



RESEARCH ARTICLE

HOW COMMUNITY AND PREVENTATIVE DENTISTRY CAN REDUCE COST AND IMPROVE PATIENTS' HEALTH VIA TECHNOLOGY-DRIVEN COOPERATION BETWEEN DENTAL PRACTICES AND HOSPITALS

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ABSTRACT

Purpose: The purpose of this paper is to discuss ways in which dentistry can be efficiently integrated with the general health care system to improve quality of care and save costs.

Design/Methodology/Approach: The authors evaluated a possibility of improving patients' outcomes and reducing costs via employing cell a phone technology-based approach to integration between dental care and the hospital-based health care system.

Findings: Despite the huge implications of oral health on general health, the field of dentistry has remained somewhat isolated from the larger health care network. For the past thirty-five years, health care spending in the U.S. has skyrocketed to costs nearing 3.2 trillion dollars. However, the access and outcomes of care lag far behind those of other developed nations despite this spike. Finding an efficient way to connect dental care and general care would greatly aid in alleviating the fiscal and structural challenges faced by the US health care system by uniting two of the most important aspects of health.

Originality/Value: The authors find that involvement of dental "physicians" in providing community-based health care with robust ties to hospitals has potential to substantially reduce costs for the treatment of a number of chronic conditions.

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INTRODUCTION

The important role of community and preventative dentistry in the general well-being of the population cannot be denied (Poul Erik Petersen, 2003). Dental practices have a two-fold duty towards their patients, providing not only "physician-like" services but also work of "excellent craftsmanship". It is an uncommonly personalized field, which is quite natural given the variety of anatomical discrepancies within the population. Mountingscientific evidence suggest thatgood oral health is connected with a marked decrease in numerous physicalhealth risks (Heimonen *et al.*, 2008; Scully *et al.*, 2007; Ward *et al.*, 2014). Miscarriages, cancer, and various heart conditions (Heimonen *et al.*, 2008; Scully *et al.*, 2007) may be prevented via improved oral health. In addition, good oral health aids in maintaining a sound mentalcondition, helping prevent stress, anxiety, and depression (Ward *et al.*, 2014). However, rapid rates of increase in health care costs have defined the U.S. health care sector for the past thirty-five years. The lack of effective competition in the health care market place and effective public policy to constrain cost increase are some of the reasons for the spending growth. The health care spending

in the Unites States has quickly skyrocketed into stratosphere during the previous two decades, with spending nearing 3.2 trillion dollars. (Poul Erik Petersen, 2003; Heimonen *et al.*, 2008) It is interesting to note that the field of dentistry remains a somewhat isolated, stand-alone provider as far as the general health of the population is concerned, and so dentists are more isolated from participation in total health care enterprises. Dentistry is not only focused on providing "physician-like" services but frequently "focused on providing an excellent craftsmanship." Therefore, focus on community and preventive dentistry has become more important than ever. A resourceful bridging of the gap between dentistry and general health would help alleviate the immense organizational and financial burdens and challenges that hospitals and dental practices face. Cell phone technology is a fast-growing, ingeniousway of communication that is used by millions on a daily basis nationwide. It is a familiar sight in the health care industry, and promises to continue growing and developing at a dizzying rate in the coming decades. Due to its popularity and simplicity, cell phone technology has proven to be a promising candidate in uniting dental practices and hospitals in their efforts to improve the care and quality of a patient's experience (International Conference on Intelligent Virtual Agents IVA 2010). Initiatives such as True Image Interactive, Asthmapolis, and

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Ginger.ioare revolutionizing the field of health care in the US by incorporating mobile technology in improving the efficiency and scope of their services. The overall goal of providing high-quality coordinated care in order to lower health care spending might be within reach via the employment of cell phone technology in the health care systems. Such technology has a potential to tap into earlier unexplored health related "collaborations" in an effort to minimize cost. The newly evolving cell phone based technologies have a strong potential of leading the health care system as a whole towards demand and diversity.

Background

The mouth is incontestably linked to the body and that is why oral health plays a critical role in whole-body health. Although a body of scientific evidence revealing the "mouth-body" connection is still emerging, several chronic conditions are unambiguously linked to oral health (American Family Physician, 2008). Moreover, integration of dental practices under the overall general health care umbrella is important via-a-vis the effort of improving quality of care and reducing cost, since a simple dental screening may lead to uncovering the need for detrimental general health related follow ups with a number of physicians at a hospital. True Image Interactive, LLC has adapted cell phone based app aiding patients in their management of diabetes, a chronic disease that affects nearly 25 million people in the US. True Image Interactivesoftware later expanded into the making of a human avatar that aided customers as a health coach for heart disease. The health coach empowers patients with an empathetic approach that goes far beyond the traditional approach used during a patient's stay at the hospital. Patients used the avatar, particularly, to learn more about their condition and their diet. They did so by reading the educational content, listening to the avatar, and by asking questions. The human avatar enabled clients to manage their daily care, including diet, exercise, medication, appointment reminders, and tracking (Unpublished Company Communication). The app also acts as a conversational IVR for automated patient follow-up surveys. As a health coach, True Image has many advantages over traditional post-hospital care, such as personalization to diagnosis and real-time monitoring. Thus far, it has reduced 30-day hospital readmissions by 50%, and produced a 39% improvement in patient satisfaction. As a conversational IVR for patient follow up surveys, the digital avatar also achieved an enormous success rate, engaging 30,000 patients per year and having 85% of these clients complete the surveys. (Unpublished Company Communication)

Ginger.io is an initiative launched to assist with behavioral health therapies such as stress, anxiety, or depression. The app allows patients to connect with licensed, accredited therapists and psychiatrists that are available at all times via text or video. It is highly personalized, and is based upon the condition and needs of a given client, which are a vital point of consideration when choosing therapists and/or psychiatrists to work with. (Unpublished Company Communication) Propeller Health designed an app that connects to sensors on an inhaler and gathers information that aids patients in managing their asthma. It gains knowledge on personal triggers and how to avoid them, thereby allowing a reduction of the costs and time that asthma consumes. Thus far, results have demonstrated a 79% decrease in asthma attacks, a 50% increase in doses taken on schedule, and a 50% increase in symptom-free days. Via

cell phone technology, the propeller provides an indispensable snapshot into how asthma can be curbed in a simple, efficient manner that provides answers. (Unpublished Company Communication) Figure 1 illustrates the concept of the potential cost saving modality when some chronic conditions and/or high risk patients could be identified as a result of a simple oral examination and directed towards the necessary appointments with health care providers within a hospital.



Figure 1. Leading causes of death and potential benefit to the patient via early referral for diagnosis via the dental office

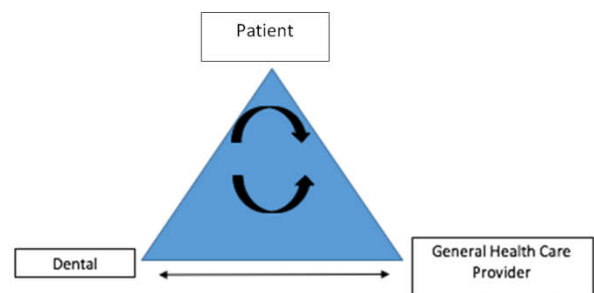


Figure 2. The schematic illustrating the possibility of interactions between the dental practice and general health care provider in an effort to screen for potential chronic and/or high risk conditions as a part of routine dental examination

A better collaboration among physicians and dentists could help in identifying high risk types for a number of women's health related as well as chronic conditions in the general population, Table 1:

1. **Miscarriage, preterm birth and low birth weight.** Oral health care patterns are related to the history of miscarriage (Unpublished Company Communication).
2. **Oral health during pregnancy.** Maintenance of oral health is extremely important for the health of the mother and the child (Unpublished Company Communication).
3. **Cancer.** Males with periodontal disease are under higher risk of developing kidney, pancreatic and blood cancers (Unpublished Company Communication).
4. **Heart condition.** Existence of periodontal disease in patients' creates an elevated risk of developing heart disease (Unpublished Company Communication).
5. **Diabetes.** Periodontal disease is considered a complication of diabetes (Unpublished Company Communication).
6. **Chronic obstructive pulmonary disease** (Unpublished Company Communication).
7. **Hypertension** (Unpublished Company Communication).
8. **Mental health** (Unpublished Company Communication).
9. **Osteoporosis** (Unpublished Company Communication).
10. **Parkinson disease** (Unpublished Company Communication).
11. **Stroke** (Unpublished Company Communication).

Table 1. Chronic Conditions that affect the general population and are linked to Oral Health

Miscarriage, preterm birth, and low birth weight	Oral Diseases, October 2008, A. Heimonen, S.J. Janket, Meurman, Furuholm, "Oral Health Care Patterns and the History of Miscarriage".
Cancer	American Family Physician, April 2008, Morgan M.A., Crall J., Goldenberg R.L., Schulkin J., "Oral Health During Pregnancy."
Heart Condition	JADA, Vol 138, September 2007, Scully C., Ettinger R.L., "The influence of systemic diseases on oral health care in older adults".
Diabetes	JADA, Vol 138, September 2007, Scully C., Ettinger R.L., "The influence of systemic diseases on oral health care in older adults".
Chronic Obstructive Pulmonary Disease	JADA, Vol 138, September 2007, Scully C., Ettinger R.L., "The influence of systemic diseases on oral health care in older adults".
Hypertension	JADA, Vol 138, September 2007, Scully C., Ettinger R.L., "The influence of systemic diseases on oral health care in older adults".
Mental Health	JADA, Vol 138, September 2007, Scully C., Ettinger R.L., "The influence of systemic diseases on oral health care in older adults".
Osteoporosis	JADA, Vol 138, September 2007, Scully C., Ettinger R.L., "The influence of systemic diseases on oral health care in older adults".
Parkinson Disease	JADA, Vol 138, September 2007, Scully C., Ettinger R.L., "The influence of systemic diseases on oral health care in older adults".
Stroke	JADA, Vol 138, September 2007, Scully C., Ettinger R.L., "The influence of systemic diseases on oral health care in older adults".

It is important to note that some dentists already embarked on the opportunity by becoming involved in a variety of roles that relate to primary care: for example, counselling for tobacco cessation, referral of hypertension, oral cancer, domestic and substance abuse, as well as recognition and treatment of eating disorders such as bulimia. However, such initiatives do not have a follow up mechanism that is embedded into the unifying educational as well as monitoring function provided by the human avatar. The use of such technology will empower patients to manage their own health by developing healthy habits that last, improve care path and medication adherence accompanied by active monitoring, ongoing education and human interaction. The evaluation of the proof of concept for the human avatar system was done by the True Image LLC in collaboration with some of the nation's leading hospitals on diabetic patients. Over 25 million people in U.S. (11.3% of the adult population) have been diagnosed with diabetes. This chronic condition is the cause of 5.3 million hospital admissions and the cost of treatment is nearly \$200 billion annually. While medicine continues to make strides in the treatment of diabetes, many patients still have poor outcomes and serious complications. The current focus is on developing a chronic care model of treatment including improved coordination of services, better clinical information systems, integrating community resources, patient engagement and self-management. Patients need tools and information to help them to be diagnosed and manage the disease. Many complications and readmissions could be avoided if patients had a better understanding of their disease, medical schedule, when to contact their primary care physician, and had tools to help with treatment compliance, diet and lifestyle. A possibility of early identification of the patients with various chronic conditions similar to diabetes as a part of routine examination at the dental office could lead to significant improvement in the quality of patients' lives due to early diagnosis and medical intervention. Moreover, such an approach is accompanied by substantial cost saving.

Systems Integration as an Approach to Control Health Care Spending

It seems that successful health care finance management must be inherently a well-gearred, collaborative, integrated system that is well versed in and flows through different fields of medicine and dentistry. The advancement of the wireless cell phone technology allows to accomplish just that with a minimal price tag. Chronic diseases are the leading causes of death and disability in the United States. According to the Center for Disease Control as of 2012, about half of all adults—117 million people—had one or more chronic health conditions. One of four adults had two or more chronic health conditions. (Poul Erik Petersen, 2003) Seven of the top 10

causes of death in 2010 were chronic diseases. Two of these chronic diseases—heart disease and cancer—together accounted for nearly 48% of all deaths. Diabetes is the leading cause of kidney failure, lower-limb amputations other than those caused by injury, and new cases of blindness among adults. Embarking on a solid possibility of preventing or limiting the number of chronic diseases in the United States may open the door for controlling the health care spending without compromising the quality of care. The possible inclusion of dentists into the overall approach of primary care may bring a benefit to the patient with an added benefit of curbing the health care cost, Figure 2. Episode-based payment, known as bundled payment for care improvement, combines the payments for multiple services received during an episode of care. Such model of payment method is of great interest vis-a-vis of possible overlap of services between dentists (oral physicians) with the general practice physicians. A bundles payment concept is based on the idea of the following cost saving mechanism: all services provided by the physician and hospital are covered in one transaction, thus lowering the total cost that is lower than the possible sum of the individual charges. (Poul Erik Petersen, 2003)

There is a strong consensus that the US health care system is dysfunctional and fails to provide either the quality or the value that it should, and that substantial restructuring is urgent. Recent incentives encourage cooperation among hospitals, physicians, and other care providers. Consequently, there is increasing interest in bundled payments that include all services associated with an episode of care that could be an early diagnosis of a chronic condition, when the initial screening could be a part of routine visit to a dentist. A recent study in the New England Journal of Medicine analyzed a cost – distribution of the 17 most expensive episodes demonstrating that the initial inpatient admissions accounted for 60% of spending. This is a rather staggering percentage and elimination of even a fraction of such admissions via early referral for diagnosis at a dental office will lead to substantial cost savings. Moreover, subsequent admissions (readmissions related to the same organ system) accounted for 23%, with separately billed physician services totaling another 10%. By averaging the cost for 17 chronic conditions in the 306 hospital referral regions and taking in to account that Medicare paid a bundled rate for episodes, with the cap set at 50th-percentile the reduction in cost for the 17 conditions would be \$4.7 billion annually.

Conclusion

The nature of the health services delivery is changing. It is rather clear that health care at this point is a potpourri of business, science, tradition, lifestyle and art. Providers'

objectives have been expanded to include customer-sensitive service, accompanied by patient compliance in following up with basic medications and health maintenance routine, delivered in the most economically efficient way possible. If any of the mentioned above aspects is overemphasized, disastrous consequences follow. On one hand, the provider and those who pursue only business interests will be no more respected as domestic court relations lawyers. On the other hand, those who disrespect business skills, marketing might end up without an income. There are vast cost saving opportunities that are embedded in the health care sector that spends \$1 million every five hours. An efficient integration of the dental practices with a hospital based physicians via "virtual" health coach may lead to the fulfilment of the "Holy Grail" opportunity where health care quality is enhanced and the health care costs are fastened and controlled. The ultimate success of the approach outlined above is tied to physician-driven, integrated delivery network with a human avatar system that is wired through an institutional electronic health record system and a domination in the market share.

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