Periodontal Microbiome

Oral-Systemic Health Research Program

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Personalized Medicine Research Project

- Population-based biobank with over 20,000 enrolled
- DNA, plasma and serum samples
- Access to medical records
- Ability to re-contact subjects
- Community Advisory Group, Ethics & Security Advisory Board, Scientific Advisory Board
Goals: Oral and Systemic Health Research Project

• Understand the connections between oral and systemic health, e.g., the mutual enhancement of periodontal disease and diabetes. Other common diseases linked to periodontal disease include heart disease, hypertension and osteoporosis and each has genetic and environmental risk factors.

• Understand the causes of oral diseases, such as periodontal disease and caries, e.g., determining the effect of genetics, diet, water source (well/city + fluoridation), and microbiome.

• Understand how improving oral health aids systemic health (comparative effectiveness) and bring PHC to the dental arena.
Primary and Secondary Target Areas

- 7 dental centers (2 more planned) providing dental services to people from all of Wisconsin's 72 counties
- 39 (FTE) dentists
- 30,680 unique dental patients [2010]
- 40,000 additional unique dental patients [2011]
Marshfield Clinic 2010 Data
Medical and Dental Patient Breakdown

<table>
<thead>
<tr>
<th></th>
<th>Medical Patients</th>
<th>189,530 (in VDW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental Patients</td>
<td></td>
<td>70,393</td>
</tr>
<tr>
<td>Medical Patient (1 visit or more in year)</td>
<td>392,684 (141,922 in VDW)</td>
<td></td>
</tr>
<tr>
<td>Dental Patient (1 visit or more in year)</td>
<td>36,471 (30,680 w/ insurance data)</td>
<td></td>
</tr>
<tr>
<td>Both Medical &amp; Dental Patient</td>
<td>26,221</td>
<td></td>
</tr>
</tbody>
</table>

* 72% of Dental Patients are also Medical Patients
Integrated Medical-Dental Electronic Health Record

An electronic dental record module integrated with electronic medical record, CattailsDental ↔ CattailsMD

Among the first in the nation to implement an integrated medical-dental electronic health record (iEHR) environment
Creating a Unique Research Resource

Personalized health care requires microbiome data

The resource will consist of:

A patient population with electronic dental and health records coupled with a comprehensive biobank (DNA, plasma, serum, standard periodic tests for fasting glucose, Hba1c and serum microalbumin, plus and periodontal microbiome characterization), plus questionnaire data on environment, diet, etc.

Built upon PMRP

1500 subjects in PMRP are dental patients of the Marshfield Clinic.

As the Clinic’s Electronic Health Record contains medical and dental care information, this research sub-cohort of PMRP can be used today to study the connections between oral and systemic health.
Oral Systemic Health Research Project (OSHRP)

- The vision is based on the success of PMRP and will be of complimentary value
- An oral systemic research committee has been formed and are currently working on pilot projects: two on diabetes
- There is already a cohort of 1488 patients in the OSHRP cohort and this number is increasing rapidly

![Venn diagram showing the overlap of Dental Patients and PMRP Cohort.]

Dental Patients: 85,245
PMRP Cohort: 20,083
1488 patients overlap

November 2011
<table>
<thead>
<tr>
<th>Age category</th>
<th>Est. # Diagnosed (%)</th>
<th>Est. # Undiagnosed (%)</th>
<th>Est. Total Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ages 18 – 44</td>
<td>79,930 (3.9%)</td>
<td>33,940 (1.6%)</td>
<td>113,870 (5.5%)</td>
</tr>
<tr>
<td>Ages 45 – 64</td>
<td>118,850 (8.2%)</td>
<td>50,470 (3.5%)</td>
<td>169,320 (11.7%)</td>
</tr>
<tr>
<td>Ages 65 +</td>
<td>95,940 (13.3%)</td>
<td>40,740 (5.6%)</td>
<td>136,680 (18.9%)</td>
</tr>
<tr>
<td>All ages adult *</td>
<td>294,720 (6.7%)</td>
<td>125,150 (2.9%)</td>
<td>419,870 (9.6%)</td>
</tr>
</tbody>
</table>

**Table 1: Diabetes Prevalence in Wisconsin [18].** *Percent is age-adjusted (direct method) to the United States 2000 standard population. Total Percent may not equal the sum of diagnosed percent and undiagnosed percent, due to rounding.*
Management of Patients with Diabetes & Periodontitis

There were a total of 47,247 unique patients on whom we had both dental and medical data within the Integrated Medical-Dental Enterprise Data Warehouse.

- **8851** moderate to severe periodontal disease within 47,247 unique patients
- A total of **2752** diabetic patients within this group who had visited a medical provider within the last three years.
  - **1858** Diabetics have had a dental visit in the last 1 year, however **894** diabetics have not had a dental visit within the last 1 year
<table>
<thead>
<tr>
<th>Last Dental Visits by Med+Dental Population</th>
<th>&lt;1yr</th>
<th>&gt;1yr</th>
<th>&gt;3y</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental Appointments</td>
<td>8,637</td>
<td>4,021</td>
<td>287</td>
<td>12,945</td>
</tr>
<tr>
<td>Hemoglobin A1c</td>
<td>1,137</td>
<td>562</td>
<td>44</td>
<td>1,743</td>
</tr>
<tr>
<td>LDL</td>
<td>3,034</td>
<td>1,539</td>
<td>116</td>
<td>4,689</td>
</tr>
<tr>
<td>HDL</td>
<td>3,257</td>
<td>1,629</td>
<td>121</td>
<td>5,007</td>
</tr>
<tr>
<td>Fasting Glucose</td>
<td>1,681</td>
<td>842</td>
<td>65</td>
<td>2,588</td>
</tr>
<tr>
<td>Random Glucose</td>
<td>4,509</td>
<td>2,231</td>
<td>178</td>
<td>6,918</td>
</tr>
<tr>
<td>Diabetic</td>
<td>474</td>
<td>292</td>
<td>21</td>
<td>787</td>
</tr>
</tbody>
</table>

Table y: Number of diabetics seen at Chippewa Dental Center
Oral Systemic Health Research Project (OSHRP)
The Microbiome-Genome-Phenome Project

EMR Data

EDR Data

DNA Data

Blood & Serum Samples

Oral Microbiome Samples
ORAL MICROBIOME

POOR ORAL HYGIENE IMMUNO DISORDER GENETICS

ABNORMAL PROPORTIONS

PARASITIC/OPPORTUNISTIC RELATIONSHIPS

IMMUNO DISORDER GENETICS

VIRULENCE FACTORS

From: ZARCO, VESS & GINSBURG, ORAL DISEASES 2011 REVIEW
Geisinger: dental services
Mayo: specialized dental services.
MCW: ?
University of Washington: dental school.
VA: dental services plus integrated EHR for its medical and dental services.
Harvard system: dental school
Univ of Chicago: ?
Univ of Alabama: dental school.
Northwestern: currently does not have dental services.
Johns Hopkins: specialized dental services.
Loyola Univ: dental services
Mount Sinai: dental services
Duke: no dental services.
Univ North Carolina: dental school.
St Jude’s: ?
Vanderbilt: dental services.
Cleveland Clinic: specialized dental services.
Univ of Maryland: dental school.