-care, language, learning, mobility, and the capacity for independent living [12]. Intellectual disability, the focus of this paper, is identified by the age of 18 and characterized by limitation in intellectual functioning or cognition, that is, IQs of less than 70 which can influence one's learning ability, reasoning, and problem-solving skills [13].

The number of people with I/DD is increasing because of population growth, better reporting, increased longevity, and the aging of this population, along with more accurate and sensitive methods of detection and diagnosis [14, 15]. These factors will result in an increased demand for all services

including health, community (housing, employment, social supports), and dental care services [5, 7, 16].

While individuals with I/DD deserve to have good oral health like anyone else, only pediatric dentistry includes individuals with special health care needs in its definition [5]. Dental care is one of the most common unmet health care needs for individuals with special needs [16]. Pediatric individuals with I/DD are often categorized as "special needs" with approximately 13% of Americans from birth to the age of 18 meeting the definition of a special needs child [17]. Reportedly, special needs children that begin care with a pediatric dentist never leave the practice, as dental care resources are limited for adults with I/DD [17].

American dental schools offer approximately 580 post-doctoral programs in two categories: General Practice and Advanced Education in General Dentistry. These programs typically include 1-2 years of residency training [18]. Special Care Dentistry Programs are more recent in the field of dental practice and are intended to fill the gap in adult dental care for medically complex and special needs patients [16]. In 2006, the Commission on Dental Accreditation in the US adopted standards specifying that dental school graduates be competent in assessing treatment needs of patients with special needs [19]. Thus, all undergraduate programs must provide such education in their core curriculum. A debate as to the need for such a specialty is presented in "A Special Care Dentistry Specialty: Sounds Good, But..." [20]. These dentists argue that the need for services for those with I/DD will continue to increase and changes in educational requirements in dental schools should better prepare graduates for formal care. They suggest the reluctance to provide services among current providers may continue and is coupled with inadequate third-party coverage along with added chair time and provider effort. The authors portend that, along with other clinical dental specialties, the burden of providing the major component of care remains with the general practitioner [20].

4. Review

The Global Oral Health Database and PUBMED were searched for the years 2001–2011 using the following keywords: intellectual disabilities, mental retardation, developmental disabilities, special needs, oral health, dental disease, prophylactic oral health care, and access to dental services. Forty papers were selected from the 524 abstracts reviewed, as they were in English, included research studies, clinical reviews, case studies, papers on best practice projects, and special needs curriculum in dental education. A series of six NIH continuing education booklets on oral care were reviewed which focused on autism, cerebral palsy, Down syndrome (DS), intellectual disability, developmental disability (DD), and physical disabilities. Federal guidelines including Healthy People 2020, and two Surgeon General Reports (Oral Health in America: A Report of the Surgeon General and Closing the Gap: A National Blueprint to Improve the Health of Persons with Mental Retardation) [2, 21–23], were also included in this paper.

5. Unmet Need for Dental Care and Services

Individuals with intellectual and developmental disabilities (I/DD) are at risk for dental disease and face substantial challenges in accessing both routine and preventative dental services. In terms of unmet needs it ranks third, following residential services and employment opportunities for this particular group of people. The oral health status of individuals with I/DD remains a significant area of concern with negative impacts on one's overall health and one's quality of life [5, 16, 22].

A myriad of issues contribute to poor oral health conditions and outcomes, although national studies to determine the actual prevalence of oral health disease among individuals with I/DD are lacking [20]. Periodontal disease, for example, is a serious and morbid oral condition among people with Down syndrome, with gingivitis and periodontitis beginning early and increasing in severity with age. These factors contribute to tooth loss among individuals with DS [24, 25]. According to the Surgeon General's Report on Oral Health in America, individuals with I/DD have significantly higher rates of dental caries, periodontal disease, and poor oral hygiene [22]. In addition, community-based residential facilities report inadequate access to dental care services as a significant issue. Data from the 2001 National Survey of Children with Special Health Care Needs was examined to explore the relationship between the receipt of routine medical and dental care among special needs children. An estimated 76% of parents reported the need for dental services in the prior 12 months, and of these 13% did not receive care. The researchers identified a link with lower income and failure to obtain routine medical care as a risk for failure to obtain dental care [26]. While access to dental care services presents its own challenges, individuals with I/DD vary considerably in their abilities to cooperate in the dental setting and treatment is usually more difficult when services are obtained. Physical or cognitive challenges may make performance and participation in oral hygiene difficult, including various behaviors like biting down on the toothbrush, refusing to open wide, or at all [16, 25, 27, 28]. It is also possible that their carers may have difficulty understanding or lack the physical ability to perform personal oral health preventive practices. In addition, some oral problems are exacerbated by associated medical problems or side effects of medication or can be caused by the disability itself [5, 6, 16].

Studies indicate that a number of individual/carer/professional and service barriers exist and contribute to oral health problems in this population. These can include an increased risk of dental disease, low expectations, fear of treatment, and a lack of awareness among individuals and carers [5, 7, 20, 29]. An additional barrier, reported by carers, was the social impact of the disability which means the carers were not sure how the individual would behave in public or at the dentist's office, and this presented an additional barrier to seeking dental care and services [16]. Other factors include problems accessing dental care or denial of services because of inadequate education and clinical training, inadequate levels of compensation to providers, and inappropriate bias.

This bias in particular may suggest that oral health is a low priority for this particular group in the context of other social and medical challenges [7, 30].

6. Greater Risk and Greater Disease Burden

Individuals with special needs have more dental disease, untreated caries, and missing teeth, and there is inadequate attention to preventing dental disease in this population [29]. Those with I/DD require greater attention to oral hygiene, and if this is neglected mucosal changes, dental disease, tooth loss, and difficulties in eating and speaking can follow [31]. Inherent risks for those with Down syndrome also include a tendency for mouth breathing which can impact saliva production, as decreased salivary secretion (Xerostomia) can contribute to oral mucosal changes, increased caries, difficulty swallowing, and chronic burning mouth syndrome [25, 31]. For individuals with cerebral palsy dental abrasion from gastroesophageal reflux is not uncommon [32]. In addition, individuals with I/DD are frequently prescribed medicine in syrup form, which can be high in sugar, exposing the teeth to increased risk of caries [5, 32]. According to reviews of dental practices, the pain, suffering, and stigma experienced by special needs clients is beyond that found in other segments of society and is often the result of ignorance, fear, stigma, misconceptions, and negative attitudes [6, 33].

Dental disease for individuals with special needs is not peculiar to the US. Studies show that dental caries are the most prevalent disease among individuals with I/DD worldwide, and "dental treatment is the greatest unattended health need of the disabled" [34]. In the UK over 200,000 adults have profound learning disabilities and/or complex medical conditions with poorer oral health, poorer health outcomes, and poorer access to services compared to the rest of their population [35]. In a study of 112 individuals with DS in Kuwait, higher plaque scores and gingival irritation were found on initial screening which decreased after 3 months of a supervised brushing program in their school [36]. Poor oral health including signs of gingivitis and untreated caries were found by dentists on screenings of 1,286 Special Olympics athletes in Nigeria [37]. Sociodemographic and clinical variables were compared in 225 individuals with I/DD in India. Researchers concluded that the major factors contributing to poor oral health were age, that is, the oldest age group had poorer oral health; having Down syndrome and carers with low educational levels [34]. Irish researchers were concerned in their longitudinal study of 753 individuals with I/DD over the age of 40, that 16.5% of those studied had no teeth or dentures, and those with severe disability were twice as likely to have their teeth removed [15].

Here, in the US, a three-group comparison study of periodontal status at three sites in Atlanta, of a Down's syndrome group ($N = 55$), and a non-Down ID group ($N = 74$) showed more missing teeth, caries, bleeding on exam, and higher gingival plaque as compared to the control group of 88 subjects [24]. Significant oral health disparities were found when 3 groups of North Carolinians were compared including 946 adults with I/DD, 1,598 adults with disability,

and 4,358 nondisabled adults. Individuals with developmental disabilities were more likely than those with no disability to have never had their teeth cleaned or not to have had their teeth cleaned in the past five years. The researchers point out that this is an especially striking finding given that the nondisabled population group did not score high on those measures [37]. Unfortunately, as these studies suggest, the risk and need for routine and preventive dental services is greater in the I/DD population, while a significant oral health disparity exists when compared to the general population. Clearly those with I/DD could benefit from specific preventative oral health programs and routine screening for dental disease.

7. Access Issues: Lack of Education, Reimbursement, Stigma

Numerous reports cite lack of access to dental care and services as a critical problem for those with special needs [6, 16, 26]. Since the mid-1970s approximately two-thirds of individuals previously living in institutions were moved into the community. Researchers point out that access to dental care services was exacerbated by this deinstitutionalization movement, as once available services became unavailable in the new community locations [16, 27]. Further complicating the issue was the lack of dental providers trained to address the special needs of this population coupled with reimbursement or limited third-party support for complex services [16, 20, 29].

The American Dental Association [18, 38] identified that the issue of limited access for those with I/DD to oral health care begins in dental schools which are providing minimal didactic and clinical experience in caring for special needs individuals. This they report causes dentists to be hesitant to treat these patients and practitioners are not prepared to provide needed services. A study of 295 third- and fourth-year dental students from five US programs reported receiving 5 hours or less of instruction devoted to caring for individuals with I/DD (68%), with 51% reporting no clinical training in this area at all [18, 38]. Dental student comfort level in treating vulnerable populations was assessed in a sample of 690 graduates from 1992 to 2004. In general, students reported that prior experience in school with this group had a positive impact on their comfort level in treating individuals with special needs [39]. Clearly, education and clinical experience in dental schools of individuals with intellectual and developmental disability should be addressed, especially given the increased need of this vulnerable population.

A survey of 22 US and Canadian dental schools, for example, revealed that separate courses on special needs was offered in only 64% of programs, while clinical experience varied; that is, only 37% of the programs had a designated clinical area where their students could learn about special needs patients. The study concludes that if oral health disparities and access issues are to be addressed for this particular group, future research needs to focus on developing best practices in educational efforts and dental programs [32]. A review of clinical services in the UK also supports the need

for special programs and the need to develop a specialized workforce to serve the needs of the most vulnerable sectors of the community currently being provided by a relatively small number of socially committed dentists [27].

Clearly people with I/DD have difficulty obtaining dental care, and even some believe that dental practices in the US actively discriminate against people with disabilities, likely because they have a disability that makes the health care professional uncomfortable [27, 32].

8. Oral Hygiene

Oral hygiene is often neglected in individuals with I/DD and obtaining access to good dental care is difficult [4, 16, 32]. A 3-year longitudinal study assessed risk factors and the oral health of 189 Japanese individuals with DS living in a nursing home. Study findings suggest that the most important factor for caries and tooth extraction prevention related to oral care practices versus the level of disability. This study also pointed out limitations to good oral hygiene practices including grimacing and spasticity of oral musculature, and difficulty using fluoride toothpaste if the individuals could not be taught to properly rinse out after brushing with fluoride [40]. Gagging when using a toothbrush is also a possibility, making the achievement of good oral hygiene difficult [5].

A study of the oral health of over 1,000 Special Olympians in the UK identified the vulnerability of the older participants to dental problems. Gum inflammation was a common finding, and this study pointed to difficulty in maintaining surveillance as individuals' age or their informal carers become less able or available to oversee oral hygiene [41]. The National Institute of Dental and Craniofacial Research has developed a series of informational guidelines on practical oral care to assist both the professional and carers for individuals with I/DD [21].

9. Compensation Issues for Services

Those with disabilities, account for a disproportionately large share of health care expenditures in every age group. Individuals with I/DD are much more likely to depend on public programs like Medicare or Medicaid to pay for health care, with an estimated 75% of individuals with developmental disabilities relying on government funding for medical and dental services [16]. Approximately 80% of those without disability are covered by private health insurance; only 44% of those with severe disability have private insurance, with approximately 40% having government insurance only and 17% with no insurance at all [16]. Needless to say, having insurance is significantly associated with more physician contacts, which has been associated with dental visits for individuals with disabilities [26].

10. Strategies for Improved Oral Health

Review articles like this can raise awareness to the need for better education of providers, carers, and individuals to the need for oral hygiene, routine, and preventative dental care

[22]. In a qualitative study of 10 carers representing 4 individuals with I/DD in Australia, positive outcomes were noted when promoting specific oral health and environmental considerations in the dental arena were considered. These included providing choice when possible, time, teaching skills, and communicating directly with the individual [42]. Best practice criteria were reviewed in all 50 states to assess how the Healthy People 2020 objectives were being met or how the practices were responding to the Surgeon General's report on oral health. The special needs practice approach is still in development but includes preparing the dental workforce, making the financing system more responsive, organizing community resources to increase accessibility and empowering individuals' parents and caregivers, and promoting advocacy [6].

Research points to poorer oral health, more treatment needs and suggest that individuals with I/DD would benefit from frequent oral health assessments. Parents and carers need to be educated on the need to supervise tooth brushing irrespective of age, especially given that oral hygiene was shown to decrease or become poorer with age [43]. Parents and carers indicated that they needed appropriate and timely oral health information early in their child's life, along with access to sympathetic dentists who were good communicators and were well informed about I/DD [20].

While poor dental care may or may not affect mortality, it certainly affects morbidity and adds to the poor health burden of those already suffering from an array of health concerns. Better oral hygiene and dental care would lead to an improved quality of life for those with intellectual and developmental disabilities. Let us give them something to smile about!

References

- [1] J. C. Harris, *Intellectual Disability: Understanding Its Development, Causes, Classification, Evaluation, and Treatment*, Oxford University Press, New York, NY, USA, 2006.
- [2] US Department of Health and Human Services, *Report of the Surgeon General's Conference on Health Disparities and Mental Retardation. Closing the Gap: A National Blueprint to Improve the Health of Persons with Mental Retardation*, Office of the Surgeon General, Rockville, Md, USA, 2002.
- [3] US Census Bureau, *Review of Changes to the Measurement of Disability in the 2008 American Community Survey*, Washington, DC, USA.
- [4] C. D. Prater and R. G. Zylstra, "Medical care of adults with mental retardation," *American Family Physician*, vol. 73, no. 12, pp. 2175–2183, 2006.
- [5] J Pearlman and E. Sterling, "Dentistry," in *Medical Care for Children and Adults with Developmental Disabilities*, I. Rubin and A. Crocker, Eds., Brookes Publishing, Baltimore, Md, USA, 2nd edition, 2006.
- [6] J. Balzer, "Improving systems of care for people with special needs: the ASTDD best practices project," *Pediatric Dentistry*, vol. 29, no. 2, pp. 123–128, 2007.
- [7] H. B. Waldman and S. P. Perlman, "Why is providing dental care to people with mental retardation and other developmental disabilities such a low priority?" *Public Health Reports*, vol. 117, no. 5, pp. 435–439, 2002.
- [8] R. L. Schalock, R. A. Luckasson, K. A. Shogren et al., "The renaming of mental retardation: understanding the change to the term intellectual disability," *Intellectual and Developmental Disabilities*, vol. 45, no. 2, pp. 116–124, 2007.
- [9] R. L. Schalock, S. A. Borthwick-Duffy, W. H. E. Buntinx, D. L. Coulter, and E. M. Craig, *Intellectual Disability: Definition, Classification, and Systems of Supports*, American Association on Intellectual and Developmental Disabilities, Washington, DC, USA, 11th edition, 2010.
- [10] IDDDA, "Centers for Disease Control reports a 17 percent overall increase in the prevalence of developmental disability among children in the United States between 1997–2008," *Monthly Newsletter*, vol. 11, no. 6, 2011, <http://www.aamr.org/FYI/>.
- [11] C. A. Boyle, S. Boulet, L. A. Schieve et al., "Trends in the prevalence of developmental disabilities in US children, 1997–2008," *Pediatrics*, vol. 127, no. 6, pp. 1034–1042, 2011.
- [12] I. L. Rubin and A. C. Crocker, *Medical Care for Children and Adults with Developmental Disabilities*, Brookes Publishing, Baltimore, Md, USA, 2nd edition, 2006.
- [13] American Psychiatric Association, *Diagnostic and Statistical Manual of Mental Disorders*, Washington, DC, USA, 4th edition, 2000.
- [14] A. Koneru and M. J. Sigal, "Access to dental care for persons with developmental disabilities in Ontario," *Journal of the Canadian Dental Association*, vol. 75, no. 2, pp. 121–121, 2009.
- [15] M. McCarron and P. McCallion, "Building a picture of ageing of people with intellectual disability: future directions for ageing well. Intellectual disability supplement to the Irish longitudinal study on ageing," in *Proceedings of the 2nd International Research Conference on Ageing and Intellectual Disability*, Dublin, Ireland, 2011.
- [16] D. J. Stiefel, "Dental care considerations for disabled adults," *Special Care in Dentistry*, vol. 22, no. 3, pp. 26S–39S, 2002.
- [17] J. M. Charles, "Dental care in children with developmental disabilities: attention deficit disorder, intellectual disabilities, and autism," *Journal of Dentistry for Children*, vol. 77, no. 2, pp. 84–91, 2010.
- [18] American Dental Association, Dental Education: Schools & Programs, http://www.adea.org/dental_education_pathways/pass/Pages/default.aspx/.
- [19] H. B. Waldman and S. P. Perlman, "A special care dentistry specialty: sounds good, but," *Journal of dental education*, vol. 70, no. 10, pp. 1019–1022, 2006.
- [20] US Department of Health and Human Services, *Oral Health in America: A Report of the Surgeon General*, National Institute of Dental and Craniofacial Research, NIH, Rockville, Md, USA, 2000.
- [21] "Healthy People 2020: Summary of Objectives: Oral Health," <http://www.healthypeople.gov/2020/topicsobjectives2020/pdfs/OralHealth.pdf>.
- [22] US Department of Health and Human Services, *Continuing Education: Practical Oral Care for People with Developmental Disabilities; Practical Oral Care for People with Autism, Practical Oral Care for People with Cerebral Pals; Practical Oral Care for People with Down Syndrome; Practical Oral Care for People with Intellectual Disability; Dental Care Every Day: A Caregiver's Guide*, National Institute of Dental and Craniofacial Research, NIH, Bethesda, Md, USA, 2009.
- [23] A. Khocht, M. Janal, and B. Turner, "Periodontal health in down syndrome: contributions of mental disability, personal, and professional dental care," *Special Care in Dentistry*, vol. 30, no. 3, pp. 118–123, 2010.

- [24] D. Boyd, A. Quick, and C. Murray, "The Down syndrome patient in dental practice, Part II: clinical considerations," *New Zealand Dental Journal*, vol. 100, no. 1, pp. 4–9, 2004.
- [25] D. Kane, N. Mosca, M. Zotti, and R. Schwalberg, "Factors associated with access to dental care for children with special health care needs," *Journal of the American Dental Association*, vol. 139, no. 3, pp. 326–333, 2008.
- [26] P. Glassman and C. Miller, "Dental disease prevention and people with special needs," *Journal of the California Dental Association*, vol. 31, no. 2, pp. 149–160, 2003.
- [27] M. R. P. S. Soares, F. O. de Paula, M. G. A. M. Chaves, N. M. S. P. Assis, and H. D. M. C. Filho, "Patient with down syndrome and implant therapy: a case report," *Brazilian Dental Journal*, vol. 21, no. 6, pp. 550–554, 2010.
- [28] P. L. Kaye, J. Fiske, E. J. Bower, J. T. Newton, and M. Fenlon, "Views and experiences of parents and siblings of adults with Down Syndrome regarding oral healthcare: a qualitative and quantitative study," *British Dental Journal*, vol. 198, no. 9, pp. 571–578, 2005.
- [29] C. Bernal, "Maintenance of oral health in people with learning disabilities," *Nursing Times*, vol. 101, no. 6, pp. 40–42, 2005.
- [30] E. O'Keefe, "Oral health of patients with intellectual disabilities," *Evidence-Based Dentistry*, vol. 11, no. 3, p. 81, 2010.
- [31] H. B. Waldman, S. P. Perlman, and M. Swerdloff, "Children with mental retardation/developmental disabilities: do physicians ever consider needed dental care?" *Mental Retardation*, vol. 39, no. 1, pp. 53–56, 2001.
- [32] O. Gurbuz, G. Alatas, E. Kurt, H. Issever, and F. Dogan, "Oral health and treatment needs of institutionalized chronic psychiatric patients in istanbul, turkey," *Community Dental Health*, vol. 27, no. 3, pp. 151–157, 2010.
- [33] M. Jain, A. Mathur, L. Sawla et al., "Oral health status of mentally disabled subjects in India," *Journal of Oral Science*, vol. 51, no. 3, pp. 333–340, 2009.
- [34] J. E. Gallagher and J. Fiske, "Special care dentistry: a professional challenge," *British Dental Journal*, vol. 202, no. 10, pp. 619–629, 2007.
- [35] M. Shyama, S. A. Al-Mutawa, S. Honkala, and E. Honkala, "Supervised toothbrushing and oral health education program in Kuwait for children and young adults with down syndrome," *Special Care in Dentistry*, vol. 23, no. 3, pp. 94–99, 2003.
- [36] F. A. Oredugba and S. P. Perlman, "Oral health condition and treatment needs of special Olympics athletes in Nigeria," *Special Care in Dentistry*, vol. 30, no. 5, pp. 211–217, 2010.
- [37] S. M. Haverkamp, D. Scandlin, and M. Roth, "Health disparities among adults with developmental disabilities, adults with other disabilities, and adults not reporting disability in North Carolina," *Public Health Reports*, vol. 119, no. 4, pp. 418–426, 2004.
- [38] D. Wasersprung, C. M. Platis, S. Cohen et al., "Case report: Sanjad—Sakati syndrome: dental findings and treatment," *European Archives of Paediatric Dentistry*, vol. 11, no. 3, pp. 151–154, 2010.
- [39] Y. Idaira, Y. Nomura, Y. Tamaki et al., "Factors affecting the oral condition of patients with severe motor and intellectual disabilities," *Oral Diseases*, vol. 14, no. 5, pp. 435–439, 2008.
- [40] S. Turner, M. Sweeney, C. Kennedy, and L. Macpherson, "The oral health of people with intellectual disability participating in the UK Special Olympics," *Journal of Intellectual Disability Research*, vol. 52, no. 1, pp. 29–36, 2008.
- [41] M. Krause, L. Vainio, S. Zwetchkenbaum, and M. R. Inglehart, "Dental education about patients with special needs: a survey of U.S. and Canadian dental schools," *Journal of Dental Education*, vol. 74, no. 11, pp. 1179–1189, 2010.
- [42] E. Grant, G. Carlson, and M. Cullen-Erickson, "Oral health for people with intellectual disability and high support needs: positive outcomes," *Special Care in Dentistry*, vol. 24, no. 2, pp. 70–79, 2004.
- [43] F. A. Oredugba, "Oral health condition and treatment needs of a group of Nigerian individuals with Down syndrome," *Down's Syndrome, Research and Practice*, vol. 12, no. 1, pp. 72–76, 2007.

Research Article

A Qualitative Study of Patients' Attitudes toward HIV Testing in the Dental Setting

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An estimated 1.1 million people in the USA are living with HIV/AIDS. Nearly 200,000 of these individuals do not know that they are infected. In 2006, the CDC recommended that all healthcare providers routinely offer HIV screening to adolescent and adult patients. Nurse-dentist collaborations present unique opportunities to provide rapid oral HIV screening to patients in dental clinic settings and reach the many adults who lack primary medical providers. However, little is known about the feasibility and acceptability of this type of innovative practice. Thus, elicitation research was undertaken with dental providers, students, and patients. This paper reports the results of qualitative interviews with 19 adults attending a university-based dental clinic in New York City. Overall, patients held very positive attitudes and beliefs toward HIV screening in dental sites and identified important factors that should be incorporated into the design of nurse-dentist collaborative HIV screening programs.

1. Introduction

An estimated 1.1 million people are currently living with HIV in the USA, yet one in five are unaware of their status [1]. Early diagnosis and treatment have dramatically increased lifespan and reduced HIV transmission; yet 55% of adults, ages 18–64, report they have never been tested for HIV. Among those who have been tested and were found to be infected, at least one-third discovered their status late in the course of their illness, thus missing the opportunity to receive the maximum benefits that early treatment provides [1].

To facilitate early diagnosis and treatment, the Centers for Disease Control and Prevention (CDC) issued revised recommendations in 2006 for widespread HIV testing [2]. The new recommendations proposed that HIV testing be offered to all individuals, ages 13 to 64, in all healthcare settings on an “opt-out” basis, rather than waiting for patients to request testing. These revisions brought HIV testing in line with other STI protocols and helped reduce what had been referred to as “HIV exceptionalism” [3]. Requirements

that were specific to HIV testing that were often viewed as barriers to expanded screening, for example, written informed consent, were eliminated [2]. In addition, the CDC recommended that prevention counseling no longer be required. These revised standards, along with the availability of rapid testing technology, have helped bring HIV screening to new venues [4–6].

Dental practice sites represent new venues with great promise [6–8] and the potential to reach millions of Americans who see a dentist but not a physician annually [4, 5, 9, 10]. Although HIV testing may not appear, on the surface, to be within the scope of dental practice, the development of rapid oral fluid diagnostic test kits for HIV provides the opportunity for oral screening to become a logical extension of routine dental care [4, 5]. However, to date, few dentists and few academic dental centers have incorporated HIV screening into practice [5].

The American Academy of Nursing Expert Panel on Emerging and Infectious Diseases (AAN Expert Panel) posited that providers' perceived barriers to HIV testing might

be inhibiting uptake into practice in a variety of healthcare settings [11]. However, there is a dearth of research that has examined the factors that promote or inhibit HIV screening in dental practice sites. One study conducted with dental educators found that, although the majority support offering HIV screening in the dental setting, only a small percentage actually do so [5]. A recent study with dental faculty and students [7] found that, consistent with the 2010 AAN Expert Panel report [11], there were a number of negative provider perceptions acting as barriers to HIV testing [7]. Consistent with the findings from an earlier national study [5], dental providers' reported barriers to HIV testing included perceived lack of skills in HIV testing and counseling, lack of appropriate referral sources and logistical issues such as time, cost, and patient privacy [7].

Many of these potential barriers to HIV testing could be addressed through collaborations between nurses and dental providers [7, 8]. Since early in the AIDS epidemic, nurses have played an important role in the provision of HIV testing and counseling [12]. The 2010 American Academy of Nursing Expert Panel endorsed widespread HIV testing and advocated for interdisciplinary partnerships between nurses and other healthcare providers in order to facilitate the implementation of the CDC recommendations for widespread HIV testing in all healthcare settings [11]. Although there is little precedent for dental-nursing collaboration in general, in the field of HIV/AIDS care, nurses have become knowledgeable about oral manifestation of HIV despite the lack of much formal training in oral health assessments [12]. Formal training by dentists to conduct comprehensive oral examinations could enhance early detection of oral health-related problems by nurses. Similarly, dentists can benefit from nurses' knowledge about the management of potential patients concerns about HIV testing and counseling and referral of those who screen positive.

In addition to concerns about personal skills and logistical issues, some dentists and dental students have voiced concerns that patients would react negatively to offers of HIV testing [7]. However, these findings were limited to the perspectives of dentists and dental students. Few studies have examined patients' actual beliefs and perceptions regarding HIV testing in the dental setting. Following implementation of the revised CDC HIV testing recommendations in 2006, several studies found high levels of patient acceptability of HIV testing in nondental healthcare settings, including emergency departments [13], and outpatient clinics [14, 15]. Two studies found similarly high levels of acceptability of HIV testing among dental patients [6, 16]. In 2007, a patient survey conducted at an urban, free dental clinic in Kansas City Missouri found that 73% of 150 participants stated they would accept free HIV screening at their dental visit [6]. Most of the participants were African American females who resided in neighborhoods with high HIV prevalence; 61% had previously been tested for HIV. Among those who had never been tested, 74% stated that they would agree to be tested if offered in the dental setting. Most participants had no specific preference as to who should provide HIV testing results and only 11% suggested that it should be a

counselor trained in HIV counseling. Reasons for refusal included pain due to dental procedures, concerns about HIV stigma from providers and others, accuracy of the rapid HIV test, and time constraints [6]. In 2008, a counselor-based rapid HIV (blood) testing program was implemented in the Harlem Hospital dental clinic. More than 97% of the 3,565 individuals who were offered free testing accepted [16].

While encouraging, these results reflected experiences in single dental practice sites. They also did not provide the depth of understanding of patients' beliefs, perceptions, and site-specific barriers necessary to guide the development of a collaborative nurse-dentist rapid oral fluid HIV screening program at a large, urban, university dental center. Thus the purpose of this study was to examine dental patients' attitudes, beliefs, and perceived barriers to HIV screening in order to address these factors in an implementation plan.

2. Materials and Methods

Data from patients were collected as part of a larger pilot study assessing the feasibility of implementing routine HIV screening and counseling in a large university-based dental clinic. In-depth interviews were conducted with 19 new patients between April and May of 2011 to assess their attitudes, beliefs, and perceived acceptability of rapid oral HIV testing in the dental clinic setting.

2.1. Setting and Participants. The study took place at the NYU College of Dentistry (NYUCD), the single largest provider of low-cost dental care in New York state. NYUCD serves as an essential safety net for the underserved, uninsured, underinsured and other marginalized and at-risk residents of New York City and its surrounding areas. In 2010, the clinic served more than 82,000 new patients and provided over 383,000 clinic visits, 41% came from the 30 New York City area Zip Codes with the highest HIV seroprevalence rates. Among NYUCD patients 74% are between the ages of 30 and 49, slightly more than half (54%) are female, about 60% are Black or Latino, 40% are uninsured, 55% Medicaid insured, and 5% have private insurance. Prior to initiating the study, all of the human subjects-related documents and procedures were approved by the appropriate IRB at New York University. Although all potential participants were given a copy of the written informed consent along with contact information of the principal investigator, signed informed consent forms were not collected as these would have been the only participant identifiers.

2.2. Procedures. A convenience sample of study participants were recruited from patients who were registering for care at the NYUCD Admissions Clinic during afternoon sessions on variable week days. Patients were approached in the waiting room by a trained and experienced research assistant and invited to participate in the study (complete an interview). Potential participants were given an information sheet/invitation to participate that explained the purpose of the study as well as the incentive offered (a \$20 New York City

transit card). Those who agreed to participate were taken to a quiet private area for interviews.

2.3. Data Collection and Analysis. A patient interview guide was used that focused on eliciting patients' beliefs and attitudes and intentions regarding HIV screening in the dental clinic. Participants were also asked for their perceptions of factors that would make it easier (facilitators) and those that would make it more difficult (barriers) to be screened for HIV in the dental setting. Interviews lasted between 15 and 25 minutes and were audiotaped. Audiotapes were subsequently transcribed verbatim and qualitative thematic content analysis [17, 18] was conducted by two investigators and a graduate public health student to develop a preliminary coding scheme. The coding scheme facilitated the systematic identification of analytic patterns that became apparent from the data, as well as theoretically important concepts. Limited demographic information was obtained from participants.

Eighteen of the nineteen interviews were conducted in English. One interview was conducted in Spanish because the bilingual participant requested Spanish. All participants were cognitively functional and medically stable and were over the age of 18.

3. Results

About three quarters of participants were between the ages of 30 and 49; 58% were female. More than 50% were Caucasian, 22% Latino, and 11% African American. Almost half were unemployed, 53% were Medicaid insured, 22% had no insurance, and 22% had private insurance. Almost one-third stated they had no primary care provider; however about 90% reported seeing a healthcare provider in the last year. Only 42% reported having been previously offered oral HIV testing by a medical provider.

Analysis of the interview transcripts revealed three main themes related to patients' views on rapid oral HIV testing in the dental setting: (1) acceptability and perceived advantages to rapid oral HIV testing in the dental setting, (2) congruence between HIV screening and patients' views of dental settings and the role of dentists, and (3) logistical issues related to implementation of rapid oral HIV testing in the dental setting.

3.1. Theme 1: Acceptability and Perceived Advantages to HIV Testing in Dental Settings. All study participants expressed very positive attitudes toward rapid oral HIV testing in the dental setting for themselves and for other patients. Almost three-quarters (74%) said they would accept screening if it were offered as part of the dental visit. A variety of reasons were offered. Some thought that it was important for people to *know* their HIV status as the following statements illustrate: "I think that is terrific...because people might have it—might be a carrier and not know it" (R1); "It's a good thing...there's no risk involved, there's a lot of people out there that would want to be checked" (R8).

Other participants stressed the *convenience* of getting HIV testing in the dental environment: "It would be a great idea because...there is never enough time to check my HIV status" (R17); "I'm gonna be laid back getting my teeth done, I might as well—two birds with one stone" (R14); and "It might be a perfect time, because it's through the mouth" (R19). One participant responded enthusiastically, "Wow, this is a very good idea. I came to the dentist and they did the test. Better than when you have to go to a particular place and wait a long time" (R6).

Two of the advantages identified by participants were that the test would be offered *free of charge* and *universally*. One participant explained, "for people like myself who can't afford insurance, aren't in a stable position, [they can't] go somewhere else and get it done" (R4). Another said an incentive for him was "it's cheap, it's free" (R13). Most participants said that everyone should be offered testing and most said that it should be voluntary. One participant noted the disadvantage of specific patients being offered testing saying, "It should be offered to everyone who comes...if you pigeon hole it, then people are going to say, well you're acting in a racist manner, social Darwinistic manner" (R19).

When participants were asked why some patients might not accept rapid oral HIV testing, responses included: *fear* of getting a positive HIV test result, for example, "Some people are afraid of the results" (R1); *ignorance*, for example, "People aren't really educated about HIV or know what it is about...they do not want to be anywhere near it, around it, talk about it. It's not going to happen to me"; *prior knowledge*, for example, "They might know they have it." Several stated that older patients might not recognize the importance of testing because of low self-perceived risk for HIV infection.

When asked whether other patients might be offended at being offered rapid oral HIV testing in the dental setting, one responded, "I think a lot of Caucasian folks who are middle class they would be adverse to it" (R9). However, others noted, "[HIV] has been [around] quite a few years...things have changed" (R1), and "we live in a huge metropolitan city...most people are at least aware" (R4).

3.2. Theme 2: Congruence of HIV Screening and Patients' Views of Dental Settings. Participants were very positive about being offered rapid oral HIV testing in the dental clinic setting and thought it consistent with their view of dental practice. One participant stated, "I strongly believe that, if a place like this is offering testing, it's only for the good of everybody, for patients as well as doctors. It totally shows me that this place cares about peoples' health" (R18). Another noted that patients might initially be surprised about being offered rapid oral HIV testing but thought it was a good idea: "It's a good thing...I'd probably be surprised just because it wouldn't occur to me that a dentist would offer that but I think as long as there was some sort of counseling available...It would be a surprise factor, not really expecting this...you expect to be asked about your oral history, not necessarily your sexual history" (R4). Others expressed no surprise at the idea because the testing was by oral swab: "It kind of goes together, the teeth, the mouth, the dentist"

(R19); “But with the swab, I think because it’s an oral thing, I can see why that makes sense” (R4). Other participants saw dental care as an integral part of medical care as the following statements reflect: “I believe dental care is medical care” (R18); “I feel they are so closely related [medicine and dentistry] that it’s not like we’re going to the grocery store to get tested” (R18); “I don’t see any difference between a dentist or a doctor” (R7). In addition, one participant suggested that in some circumstances a patient may go to a dentist but not necessarily a doctor, “Sometimes people don’t go to doctors but if they have a toothache, they will go to a dentist” (R5).

3.3. Theme 3: Logistical Issues Related to Implementation. Participants identified a number of logistical issues related to implementation of rapid oral HIV testing in the dental practice setting, including getting positive test results; need for professional counseling and linkage to care for HIV-positive patients, providing HIV prevention educational materials and the need for privacy.

Most participants raised concerns about how they or another patient might feel about learning they have a positive test result and their ability to deal with those emotions. As one participant explained, “I would be stressed out” (R3). About one-third stated they believed there was a need for professional counseling for HIV-positive patients in dental settings: “you need someone to deal with the psychosocial effects” (R2). Another said, “I think how you receive the news is very important. . . I wouldn’t want to hear it from a dental student” (R4). Another pointed out the stress this would create for the dental provider as well as the patient: “I’d be concerned that there wouldn’t be anyone there to really work with the person if they did get a positive or even if it was a false positive. I don’t want to speak for dentists but I’m sure it’s stressful but nowhere near as stressful as delivering some pretty devastating news to people” (R17). One participant thought the patient should not be given the results until the confirmatory test was done. Several participants stressed the importance of privacy for getting test results especially in the dental clinic setting where many patients, dental students, and dental faculty are in close proximity.

When asked about HIV prevention education in the dental setting, participants were unanimous in their support for providing educational materials in the dental clinic but much more cautious about offering free condoms. One said simply, “I would be offended [if someone offered me condoms]” (R1). Another participant suggested that condoms could be offered discretely: “in a bag” (R2); “it’s tricky. . . they should be free and available but if a mother came in with a 16-year-old. . .” (R4); “I don’t think there should be someone at the door handing them out. There should be something on the side of the office with a sign “Practice safe sex, there’s condoms. Take one if you want” (R7); “It’s a little strange to see them in a dentist’s office. You might scare people a little” (R11). Another participant pointed out that some patients might have religious objections to being offered condoms: “handing them out is over the top. . . you know, maybe they’re conservative Catholic, Hasidim, conservative Muslim. . . that might piss them off” (R9).

4. Discussion

Participants reported universally positive attitudes about being offered rapid oral HIV testing in dental settings and expressed beliefs that the provision of such testing was consistent with their view of the dentist’s role. These findings are consistent with dentists’ and dental students’ perceptions in a recent study [7], as well as two studies of patient acceptability for HIV testing in the dental practice setting [6, 16]. The main benefits patients identified for such testing were increasing individuals’ knowledge of their HIV status and the convenience of being tested while they were receiving dental care. While the study did not directly explore the issue of cost, several participants voluntarily mentioned free testing as an important incentive. The two previously published studies of patient perspective on HIV screening in dental setting provided free testing and demonstrated high acceptability [6, 16]. Even though only 22% of participants were uninsured, both insured and uninsured patients voluntarily mentioned cost as an issue, thus, it is likely that reducing financial barriers to HIV testing will increase acceptability. The vast majority of participants felt HIV testing should be offered to everyone on a voluntary basis. The identified barriers to HIV testing for dental patients included fear of receiving a positive result, lack of awareness of HIV, and knowing their HIV status already.

Several challenges to HIV testing in the dental setting were identified by patient participants. Most were concerned about the emotional impact of learning about an HIV-positive test. This concern was not specific to the dental environment but a general concern about the emotional impact of such information. Many participants suggested that, although dental providers could convey an HIV-positive test result to a patient, they should provide timely access to a professional with HIV psychological counseling skills to provide further information and support to patients. Several participants stressed the importance of privacy for receiving test results in this setting. Though they were unanimous in their support for dental professionals providing education to their patients about HIV prevention, many felt that offering condoms to dental patients might offend some patients and recommended a discrete, passive availability of condoms.

Patient concerns about HIV testing in the dental setting in this study differ from those reported by Deitz and colleagues [6] just after the 2006 CDC HIV testing policy changes were released. In that study, patients identified concerns about HIV stigma from dental providers and others, accuracy of the rapid HIV, test and time constraints as important barriers. The absence of patient concerns about stigma and testing accuracy in the current study may reflect changes in public perceptions during the past five years, geographic differences as the current study took place in New York City, and/or the impact of the CDC policy to routinely test for HIV rather than testing on the basis of HIV “risk.”

Further, the data presented here suggest that in order to address patient concerns there is a need to develop detailed protocols for rapid oral HIV testing that address protecting patient privacy, providing professional psychosocial support for patients who receive positive HIV test results, managing

referrals and linkages to care for those who test positive, and providing educational materials in the dental practice setting. The present study contributes important information to the small body of literature on the acceptability of HIV testing by dental patients. This is the first qualitative study to examine these issues and provides important contextual information to guide the development of protocols to address patient concerns. The findings support recommendations for the establishment of new interdisciplinary models of care to provide HIV testing in dental settings and to meet the needs of the dental patient with a positive HIV test [7, 8].

5. Limitations

These findings should be viewed in light of several study limitations. The study setting is a large urban academic dental clinic in a city with high HIV seroprevalence; adults from suburban and rural areas were not represented among the participants, and their perspectives were not reflected in the data. Although the sample size was small, that was not considered a limitation as data saturation was reached for all themes. Study participants were similar to the general clinic population in terms of age and gender but less likely to be uninsured (22% versus 40%). Since dental services in the USA are largely financed through self-payment rather than through dental insurance, the findings here may not be applicable to the larger uninsured population. Also, fewer than 50% of the participants were from minority racial and ethnic groups, compared to 70% in the larger clinic population. However, in other studies, individuals who were uninsured and members of minority groups at high risk for HIV demonstrated very high acceptability for HIV testing. Thus, the positive attitudes presented here may be similar to those held by those dental patients. Despite this, individuals who held extremely negative attitudes towards HIV testing in the dental clinic may have been less likely to agree to participate. As such, their voices would not have been heard.

6. Conclusions

Rapid oral HIV testing in the dental practice setting holds great promise for reaching a proportion of the population not currently accessing primary care in more traditional medical settings. For HIV testing in this setting to be successfully implemented, concerns raised by patients will need to be addressed including testing-related privacy, availability of expert posttest counseling, psychosocial support, follow-up confirmatory testing and linkage to medical care. Collaborations between dentists and other health professionals with specialized training in HIV testing and counseling, such as nurses, provide an innovative approach to address these issues. Such a collaborative approach to HIV testing in a dental clinic setting is currently being developed between the NYU College of Dentistry and the NYU College of Nursing Faculty Practice located at the College of Dentistry. In this model, the dental faculty or dental students will offer testing as part of routine care at the beginning of the oral examination. For patients who accept the offer of

testing, dentists/dental students will conduct the oral swab HIV test and the nurse coordinator for the project will report the test results to the patient in a private setting at the end of the visit. For patients whose test is reactive the nurse will provide posttest counseling and linkage to care under the supervision of the NYU NFP. The collocation of these programs offers seamless continuity of care and linkage to specialized care for patients who test positive for HIV [8]. Although most dental practices do not have this kind of co-located access to nurses or other medical providers, developing collaborative relationships with nurse practitioners in the local community for purposes of HIV testing and referral offers a potential solution for dentists in small or solo practices. Although there are no scope of practice issues for dentists or nurses in performing oral diagnostic tests, insurance reimbursement mechanisms for HIV testing and other oral diagnostics in collaborative models such as this will need to be addressed.

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References

- [1] Centers for Disease Control and Prevention (CDC), "CDC's HIV prevention progress in the US," 2010, <http://www.cdc.gov/vitalsigns/pdf/2010-11-30-vitalsigns.pdf>.
- [2] B. M. Branson, H. H. Handsfield, M. A. Lampe et al., "Revised recommendations for HIV testing of adults, adolescents, and pregnant women in health-care settings," *Morbidity and Mortality Weekly Report*, vol. 55, no. RR14, pp. 1–17, 2006.
- [3] R. Bayer, "Public health policy and the AIDS epidemic. An end to HIV exceptionalism?" *New England Journal of Medicine*, vol. 324, no. 21, pp. 1500–1504, 1991.
- [4] H. A. Pollack, L. R. Metsch, and S. Abel, "Dental examinations as an untapped opportunity to provide HIV testing for high-risk individuals," *American Journal of Public Health*, vol. 100, no. 1, pp. 88–89, 2010.
- [5] L. L. Patton, V. A. Santos, R. G. McKaig, D. C. Shugars, and R. P. Strauss, "Education in HIV risk screening, counseling, testing, and referral: survey of U.S. dental schools," *Journal of dental education*, vol. 66, no. 10, pp. 1169–1177, 2002.
- [6] C. A. Dietz, E. Ablah, D. Reznik, and D. K. Robbins, "Patients' attitudes about rapid oral HIV screening in an urban, free dental clinic," *AIDS Patient Care and STDs*, vol. 22, no. 3, pp. 205–212, 2008.
- [7] M. K. Hutchinson, N. Van Devanter, D. Malamud, J. Phelan, A. Vernillo, and J. Combellick, "Pilot study to assess the feasibility of integrating HIV antibody screening into an urban university," under review.
- [8] M. K. Hutchinson and M. Lloyd, "Implementing rapid oral fluid HIV testing in dental care settings: opportunities for

- nurse practitioner-dentist collaborations,” *Nurse Practitioner*. In press.
- [9] T. Fulmer, “New York University College of Nursing takes on the challenge of innovation for the healthcare system,” *MCN: American Journal of Maternal/Child Nursing*, vol. 33, no. 1, p. 7, 2008.
- [10] S. Strauss, M. Alfano, D. Shelley, and T. Fulmer, “Identifying unaddressed systemic health conditions at dental visits: patients who visited dental practices but not general health care providers in 2008,” *American Journal of Public Health*, vol. 102, no. 2, pp. 253–255, 2012.
- [11] American Academy of Nursing Expert Panel on Emerging and Infectious Diseases (AAN Expert Panel), “Routine screening for HIV to decrease personal disease burden, health costs, and transmission of HIV,” 2010, <http://www.aannet.org/files/public/EIDPolicyBrief.pdf>.
- [12] N. L. Van Devanter, J. A. Grisaffi, M. Steilen et al., “Counseling HIV-antibody positive blood donors,” *American Journal of Nursing*, vol. 87, no. 8, pp. 1026–1030, 1987.
- [13] J. S. Haukoos, E. Hopkins, and R. L. Bynny, “Patient acceptance of rapid HIV testing in an urban emergency department: assessment of the 2006 CDC recommendations for HIV screening in health care settings,” *Annals of Emergency Medicine*, vol. 51, no. 3, pp. 303–309.e1, 2008.
- [14] R. Drayton, F. Keane, and E. Prentice, “Patients’ attitudes towards increasing the offer of HIV testing in primary and secondary care,” *International Journal of STD and AIDS*, vol. 21, no. 8, pp. 563–566, 2010.
- [15] M. S. Stefan, J. M. Blackwell, K. M. Crawford et al., “Patients’ attitudes toward and factors predictive of human immunodeficiency virus testing of academic medical clinics,” *American Journal of the Medical Sciences*, vol. 340, no. 4, pp. 264–267, 2010.
- [16] O. J. Blackstock, J. R. King, R. D. Mason, C. C. Lee, and S. B. Mannheimer, “Evaluation of a rapid HIV testing initiative in an urban, hospital-based dental clinic,” *AIDS Patient Care and STDs*, vol. 24, no. 12, pp. 781–785, 2010.
- [17] M. Sandelowski, “Focus on research methods: whatever happened to qualitative description?” *Research in Nursing and Health*, vol. 23, no. 4, pp. 334–340, 2000.
- [18] M. Sandelowski, “The problem of rigor in qualitative research,” *Advances in Nursing Science*, vol. 8, no. 3, pp. 27–37, 1986.

Review Article

Toothbrush Contamination: A Review of the Literature

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Toothbrushes are commonly used in hospital settings and may harbor potentially harmful microorganisms. A peer-reviewed literature review was conducted to evaluate the cumulative state of knowledge related to toothbrush contamination and its possible role in disease transmission. A systematic review was conducted on adult human subjects through three distinct searches. The review resulted in seven experimental and three descriptive studies which identified multiple concepts related to toothbrush contamination to include contamination, methods for decontamination, storage, design, and environmental factors. The selected studies found that toothbrushes of healthy and oral diseased adults become contaminated with pathogenic bacteria from the dental plaque, design, environment, or a combination of factors. There are no studies that specifically examine toothbrush contamination and the role of environmental factors, toothbrush contamination, and vulnerable populations in the hospital setting (e.g., critically ill adults) and toothbrush use in nursing clinical practice.

1. Introduction

Toothbrushes play an essential role in oral hygiene and are commonly found in both community and hospital settings. Toothbrushes may play a significant role in disease transmission and increase the risk of infection since they can serve as a reservoir for microorganisms in healthy, oral-diseased and medically ill adults [1]. Contamination is the retention and survival of infectious organisms that occur on animate or inanimate objects. In healthy adults, contamination of toothbrushes occurs early after initial use and increases with repeated use [2, 3]. Toothbrushes can become contaminated from the oral cavity, environment, hands, aerosol contamination, and storage containers. Bacteria which attach to, accumulate, and survive on toothbrushes may be transmitted to the individual causing disease [4, 5]. In the hospital setting, toothbrushes are commonly used for oral care by nurses. There is a need for standardized nursing guidelines to prevent toothbrush contamination, which may increase the risk of infections from potentially pathogenic microorganisms and is clinically relevant for assessing the risks and benefits of oral care and informing nursing practice. This review of peer-reviewed literature was

conducted to evaluate the cumulative state of knowledge related to toothbrush contamination, its possible role in disease transmission, and in preparation for a research study related to toothbrush contamination in critically ill adults.

2. Methods

A systematic review of the scientific literature was conducted. There were no relevant articles available in print prior to 1977. Articles published from 1977 to 2011, on human subjects and using the English language were obtained. The review included studies that evaluated toothbrush contamination in healthy and oral-diseased adults, guidelines for toothbrush and oral care in both healthy and medically ill persons, hospitalized and nonhospitalized patients, and interventions for reducing contamination of toothbrushes. Experimental and nonexperimental designs were included in the review. The following databases were searched: Pub Med (clinical inquiries and MESH), CINAHL, Cochrane Library, National Guidelines Clearinghouse, Web of Science, and Google Scholar. Key search terms used in the review were *toothbrush*, *tooth brushing*, *colonization*, *bacterial contamination*, *contamination*, *oral hygiene*, *oral health*, *nursing practice*,

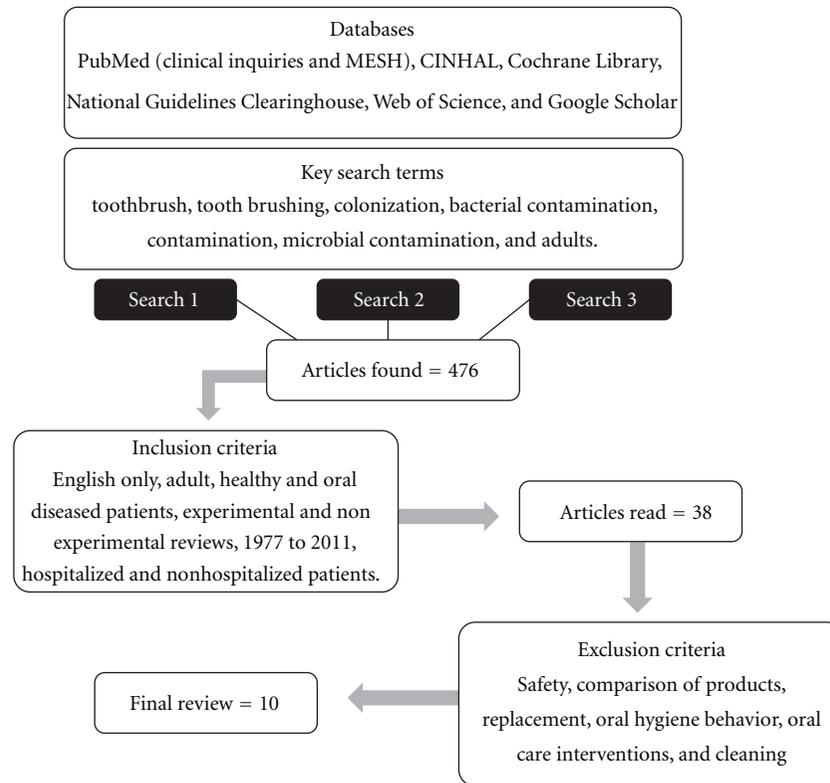


FIGURE 1: Literature search process.

TABLE 1: Results of Search 1.

Database	Initial number of articles located
PubMed	26
CINAHL	16
Cochrane Library	10
National Guidelines Clearinghouse	None
Web of Science	22
Google Scholar	376

microbial contamination, and *adults*. This search strategy was verified by a health sciences librarian. A total of three separate searches were conducted in a systematic fashion using the inclusion and exclusion criteria and search terms. The first search (search 1) identified articles in the selected databases and complete copies of articles that were considered to have met the inclusion criteria were obtained for further review (Table 1). Articles were excluded if they did not meet the inclusion criteria listed above, were conducted on a pediatric population, were duplicates from other databases, or only explored antibacterial methods.

The second search (search two) included articles identified through cited articles and were reviewed following the same criteria. There were a total of 23 new articles identified through the second search. A third search (search three) was conducted one year after the first search in order to

capture any recently published articles. There were three new articles identified in the third search. After a review of the abstracts for the articles obtained through the three searches, a total of 88 relevant articles were identified for further evaluation. After inclusion criteria were applied, 38 articles were selected; after exclusion criteria were applied, ten articles were retrieved to be read in their entirety and included in this review (Figure 1).

3. Results

A comprehensive summary of the studies is listed in Table 2. Studies that were reviewed included: seven experimental and three descriptive studies. The selected studies are grouped by setting in vivo, in vitro, and studies that combined both types of settings. The sample sizes ranged from 3 to 103 with the majority of studies having a sample size under 30. Overall, the studies evaluated several perspectives related to toothbrush contamination to include: contamination, methods for decontamination, storage, design, and environmental factors.

3.1. Contamination. All of the studies examined toothbrush contamination and found significant bacterial retention and survival on toothbrushes after use [6, 7]. Glass found that toothbrushes from both healthy patients and patients with oral disease contained potentially pathogenic bacteria and viruses such as *Staphylococcus aureus*, *E. coli*, *Pseudomonas*,

TABLE 2: Studies Selected.

Study	Purpose	Design	Sample	Results
In vitro studies				
Bunetel et al. (2000) [8]	Does retention and survival of microorganisms on toothbrushes pose a threat to patients at risk of infection?	Experimental	<i>N</i> = 3 toothbrush types with two series of experiments	Contamination of toothbrushes occurs early in the life of the brush and tends to increase with repeated use.
Dayoub et al. (1977) [18]	To determine the degree of bacterial contamination of toothbrushes after contamination and storage in vented containers or in air.	Experimental	<i>N</i> = 103 toothbrushes	The numbers of bacteria on toothbrushes stored in room air after use decrease more quickly than on brushes in containers.
Glass and Jensen (1994) [9]	To evaluate toothbrush design and UV sanitation on microbial growth.	Experimental	<i>N</i> = 72 toothbrushes	UV sanitizing kills bacteria; viruses can survive on toothbrushes for 24 hours; toothbrush design, color, opacity, and bristle arrangement are a major factor in retaining microorganisms.
In vivo studies				
Efstratiou et al. (2007) [14]	To examine the contamination and the survival rate of periodontopathic and cariogenic species on new toothbrushes with antibacterial properties after a single use in periodontic patients.	Experimental	<i>N</i> = 10 patients; 4 toothbrushes per patient.	Immediately after brushing, the toothbrushes harbored a significant number of microorganisms with no difference between the types of toothbrushes. The antibacterial toothbrush did not limit bacterial contamination.
Mehta et al. (2007) [10]	To determine the extent of bacterial contamination of toothbrushes after use, evaluate the efficacy of chlorhexidine and Listerine in decontamination, and effectiveness of covering the toothbrush head with a cap.	Experimental	<i>N</i> = 10 patients	Toothbrushes become contaminated during use; retention of moisture and the presence of organic matter may promote bacterial growth. Toothbrush contamination may lead to colonization and infection. Caps increase bacterial growth. Chlorhexidine was more effective than Listerine.
Quiryren et al. (2003) [15]	To evaluate the effects of coated tufts and toothpaste on toothbrush contamination.	Experimental	<i>N</i> = 8 patients	Toothbrushes become contaminated and toothpaste reduced bacterial growth in toothbrushes.
Taji and Rogers (1998) [11]	To investigate the microbial contamination of toothbrushes.	Descriptive	<i>N</i> = 10 patients	Most toothbrushes were contaminated.
Verran and Leahy-Gilmartin (1996) [13]	To evaluate toothbrush contamination using a range of selective and nonselective media.	Descriptive	<i>N</i> = 28 toothbrushes	Used toothbrushes supported a wide variety of microorganisms. All media showed growth.
Combination of both in vitro and in vivo studies				
Caudry et al. (1995) [5]	To demonstrate, quantitatively, the presence of microorganisms adherent to toothbrush bristles.	Experimental	<i>N</i> = 20 toothbrushes	Toothbrushes, in normal use, are heavily contaminated by microorganisms and the bacteria are extremely adherent to the bristles.

TABLE 2: Continued.

Study	Purpose	Design	Sample	Results
Glass and Lare (1986) [6]	Do toothbrushes harbor pathogenic microorganisms and if there is a correlation between contaminated brushes and the presence of disease.	Descriptive	$N = 30$ toothbrushes	Toothbrushes can harbor pathogenic microorganisms.

and herpes simplex virus [1]. Glass also found toothbrushes contaminated with herpes simplex virus 1 in numbers sufficient to cause an infection in the patient [1]. Bunetel et al. found that toothbrushes used by patients with existing oral disease quickly became contaminated [8]. This study also found a significant relationship between repeated use and bacterial retention on toothbrushes and that the oral cavity can be inoculated from a contaminated toothbrush. Several of the studies found that toothbrushes were contaminated before use [5, 9]. Caudry et al. found that toothbrushes are heavily contaminated with normal use [5]. Mehta et al. found that 70% of the toothbrushes in their study became heavily contaminated with pathogenic microorganisms after use [10]. Studies by both Taji and Rogers [11] and Glass [12] found extensive toothbrush contamination after use except in cases where an oral antiseptic, such as mouthwash, was used immediately prior to brushing. Verran and Leahy-Gilmartin found that toothbrushes supported many different bacteria and the amount of growth was varied [13].

3.2. Decontamination. Several studies included in this review explored decontamination techniques for contaminated toothbrushes. Bunetel et al. found that toothpaste, mouthwash, and oral antiseptics all decrease microbial load on toothbrushes [8]. Caudry et al. examined toothbrushes in healthy adults as well as possible options for disinfection [5]. Their study found that the toothbrushes became heavily contaminated after use. Soaking the toothbrush in Listerine for 20 minutes prior to and after brushing decreased the microbial load. The use of antimicrobial coated toothbrushes in adults with oral disease was explored by Efstratiou et al. as a means to prevent toothbrush contamination [14]. This study, however, found that coating the bristles with triclosan did not change bacterial growth but the use of toothpaste did. Glass and Jensen explored ultraviolet light as a means of decontamination and found this method to be effective at reducing the bacterial load on toothbrushes [9]. The use of coated tufts and toothpaste was investigated in adult patients with oral disease. Quirynen et al. found that coated tufts did not inhibit contamination but use of toothpaste did reduce contamination [15]. Mehta et al. found that an overnight immersion in chlorhexidine gluconate was highly effective in decreasing toothbrush contamination and chlorhexidine was more effective than Listerine in reducing the microbial load of bacteria [10]. Sato et al. found that rinsing toothbrushes with tap water resulted in continued high levels of contamination and biofilm [16]. Warren et al. found that the use of regular and triclosan-containing

toothpaste resulted in lower toothbrush contamination than no toothpaste use [17].

3.3. Storage and Environment. Toothbrushes can become contaminated through contact with the environment, and bacterial survival is affected by toothbrush storage containers. Dayoub et al. found that toothbrushes placed in closed containers and exposure to contaminated surfaces yielded higher bacterial counts than those left open to air [18]. Mehta et al. found that the use of a cap for toothbrush storage increased bacteria survival [10]. Glass found that increased humidity in the environment increased bacterial survival on toothbrushes [12]. In addition, Glass found that bacteria survived more than 24 hours when moisture is present [12].

3.4. Design. Toothbrushes are manufactured in a variety of styles. Toothbrush bristles range from soft to hard with different cluster patterns and plastic shapes while toothbrush handles included different plastic shapes and decorative moldings. Different toothbrush design elements were examined by some of the studies. Bunetel et al. found that bacteria become trapped inside the bristles of the toothbrush and bacterial survival is dependent upon the bacteria (aerobic versus anaerobic) and toothbrush design [8]. In addition, the researchers found that solid handles had less bacteria retention and that as the surface area increased, so did the microbial load. Efstratiou et al. found that filament type affected bacterial retention [14]. Toothbrushes with bristles that are frayed and arranged closely together trapped and retained more bacteria [19]. This finding was also echoed in a study by Glass [1] that explored the level of bacterial retention based on toothbrush brand, color and bristle pattern. Contamination was the lowest in soft and round, clear, two bristle row toothbrushes. Glass also found that pathogenic bacteria adhere to plastic after short exposure times [1]. Caudry et al. found that bacteria strongly adhere to the bristles [5]. Mehta et al. found that the retention of moisture and oral debris in the bristles increased bacterial survival [10].

4. Conclusions

Due to the limited number of publications specifically related to toothbrush contamination, it was necessary to conduct a preliminary evaluation of the majority of identified articles for this review. For example, several of the articles combined an *in vivo* examination of bacterial survival on actual patient's toothbrushes and then conducted an *in vitro* autoinoculation experiment to examine decontamination

methods on sterile toothbrushes in the laboratory. This made database searching and identification of articles for the review more challenging. The selected studies all found that toothbrushes of healthy and oral diseased adults become contaminated with potentially pathogenic bacteria from the dental plaque, design, environment, or a combination of factors. The trend identified in the literature is to evaluate methods to reduce toothbrush contamination or toothbrush design rather than evaluating the process related to how the toothbrush initially becomes contaminated, is stored, or is disinfected.

In a vulnerable population such as critically ill adults, pathogenic contamination may increase the risk of infection and mortality. Although some interventions such as chlorhexidine, toothpaste, mouthwash, and ultraviolet sanitizers reduce bacterial survival, oral hygiene practices in the hospital setting by nurses vary. Currently, there are no nursing guidelines related to toothbrush frequency of use, storage, and decontamination. In the hospital setting, the environment as a source of pathogenic bacteria is now a hot topic and the focus of many current infectious disease research studies. Surfaces in close contact with the patient such as bed frames, countertops, sinks, bedside tables, linens, and mattresses may act as fomites. Toothbrushes may come into contact with these surfaces prior to or after use thus increasing risk. While there is significant literature available on environmental contamination and risk for infection, no studies have specifically examined the toothbrush on more vulnerable hospital populations such as critically ill adults.

Toothbrush storage is inconsistent in both community and hospital environments and may increase exposure to pathogenic organisms. The storage conditions of toothbrushes play an important role in bacterial survival: toothbrushes stored in aerated conditions had a lower number of bacteria than those stored in plastic and bacterial growth on the toothbrush increased 70% in a moist, covered environment [10]. In clinical practice, the author has observed that there is no standardized nursing protocol for the storage or replacement of toothbrushes and that some commonly observed nursing practices include storing the toothbrush in the bath basin with other bathing/personal supplies and linens, in a paper towel, in a plastic wrapper, on the bedside table, next to the sink, and in an oral rinse cup at the bedside. These practices may impact the contamination of toothbrushes.

In this review, the majority of studies identified had small sample sizes. Studies with larger sample sizes would be beneficial in future studies. Importantly, despite multiple studies supporting toothbrush contamination and the likely relationship between contamination and disease transmission, there are no studies that specifically examine toothbrush contamination and the role of environmental factors, toothbrush contamination and vulnerable populations in the hospital setting (e.g., critically ill adults), and toothbrush use in nursing clinical practice. Additional descriptive studies to evaluate these relationships would be beneficial and informative for future research. The relationship between environmental factors, toothbrush contamination, and patient oral colonization would inform development of nursing oral care

guidelines for adults that minimize risks related to toothbrush contamination.

References

- [1] R. T. Glass, "The infected toothbrush, the infected denture, and transmission of disease: a review," *Compendium*, vol. 13, no. 7, pp. 592–598, 1992.
- [2] M. J. M. Bonten, M. K. Hayden, C. Nathan et al., "Epidemiology of colonisation of patients and environment with vancomycin-resistant enterococci," *The Lancet*, vol. 348, no. 9042, pp. 1615–1619, 1996.
- [3] Centers for Disease Control. In CDC's National Center for Infectious Diseases, 2002, <http://www.cdc.gov/oralhealth/infectioncontrol/factsheets/toothbrushes.htm>.
- [4] ADA.org: ADA statement on toothbrush care: cleaning, storage and replacement, 2009, <http://www.ada.org/1887.aspx>.
- [5] S. D. Caudry, A. Klitorinos, and E. C. Chan, "Contaminated toothbrushes and their disinfection," *Journal (Canadian Dental Association)*, vol. 61, no. 6, pp. 511–516, 1995.
- [6] R. T. Glass and M. M. Lare, "Toothbrush contamination: a potential health risk?" *Quintessence International*, vol. 17, no. 1, pp. 39–42, 1986.
- [7] N. Grewal and K. Swaranjit, "A study of toothbrush contamination at different time intervals and comparative effectiveness of various disinfecting solutions in reducing toothbrush contamination," *Journal of the Indian Society of Pedodontics and Preventive Dentistry*, vol. 14, no. 1, pp. 10–13, 1996.
- [8] L. Bunetel, S. Tricot-Doleux, G. Agnani, and M. Bonnaure-Mallet, "In vitro evaluation of the retention of three species of pathogenic microorganisms by three different types of toothbrush," *Oral Microbiology and Immunology*, vol. 15, no. 5, pp. 313–316, 2000.
- [9] R. T. Glass and H. G. Jensen, "The effectiveness of a u-v toothbrush sanitizing device in reducing the number of bacteria, yeasts and viruses on toothbrushes," *Journal—Oklahoma Dental Association*, vol. 84, no. 4, pp. 24–28, 1994.
- [10] A. Mehta, P. S. Sequeira, and G. Bhat, "Bacterial contamination and decontamination of toothbrushes after use," *The New York State Dental Journal*, vol. 73, no. 3, pp. 20–22, 2007.
- [11] S. S. Taji and A. H. Rogers, "The microbial contamination of toothbrushes. A pilot study," *Australian Dental Journal*, vol. 43, no. 2, pp. 128–130, 1998.
- [12] R. T. Glass, "Toothbrush types and retention of microorganisms: how to choose a biologically sound toothbrush," *Journal—Oklahoma Dental Association*, vol. 82, no. 3, pp. 26–28, 1992.
- [13] J. Verran and A. A. Leahy-Gilmartin, "Investigations into the microbial contamination of toothbrushes," *Microbios*, vol. 85, no. 345, pp. 231–238, 1996.
- [14] M. Efstathiou, W. Papaioannou, M. Nakou, E. Ktenas, I. A. Vrotsos, and V. Panis, "Contamination of a toothbrush with antibacterial properties by oral microorganisms," *Journal of Dentistry*, vol. 35, no. 4, pp. 331–337, 2007.
- [15] M. Quirynen, M. De Soete, M. Pauwels, S. Gizani, B. Van Meerbeek, and D. van Steenberghe, "Can toothpaste or a toothbrush with antibacterial tufts prevent toothbrush contamination?" *Journal of Periodontology*, vol. 74, no. 3, pp. 312–322, 2003.
- [16] S. Sato, V. Pedrazzi, E. H. Guimarães Lara, H. Panzeri, R. F. De Albuquerque, and I. Y. Ito, "Antimicrobial spray for toothbrush disinfection: an in vivo evaluation," *Quintessence International*, vol. 36, no. 10, pp. 812–816, 2005.

- [17] D. P. Warren, M. C. Goldschmidt, M. B. Thompson, K. Adler-Storthz, and H. J. Keene, "The effects of toothpastes on the residual microbial contamination of toothbrushes," *Journal of the American Dental Association*, vol. 132, no. 9, pp. 1241–1245, 2001.
- [18] M. B. Dayoub, D. Rusilko, and A. Gross, "Microbial contamination of toothbrushes," *Journal of Dental Research*, vol. 56, no. 6, article 706, 1977.
- [19] M. C. Goldschmidt, D. P. Warren, H. J. Keene, W. H. Tate, and C. Gowda, "Effects of an antimicrobial additive to toothbrushes on residual periodontal pathogens," *Journal of Clinical Dentistry*, vol. 15, no. 3, pp. 66–70, 2004.