Vitamin D deficiency in Prenatal Women and Early Childhood Cavities in their Infants

Alaska Native Health Research Conference
Oct 17, 2017

Rosalyn Singleton MD MPH
ANTHC, Community Health Services
risingleton@anthc.org
Objectives

• Identify how decline in fish intake can lead to lower vitamin D levels in Alaska Native pregnant women

• Show how vitamin D levels in pregnant women can be related to early childhood cavities in their infants

• Discuss plan to evaluate extra vitamin D supplements in pregnancy
Early Childhood Cavities (ECC)

- ECC can cause pain, require extensive restoration, and impact adult teeth

- Alaska Native children have one of the highest rates of ECC
  - In 2011-2015, 73% of Yukon Kuskokwim Delta children had FMDR by the time they were 6 years old

Full Mouth Dental Rehabilitation (FMDR)
Decayed, Missing, Filled Teeth (dmft)

Decayed

Missing

Filled

ECC is defined by the number of decayed missing or filled teeth – the dmft score!
Mean Decayed, Missing or Filled Primary Teeth by Age Group, YKHC and Total United States

- 4 – 5 years: YKHC = 7.3, Total U.S. = 1.6
- 6 – 11 years: YKHC = 4.1, Total U.S. = 1.8

YKHC 5x higher than total U.S.

Causes of Early Childhood Cavities (ECC)

• Many factors are associated with higher dental cavities
  – High soda consumption
  – Lack of fluoridated water
  – Etc.

• A few studies have shown an association between vitamin D deficiency in prenatal women and ECC in their children
What is Vitamin D?

• Vitamin D is an essential vitamin that is produced in the skin when sunlight contacts the skin.
• It is also naturally present in some foods, like oily fish (e.g., salmon,).
• Vitamin D promotes bone health by maintaining levels of calcium and phosphorus.
• Vitamin D deficiency causes bone disorders, including rickets in children and osteomalacia in adults.

Alaska Native children have a high rate of rickets which increases with latitude.
Serologic Survey of Biomarkers for Traditional Marine Diet and Vitamin D Levels in YK Delta Childbearing-aged Women

**Background:**
- We were concerned about an apparent increase in rickets in Alaska Native infants
- We hypothesized that vitamin D levels in their mothers were lower than in the past
- We got approval to do a study to explore how intake of traditional marine foods and serum Vitamin D levels have changed in YK women from 1960’s through the present

**Method:**
- We tested Specimen Bank serum samples of YK Delta women 20-29 years old at points from 1960s to 1990s, for biomarkers of traditional marine diet (δ^{15}N) and vitamin D levels
Serum Vitamin D and traditional marine diet intake, YK Delta women, 20-29 yrs, 1960s-2010s

• Traditional diet decreased during 1960-1990s. 1960s diet high in fish. 2000s diet low in fish.

• Decreased fist diet was related to a decrease in Vitamin D levels. In 1960s 100% of women had sufficient vitamin D – in 2010s only 53% had sufficient Vit D.
Vitamin D: Non-Bone Effects?

• Recent single observational studies have shown associations between vitamin D deficiency and many non-bone health outcomes
  – Like cancer, cardiovascular disease, depression, diabetes, prematurity, etc.

• A review of hundreds of studies doesn’t support most associations
  – However, studies do support Vitamin D associations with child cavities

• An association between Early Childhood Cavities and prenatal Vitamin D deficiency makes sense
  – Vitamin D deficiency affects bone development, bone density and dental enamel

Theodoraou E. Vitamin D and multiple health outcomes...BMJ 2014:348:1-19.
**Current Study**

**Objective:** determine if there is an association between low vitamin D levels in prenatal women, and ECC in their children

**Method:**
- Retrospective analysis of existing samples
- We analyzed *maternal vitamin D levels* collected in the "Maternal Organics Monitoring Study (MOMS)" at prenatal visits and in cord blood.
- We evaluated YKHC electronic dental records for decayed, missing, filled, primary teeth (dmft) scores in MOMs infants at 12-60 months old
- We evaluated potential confounding factors
### Results: Association between Vitamin D and ECC

<table>
<thead>
<tr>
<th>Age</th>
<th>Mean dmft</th>
<th>25(OH)D &lt;12 ng/ml</th>
<th>25(OH)D &gt;12 ng/ml</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;36 months (cord blood)</td>
<td>10.2</td>
<td>5.5</td>
<td>P=0.02</td>
<td></td>
</tr>
<tr>
<td>&gt;36 months (cord blood)</td>
<td>11.0</td>
<td>11.4</td>
<td>P=0.78</td>
<td></td>
</tr>
<tr>
<td>&lt;36 months (prenatal visit)</td>
<td>8.5</td>
<td>6.8</td>
<td>P=0.39</td>
<td></td>
</tr>
</tbody>
</table>

- Key finding: Children less than 36 months of age with low birth vitamin D level had a mean dmft score 2 times higher than children who were not low.
  - No difference in dmft score of children over 36 months who were deficient vs. non-deficient.
  - Not a significant difference in dmft score in all children under 36 months whose mothers had “deficient” vs. “non-deficient” vitamin D levels at any prenatal visit.
Association between Vitamin D and ECC

• Low deficient vitamin D levels at birth were associated with early childhood cavities in children < 3 years.
  – The biggest association was for children 24-35 months
  – Children 24-35 months have all of their baby teeth
  – Children 24-35 months of age with low birth vitamin D level had a mean dmft score 2 ½ times higher than children who weren’t low

<table>
<thead>
<tr>
<th>Age</th>
<th>Mean dmft</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>24-35 months (cord blood)</td>
<td>10.5</td>
<td></td>
</tr>
<tr>
<td>25(OH)D &lt;12 ng/ml</td>
<td>4.4</td>
<td>P=0.003</td>
</tr>
<tr>
<td>25(OH)D &gt;12 ng/ml</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Summary and Next Steps

• Vitamin D deficient at birth was associated with increased early childhood cavities

• In Fall 2016 YKHC implemented guidelines to give 1,600 IU of vitamin D to prenatal women

• We will measure whether higher vitamin D levels are associated with lower early childhood cavities
• Timothy Thomas MD, ANTHC
• Gretchen Day MS, ANTHC
• Joseph Klejka MD, YKHC
• Dane Lenaker DDS, formerly YKHC, now SEARHC
• James Berner MD, retired

• The tribal review committees and IRB
• The MOMs study participants and their infants.