ORAL HEALTH AND FRAILTY

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Frailty

✓ Geriatric Syndrome
  ➢ Diminished reserve capacity that increase the risk for adverse outcomes
  ➢ “Excess demand imposed upon reduced capacity”

✓ Phenotype of Frailty
  ➢ Weakness (lowest quintile of population/sample)
  ➢ Slowness (lowest quintile of population/sample)
  ➢ Low physical activity (lowest quintile of population/sample)
  ➢ Low energy/poor endurance (self-report of fatigue)
  ➢ Unintentional weight loss (≥5 Kg during the last year)

Oral Health

☑ Oral Health problems

➢ Change in food selection
  ◊ ↓Tocoferol, Carotenoids, Protein, Fiber, Vitamins

➢ Malnutrition status
  ◊ Anorexia of the elderly
  ◊ Sarcopenia (sarcopenic-obesity)

Avlund K et al. 2011
Semba RD et al. 2006
Sheiham A et al. 2001

Ahmed N et al. 2007
Koehler J et al. 2008
Hutton B et al. 2002

N’Gom P I et al. 2002
Nowjack-Raymer RE et al. 2003
Walls AW et al. 2000
Oral Health

✓ Oral Health problems
   ➢ Acute inflammation
   ➢ Chronic inflammation
     ◦ ↑IL-1β, IL-6, TNF-α, PGE₂, Leukotrienes, Histamine
     ◦ Reach liver to release C-Reactive Protein, fibrinogen, and others
     ◦ With multiple pro-inflammatory activities and stimulation for tissue repair mechanisms.
   ➢ Effects on
     ◦ Liver, kidney, cognitive impairment, cardiovascular system

Madianos PN et al. 2010
Lipsitz LA. Sci Aging Knowledge Environ. 2004
Walston J. Sci Aging Knowledge Environ. 2004

Oral Health during Life Course

Physiologic Changes

Primary Dentition
- Period of Eruption of Primary Dentition

Permanent Dentition
- Lower cellular replacement rate
- Lower thermal and pressure sensitivity
- Dysgeusia
- Period of Eruption of Permanent Dentition

Acquired Changes (Cumulative)

- Birth
  - 6m
    - Caries (Primary Dentition)
    - Premature Tooth Loss
  - 2y
  - 6y
    - Caries
    - Periodontal Diseases (Gingivitis)
    - Root Caries
  - 12y
    - Need for dental prostheses
  - 18y
    - Periodontal Diseases (Periodontitis)
  - 30y
  - 50y
    - Xerostomia, Hyposalgia, Presbyphagia, Dysphagia
  - ≥100y
    - Diagnosis of Non-Communicable Diseases

Risk Factors for Non-Communicable Diseases
- Genetics
- Smoking
- Alcohol
- Diet
- Sedentarism
- Sociodemographics
- Epigenetics

Development of Non-Communicable Diseases

Diagram by RC Castrejón-Pérez

Castrejón-Pérez RC, Borges-Yáñez SA. JFA. 2014
Oral Health and Nutrition

Effects:
- Food choices
  - Quality
  - Consistency
- ↓ Fiber
- ↓ Protein
- ↓ Vit. A, B6, B1, C
- ↓ Calcium & Iron
- ↓ Folic acid
- ↓ Weight loss (unintentional)
- ↑ Carbohydrates and sucrose
- ↑ Risk for obesity

Diagram by RC Castrejón-Pérez

References:
- Revista de Nutrición Clínica 2003;6:9-16
- Gerodontology 2007;24 (2): 87
- J Can Dent Assoc 1994 May;60(5):443-6
- J Can Dent Assoc 1994; 60(5):443-449
- Oral Dis 1999; 5:32-8
- Br Dent J 1994 Oct 8;177(7):243-7
- Nut Clin 2003;6(1) :46.52
- Journal of Frailty and Aging 2014; 3(3):180-186
Objective

To evaluate the association among oral health conditions and utilization of dental services with the incidence of frailty in elderly 70 years old and over in one district of Mexico City.
METHODS
Methods

✓ Type of study
  ➢ Cohort 2008-2011
  ➢ Two measurements
  ➢ Household survey

✓ Study population
  ➢ ≥70 years
  ➢ Residents of Coyoacán, México
  ➢ Registered at the Food Support, Medical Care, and Free Drugs Program (33000)
Methods

✓ Sample
  ➢ Probabilistic representative sample (n=1294)
  ➢ Stratified by sex and age

✓ Inclusion criteria
  ➢ ≥70 years registered at the Food Support, Medical Care, and Free Drugs Program, residents of Coyoacán, México
  ➢ Accepted the dental clinical evaluation

✓ Exclusion criteria
  ➢ Did not accept to participate in the second stage or did not agree to the dental clinical evaluation
Variables

Independent variables

✓ Socio-demographic
  ➢ Age, Sex, Education (years), Marital status
✓ Medical conditions (Yes/no)
  ➢ Stroke, Hypertension, Diabetes, Osteoporosis, Arthritis, Urinary incontinence
✓ Oral health (Yes/no)
  ➢ Utilization of dental services
  ➢ Xerostomia
✓ Oral Health Impact Profile (14-Sp)

Dependent variable

Frailty

✓ Yes = Having ≥3 of five components
  ➢ Weakness
  ➢ Slowness
  ➢ Low physical activity
  ➢ Fatigue
  ➢ Unintentional weight loss
✓ No ≤2 of the components
Oral Health Variables

✓ Clinical evaluation

- Number of teeth (0/1-24/≥25)
- Wearing Removable Partial Dentures [RPD] and/or Complete Dentures [CD] (Y/N)
- Functionality of RPD and/or CD (Ettinger) (Y/N)
- Severe periodontitis (Periodontal Screening and Recording modified) (≥2 teeth with ≥5 mm attachment loss)

American Dental Association. Periodontal Screening and Recording
Methods

✓ Oral Health Clinical evaluation
  ➢ 4 standardized dental students (National Autonomous University of Mexico)
    ◈ Functionality of RPD/CD (K=0.9)
    ◈ Periodontitis (K=0.7)

✓ Protocol for infection control

✓ Ethics
  ➢ Informed consent
Statistical Analysis

- Prevalence of frailty during 2008-2009
- Incidence of frailty in 2011
- Univariate analysis... ...by incidence of frailty
  - ...Socio-demographic...
  - ...Medical conditions...
  - ...Oral health conditions...
- Poisson regression model (dependent variable: incidence of frailty)
RESULTS
Characteristics of the participants (n=699)

✓ Age
  ➢ 77.9 ± 6.3 years old
✓ Women 53.2% (n=372)
✓ Married
  ➢ Men (57.3%)
✓ Widowed
  ➢ Women (46.3%)
✓ Education (years of schooling) (7.3 ± 5.4) (p<0.05)
  ➢ Men (7.9 ± 5.8)
  ➢ Women (6.7 ± 5.0)
Flow of participants and Incidence of Frailty

2008 - 2009

Not frail
n=595

2011

Interview
n=343 (57.7%)

Atrition (42.3%)
- Death = 49 (8.2%)
- Change address = 10 (1.7%)
- Not located = 100 (16.8%)
- Not willing to participate = 93 (15.6%)

Frailty evaluation n=252 (73.5%)

Incidence of frailty
n= 37 (14.7%)

Not frail
n=215 (85.3%)

Incomplete data for diagnosis of frailty
n= 91 (26.5%)
Characteristics of the participants (n=252)

- Age 77 ± 5.3 years old
- Women 51%
- Illiteracy 10.8%
- Self-rated general health (regular-bad) 41.7%
- Edentate 21.8%
- Xerostomia 43.7%
- Severe periodontitis 17%
- Stroke 2.4%
- Hypertension 56%
- Hypercholesterolemia 35.7%
- Hypertriglyceridemia 20.6%
- Osteoporosis 14.7%
- Arthritis 18.7%
- Diabetes 18%
Incidence of Frailty by Socio-Demographic

✓ Those who developed frailty were
  ➢ Older (80.4 ± 6.4 years Vs. 75.8 ± 4.8 years) [p<0.001]
  ➢ Have less years of education (5.4 ± 4.3 Vs. 7.3 ± 5.0) [p<0.05]

✓ No differences (14.7%) were found by...
  ➢ ...Sex
  ➢ ...Marital status
  ➢ ...Utilization of dental services
  ➢ ...Xerostomia
## Incidence of Frailty by Medical Conditions

<table>
<thead>
<tr>
<th>Baseline factors</th>
<th>Non Frail/Frail (%)</th>
<th>RR [95% CI]</th>
<th>p value$^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age in years [Mean (SD)]</strong></td>
<td>75.71 (4.7)/80.34 (6.4)*</td>
<td>1.11 [1.07-1.15]</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Education in years [Mean (SD)]</strong></td>
<td>7.26 (4.9)/5.35 (4.3)*</td>
<td>0.93 [0.87-0.99]</td>
<td>0.048</td>
</tr>
<tr>
<td>Gender [Men/Women]</td>
<td>13.0/16.4</td>
<td>1.26 [0.68-2.34]</td>
<td>0.470</td>
</tr>
<tr>
<td>Marital status [Married/Nor Married]</td>
<td>11.5/18.3</td>
<td>1.59 [0.85-2.98]</td>
<td>0.147</td>
</tr>
<tr>
<td><strong>Number of medications [Mean (SD)]</strong></td>
<td>2.38 (1.8)/3.74 (4.0)*</td>
<td>1.35 [1.19-1.54]</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>MMSE score [Mean (SD)]</strong></td>
<td>23.23 (3.5)/21.14 (3.5)*</td>
<td>0.86 [0.79-0.95]</td>
<td>0.002</td>
</tr>
<tr>
<td>Stroke [No/Yes]</td>
<td>14.8/16.7</td>
<td>1.13 [0.18-6.96]</td>
<td>0.897</td>
</tr>
<tr>
<td>Hypertension [No/Yes]</td>
<td>9.0/19.0</td>
<td>2.11 [1.03-4.31]</td>
<td>0.041</td>
</tr>
<tr>
<td>Diabetes [No/Yes]</td>
<td>11.9/27.3</td>
<td>2.29 [1.23-4.24]</td>
<td>0.009</td>
</tr>
<tr>
<td>Osteoporosis [No/Yes]</td>
<td>11.9/30.6</td>
<td>2.56 [1.38-4.76]</td>
<td>0.003</td>
</tr>
<tr>
<td>Arthritis [No/Yes]</td>
<td>13.5/20.5</td>
<td>1.51 [0.76-3.00]</td>
<td>0.238</td>
</tr>
<tr>
<td>Smoking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never/Former</td>
<td>16.5/13.9</td>
<td>0.84 [0.44-1.60]</td>
<td>0.598</td>
</tr>
<tr>
<td>Never/Current</td>
<td>16.5/11.5</td>
<td>0.70 [0.22-2.21]</td>
<td>0.542</td>
</tr>
<tr>
<td>Drinker [No/Yes]</td>
<td>17.8/9.4</td>
<td>0.53 [0.25-1.11]</td>
<td>0.095</td>
</tr>
<tr>
<td>Baseline factors</td>
<td>Non Frail/Frail (%)</td>
<td>RR [95% CI]</td>
<td>p value&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>---------------------</td>
<td>------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>OHIP-14 [Median (IQR)]</td>
<td>6 (0-26)/3 (0.35)</td>
<td>1.03 [1.00-1.06]</td>
<td>0.032</td>
</tr>
<tr>
<td>Utilization of dental services [No/Yes]</td>
<td>15.1/14.4</td>
<td>1.05 [0.56-1.94]</td>
<td>0.886</td>
</tr>
<tr>
<td>Xerostomia [No/Yes]</td>
<td>13.6/16.2</td>
<td>1.19 [0.64-2.19]</td>
<td>0.583</td>
</tr>
<tr>
<td>Number of teeth [Mean (SD)]</td>
<td>12.55 (9.6)/9.57 (9.5)*</td>
<td>0.97 [0.94-1.00]</td>
<td>0.100</td>
</tr>
<tr>
<td>Severe periodontitis [No/Yes]**</td>
<td>10.8/18.4</td>
<td>1.70 [0.79-3.65]</td>
<td>0.171</td>
</tr>
<tr>
<td>Utilization of RDP [No/Yes]</td>
<td>10.9/17.6</td>
<td>1.13 [0.18-6.96]</td>
<td>0.897</td>
</tr>
<tr>
<td>Not functional RDP [No/Yes]</td>
<td>19.1/14.9</td>
<td>1.28 [0.57-2.88]</td>
<td>0.547</td>
</tr>
<tr>
<td>Tooth remnants [No/Yes]</td>
<td>18.3/10.8</td>
<td>0.59 [0.31-1.13]</td>
<td>0.115</td>
</tr>
</tbody>
</table>

** Estimated among 188 dentate participants
### Poisson Regression Model (Number of teeth n=252)

<table>
<thead>
<tr>
<th>Oral health measures</th>
<th>Model 1 (RR [95% CI])</th>
<th>Model 2 (RR [95% CI])</th>
<th>Model 3 (RR [95% CI])</th>
</tr>
</thead>
<tbody>
<tr>
<td>RR [95% CI]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (Years)</td>
<td>1.10 [1.06-1.14]*</td>
<td>1.09 [1.05-1.14]*</td>
<td>1.08 [1.04-1.13]*</td>
</tr>
<tr>
<td>Gender (Male/Female)</td>
<td>1.06 [0.59-1.92]</td>
<td>0.73 [0.42-1.29]</td>
<td>0.77 [0.42-1.42]</td>
</tr>
<tr>
<td>Education (Years)</td>
<td>0.93 [0.87-0.99]*</td>
<td>0.94 [0.88-0.99]*</td>
<td>0.94 [0.88-1.00]*</td>
</tr>
<tr>
<td>Hypertension (No/Yes)</td>
<td>1.83 [0.98-3.44]</td>
<td>1.58 [0.83-3.01]</td>
<td></td>
</tr>
<tr>
<td>Diabetes (No/Yes)</td>
<td>1.62 [0.85-3.07]</td>
<td>0.70 [0.29-1.67]</td>
<td></td>
</tr>
<tr>
<td>Osteoporosis (No/Yes)</td>
<td></td>
<td>2.30 [1.19-4.44]*</td>
<td>2.39 [1.27-4.46]*</td>
</tr>
<tr>
<td>MMSE (score)</td>
<td>0.94 [0.85-1.04]</td>
<td>0.94 [0.86-1.03]</td>
<td></td>
</tr>
<tr>
<td>Number of medications</td>
<td>1.23 [1.08-1.40]*</td>
<td>1.26 [1.11-1.44]*</td>
<td></td>
</tr>
<tr>
<td>Number of teeth [0-32]</td>
<td>0.98 [0.95-1.01]</td>
<td>0.98 [0.95-1.01]</td>
<td>0.95 [0.91-0.98]*</td>
</tr>
<tr>
<td>Interaction term (number of teeth by diabetes)</td>
<td>1.08 [1.02-1.15]*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* *p<0.05
Poisson Regression Model  (Periodontitis n=188)

<table>
<thead>
<tr>
<th>Oral health measures</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RR [95% CI]</td>
<td>RR [95% CI]</td>
<td>RR [95% CI]</td>
</tr>
<tr>
<td>Age (Years)</td>
<td>1.09 [1.05-4.36]*</td>
<td>1.09 [1.03-1.16]*</td>
<td>1.09 [1.02-1.16]*</td>
</tr>
<tr>
<td>Gender (Male/Female)</td>
<td>1.33 [0.68-2.61]</td>
<td>0.92 [0.48-1.77]</td>
<td>0.93 [0.46-1.87]</td>
</tr>
<tr>
<td>Education (Years)</td>
<td>0.89 [0.82-0.92]*</td>
<td>0.93 [0.85-1.02]</td>
<td>0.91 [0.83-1.00]</td>
</tr>
<tr>
<td>Hypertension (No/Yes)</td>
<td>2.94 [1.26-6.84]*</td>
<td>2.56 [1.09-6.04]*</td>
<td></td>
</tr>
<tr>
<td>Diabetes (No/Yes)</td>
<td>1.95 [0.94-4.04]</td>
<td>0.62 [0.11-3.49]</td>
<td></td>
</tr>
<tr>
<td>Osteoporosis (No/Yes)</td>
<td>1.88 [0.83-4.25]</td>
<td>1.81 [0.79-4.10]</td>
<td></td>
</tr>
<tr>
<td>MMSE (score)</td>
<td>0.92 [0.81-1.05]</td>
<td>0.94 [0.83-1.06]</td>
<td></td>
</tr>
<tr>
<td>Number of medications</td>
<td>1.23 [1.06-1.44]*</td>
<td>1.26 [1.07-1.49]*</td>
<td></td>
</tr>
<tr>
<td>Severe periodontitis (No/Yes)</td>
<td>2.14 [1.05-4.36]*</td>
<td>2.52 [1.25-5.07]*</td>
<td>2.13 [1.01-4.50]*</td>
</tr>
<tr>
<td>Number of teeth [0-32]</td>
<td></td>
<td></td>
<td>0.94 [0.90-0.99]*</td>
</tr>
<tr>
<td>Interaction term (number of teeth by diabetes)</td>
<td></td>
<td></td>
<td>1.08 [0.99-1.18]</td>
</tr>
</tbody>
</table>

*p<0.05
Conclusion

✓ Diabetes, severe periodontitis, age and number of medication increases the risk for developing frailty.

✓ The number of teeth reduces the risk for development of frailty

✓ Clinicians should consider diabetes and number of teeth as conditions associated to the incidence of frailty.
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