

Call for an Integrated (Medical/Dental) Health Care Model that Optimally Supports Chronic Care, Pediatric Care, and Prenatal Care as a Basis for 21st Century EHR Standards and Products: EHR Position Paper

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Abstract

Significant changes in the model for health care have been set in motion. Triggered by science and research and the evolution of medical and dental practice, a very costly domain in healthcare, **chronic care**, now demands that medical and dental care and data be integrated. To reduce the costs of such change and facilitate this change and to assure the highest quality care and safety for patients, the model that informs electronic health record standards, design and implementation needs to correspond to the anticipated model for integrated health care that supports communication among medical and dental providers, avoids discrepancies between records and information available to different providers for the same patient, optimally supports a wellness model of healthcare, and permits the greatest benefit to be derived from the collaboration of the medical and dental professions. Systems which are not so integrated are not coherent, evidence discrepancies between records for the same patient, and are at risk of becoming obsolete. An insurance and claim structure that is not correspondingly integrated into a single coherent approach likewise risks obsolescence and can no longer effectively support the demands of 21st century patient care. This paper recommends the steps necessary to embrace and facilitate such change.

Table of Contents on page 51 (last page)

0. General Introduction; Modeling and Specifying a System with Safety and Quality of Care

Before we begin to design the Electronic Health Record (EHR), we must be certain we are using a correct model of health care and its transactions. This is a conventional rule in database design. The process of ascertaining the functional model is often called systems analysis. The complexity of health care, the practice protocols of its multiple types of providers and subspecialties, its associated technologies, and standards of care assure that such analysis will be a challenging task.

In general the design of any system must be preceded by agreement on and specification of what that system is required to provide, an idea, a model, a set of explicit specifications of what that system should be and should deliver in the way of functionality. The process of developing the National Health Information Network (NHIN) has begun, so as we call attention to the routine requirement for a correct model,

we are concerned about what adverse impact has already been taken place if the model being used is incorrect and does not contain basic specifications. This impact may occur where EHR standards and products do not correspond to the correct healthcare model. The ultimate result could consist of harm to patients (such as inadequate or inappropriate management of an illness or condition that leads to a more serious illness, preventable injury or incapacitation, or an untimely death) who have not received appropriate diagnosis or treatment through the implementation of an obsolescent healthcare model that predates EHRs and the NHIN.

If this model of healthcare is “broken” in any significant way, then the standards and EHR products may be correspondingly “broken” or unreliable in their function, incapable of reliably, predictably and consistently delivering **safety** and **quality of care**. If there are any significant errors or omissions in the fundamental model, these errors and gaps in foundation will be institutionalized by development and implementation of EHR technology, placing even more barriers in the path of providing appropriate patient care, as it takes time and money to revise technology when necessary. Any significant error or omission in the fundamental model will be reflected in the development and implementation of the EHR. This creates additional barriers to the providing appropriate care. Correction of the model (removal of these barriers) is **costly and disruptive to workflow**. Further, appropriate care is a dynamic process. The various sciences and technologies that serve health care often see new discoveries and change, leading to revisions of practice and also of education of health care professionals in many ways.

As Dr. Gür-Shahnas points out (2008), in describing German Federal efforts to establish a health information infrastructure in Germany, the aims in that country are optimization of the quality of care, avoidance of redundant examinations and tests, and providing an information foundation to support reducing the length of time needed to effect treatment.

Heterogeneous databases, where they are required to support an application, must represent data without semantic drift (information refraction) ordinarily implicit in combining data from two modes of representation. The safety and quality of care requirements of clinical data systems demand unambiguous representation of data, including documentation of the context of data capture, as routinely necessary in health care. In this respect and apart from other considerations, healthcare database design is best served by a coherent, integrated model.

Computer science has documented how software and systems can be less rigid and less fragile, less easily broken with respect to their purpose, or more resilient and more able to be modified (upgraded) with less negative impact and cost. We learn to seek the appropriate levels of generality and abstraction in our specifications. We should consider whether the standards for EHRs are the foundation for fragile or resilient systems serving health care. Whatever model of health care is deemed to be an accurate representation in 2008 could be subject to updating in the future.

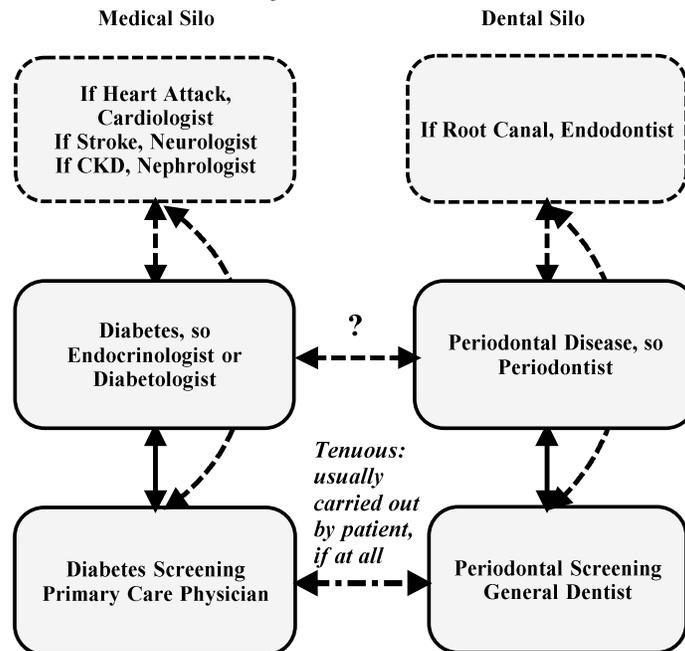
1. Introduction to Siloization in U.S. Health Care, International Context, Providers’ Care Streams Connected Tenuously, Discrepancies Between a Patient’s Medical and Dental Records

In health care today in the U.S., there are two “streams” of care, inadequately articulated: **oral health care** for the oral cavity and its associated structures (called dental care and

delivered by dental providers (general dentists, periodontists, endodontists, etc. with degrees like DDS and DMD)) and **systemic health care** for the rest of the body (called medical care and delivered by medical providers (allopathic physicians, osteopathic physicians, nurse practitioners, etc. with degrees like MD, DO, DNP). This artificial division of care into organizational **silos** ignores the fact that ***the mouth is part of the body*** (NIH, 2000). Where standards perpetuate this division, initiatives like the NHIN will fall short as a result, leading to failure to deliver the desired quality of care, safety, and health care cost reduction for Americans.

This siloization in the U.S. persists despite international recognition of the need for integration of the disciplines. According to the World Health Organization (WHO), “The strategy is that oral disease prevention and the promotion of oral health needs to be integrated with chronic disease prevention and general health promotion as the risks to health are linked.” Further, “The objectives of the WHO Global Oral Health Programme, one of the technical programmes within the Department of Chronic Disease and Health Promotion, imply that greater emphasis is put on developing global policies based on common risk factors approaches and which are

Figure 1
Flow of Information in Patient Care for Providers



coordinated more effectively with other programmes in public health. The policy of the WHO Global Oral Health Programme emphasises that oral health is integral and essential to general health, and that oral health is a determinant factor for quality of life.” Also, with regard to health information technology, “The WHO/FDI goals for oral health by the year 2000 urged Member States to establish oral health information systems, and this remains a challenge for most countries of the world. The WHO Oral Health Programme is prepared to assist countries in their efforts to develop oral health information systems which include data additional to epidemiological indicators.” (Petersen, 2008) According to WHO’s “Global goals for oral health 2020,” (Hobdell et al., 2003) Goal 2 is “To minimize the impact of oral and craniofacial manifestations of systemic diseases on individuals and society, and to use these manifestations for early diagnosis, prevention and management of systemic diseases,” and Objective 6 states, “To integrate oral health promotion and care with other sectors that influence health, using the common risk factor approach.”

Please examine Figure 1. Note that communication between the general dentist, who normally does the initial periodontal screening, and the specialist treating diabetes or stroke is typically indirect, proceeding through the Primary Care Physician (PCP) via the chart, EHR, or relies on the patient's

Table 1.1 – Timeline Summary	
1994	Oral Physician Speech (Nash)
1994	<i>British Dental Journal</i> reports pilot study
1994	WHO Oral Health Report: <i>Oral Health for the 21st Century</i>
1995	IOM Report on Dental Education at the Crossroads
1996	UK Gov't White Paper proposes pilot integr. schemes
1998	Midwest Collab. using CCM
1998	<i>British Dental Journal</i> reports on 3-year study of integration
2000	Surgeon General Report – Oral Health
2000	<i>Healthy People 2010</i> with dental objectives
2002	First Marshfield Clinic dental clinic in Ladysmith, WI
2003	Amer. Diabetes Ass'n. Clinical Practice recommendations
2004	Wis. diabetes care guidelines
2006	Aetna announces Dental/Medical Integration
2007	New IHS RPMS Dental System
2007	AADE dental visit measure
2007	Scottsdale Project
2007	WHO global policy for improvement of oral health – World Health Assembly 2007
2008	Amer. Diabetes Ass'n. SoC include “dental referral”
2008	AAMC MSOP: Medical and Dental Students Education
2008	Amer. Acad. of Pediatricians' statements on oral health for 21 st century

initiative. Any medical specialists (endocrinologists, cardiologists) treating a patient are ordinarily dependent on the patient's primary care physician for contact with the providers in the same patient's dental silo. A neurologist, for example, who might gain in the processes of diagnosis and treatment from a well-established model of interdisciplinary medical-dental communication, is dependent on the referring PCP for dental silo information, and that referring PCP might not have a direct channel of communication with the patient's dental provider(s). Figure 1 shows a dotted line (labeled with a question mark) for possible communication between an endocrinologist or diabetologist and periodontist.

Unfortunately the two silos both lack a systematic approach to communication with each other unless, in an individual practice, the provider teams (physician and nurse on the medical silo and general dentist and dental hygienist, who has a preventive and patient education role in care (Monajem, 2006), in the dental silo) happen to have mobilized to include seeking a patient's other-silo information in the process of patient assessment. In general this connection must also be regarded as tenuous, as reflected in the dot-dash line. The arrow in the diagram

might suggest that the communication is provider to provider and often, the cross communication, in reality is dental provider via patient as active carrier of the message to the medical provider. The education base for each respective silo does not prepare providers for this particular dimension of care. A well-established model for efficient communication among medical and dental providers caring for the same patient, does not exist in general.

According to Schleyer (2008), “I think the healthcare system has plenty of opportunities to improve the quality of care by simply improving the communication among the people who provide it. However, there are several reasons why this is not happening very much now. Many of them are historical and ‘ingrained’ in the way each discipline practices, but others are contemporary barriers. ... we have to acknowledge that technology is only a piece of the puzzle. It certainly will not be the silver bullet for solving healthcare communication problems. It needs to work hand-in-hand with efforts to (1) augment standards of care to represent the best evidence available; (2) break down professional, systemic, cultural and personal barriers to improved communication; and (3) make the patient the central and focal point of healthcare.”

During the past two decades, there have been unmistakable signs that this siloization is obsolete:

- (1) David Nash’ speech (1994) at the University of Rochester School of Medicine and Dentistry, “The Oral Physician: Creating a New Oral Health Professional for a New Century.”
- (2) WHO Oral Health Report (1994)
- (3) *Dental Education at the Crossroads: Challenges and Change*, (Field and Jeffcoat, 1995) and the Institute of Medicine (IOM) had already recommended closer integration of dentistry with medicine and the health care system as a whole. This IOM report predicted that scientific and technological advances in molecular biology, immunology, and genetics, along with an aging population with more complex health needs, would increasingly link dentistry and medicine, leading to the need for changes in dental education. (Sax, 2002) From the IOM report: “The report did not call for a single medical/dental profession, but it did conclude that the dental profession will and should become more closely integrated with medicine and the health care system on all levels: education, research and patient care.”
- (4) Beginning of the Midwest Disparities Collaborative in 1998, a diabetes quality improvement initiative using the MacColl Chronic Care Model (CCM), which “aims to create practical, supportive interactions between an informed activated patient and a proactive, prepared clinical team,” and rapid Plan-Do-Study-Act (PDSA) cycles from the continuous quality improvement field. (Chin et al., 2004). This chronic care initiative included dental care as well as a dilated eye exam, diet intervention, and foot care or foot examination, based on the ADA [Diabetes] clinical practice recommendations. Chronic care models have been important in integrating dental collaboration in regional and statewide initiatives, of which this is an example. The MacColl CCM was succeeded by the Wagner CCM (Wagner EH, 1996, Wagner EH et al., 1998, Wagner EH et al., 2001, Bodenheimer T et al., 2002a and 2002b)
- (5) Haughney et al. report on a three-year study of integration of primary care dental and medical services (1998): “This experimental model of health care showed the potential that exists for the coordination and integration of functions between the dental team and the primary care team. Improvement in communication by joint information exchange can be of considerable benefit to patient care. We believe

- that most of the benefits indicated on this single clinical site could be reproduced in separate locations by the use of integrated record systems and modern methods of information exchange. Integrated primary dental and medical care requires attitudinal change in health care professionals and requires greater emphasis in the education and training of health care professionals in the future.”
- (6) *Healthy People 2010* (2000) includes a national objective calling for at least 75% of people with diabetes to regularly have at least one dental visit annually by the year 2010 (U.S. Government, HHS), now only two years away.
 - (7) *Oral health in America: a report of the Surgeon General*, issued by the Department of Health and Human Services, National Institute of Dental and Craniofacial Research, and National Institutes of Health, in 2000 (NIH, 2000).
 - (8) Greg Nycz reports the first dental clinic in the Marshfield (WI) Family Health Center system was established in 2002 in Ladysmith, WI.
 - (9) American Diabetes Association Clinical Practice recommendations (ADA, 2003).
 - (10) Wisconsin Diabetes Advisory Group’s 2004 “Wisconsin essential diabetes mellitus care guidelines,” describing the Wisconsin Diabetes Prevention and Control Program, and including a chapter on Oral Health and recommendations for interdisciplinary communication (Wisconsin, 2004).
 - (11) Aetna’s Dental/Medical Integration Program (Grossman, 2006) is announced. According to Dr. Mary Lee Conicella, Aetna Dental's national director of clinical operations "The association between oral health and systemic health is consistently demonstrated in clinical studies, and the findings are positively impacting the treatment and management of patients." Further she said "Specifically, there is a significant body of research that indicates pregnant women and individuals with diabetes or heart disease benefit from early periodontal care. The member outreach program, in conjunction with enhancements to our dental offerings, is designed to motivate these individuals to seek care." (Aetna, 2006).
 - (12) Dr. George Chiarchiaro, an IHS dentist and project manager for the IHS EDR, said that the new EDR will replace the current one used by IHS and will offer dentists far more options on it than the existing dental record. Dr. Chiarchiaro stated that , “we will interface our new dental record with certain portions of that larger legacy system. One of the interfaces between our new dental software and our existing electronic health record will be to send dental information over to the electronic health record. A physician, or nurse practitioner, pharmacist or physician assistant can open the patient's electronic health record and see what dental procedures have been performed. They will not have to go into the dental application, but they will be able to access that information in the patient's primary health record.” (Basu, 2006).
 - (13) The American Association of Diabetes Educators included “saw a dentist” among its care measures (AADE, 2007).
 - (14) The Scottsdale Project (Hein et al. 2007).

- (15) The American Diabetes Association included “dental referral” and “dental history” in its Standards of Care. (ADA [Diabetes], 2008) Sue Kirkman reported that the two ADAs (Diabetes and Dental) were collaborating on conferences with year and that “the Professional Practice Committee has just commissioned a technical review of the literature to be jointly written by medical and dental professionals from "both" ADA's. This extensive review of the literature on the interactions between diabetes and periodontal disease should greatly enhance the understanding of dental and medical providers of the issue. My sense is that to date dental professionals are much more aware of the link than medical professionals, and we are working to change that.” (Kirkman, 2008) This was included in “Standards of Care in Diabetes – 2008,” in the January 2007 issue of *Diabetes Care*. The Standards of Care action by the ADA needs to be followed up with the assignment of a corresponding HEDIS code on the part of NCQA. This was preceded by including “dental referral” in the ADA clinical practice guidelines.
- (16) In June 2008 the American Association of Medical Colleges published *Contemporary Issues in Medicine: Oral Health Education for Medical and Dental Students: Medical School Objectives Project* (AAMC, 2008).
- (17) In October 2008 the American Academy of Pediatricians (AAP) PEDS 21 Symposium (Pediatrics for the 21st Century) focused on oral health and “the Pediatrician’s role in Oral Health.” From *AAP Highlight*: “More than 40 percent of children from families at or below the federal poverty line have tooth decay by the time they reach kindergarten. More than 52 million hours of school are lost each year because of dental problems. To combat these and other problems related to dental health, pediatricians are being asked to focus on the oral health of our nation’s youth. ‘Pediatricians see young infants and children frequently for preventive health care visits, putting them in an excellent position to identify children at risk for dental health problems, coordinate appropriate care and parent education, and refer affected and high risk children to pediatric dentists,’ said Suzanne Boulter, MD, pediatrician at Concord Hospital in Concord, NH. ... In 2000, the U.S. Surgeon General released the report “Oral Health in America” to raise awareness of the ‘silent epidemic’ of dental and oral disease. It concluded that dental caries is the most prevalent infectious disease among American children. While early childhood dental caries emerges within all cultural and economic pediatric populations, oral health disparities are related to socioeconomic status and race/ethnicity, it stated, ‘As a result of the Surgeon General’s report, the American Academy of Pediatrics began a push to examine children’s oral health and determine how pediatricians could become involved in addressing the epidemic,’ said Huw Thomas, B.D.S., M.S., Ph.D., dean of the School of Dentistry at the University of Alabama at Birmingham.”

Dr. Wendy Mouradian is a leader in the collaborative, interdisciplinary approach to health care, integrating medical and dental care. Dr. Mouradian writes about how she became interested in providing integrated care:

The biggest influence was when I was the Director of the Interdisciplinary Craniofacial Program at Seattle Children's Hospital where I saw the

importance of the dental and oral components of health and the consequences when these were ignored. I also began to appreciate the general medical ignorance of these issues... Then I started to realize that there was an isolation of dentistry in the area of health policy and funding, and as a consequence large gaps in access to dental care. I did a certificate in health care ethics at the UW [University of Washington] and focused on some of these issues in that program. I subsequently went on to work for NIDCR on the Surgeon General's Conference on children and oral health. (Mouradian, 2008).

She indirectly reveals that her interest was preceded by the presence of an interdisciplinary program unit. Not only have interdisciplinary integration and collaborative (medical-dental) care existed prior to the developments of the last 20 years, in talking with medical and dental providers it has been obvious that there always have been individual providers in both disciplines who have been sensitive to this need. What has been lacking in health care in the U.S. in general (except in the VA system and in the IHS which have been leaders not only in health information technology, but in integrating care and in implementing preventive and chronic care), is a consistent and generally-accepted foundation for communication among these providers for shared patients. In order to establish the proper model for healthcare's future in the U.S. and for the NHIN, the U.S. requires a model of healthcare that overcomes the "isolation of dentistry in the area of health policy and funding" that Dr. Mouradian mentions. HHS/ONC is now furnishing the leadership to assure that such a model is at the heart of the impetus for harmonized HIT standards.

Nash (2006), Giddon (2006), Giddon and Assael (2004) have discussed calling dental providers "oral physicians." Giddon points out that "unfortunately, the dental profession, which enjoys what are perceived to be the benefits of independence from medicine, including a higher average salary than physicians – at least when comparing general dentists with primary care physicians in group practice (\$174,350 for the general dentist in 2002 and \$150,000 for primary care physicians in group practice in 2002) – may not want to incur the bureaucratic disadvantages of managed care and related problems." Nash (2006) cites the oral physician curriculum at the University of Kentucky. Nash writes, "I justified the need for such a transformation based on the significant changes in the environment of dentistry, which I characterized as biological, epidemiological, technological, demographic, professional, and economic." Further Nash states, "changing our name changes nothing of substance," he wants dental education to be reformed and scorns "minor changes" and asserts "separation from medicine may have served the public well in the past. It no longer does."

As evidence accumulates to support the tighter integration of medical and dental care, the question is, where in the model for HIT standards harmonization and in set of specifications for the HIT standards harmonization, is it clearly and explicitly stated that national HIT standards harmonization should incorporate provisions for medical-dental collaboration, toward which health care in the U.S. and other countries has been moving for the past ten years? Does the HIT standards harmonization process serve an obsolescent model of healthcare as it has been or a model for the future? Leadership from HHS/ONC, acknowledging healthcare needs from an integrated viewpoint, is resolving this question.

The move toward a wellness and preventive model of healthcare is not the only reason for integration. The Department of Defense (DoD) is leading in medical/dental integration. This may be due to the fact the DoD has been aware since 1977 that as many of 10% of dental records of active duty personnel could have discrepancies when compared with their medical records (Lewis et al., 1977). In a group of 100 randomly selected active duty personnel at Walter Reed Medical Center, “eleven discrepancies of major medical significance were found.” Discrepancies between medical and dental records is due largely to the reliance on patient reports from treatment in the other discipline, rather than on an integrated electronic record system. Selzer and McDermott (1999) reported that “of patients who completed the same medical history questionnaire twice within a certain time period, 66% had at least 1 significant omission in their history.”

According to Lutka and Threadgill (1995), “medical history questionnaires and outpatient medical records of 115 patients were compared. All patients had a medical history of at least two years in both records. The dental records were initially reviewed, and patients' responses were compiled; when these were compared with the outpatient medical records, the overall discrepancy rate was > 86 percent. This overwhelming rate of error should make dentists aware that many routinely treated patients have medical conditions that are unknown to providers. Use of universal precautions, adequate medical-emergency training, and oral review of the dental health questionnaire are recommended.”

2. Interrelationships of Diabetes and other Chronic Diseases to Periodontal Disease and other Needs for Interdisciplinary Collaboration in Care and Research

2.1 Interrelationships of Diabetes, Cardiovascular Disease and Periodontal Disease

According to Mealey and Rose (2007), “the presence of periodontal diseases can have a significant impact on the metabolic state in diabetes. Diabetic subjects with periodontitis have a six-fold higher risk for worsening of glycemic control over time compared to diabetic subjects without periodontitis. Periodontitis is also associated with an increased risk for diabetic complications. In one study, 82% of diabetic patients with periodontitis experienced one or more major cardiovascular, cerebrovascular or peripheral vascular events during the study period of 1–11 years, compared to only 21% of diabetic subjects without periodontitis.”

To imagine the seriousness of periodontitis within the context of patient care in general, Professor Edward P. Heinrichs (Periodontics and Preventive Care, School of Dental Medicine, University of Pittsburgh) recently suggested comparing the aggregate “open wound” of periodontitis (dentogingival epithelial surface area or DGES), according to an authoritative source (Hujoel et al. 2001), to an open wound ranging (on the mean) from 1.24 sq. in. to 3.1 sq. in.

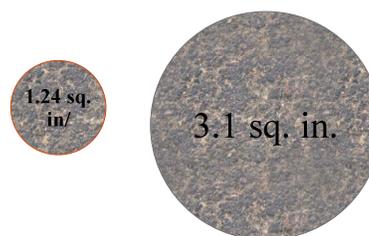


Figure 2
Open Wound Size Range from 1.24 sq. in to 3.1 sq. in: adult periodontitis DGES equivalent
(Diagrams are smaller than actual size)

According to Mealey and Rose, “the periodontium is a unique ecological niche in the human body. In people without teeth, the mucosal lining of the oral cavity is intact and is inhabited by a commensal bacterial microbiota that provides little challenge to the host, similar to that seen on an intact skin surface. The presence of teeth changes this ecological niche because the teeth project through the mucosal surface. An analogous situation would be a skin surface into which an intravenous catheter or an ostomy is placed. The formerly intact skin surface is now interrupted and the junction between the skin surface and the ostomy or catheter becomes a site of persistent microbial challenge. At the junction between the gingiva and the tooth, there is a space known as the “gingival sulcus” in health and the “periodontal pocket” in disease. In the sulcus or pocket there exists a delicate balance between microbial colonization and host defense. Periodontal diseases are initiated by bacteria residing in biofilms along the tooth surface at this interface of the gingival tissues and the tooth, many of which are Gram-negative and anaerobic. There is a persistent microbial wound present at this site, a wound contaminated by any of the more than 400 bacterial species present in the mouth. An intact wound healing response is necessary to prevent local tissue destruction or systemic dissemination of bacterial products.” Mealey and Rose provide, by mentioning catheter and ostomy sites, an analogy very useful in understanding the challenge of oral health with respect to the periodontium. They further state, “the periodontium is different from other tissues and organs, as previously mentioned, in that the periodontium undergoes constant wounding from the bacterial biofilm. The immunoinflammatory response, so critical to maintaining periodontal health, is markedly altered in many people with diabetes. Diabetes results in changes in the function of immune cells including neutrophils, monocytes and macrophages. Neutrophil adherence, chemotaxis and phagocytosis are often impaired, enabling bacteria to persist in the periodontal pocket and to significantly increase periodontal destruction.” (Mealey and Rose, 2007). Mealey (2008) points out that, “approximately 30 percent of people with diabetes mellitus” have not yet been diagnosed with diabetes mellitus. Therefore, the dental office is a health care site that can help identify undiagnosed diabetes mellitus, which can lead to better management of the care of patients with diabetes.” However, when it comes to the management of risk factors, Lamster et al. (2008) also report “researchers found that proactive management of the care of patients was not performed routinely.” They cite evidence that “dentists do not communicate with patients with DM and their physicians as well as they might.” Lamster et al. (2008) conclude, “a greater role for the oral healthcare team in the management of care of patients with diabetes is both warranted and appropriate” and characterizes this as an “opportunity the [dental] profession should embrace.” Mealey (2008) asserts that “one of the most important things physicians can do to help their dental colleagues is to provide the results of laboratory tests such as HbA_{1c} to dentists on request” and that “communication among dentists, physicians and patients is an area ripe for improvement.”

Given the importance of diabetes for the general Chronic Care Model (CCM) and the CCM emphasis on preventive care, one would expect attention to articulation of medical and dental care in the CCM. Publications describing the Wagner CCM do not reveal any particular recognition of the interrelationship between diabetes and periodontal disease or heart disease and periodontal disease and do not explicitly call for dental referral or articulation of medical and dental care as part of the CCM strategy (Wagner EH, 1996,

Wagner EH et al., 1998, Wagner EH et al., 2001, Bodenheimer T et al., 2002a and 2002b). Monajem (2006) cites dental hygienists’ “focus on preventive oral care” and calls hygienists “‘best poised’ to help accelerate the integration of oral health with primary care.”

2.1.1 Prevalence of Diabetes and Periodontitis

In this consideration of models of health care, it is useful to consider the impacts of diabetes and periodontal disease. Here are some data from the Centers for Disease Control:

(CDC) Estimated diabetes costs in the United States in 2007:

Total (direct and indirect): \$174 billion

Direct medical costs: \$116 billion

After adjusting for population age and sex differences, average medical expenditures among people with diagnosed diabetes were 2.3 times higher than what expenditures would be in the absence of diabetes.

Indirect costs: \$58 billion (disability, work loss, premature mortality)

Prevalence of diagnosed and undiagnosed diabetes in the United States, all ages, 2007

Total: 23.6 million people or 7.8% of the population have diabetes.

Diagnosed: 17.9 million people

Undiagnosed: 5.7 million people

From the CDC (Eke and Genco, 2007) – Periodontal disease prevalence: “Periodontal disease is highly prevalent in older adults, affecting 34% of the American population aged >30 years (36 million persons), and it is severe in 13% of adults.”

Robert Nelson (NIH/NIDDK) writes, “Recent studies suggest even greater complexity in the relationship between periodontal disease and diabetes. These studies report striking relationships between periodontal disease and the development of the macro- and microvascular complications of diabetes—in particular cardiovascular and kidney disease. Whether these relationships are due primarily to the hyperglycemia that typically accompanies periodontal disease or to other mechanisms remains to be determined. Some proposed mechanisms for the link between periodontitis and the complications of diabetes include chronic systemic inflammation associated with increased circulating cytokines and inflammatory mediators, direct infection of the vasculature extending beyond the oral cavity, an autoimmune response to the chronic periodontal infection that leads to endothelial dysfunction, or common susceptibility factors that lead to increased susceptibility to periodontal disease and to vascular diseases simultaneously. Perhaps several or all of these mechanisms are involved.” (Nelson, 2008).

Ample research literature exists documenting the role of inflammation, common to periodontal diseases and other systemic diseases (Cochran, 2008; Genco, 2008; Graves 2008; Ordovas and Shen, 2008; Serhan, 2008; Van Dyke and Kornman, 2008; Wilson, 2008). Some research focuses on periodontal disease and bone loss (Cochran, 2008), Alzheimer’s disease (Rogers, 2008), Metabolic Syndrome (Ordovas and Shen, 2008), and Atherothrombosis (Ridker and Silvertown, 2008).

Healthcare has not thought through and has not provided for the integrated process of communication that would support coordinated care for a patient by a family physician (and staff) and a periodontist (and staff), for example. Periodontists communicate typically within the dental "silo," such as with general dentists, and rarely with healthcare professionals in the medical "silo." The report that a periodontist might send to the patient's family physician, endocrinologist, diabetologist or cardiologist might not be the same as a report intended for the patient's general dentist.

2.2 Dental infection in chronic cardiovascular disease

Slavkin and Baum (2000) wrote, "in particular, we call attention to the ongoing research into the role of dental infection in chronic cardiovascular disease. Several prospective studies have demonstrated a significant association between dental infection and atherosclerosis or coronary heart disease." *Healthy People 2010* includes a national objective calling for at least 75% of people with diabetes to regularly have at least one dental visit annually by the year 2010 (U.S. Government, HHS). Mochari et al. (2008) relied on self-reporting to determine that "a history of periodontal disease was associated with significantly higher levels of Lp-PLA₂ compared with those without periodontal disease" and to assert that "these data support a possible independent association between oral health and CVD."

2.3 A collaborative medical-dental approach to geriatric care.

Coleman (2005) deals with nursing-dental collaboration to address oral health needs among the elderly.

2.4 Prenatal care, periodontal disease and low birth weight

According to Kushtagi et al. (2008), "the association of low birth weight neonates with high health care costs and high infant mortality has been well established." In a study of 150 women with appropriate variables controlled for, "the presence of periodontal infection was found to be significantly higher in women who delivered low birth weight neonates compared with the control group." Dasanayake et al. (2008) recommend that "because treatment of periodontal disease during pregnancy is both safe and effective, nurses, nurse practitioners, and nurse-midwives who care for mothers and infants can play an important role in educating pregnant women about oral health. Because nearly two-thirds of pregnant women do not receive dental care during pregnancy, nursing professionals can counsel pregnant women to seek dental care during pregnancy. If mothers understand that there is a potential link between the bacteria in their mouth, their health, pregnancy outcomes, and the health of their infant, they may be more receptive to and interested in seeking dental care." Michaliwicz et al. (2006) confirm the safety of periodontal care during pregnancy. Vettore et al. (2008) describe "the relationship between periodontitis and preterm low birthweight."

2.5 Interdisciplinary care needs in postradiation osteonecrosis (ORN) and biphosponate-caused osteonecrosis (ONJ)

An interdisciplinary response is also called for in the case of osteoradionecrosis. Jolly (2005) writes, "Osteoradionecrosis (ORN), also known as postradiation osteonecrosis (PRON), is a serious, debilitating and deforming potential complication of radiation therapy for the treatment of cancer of the head and neck. It has been defined as a necrosis or death of the bone of the mandible or maxilla that may occur following radiation

therapy for cancer in the oral and perioral region. It is known to occur when bones, in this case the mandible and/or maxilla, are directly in the field of radiation.”

According to Ronald P. Strauss (AAMC, 2008), “Nothing prepared me for the destruction that I witnessed on Mr. J’s jaw caused by osteoradionecrosis. His jaw bone melted away on the X-rays until he had a fractured mandible, all because he had radiation treatment for oral cancer years ago. Mr. J developed root caries on one of his few remaining teeth. It had already advanced into the pulp, and when I saw him for dental pain, the X-ray showed a large area of bone loss that quickly progressed in spite of our treatment. This experience has shown me that people who have had radiation therapy for oral and pharyngeal cancer must be carefully followed for preventive dentistry and emerging dental needs. Even years after the original cancer treatment, they may be at risk for radiation-associated dental caries and osteoradionecrosis. It is critical that the dentist and the oncology team communicate closely about the care of patients who have had head and neck radiation treatment for oral or pharyngeal cancer.”

Recently, there have been reports of osteonecrosis of the jaws (ONJ) in cancer patients receiving concomitant anticancer therapy (chemotherapy, steroid therapy, or head and neck radiotherapy) and an intravenous (IV) bisphosphonate (Domato et al., 2004). There are multiple recognized conditions and risk factors associated with the development of osteonecrosis (not limited to the jaws) in cancer patients. (Marx, 2003; Migliorati et al., 2003; Ruggiero et al., 2004). Potential liability in the cases involving bisphosphonate gives another reason why dentists need to be linked into medical information. A patient’s dentist may not be the one who prescribes a given bisphosphonate but may very well be the first one to observe the complication;

2.6 Oral Cancer Screening; Tobacco Use Screening and Oral Cancer Prevention

Dental providers are now performing oral cancer screenings for cancers of the head, neck, and mouth. According to an online page from the Oral Cancer Foundation (OCF, 2008), in addressing dental providers, “For general dental practitioners OCF believes your responsibility is at minimum creating awareness, and being involved in opportunistic discovery of suspect tissue through routine screening of your entire patient population, and referral for second opinion or biopsy when appropriate. For dental specialists such as oral surgeons and periodontists, as well as oral medicine specialists, it is providing second opinions, and when requested, performing biopsy of any suspect area.” Macpherson et al. (2003) examined the trade-offs (in the UK) between seeking more routine dental visits to improve oral cancer screening, as a dental check-up would support early detection, and getting general medical practitioners (GMP) to play more of a role in oral cancer screening. Macpherson et al. stated that “a high proportion of GMPs (87%) indicated they routinely made enquiries of their patients in relation to smoking habits” and yet reported only “19% of dental respondents routinely made enquiries into smoking habits, with a further 49% doing so ‘occasionally.’” Thus the health professional (dental), perhaps most appropriately in a position to do oral cancer screening, appears not to be as engaged in this aspect of health promotion, even though tobacco use is regarded as a high risk behavior for oral cancer.

2.6 Dental provider screening for eating disorders

DeBate and Tesco (2006) describe how general dentists can play a role in preventing eating disorders: the “dentist, in particular, has a uniquely important and valuable role with respect to assessment of oral and physical manifestations [of anorexia nervosa and bulimia nervosa]. ... Despite this crucial role, few dentists are engaged in eating disorder-specific secondary prevention.”

2.7 A collaborative medical-dental approach to pediatric care

Dentists can be particularly important to the success of pediatric care. Chu et al. (2007) document referrals by nondentist providers for oral health care. Wendy Mouradian (2003, 2004) has been a pioneer and strong advocate for collaborative medical/dental approaches to pediatric oral health care. Other information on interdisciplinary approaches to pediatric dentistry can be found in (Mabry et al. (2006), Chu et al. (2008), Douglass et al. (2005)). Mouradian (2004) writes, it” is clear that oral health disparities cannot be addressed without collaborative efforts between dentistry and medicine and other health professions.” According to Riter et al. (2008), “Dental disease, the most prevalent chronic disease of childhood, affects children's overall health and ability to succeed. Integrating oral health into routine well-child checkups is an innovative and practical way to prevent dental disease. The Washington Dental Service Foundation (WDSF) is partnering with Group Health Cooperative, a large integrated delivery system, and other providers in Washington State to change the standard of care by incorporating preventive oral health services into primary care for very young children.”

2.8 Oral hygiene and respiratory infections

Yoneyama et al (1996) point out the role of oral hygiene in reducing respiratory infections in “elderly bed-bound nursing home patients.” According to Scannapieco (1999), “recent evidence has suggested a central role for the oral cavity in the process of respiratory infection. Oral periodontopathic bacteria can be aspirated into the lung to cause aspiration pneumonia. The teeth may also serve as a reservoir for respiratory pathogen colonization and subsequent nosocomial pneumonia. Typical respiratory pathogens have been shown to colonize the dental plaque of hospitalized intensive care and nursing home patients. Once established in the mouth, these pathogens may be aspirated into the lung to cause infection. Other epidemiologic studies have noted a relationship between poor oral hygiene or periodontal bone loss and chronic obstructive pulmonary disease. Several mechanisms are proposed to explain the potential role of oral bacteria in the pathogenesis of respiratory infection: 1. aspiration of oral pathogens (such as *Porphyromonas gingivalis*, *Actinobacillus actinomycetemcomitans*, etc.) into the lung to cause infection; 2. periodontal disease-associated enzymes in saliva may modify mucosal surfaces to promote adhesion and colonization by respiratory pathogens, which are then aspirated into the lung; 3. periodontal disease-associated enzymes may destroy salivary pellicles on pathogenic bacteria to hinder their clearance from the mucosal surface; and 4. cytokines originating from periodontal tissues may alter respiratory epithelium to promote infection by respiratory pathogens.” Azarpazhooh and Leake (2006) describe the role of “aspiration pneumonia,” leading to more than 15,000 deaths per year in the U.S., with more than 200,000 cases annually, and states that “among ICU patients, those being mechanically ventilated are particularly susceptible to pneumonia.”

2.7 Kidney disease and periodontal diseases

Fischer et al. (2008) describe periodontal disease as a risk factor for kidney disease. Craig (2008) describes how “renal replacement therapy can affect periodontal tissues, including gingival hyperplasia in immune suppressed renal transplantation patients and increased levels of plaque, calculus, and gingival inflammation and possible increased prevalence and severity of destructive periodontal diseases in ESRD patients on dialysis maintenance therapy. Also, the presence of undiagnosed periodontitis may have significant effects on the medical management of the ESRD patient. ... periodontitis may be a covert but treatable source of systemic inflammation in the ESRD population.” Bayraktar et al. (2006), reported in a study that more plaque and calculus and bleeding on probing were found in the HD (hemodialysis) than in the C (control) group. This evaluation is complex, as HD patients might receive anticoagulation therapy, affecting bleeding, and the altered serum calcium-phosphorus balance possible in ESRD patients. Bayraktar et al. point out that oral health care for CRF (chronic renal failure) patients should begin “before the beginning or at least within 1 month of their first dialysis treatment,” as without oral health maintenance “oral pathologies and infections could jeopardize the opportunity to receive a successful kidney transplant.”

It is obvious that the interdisciplinary nature of care has advanced to the point that the National Health Information Network (NHIN) should account for it among its priorities.

3. An Interdisciplinary Communication Model for the 21st Century.

If the NHIN provides for a synthesis of medical and dental data to support optimal patient care, a suitable, efficient interdisciplinary communication model is required. However general interdisciplinary agreement on the nature of such communication does not exist and thus is not available to support the education of medical and dental providers. When a periodontist receives a patient referred by a general dentist, it is clear what information should be sent to the referring dental provider. That same information, however, might not be meaningful or useful to a referring primary care physician or endocrinologist providing care for a patient with diabetes. A collaborative medical-dental approach to care would also lead to reciprocal best practice concepts for screening, such as the opportunities for dental providers to screen for eating disorders or oral cancer or for

Category	Not on <i>medical</i> records	Not on <i>dental</i> records	Total
Life threatening	2	4	6
Important	1	14	15
Relevant	20	58	78
Total	23	76	99

medical providers to screen for oral health as suggested by a number of sources. Providers in both silos sharing care of patients need accurate information on medications prescribed in the other silo (blood thinners, antibiotics, pain medications) and on certain tests ordered in one of the silos. Haughney et al. (1998) reported that “the joint use of patient record systems avoided discrepancies in patient information which would have affected the quality of patient care” and “joint consultations reduced the need for secondary referrals.” According to Haughney et al., “the pilot study had revealed, [for 178 joint patients] in a retrospective study, a large number of discrepancies between

information contained in the medical records summary and the medical history in dental records.”

Elliott-Smith et al. portrays the current situation in dental care, where lack of interdisciplinary communication on medical and dental conditions is evident, even in the waiting room:

“One patient wasn't healing properly. Another had elevated blood pressure. Yet another was battling anorexia, but didn't share that information during a checkup. Instead, she complains of trouble with acid reflux. An elderly patient in for an early morning visit experienced dizziness, which turned out to be a mild stroke. These cases seem like a typical day at the physician's office. In actuality, they all started in the dentist's office. On a daily, weekly and monthly basis, medical conditions invade the dental operator. Who has the experience to handle them? What is the treatment protocol? Who holds the responsibility for the patient's care?” (Elliott-Smith et al., 2008).

The medical dimension of the dental office and operator were underscored by suspension of two Illinois dentists' licenses because a patient died while under sedation in their office. They must now pay the patient's family \$3.9 million. The Illinois Department of Financial and Professional Regulation (IDFPR) charged the brothers with failing to take a proper medical history of the patient, administering excessive doses of mepivacaine (Carbocaine) and meperidine (Demerol), failing to properly monitor the patient's vital signs during the procedure, and failing to ensure adequate training for their staff (Kincade, 2008). Also, Dental x-rays cause a lot more cancer than previously assumed, according to new estimates published in the September *Journal of the American Dental Association* (September 2008, Vol. 139:9, pp. 1237-1243). Additional perspectives on the medical dimensions of dental care are provided by Lockhart (2003).

The Scottsdale Project, mobilized by Casey Hein and others in 2007, not only documented the science related to periodontal disease and various other chronic conditions, but made some recommendations about communication (Hein et al., 2007). The Scottsdale Project recommended that physicians should screen for periodontal disease, either by inquiring of the patient, or by oral exam, based on the observation of bleeding gums, unsteady teeth, or gum recession. The project also recommended that patients at risk of cardiovascular disease should be referred to their physician and that in the case of patients diagnosed with diabetes and/or cardiovascular disease, “dentists should work collaboratively with physicians to achieve the best possible patient care outcomes.” Regarding communication, the Scottsdale Project recommended that “a set of guidelines should be developed to define what is important for bidirectional interprofessional communication.” Additional possible screening protocols were covered by the Scottsdale Project.

The Wisconsin Diabetes Advisory Group, “Wisconsin essential diabetes mellitus care guidelines,” (Wisconsin, 2004) provides an interdisciplinary referral form online (See Appendix B) as part of the oral health chapter of the guidelines. The Wisconsin guidelines state: “An *oral screening* should be performed at diagnosis and at each diabetes-focused visit occurring thereafter. Any positive findings should initiate referral to a dentist or dental specialist to ensure early and prompt diagnosis and treatment. The

screening includes an evaluation of the oral cavity for signs of redness, bleeding, halitosis, accumulation of debris around the teeth, gingival recession with exposed root surfaces, separation of teeth, and tooth mobility. People without teeth (edentate) should also receive an evaluation for signs of tissue inflammation or irregularities, white or red lesions, and any change in the fit of their dentures. Physicians, nurses, ancillary healthcare professionals, and caregivers can all perform this evaluation and must reinforce the importance of oral and dental care.” An “Oral Screening Guide” diagram with illustrations is included in the Oral Health section (9) of the guidelines.

Geist and Geist (2008) recommend a structured request form for medical consultation responses, stating, “physicians often do not provide adequate information regarding patients’ medical conditions when presented with consultation requests (CR) generated by dental students and their instructors about the students’ patients.” The Geists proposed educational approaches that would “reduce the number of unwarranted CRs sent to physicians.” The Geists characterize the “root cause” of “unnecessary consultation requests” as being the “lack of familiarity on the part of dental faculty with the diseases that impact dental care versus the conditions that do not, as well as the current guidelines and best available evidence.” The example forms (designed for the University of Detroit Mercy School of Dentistry) provided by the Geists were (1) an unstructured form, “requiring students and faculty members to write their own questions to the physician,” (2) a structured CR for diabetes mellitus requesting (most recent) HbA1c and patient’s glycemic control goal in terms of HbA1c. The unstructured form was used to gather information on what kinds of information to support dental patient management were necessary. This study focused on diabetes, hypertension (high BP readings), self reported heart murmur, and oral anticoagulant therapy. CRs were generated for heart murmurs to requests the physician’s differentiation of “functional” from “pathologic” heart murmurs to avoid overuse of antibiotics. Additional topics covered in the project were bisphosphonate osteonecrosis as a “new development” and the most current American Heart Association guidelines for antibiotic prophylaxis for infective endocarditis. The Geists demonstrated in their project that a structured CRs led to more consistent responses with appropriate information necessary for dental patient management. The controversy regarding overuse of antibiotics with patients having endocarditis has been treated in detail by Thomas Pallasch (2000),

“The focus of this issue of the *Journal* is to address three central themes: the role of antimicrobials in the management of periodontal disease, the influence that the world epidemic of microbial resistance to antibiotics may have on our clinical judgment as to when and how antimicrobials should be employed in dentistry, and what factual evidence is extant to justify the return of the focal infection theory of disease. As corollaries to these themes, information is presented regarding the influence of antimicrobial misuse in our daily personal lives; how we may gain critical judgment in determining the veracity of claims of epidemiological "associations" or "causations" that may affect patient care or our personal health decisions; and, not insignificantly, the medicolegal dangers inherent in promoting the oral cavity as a source of systemic disease..”

In response to our question about use of a communication model in the Marshfield Clinic, Greg Nycz responded as follows:

“I am not aware of any specific form, but I will ask around. We do provide priority in interdisciplinary referrals, both with medicine and with public health. Examples of such referrals from dentistry to medicine include the oral cancers, as well as abnormally high blood pressures, and for selected patients, blood sugars (I think our record at Ladysmith is a blood sugar of 520). These dental to medical referrals are important because access to dental care is so diminished among the poor in our state that it is not rare to find individuals with severe oral health problems who have not been seen in medicine in many years. Medicine to dental referrals are prioritized for physicians in the Marshfield Clinic, Family Health Center's principal partner in establishing increased access for dental care. As you might expect, many of these referrals are for emergent needs and might come through emergency room physicians, urgent care physicians or other primary care physicians who are faced with a patient with an oral health need that has been unable to find a dentist to treat it. However, there are many other medical to dental referrals. A few that I am aware of include examples such as a cancer patient with severe oral disease impacting nutritional intake, patient losing weight, oncologist is concerned, makes referral to dental, we fix the problem, patient begins regaining weight. Special needs child that is noncommunicative and hostile to exams must be treated in hospital with sedation for oral health needs, coordination with medicine allows for lab draws, vaccination, ENT, and other exams to take place at one setting, benefiting the patient, the parents and the taxpayers.” (Nycz, 2008)

With regard to electronic integration, Nycz added,

Marshfield Clinic has in many ways led the nation in electronic medical record development. They have the only electronic record built by physicians for physicians that is federally certified. As we began to stand up dental capacity (something the Marshfield Clinic had not done prior to 2002), Family Health Center wrote for and received [a specific amount] in funding that we combined with some of our reserve funds to finance the integration of the clinic administrative and electronic record systems. Currently our dentists have full access to the electronic medical record, which they tell me is particularly helpful in constructing treatment plans on patients with numerous medical conditions. They can, for example, immediately verify the most recent lab results for a patient on Coumadin. We will soon have the systems in place for our pediatricians and other physicians to follow their patients into the dental office. This is particularly important for us. As we grow our dental capacity we plan to use decision support to recruit physicians to address dental health literacy issues and move their patients into dental practice. They will be able to close the feedback loop by verifying whether or not their patients complied. Once fully deployed the new record will allow virtual teaming on patients who could benefit from such an approach. Integration at the administrative and appointment system level will allow us to better meet the needs of patients who are traveling a distance to complete their oral,

medical, and any behavioral health needs within a single trip. (Nycz, 2008)

Nycz also described the clinic implementation process that includes integration of care (medical, mental, dental) and characterized the clinic system's role in a larger state initiative:

In November 2002, we set up our first dental clinic in Ladysmith, Wisconsin (five dentists and five hygienists). We now have four dental clinics with 22 dentists and will soon be breaking ground on a fifth five-dentist clinic. Plans for three additional dental clinics in three new communities are in process. Our health center in partnership with Marshfield Clinic is seeking to develop a second dental school in the state and field 120 dentists throughout our large rural service area that comprises about 49% of the state's geography. Our clinics are open to everyone and we have a sliding-fee for those who have limited incomes and no insurance. We have special rooms and equipment and are pursuing training opportunities for our staff to end the serious access barriers faced by our developmentally disabled community. To achieve our ends we recognize that standing up this very significant dental capacity is necessary but not sufficient. We must also overcome significant health literacy issues within our target population. One of many key strategies that will be needed to complete this task is to be able to virtually team patient care with physicians and to recruit the physician community to address some of the health literacy issues regarding the importance of preventive dental checkups. We seek to approach the problem in the same manner as we successfully used to deal with under immunization. The administrative and clinically integrated medical and dental electronic record system is not the only avenue we are pursuing. Outreach to schools and nursing homes and partnership with public health are other key strategies. Because there are over 700 physicians in the Marshfield Clinic system, we currently have an imbalance between potential referring physicians and dentists able to accept those referrals. While we seek to rapidly grow dental, reality has forced us to cautiously grow the referral relationship, focusing on those patients in greatest need. (Nycz, 2008).

One of the co-authors of this paper, Dr. Frank Din, created a basic decision support system for dentists in 2002 in which responses by a patient to basic medical questions led to prompts for further information until a recommendation based on best practices could be determined. His decision support application would pop up the appropriate alert as needed. For instance, a recommendation for premedication, a note to alert the patient's physician, etc. Dr. Din made a PC version and a PALM (3.1) version. He sold the PALM version to about 150 dentists using PALMGEAR and HANDANGO web sites.

In a telephone interview, Brian Mealey, University of Texas Health Science Center in San Antonio, stated that he requests all HbA1c values for a patient with diabetes for the entire preceding year to get an idea of how closely the patient's diabetes is being followed. Mealey (2007) wrote about the importance of diabetes evaluation for dental practice.

Susan Johnson, of the King County Health Action Plan, Public Health Seattle, kindly reported for this project,

“WDSF has an actual curriculum for medical providers that we believe has a section on referrals and communication. We don't have anything formal, but I'd share these general best practices with you from our experience:

- (1) Have the medical and dental staffs meet together regularly; often staff even in the same building who are part of the same agency don't do this;*
- (2) Hold joint trainings i.e. have dental staff train medical staff about early oral health messages, screening, fluoride application etc. Have dental staff attend medical staff meetings every few months to provide refreshers and reminders;*
- (3) Treat dental referrals the same way you treat any other referral, i.e. to cardiology or dermatology; make sure the patient completes the visit and that pertinent info is communicated. Different sites achieved this in various ways, including for co-located clinics: routing slips, joint appt. scheduling, scheduling of and/or fitting in dental visits at time of WCCs [Well Child Checks], staff i.e. MA/RN review of charts each morning to screen for necessity of dental screening or visit, etc.;*
- (4) For non co-located clinics, referral slips, calls to dentists, Each practice seems to find a system that works best for them given their parameters;*
- (5) If they're familiar with the concepts, have the staff use QI [quality improvement] tools to implement systems i.e. PDSA [Plan-Do-Study-Act] cycles;*
- (6) Small tests of change or “What can we change by Tuesday and how will we know if it's working?” rather than designing a perfect system before implementation;*
- (7) Use champions on both sides - i.e. Medical and Dental Director or other clinicians that understand the science, can communicate well, and can motivate staff to do "one more thing" because it's the right thing to do;*
- (8) One last lesson that doesn't involve communication or referrals per se, but relates: Our most successful teams use simple incentives and competitions to achieve their results. If you want Docs to refer all kids to the dentist, for example, post each provider's or each team's referral rates on a bulletin board each month and reward the winners with a pizza lunch or coffee. Having the winning team post best practices on the board is a nice touch” (Johnson, 2008).*

The California Health Care Foundation describes an oral health promotion effort which has co-located oral healthcare in the same facilities as medical care. There is reason to believe that these co-located sites will be sources of information on integrated models of medical and dental care, based on local initiative. (Finochio, 2008).

Collaborative additional research, study, and development are needed to establish national interdisciplinary communication practices.

4. Educational Implications

Educational impacts for both the medical and dental disciplines are to be expected. Hein states in discussing “the lessons learned from Scottsdale,” that “in spite of the growing acceptance within the dental community, it cannot be assumed that the medical community is aware of the research to support the effect of periodontal disease on local and systemic inflammation” (Hein, 2007). According to Fuchs (2008), regarding the AAMC report prepared jointly with the American Dental Education Association (ADEA), “students should be familiar with certain clinical events, such as oral and pharyngeal cancers, and orally based indicators of sexually transmitted diseases and eating disorders, among other conditions.” Fuchs cited a new combined M.D./D.M.D. program at Case Western University begun this year, and the RIDE program at the University of Washington.

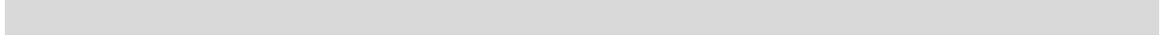
The AAMC MSOP document this year states, “In an earlier 1995 study, *Dental Education at the Crossroads: Challenges and Change*, the Institute of Medicine (IOM) had already recommended closer integration of dentistry with medicine and the health care system as a whole: This IOM report predicted that scientific and technological advances in molecular biology, immunology, and genetics, along with an aging population with more complex health needs, would increasingly link dentistry and medicine, leading to the need for changes in dental education. As physicians come to see oral health as a legitimate domain of involvement for their profession, and dentists acquire better understanding of the systemic implications of oral disease, asking the right questions will be as much a matter of perspective as of knowledge and skills. Cultivating such a perspective will require significant change in the curricula of both professions. This report is intended to promote curricular change by defining the attitudes, knowledge, and skills that underlie such a perspective” (AAMC, 2008). Haughney et al. (1998) foresaw the educational changes required to support integrated care.

Robert Nelson (NIH/NIDDK) wrote, “I propose a more proactive stance towards the management of periodontal disease in the setting of diabetes. If enough people petition the ADA to expand their clinical practice guidelines to include more information about periodontal disease--perhaps in conjunction with the American Dental Association--it may produce positive results.” (Nelson, 2008) DePaola and Slavkin (2004) wrote: “In essence, the SGR [Surgeon General’s Report, NIH (2000)] articulated and documented that the mouth is connected to the body, that oral and systemic diseases and disorders can be associated, that oral diseases and disorders can compromise health and well-being over the human lifespan, and that disparities exist in oral health and disease patterns.” Among the critical educational needs they cite are: “increase interdisciplinary perspective/practice; and improve our students’ ability to relate to and address the overall health of the patient.”

Rader (2007) cites needs for treating patients with special health care needs and describes principle regarding patients with neurodevelopmental disorders and intellectual disabilities and the extent to which this population has been underserved with regard to oral healthcare. Mouradian treats oral health disparities for the elderly and individuals with mental retardation and other developmental disabilities (Mouradian et al., 2003).

She emphasizes that oral-systemic health interactions are important for these populations. She states, “one potential contributing factor to health disparities that is rarely discussed in this context is the separation of dental and medical systems and resultant gaps in the education of health professionals.”

An example of a course meeting the AAMC initiatives is “A New Oral Health Elective for Medical Students” (Mouradian et al., 2006). However, according to Rafter et al. (2006), “At a recent conference evaluating dental education (Santa Fe Group) participants determined that an important factor responsible for the difficulties in dental education was the ‘silo’ approach so commonly found in health education: ‘By their reliance on independent curricula, faculty, facilities and research programs, ‘silos’ contribute to the isolation of health professional training programs.’”



5. Separate, Inadequately Articulated Insurance Claim Silos and Their Impacts on Care, Performance Assessment, and Research

The “Healthcare Bus” has one wheel that is smaller than the others: dental insurance. This plays a role in care itself, care performance assessment and research, biomedical research, and health care disparities.

The traditional separation and distinction between medical care and dental care is *reflected and reinforced* in the *separate insurance realms* (medical vs. dental insurance). This complicates the coordination of care and insurance coverage. A more coordinated approach should *yield significant improvements in patient and public health outcomes* like, (a) formally connect the relationship between systemic (medical) and oral (dental) health care streams, (b) reduce disparities of coverage of unserved and underserved populations, (c) better support performance measure assessment and biomedical research. The fact that there are separate insurance frameworks (medical insurance, dental insurance) in health care has important effects.

- We have two (in general) inadequately articulated sets of codes and terminologies for claims: CPT (for medical care) and CDT (for dental care). Also used: ICD, HCPCS.
- It impedes the coordination of care.
- Having two separate claim silos (streams) impedes care performance assessment from technical and organizational standpoints.
- We have two taxonomies for clinical findings, inadequately articulated with each other: SNOMED (well-known and maintained) and SNODENT (less well-known and not maintained).
- This circumstance impedes biomedical research.

The American Dental Association is responsible for SNODENT.

The situation of having two silos for **systemic** (medical) and **oral** (dental) **health insurance** should be reviewed and analyzed, so that **these two silos can be merged into a single health insurance framework**, with appropriate attention to (a) the interrelationships between systemic (medical) and oral (dental) health care, including a common terminology to ensure semantic consistency, (b) disparities of coverage, and (c) foundations for performance assessment and biomedical research. There is literature covering oral health disparities in detail (Fisher-Owens et al., 2008), Mouradian et al., 2003, 2004; Pyle and Stoller, 2003).

Further, Medicare provides no routine or preventive dental care by statutory exclusion. This statutory exclusion is obviously based on understandings of systemic care from a prior century (perhaps two centuries back). To get a sense of the effort to provide integrated dental care within the context of a single state, please see information contributed by Dr. Matt Holder (with actual dollar figures omitted):

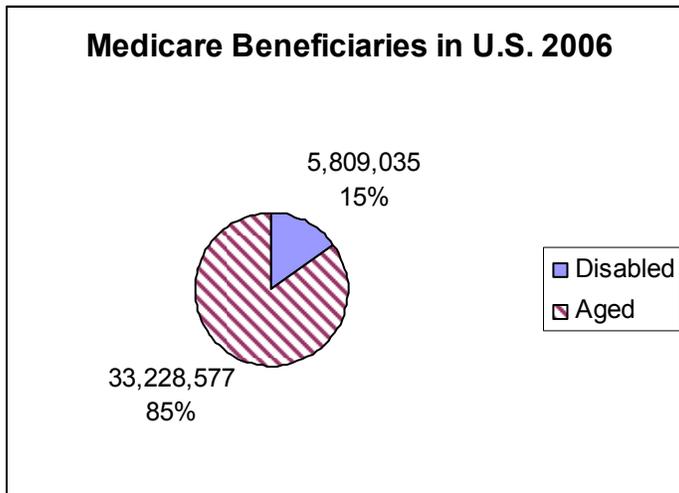
“About 95% of the patients at the Underwood and Lee Clinic in Louisville are either on Medicaid or Medicare (probably 55% Medicaid, 40% Medicare). 100% of our patients have a neurodevelopmental disorder and

therefore are little more involved than other patients. Our dental clinic is funded (via hard-fought advocacy) through the state general fund.

Though I truly believe that we deliver high quality dental care at our clinic, the fact that many of our patients drive 4 or 5 hours each way, just to receive dental services is a testament, not to how good of a dental clinic we are, but to how inaccessible dental services are in the rest of the state for Medicare and Medicaid patients.

To give you some hard data about our dental clinic, we serve as the safety net for 800 special needs patients. This year, we are on track to provide [a given amount] in dental services to our patients. The state will reimburse us about [about two thirds]. We'll be lucky if we see [a minor amount] in Medicaid reimbursement. We will see nothing in Medicare reimbursement.

The bottom line is that if our clinic did not exist and have external funding that allows us to treat



Medicaid/Medicare patients (without going bankrupt), our patients would not be receiving dental services. We know this is true, because the majority of these patients were not receiving dental services before they found our clinic.” The bottom line is that if our clinic did not exist and have external

funding that allows us to treat Medicaid/Medicare patients (without going bankrupt), our patients would not be receiving dental services. We know this is true, because the majority of these patients were not receiving dental services before they found our clinic.” (Holder, 2008).

Greg Nycz, Director of the Family Health Center of Marshfield, Inc, Marshfield, WI, reported with regard to Medicare:

As a federally and state supported community health center we have managed to obtain the resources to provide a sliding fee for low-income Medicare covered individuals. Given this resource, the response by the Medicare community has been significant, indicating a significant underlying problem that is implicit in your question. We overcome this problem by offering a sliding fee based on the Medicare individuals income. (Nycz, 2008)

With regard to disparities, Nycz added in response to our inquiry:

In March 2007 at the request of Secretary Hayden (cabinet officer to the Governor within our Department of Health Services) we developed a comprehensive 10 year plan on how Wisconsin's community health centers could assist in ending the oral health disparities that plague our state. If you are interested in receiving a copy of that plan, let me know. Family Health Center working with Marshfield Clinic is well on our way to meeting that vision within a large service area in northern Wisconsin. (Nycz, 2008)

According to the Kaiser Family Foundation and Health Research and Educational Trust, “Employer Health Benefits 2008” (Menlo Park, CA), Kaiser Family Foundation (2008), available at <http://ehbs.kff.org/pdf/7790.pdf>, forty-four percent of firms offering health benefits offer or contribute to a dental insurance benefit for their employees that is separate from any dental coverage the health plans might include. This is not statistically different from the 50% in 2006, which is the last time the survey asked about dental benefits. Large firms (200 or more workers) are far more likely than small firms (3–199 workers) to offer or contribute to a separate dental health benefit, at 82% versus 43%.” If there are systemic health implications of the level of dental care, this arrangement is irresponsible.

The variety of interdisciplinary collaborations underscores the need for a basis of support for dentistry that recognizes its many contributions to both systemic and mental health, facilitates research, and, in the long run, will encourage a more interdisciplinary approach to the education of professional in the collaborating fields of proving care. Such support for dentistry within the general systemic framework will fundamentally help assure patient-centered care.

Here are the reasons:

- (1) If oral health is important for systemic health, as in the case of the diabetes-periodontal disease relationship, it makes sense to decide the level of support for oral health procedures within a framework of systemic health impacts;
- (2) If interdisciplinary collaboration delivers interdisciplinary screening or care, support levels for care should be decided within a single framework;
- (3) Having claims in separate organizational silos impedes chronic care, quality of care improvement, medical home, and health care cost reduction initiatives by placing technical barriers in the path of evaluating performance measures and in the path of biomedical research.

Using the Wisconsin Diabetes Guidelines Diabetes Referral Form as a basis, Lecal suggested using SNOMED CT to encode the Interdisciplinary Diabetes Dental Referral Form (Lecal, 2008). Lecal concedes that “semantic interoperability with health data is sometimes a hard challenge.” Din comments: “Some measure of semantic drift occurs every time you do a mapping. Some meaning is lost or incorrectly linked” (Din, 2008).

Since merger of medical and dental insurance plans is a drastic step, creating significant uncertainties for the dental profession (please note the dental-medical salary differential cited by Giddon (2006)) and for the healthcare insurance industry, is there an alternative to complete merger of

plans? Since the two goals of merger would be (1) to eliminate the technical problem of separate claim streams that impede performance assessment and research, and (2) to combat the problem of dental care disparities, which then unavoidably have impacts (in terms of quality of care and costs) in systemic care, particularly in chronic care and prenatal care. Effort could be applied to discovering and evaluating practical means of dealing with requirements through some yet-to-be-determined form of articulation of medical and dental insurance. The problems with the distinct CPT and CDT systems would have to be resolved in a manner that would efficiently support an articulated pair of medical and dental insurance plan models.

Such an approach might be useful indefinitely or might serve as a necessary transitional phase to eventual merger to achieve greater efficiency and simplicity, if the concerns of the dental profession and the healthcare insurance industry are met through implementation and validation of the articulated plan approach, and consensus develops that healthcare is ready for a fully integrated strategy. What is happening now resembles the articulated approach, except that it lacks *clarity of vision* and *priority* regarding the aims of optimizing healthcare and proceeding with some sense of urgency in improving quality of care, improving safety, and reducing costs for patients who already require the improvements in the fundamental care model at this time. It is appropriate in this context to revisit momentarily the CDC prevalence data for diabetes and periodontal disease in Section 4 above to grasp the magnitude of current need. Clear goals and priorities, acceptable to stakeholders, that help us visualize what needs to be done and why, are vital to progress in developing any alternative to insurance plan merger.

In the case of Medicare, the siloization extends to complete exclusion of coverage for dental services, except “extractions done in preparation for radiation treatment for neoplastic diseases involving the jaw,” and “oral examinations, but not treatment, preceding kidney transplantation or heart valve replacement.” (CMS, 2005). The legal barrier to treatment in this case is: “Section 1862 (a)(12) of the Social Security Act states, ‘where such expenses are for services in connection with the care, treatment, filling, removal, or replacement of teeth or structures directly supporting teeth, except that payment may be made under part A in the case of inpatient hospital services in connection with the provision of such dental services if the individual, because of his underlying medical condition and clinical status or because of the severity of the dental procedure, requires hospitalization in connection with the provision of such services.’” (CMS, 2005) Further a definition is included to the effect that “structures directly supporting the teeth means the periodontium, which includes the gingivae, periodontal membrane, cementum of the teeth, and the alveolar bone (i.e. alveolar process and tooth sockets).” This barrier is not only a direct barrier to providing important routine and preventive oral healthcare to those served by Social Security and thus is indirectly to the maintenance of systemic health of these individuals, but by its example discourages insurance plans from taking seriously the need to approach dental care support on the basis of its impact on systemic health. Only when the government itself acknowledges the importance of oral health for systemic health by supporting care for both within a single framework, will the U.S. have a clear basis for the U.S. Healthcare System and insurance

organizations to do likewise. Fortunately, “all children enrolled in Medicaid are entitled to comprehensive dental services,” according to Tobler (1999).

6. Standards Organizations: HL7, ASTM E31, ADA SCDI, and the Healthcare Information Technology Standards Panel (HITSP).

Four standards arenas are particularly interesting for health care informatics and can provide a foundation for the National Health Information Network (NHIN) with regard to the integration of medical and dental data to achieve an interdisciplinarily unified record for the patient: Health Level 7 (HL7), HITSP, ASTM E31, and ADA SCDI. HL7 has established a Clinical Interoperability Council, among which reasons are to more closely align technical standards with health care practice. That alignment is important in informatics standards since healthcare practice has considerable variability by profession, discipline, specialty, and even location, and the absence of such alignment risks a standard being not relevant or prohibitively difficult to implement across all of healthcare.

The question as to whether dental care should be integrated into the NHIN was studied in 2004 by Dr. Titus Schleyer, a dental informatics professor at the University of Pittsburgh School of Dental Medicine. His concern was that the shortsighted focus on only the medical domain in setting the health information technology standards will lead to ignorance of the need to account for dental care to the detriment of the patient.

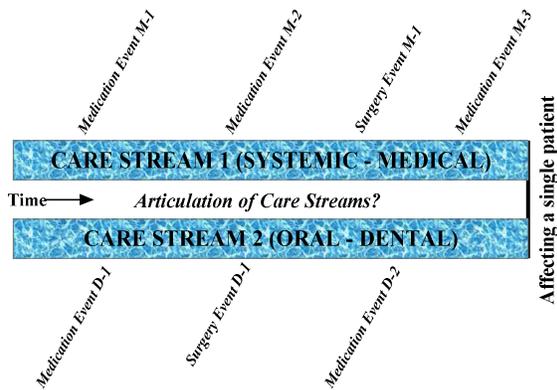


Figure 3
Model of unarticulated care streams of a patient

The ADA was participating in interoperability discussions and NHIN foundation concepts before 2004. For example, the interoperability of patient health information was addressed by the ADA House of Delegates Resolution 92H-1996 that addresses for optimal health outcomes the patient's health information must be seamlessly available at the time and point of care to all authorized users and cross the traditional boundaries of profession, specialty, discipline and care delivery environment.

6.1. Case Study 1: An HL7 document, an example of what could happen without dental care inclusion in overall integration of electronic medical and dental records.

As a case study, the 2005 RBAC document “HL7 Healthcare Scenario Roadmap - Licensed Healthcare Providers” contains specifications that highlight a concern that role-based capabilities are partitioned by a traditional view of the health professions. This document consists of a large CRUDE (Create, Read, Update, Delete, Execute) matrix (spreadsheet) of operations and health care practitioner roles. There are only two vertical dental provider categories (vertically): Dentist and Oral Surgeon. The horizontal categories in question are: PPD-044 through PPD-046 with scenario IDs SPD-014/003 covering, sequentially New Patient Acuity, Exit/Addend Patient Acuity, Record Medication Administration Record (MAR). These are marked in the matrix "O" for "does not perform." Also, a dental provider can not deal with discharge summary, PPD-039/030

or Patient Testing Reports, PPD-020/021. Dental informaticists reviewing this document reported concerns about the criteria used for identifying only two categories of dental provider for the matrix.

Although dental providers (dentists and oral surgeons) routinely prescribe medications, with a system based on this matrix they would be blocked out by this roadmap role matrix from being able to enter such prescribing (create a Medication Administration Record or MAR) into the EHR. According to this model, a dental provider could not update the patient's medication record when prescribing a medication. The document does not, however, represent an accepted standard. In the process of this research, the document has been identified to HL7.

Increasing evidence of interrelationships between periodontal diseases and diabetes exemplifies the importance for any model of patient records to support communication among the various medical and dental providers. This has been underscored in 2008 by the American Diabetes Association including “dental referral” and “dental history” in its Standards of Care and engaging in intensified collaboration with the American Dental Association. In the 21st century we need a model of care and patient records that is appropriate to today's understanding of health care and the needs of patients, not a model inherited from the 1800s.

Failure to have an accurate, coherent model can lead to failures in standards development, such as the work of the Healthcare Information Technology Standards Panel (HITSP). ASTM defined the CCR (Continuity of Care Record) as a vehicle to coordinate care for the case at hand across multiple providers; HITSP identifies standards that promote health information interoperability.

One might wonder how “tooth number” should be handled in standards supporting electronic dental records. There is more than one standard for “tooth number.” For example, if *dentist1* uses "UR1" to describe the right central incisor and sends "UR1" to *dentist2* whose EDR (electronic dental record) uses "8" to identify the same tooth, will "UR1" throw an error in *dentist2*'s system? This is another example of a possible impact of not having a clear perspective of integration of medical and dental care and data when beginning the design of health information infrastructure. Any problems of this sort would be avoided by clear national goals for health information technology.

In the ANSI/ADA Specification 1000 for a clinical data architecture, the code identifier is a composite of code system, version, and code. In order to achieve greater utility the specification does not use Tooth Number, but an **Anatomic Location Identifier**. In tiered systems architecture, the system can store the tooth identifier or other anatomic identifier in any manner in the data tier, but it must present this identifier to the system user in whatever form the user requires, i.e. translating the internally-stored identifier into the appropriate label (eg. name, code, number) and/or graphic form required by the user. In the case of tooth-related identification, the Anatomic Location better handles instances of atypical findings, such as supernumary teeth, and pathologies, such as fusion of adjacent teeth into one.

This approach is further addressed in the Anatomic Location section in the recently balloted ANSI/ADA Specification 1000 v2 revision and in the Specification 1000 Implementation Guide.

6.2. Case Study 2: National Quality Forum HIT Standards

According to Jean DerGurahian in *Modern Healthcare*, August 29, 2008, “the National Quality Forum [NQF] endorsed nine health information technology standards through its National Voluntary Consensus Standards program. The standards fall into the areas of electronic prescribing, electronic health-record interoperability, care management, quality registries and the medical home. The NQF, which put the nine measures up for a vote in July, suggests providers incorporate harmonized measures for using electronic prescribing, generating drug-event reports, developing interoperable databases and participating in standardized quality registries to exchange information.” NQF’s proposed *National Voluntary Consensus Standards for Health Information Technology: Structural Measures, 2008* contain no explicit provision for integration of medical and dental care and records. This action was not within the context of formal ANSI-approved standards development but represents an attempt to gain “voluntary consensus standards,” and presumably, to support the work of the Healthcare Information Technology Standards Panel. It was subsequently discovered that the key organization behind NQF is a plan not providing dental insurance. Working within the medical scope of this activity, the integration of medical and dental records was not addressed, an impact of siloization of medical and dental care in the U.S. healthcare system.

6.3 The Healthcare Information Technology Standards Panel (HITSP).

According to ANSI,

“The mission of the Healthcare Information Technology Standards Panel is to serve as a cooperative partnership between the public and private sectors for the purpose of achieving a widely accepted and useful set of standards specifically to enable and support widespread interoperability among healthcare software applications, as they will interact in a local, regional and national health information network for the United States.”

Stanford wrote: “The Panel is sponsored by the American National Standards Institute (ANSI) in cooperation with HIMSS, ATI and Booz Allen Hamilton. Funding is provided via a contract from the U.S. Department of Health and Human Services.” One of co-authors for this paper, Dr. Frank Din, recently carried out work to identify the inclusion of dentistry in AHIC use cases when necessary for clarification. In most use cases, dental care is missing from a itemization of what constitutes a covered clinician. Such omissions should be remedied.

6.4 Standards Summary

Interoperability and EHR standards likewise cover data 'interoperability' such as where two or more systems communicate the anatomic identifier. The mechanisms used for this communication have typically been established by a trading partner agreement or standard, such as the means to identify a tooth in the electronic submission of a dental claim to a payer. Meeting the more versatile data 'interoperability' requirement is one aspect in the domain of ADA-HL7 collaboration that has existed for several years to promote the integration of dental and medical interoperability. A significant product of this collaboration is the standardization of the periodontal claim attachment where the

tooth identification was specified by the ADA and the communication method by HL7. In such collaboration the ADA typically specifies the content (like the tooth identification) and HL7 specifies the nature of the communication vehicle. A metaphor that applies to this case is: “HL7 builds the truck and ADA builds the cargo.”

The ANSI/ADA Specification 1039 Clinical Conceptual Data Model includes a foundation healthcare process model that was originally part of the 2001 version of the ANSI/ADA Specification 1000. This model is derived from a healthcare process analysis conducted in the 1990’s as part of a Computer-based Oral Health Record exploratory

Table 7.1: Summary of established/proposed areas of interdisciplinary (medical/dental) collaboration, research (see Section 2 above):
Diabetes – Periodontal Diseases; reciprocal screening opportunities
Cardiovascular Disease, Heart Disease, Stroke – Periodontal Diseases
Pneumonia – Periodontal Diseases
Chronic Kidney Disease – Periodontal Diseases
Periodontal Diseases – Systemic Inflammation
Osteoradionecrosis (Postradiation osteonecrosis)
Oral Health – Prenatal Care – Obstetrics
Pediatric Care – Pediatrics, Pediatric Dentistry
Geriatric Care
Mental Health – Eating Disorder Screening by General Dentist
HIV/AIDS – Screening by General Dentist
Oncology – Oral Cancer Screening by General Dentist; Tobacco use screening (risk factor for oral cancer)
Ectodermal Dysplasia and Severe Hypodontia
Reducing disparities in healthcare (including dental care)

study by the ADA and with a goal of viewing patient care as a single continuum. Basing EHR standards on such a clinical process model addresses the data interoperability gap where standards and systems perpetuate the traditional siloing of the health professions and specialties.

The necessary degree of code-level semantic interoperability can be achieved through application of the Codes and Nomenclature subject area of Specification 1000 - in which a data structure relates two or more code system codes. A standard reference data set would provide that semantic interoperability capability. That amount of work is quite large, as in any semantic exercise of the scope needed.

7. Analysis

Patient record separation into separate medical and dental records is **obsolete** and ultimately not in the patient’s best interest. The traditional distinction between medical care and dental care with respect to patient records (*paper or electronic*) is **obsolete** and needs to be dismantled in favor of a truly integrated approach to care and records. HHS

and the ONC (Office of the National Coordinator for Health Information Technology) should prioritize the inclusion of oral health records into all the efforts to promote adoption of electronic

health records and further into the efforts to establish the nationwide interoperability standards for the integration of dental and medical records and so that oral health record incorporation will be included in the standards work at the earliest possible time. A fully integrated patient record and care model for both systemic health (medical) and oral health (dental) will serve for the National Health Information Network (NHIN) standards, implementation, and interoperability in order to support and satisfy quality of care, safety, and health care cost reduction initiatives. Dr. Wendy Mouradian summed up the

importance of integrated care this way, **“patients’ health is impacted by this separation, from both sides”** (Mouradian, 2008).

Why? Patient safety and care quality may be compromised by having two independent care streams affecting a patient in the same time frame inadequately coordinated. It is neither prudent nor wise to set up an Electronic Health Record (EHR) system for the future of U.S. health care in which two care streams (medical and dental) are not articulated because one (dental) is ignored, and thus further institutionalize an obsolete structure. An existing standard (ASTM E-2369-05, “Standard Specification for Continuity of Care Record (CCR)” together with ANSI/ADA Specification 1040

Dental Extension to the Continuity of Care Record), a combined model capable of supporting medical-dental communication, is not being required in AHIC/HITSP standards development. Models for interdisciplinary referrals using paper records, like that of the “Wisconsin essential diabetes mellitus care guidelines,” are available at present, but likely not widely used in the U.S. Large populations are affected if medical-dental care and data articulation is neglected.

HHS/ONCHIT has now provided explicit instructions for integrating medical and dental care and data in its efforts to achieve a National Health Information Network. Correspondence with CCHIT says,

“Thank you for your interest in CCHIT certification. We do not specifically include dental criteria in any of our current certifications. We are however adding specialty certifications, most recently Cardiovascular Medicine and Pediatric populations.

We do have general criteria covering patient history, reporting, referrals and interoperability. While these are not specific to dental records they do support functionality to allow users of both Ambulatory and Inpatient systems to document and transmit information to outside health care providers, which would of course include dental professionals.” [Shading added to emphasize wording.]

What is available in CCHIT is the opportunity to provide support for integration of care and data. HHS/ONC is providing leadership for a model that includes both medical and dental care, so such integration support is now likely to be designed, implemented, and included in certifications and products. What is lacking also, and requires effort, perhaps through AMIA, is a model for communication between medical and dental providers, since such a model has not been widely accepted, disseminated, and included in dental and medical education in the past. Such a model could be used in fulfilling the 2008 Objective Project (MSOP) of the Association of American Medical Colleges. Beginning points could be the models in the Wisconsin Diabetes Guidelines and the Scottsdale Project report recommendations. This effort to integrate medical and dental care is part of the larger effort to integrate medical, dental, and behavior care, as documented to us by Dr. Holder, Louisville, KY, and Mr. Nycz, Marshfield, WI. We have also received allegations during this project that not at medical specialties are adequately integrated with each other.

Statements from the IOM and AAMC confirm that change toward integration of medical and dental care is under way as well as change toward articulation of medical and dental

education curricula. It is certainly obvious to you that without an initiative on the part of attendees and presenters at this conference hosted by the Wake Forest University Translational Science Institute we will likely not have such a model for our work on EHR standards, design, and implementation. It is in our hands to take such an initiative to assure that an accurate, coherent model of healthcare is in use that can furnish the proper basis not only for care today, but for the future of both care and health information technology. This will mean insisting that a coherent health care process model, integrating medical and dental care and data, that is suited to patient-centered care, evidence-based care, preventive care, chronic care, and prenatal care, be used by the healthcare professions and in their protocols, by professional organizations, and by the U.S. Department of Health and Human Services.

There are general barriers to EHR/EDR/HIT adoption on the part of medical and dental providers who are greatly concerned about liability and impacts of medical and financial ID theft and the costs of adoption. The liability issue can be addressed by legislation like this in West Virginia affecting health networks: **§16-29G-5. Immunity from suit; limitation of liability.** “The network is not a health care provider and is not subject to claims under article seven-b, chapter fifty-five of this code. No person who participates or subscribes to the services or information provided by the network is liable in any action for damages or costs of any nature, in law or equity, which result solely from that person's use or failure to use network information or data that was imputed or retrieved in accordance with the Health Insurance Portability and Accountability Act of 1996 and any amendments and regulations under the act, state confidentiality laws and the rules of the network as approved by the Health Care Authority. In addition, no person is subject to antitrust or unfair competition liability based on membership or participation in the network, which provides an essential governmental function for the public health and safety and enjoys state action immunity..”

Our recommendations for action:

1. Study the communication model practices (or lack of them) now in place. Establish a model collaboratively with both medical and dental input that can be used in both pre-practice and continuing education. Sources of experience, apart from the Seattle, Washington, Wisconsin Diabetes Guidelines, Marshfield, California, and University of Detroit Mercy examples cited above, and also the Federal IHS and VA health care systems, and any other examples not listed here, should be consulted to learn about interdisciplinary (medical-dental) communication. The ideas communicated above need collaborative review and refinement. Anecdotal information, offered spontaneously to the investigators for this project, could not be incorporated into this document, as the extent of breakdown in communication among medical and dental providers for a patient cared for in both silos is likely more serious than anticipated when this project was designed. Research that consults patient input and that checks for records discrepancies for joint patients is needed.
2. Study the correspondence between medical and dental records of joint patients. Haughney et al. (1998) reported 99 discrepancies between medical and dental records for 178 joint patients. Six of these discrepancies were classified as “life-threatening.”

3. Design a strategy to dealing with the personnel needs of the dental professions. There is a shortage of dental informaticists.
4. Mobilize the code-level semantic interoperability project to populate the appropriate reference data sets of ANSI/ADA Specification 1000.
5. Study insurance siloization by professional discipline, and design and implement an integrated health care insurance strategy that meets national needs; either (1) a merger of plans or (2) articulation of plans so that (a) claim streams can be merged from a technical standpoint in performance assessment and research and (b) dental plans can be designed to appropriately deal with dental care needs from the standpoint of systemic healthcare (assuring adequate levels of support for systemically necessary procedures and helping to remove disparities in dental care.)
6. As the AAMC and ADEA both recommend, move forward with modifications to medical and dental education (both pre-graduation and continuing) to assure that providers can deliver the best care that integrates attention to oral and systemic health.
7. Continued HHS/ONC leadership with regard to the integration of medical and dental care and data, and to NHIN standards harmonization, is essential to progress. The AHIC Successor organization can play a useful role in interpreting and guiding change. It should be explicitly stated that the NHIN integrates both medical and dental records and care.
8. Standards organizations, such as HL7 and HITSP, should embark on efforts to assess what adverse impact, if any, has occurred in standards development so far by using the traditional siloed view of care delivery.
9. Certification (CCHIT) should be examined to see if changes and explicit acknowledgement of the importance of oral healthcare for systemic healthcare are needed. Similarly HIT products should be evaluated (if necessary, reevaluated) with respect to their suitability according to any certification updates needed, and their interoperability with respect to integration of EHRs and EDRs.
10. Amend the Social Security Act of the U.S. to include provision for routine and preventive oral healthcare (dental care) as an integral part of systemic healthcare.
11. Deal with liability and patient trust concerns of providers with regard to EHR/EDR adoption and use of networks and registries. Network liability issues can be addressed by legislation like West Virginia §16-29G-5: Immunity from suit; limitation of liability.
12. Deal with costs concerns of medical and dental providers with regard to EHR/EDR adoption.

Considering the patient populations (please see Section 4 above on CDC prevalence data just for diabetes and periodontal disease) and the personal, economic and health care costs impacts, we should work expeditiously to assure progress. These steps will be important for success of nationwide, statewide and other initiatives on chronic care, medical home concepts, safety, and care quality. Prenatal care will also be served.

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9. Disclaimer

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Appendix A – A Guide to Organizations and Acronyms

- AADE = American Association of Diabetes Educators:
<http://www.diabeteseducator.org/ProfessionalResources/AADE7/Background.html>
- AAP = American Academy of Periodontology: <http://www.perio.org/>
- ADA (Dental) = American Dental Association: <http://www.ada.org/>
- ADA (Diabetes) = American Diabetes Association:
<http://www.diabetes.org/home.jsp>
- ADA SCDI = American Dental Association Standards Committee on Dental Informatics: http://www.ada.org/prof/resources/standards/informatics_about.asp
- AHIMA = American Health Information Management Association:
<http://www.ahima.org/>
- AHIC = The American Health Information Community:
<http://www.hhs.gov/healthit/community/background/> Note: the process of replacing AHIC with a successor is currently active:
<http://www.hhs.gov/healthit/community/background/AHICsuccessor.html>
- AHLTA = Armed Forces Health Longitudinal Technology Application
- ASTM E31 = ASTM (American Society for Testing and Materials) Committee on Healthcare Informatics: <http://www.astm.org/COMMIT/COMMITTEE/E31.htm>
- CCD = Continuity of Care Document (HL7):
<http://www.hl7.org/documentcenter/public/pressreleases/20070212.pdf>
- CCHIT = Certification Commission for Health Information Technology:
<http://www.cchit.org/>
- CCM = Chronic Care Model; for example, see:
http://www.improvingchroniccare.org/index.php?p=The_Chronic_Care_Model&s=2
and <http://www.ihl.org/IHI/Topics/ChronicConditions/AllConditions/Changes/>
- CCR = Continuity of Care Record (ASTM): <http://www.centerforhit.org/x201.xml>
- CDA see HL7 CDA: <http://hl7cda.com/>
- CDT = Current Dental Terminology:
<http://www.ada.org/ada/prod/catalog/cdt/index.asp>
- CPT = Current Procedural Terminology: <http://www.ama-assn.org/ama/pub/category/3113.html>
- DGES = dentogingival epithelial surface area
- EDR = Electronic Dental Record
- EHR = Electronic Health Record
- ESRD = End Stage Renal Disease
- HCPCS = Healthcare Common Procedure Coding System:
<http://www.cms.hhs.gov/MedHCPCSGenInfo/>

- HEDIS = The Healthcare Effectiveness Data and Information Set (HEDIS) is a tool used by more than 90 percent of America's health plans to measure performance on important dimensions of care and service:
<http://www.ncqa.org/tabid/59/Default.aspx>
- HITSP = Healthcare Information Technology Standards Panel: <http://www.hitsp.org/>
- HIT = Health Information Technology: <http://www.hhs.gov/healthit/>
- HL7 = Health Level 7 (U.S.): <http://www.hl7.org/>
- HL7 CDA = HL7 Clinical Document Architecture:
http://www.hl7.org/library/standards_non1.htm
- ICD = International Classification of Diseases:
<http://www.who.int/classifications/icd/en/>
- IHS = Indian Health Service: <http://www.ihs.gov/>
- NCQA = National Committee for Quality Assurance: <http://www.ncqa.org/>
- NHIN = National Health Information Network; American Dental Association page on NHIN at <http://www.ada.org/prof/resources/topics/NHIN.asp>
- NIDCR = National Institute of Dental and Craniofacial Research:
<http://www.nidcr.nih.gov/>
- NIDDK = National Institutes of Diabetes and Digestive and Kidney Diseases:
<http://www2.niddk.nih.gov/>
- NIH = National Institutes of Health: <http://www.nih.gov/>
- OCF = Oral Cancer Foundation: <http://www.oralcancerfoundation.org/>
- ONCHIT = Office of the National Coordinator for Health Information Technology:
<http://www.hhs.gov/healthit/onc/mission/>
- RBAC = Role-Based Access Control:
<http://csrc.nist.gov/groups/SNS/rbac/standards.html>
- RPMS = Resource and Patient Management System (IHS)
- SCDI see ADA SCDI
- SNODENT = The Systematized Nomenclature of Dentistry:
http://www.ada.org/prof/resources/topics/NHIN_ehr_update01.pdf
- SNOMED CT = Systematized Nomenclature of Medicine -- Clinical Terms:
<http://www.ihtsdo.org/>
- VA = U.S. Department of Veterans Affairs: <http://www.va.gov/>
- WCC = Well Child Check
- WDSF = Washington Dental Service Foundation:
<http://www.deltadentalwa.com/WDSFoundation/WDSFoundation.aspx?DView=WDSFoundation>
- WHO = World Health Organization
- WHO/FDI – WHO/International Dental Federation; see www.fdiworldental.org

Appendix B.1 – Wisconsin Diabetes Guidelines Diabetes Referral Form

INTERDISCIPLINARY DIABETES DENTAL REFERRAL FORM

Medical Provider: Complete this section

1) Type of diabetes: Type 1 diabetes Type 2 diabetes

2) List medications:

3) Recent A1c: _____ % Date: _____

4) Antibiotic pre-medication required? YES NO

5) Drug allergies:

6) Consulting medical provider: _____

Address _____

City/State _____

Phone _____

Fax _____

Dental Provider: Complete this section

1. Date of dental visit:

2. Periodontal status (check):

Gingivitis Early Periodontitis Moderate Periodontitis Advanced Periodontitis

3. Significant oral findings:

4. Treatment needs: _____

5. Next appointment or F/U: ____ / ____ / _____

6. Consulting dental care provider:

Address _____

City/State _____

Phone _____

Fax _____

I, _____, consent to the release and exchange of medical/dental information pertinent to my diabetes management and overall healthcare.

PLEASE FAX THIS FORM TO THE CONSULTING DENTAL OR MEDICAL PROVIDER.

Appendix B.2 – University of Detroit Mercy Structured Form (Geist and Geist)

	<p>University of Detroit Mercy School of Dentistry 8200 W. Outer Drive Detroit, MI 48219-0900</p>	<p>University of Detroit Mercy Dental Service DRH/UHC 4201 St. Antoine Detroit, MI 48201</p> <p style="text-align: center;">(313) 494-6700</p>
-----------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------

Medical Consultation

Consultant: _____

Address: _____

Date: _____

Patient: _____ UDM Chart Number: _____

Clinic requesting medical consultation:
Emergency/Screening 313-494-6718
Surgical Services 313-494-6739

REASON FOR CONSULTATION

Dear Dr. _____

Our patient as identified above presented to the University of Detroit Mercy School of Dentistry on ___/___/____. During the medical history review, the patient stated that he/she has Type ___ diabetes mellitus. Please provide the following information requested below so that his/her dental treatment can be initiated.

Your assistance is appreciated. Thank you.

Faculty Signature: _____

RELEASE
I hereby consent to the release of my medical records to the University of Detroit Mercy School of Dentistry including any information regarding HIV status and infectious disease. I understand that this information will remain confidential.

Patient Signature: _____

PHYSICIAN'S RESPONSE

1. The current HbA1c is _____% as measured on the date of _____.
2. The glycemic control goal for this patient is HbA1c _____%

Physician Signature: _____
Date: _____

Disposition _____

Faculty Signature: _____
Date: _____

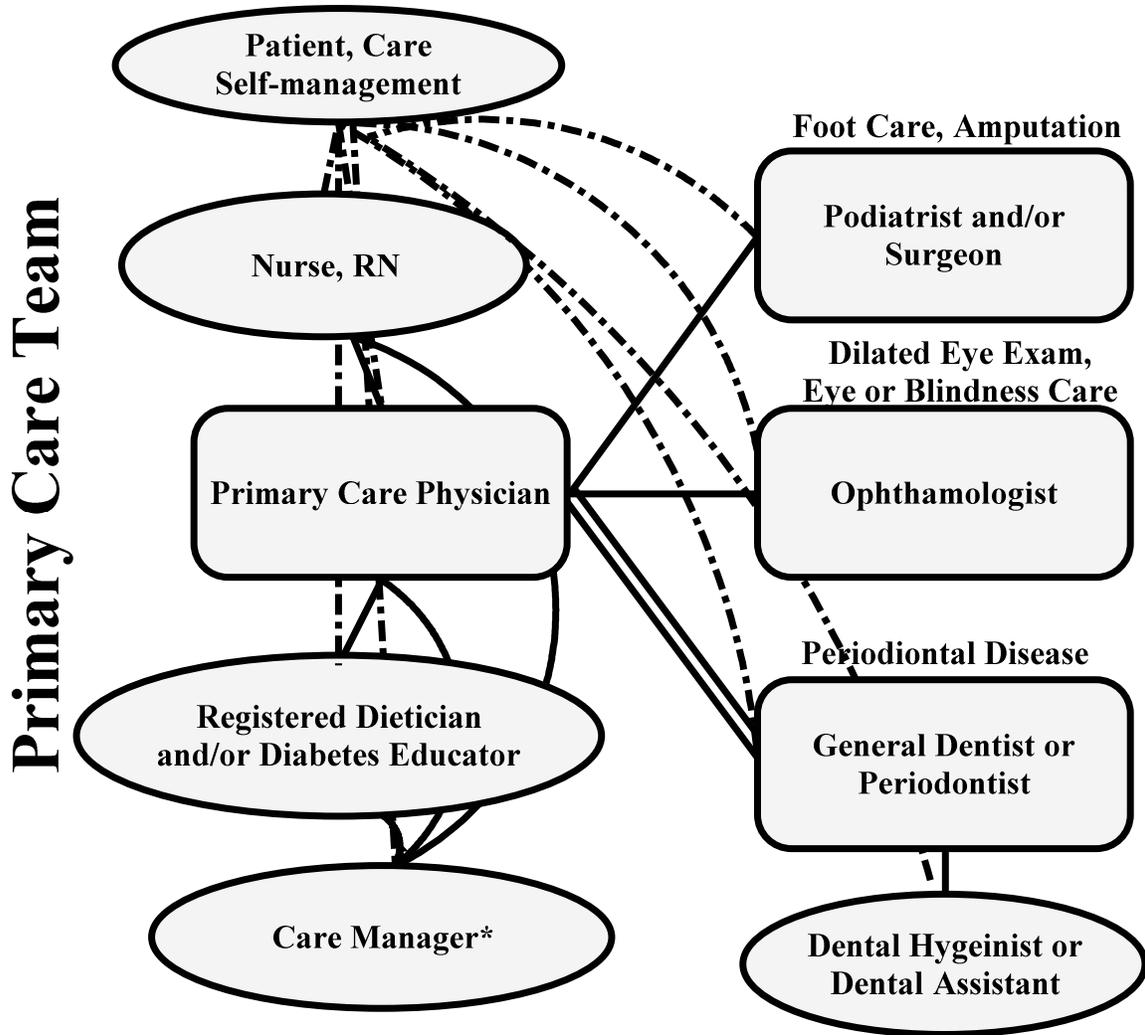
Figure 2. An example of the new structured CR form for diabetes mellitus

Note that the request for information includes a standardized opening, in which the faculty member must specify the type of diabetes reported by the patient, and closed-ended questions for the physician to answer regarding the most recent HbA1c measurement and its date and the glycemic control goal for the patient.

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Appendix C – A Diabetes Care Team Model

Figure 4
Diabetes Care Team Model



Notes: The members of the entire care team are the primary care team (patient (responsible for care self-management), the PCP, dietitian and/or diabetes educator, care manager) along with other providers as needed such as general dentist or periodontist, dental hygienist, ophthalmologist, podiatrist and/or surgeon. The double line indicates the information flow (communication) being dealt with in this paper between the dental provider and the PCP. The dotted lines indicate patient communications. The Care Manager (marked with an asterisk) is specified in care models such as those under consideration by chronic care or medical home initiatives.

Appendix D – Project Survey Questions for Sites Confirming Integration of Care

- 1) Do you have any special forms or procedures regarding interdisciplinary referrals or reports among medical and dental providers?
- 2) Do you use an electronic health record system through which medical and dental providers receive integrated access to patient records?
 - a. If so, which system, from which vendor?
- 3) Do you encounter any particular problems because of the Medicare exclusion of most dental care?
 - a. If so, how would you characterize these problems?
 - b. If not, why is that exclusion not a problem?
- 4) Do you have any position or policy statements on this topic you would care to add on behalf of your site?

Table of Contents

Title, Abstract	1
0. General Introduction; Modeling and Specifying a System with Safety and Quality of Care	1
1. Introduction to Siloization in U.S. Health Care, International Context, Providers' Care Streams Connected Tenuously	2
2. Interrelationships of Diabetes and other Chronic Diseases to Periodontal Disease and other Needs for Interdisciplinary Collaboration in Care and Research	9
3. An Interdisciplinary Communication Model for the 21 st Century.	15
4. Educational Implications	21
5. Separate, Inadequately Articulated Insurance Claim Silos and Their Impacts on Care, Performance Assessment, and Research	23
6. Standards Organizations: HL7, ASTM E31, ADA SCDI, and the Healthcare Information Technology Standards Panel (HITSP).	27
7. Analysis	30
8. Acknowledgements	34
9. Disclaimer	36
10. References	36
Appendix A – A Guide to Organizations and Acronyms	45
Appendix B.1 – Wisconsin Diabetes Guidelines Diabetes Referral Form	47
Appendix B.2 – University of Detroit Mercy Structured Form (Geist and Geist)	48
Appendix C – A Diabetes Care Team Model	49
Appendix D – Project Survey Questions for Sites Confirming Integration of Care	50