Consequences of Community Water Fluoridation Cessation for Medicaid Eligible Children and Adolescents

BY
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Thank you for your time and attention today.

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Consultant: Dr. Brad Whistler DDS, Retired SOA Chief Dentist
Presentation Agenda

Section 1 – background, setting, and research questions

Section 2 – methods and analysis

Section 3 – results and interpretation

Section 4 – conclusions and recommendations
Section 1: Background

CWF is safe and effective intervention for caries prevention and endorsed by the CDC, AMA, ADA, APHA, WHO, AAP, AAPHD, among others.\textsuperscript{1,2}

CWF cessation is a recent policy trend.\textsuperscript{3,4,5,6}

Early signs from the few available studies on cwf cessation indicate vulnerable groups are more adversely affected by CWF cessation policy\textsuperscript{5-9}

The percent of Alaska’s population served by CWF was 65% in 2007, and has fallen to 49.3% in 2014.\textsuperscript{10,11}
The focus of this retrospective comparison quantitative study was to determine the impacts of CWF discontinuation on the oral health of Medicaid eligible children and adolescents as measured by dental caries procedures and caries treatment costs.
Juneau Water System Services
Reaches 96% of 99801 residents

Setting: CWF ceased communities:
Target Population

Children and adolescents between the ages of 0-18 living in one zip code under challenging economic conditions therefore eligible for Medicaid.

The rationale for this focus was to compare two groups during different environmental conditions (+/-CWF) residing in same zip code, of similar ages and SES, thus mitigating the influence of confounding factors such as age, parent educational attainment, and income.

Families living in poverty also represent the most vulnerable group likely to be affected by CWF cessation policy decisions, and those least able to participate in the health policy decision making processes.
Juneau Water Quality Reports 2004-2013 (optimal CWF 0.7-1.2mg/L)  
(Per statements by Dr. Whistler, Juneau has been optimally fluoridated since the early 1980’s. ***Some media reports indicate that water managers periodically stopped adding fluoride in 2003).

<table>
<thead>
<tr>
<th>Juneau CCR’s available on City Website</th>
<th>Fluoride mg/l Range</th>
<th>Last Chance Basin Wells</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salmon Creek</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>0-1.24 avg .83</td>
<td>0-1.44 avg .83</td>
</tr>
<tr>
<td>2005</td>
<td>0-1.0, avg .67</td>
<td>.34-1.0 avg .67</td>
</tr>
<tr>
<td>2006</td>
<td>0 to1.0 avg 0.77</td>
<td>0.0 to 0.98 avg 0.71</td>
</tr>
<tr>
<td>2007 (not added since Jan/2007) measured after tx</td>
<td><strong>Jan only</strong> range 0.68 - 0.81 0.74 avg</td>
<td><strong>Jan only</strong> range 0.56 - 0.80 0.72 avg</td>
</tr>
<tr>
<td>2008</td>
<td>‘’</td>
<td>‘’</td>
</tr>
<tr>
<td>2009</td>
<td>‘’</td>
<td>‘’</td>
</tr>
<tr>
<td>2010</td>
<td>0.000120</td>
<td>0.06550</td>
</tr>
<tr>
<td>2011</td>
<td>0.050</td>
<td>0.06550</td>
</tr>
<tr>
<td>2012</td>
<td>0.050</td>
<td>0.06550</td>
</tr>
<tr>
<td>2013</td>
<td>0.050</td>
<td>0.050</td>
</tr>
</tbody>
</table>
Section 1: Research Question(s)

RQ1. To what extent does CWF cessation impact the frequency of dental caries as measured by caries related procedures among Medicaid eligible children and adolescents?

RQ2. To what extent does CWF cessation impact caries severity as measured by caries related treatment costs among Medicaid eligible children and adolescents?

RQ3. To what extent does CWF cessation impact caries attack rates for specific age cohorts among Medicaid eligible children and adolescents?
Section 2: Analysis Process

For all three questions the analysis plan was similar.

Bivariate: between IV and DV, t test if dv normally distributed, and Mann Whitney U test, if not normally distributed.

Multivariate: between DV and IV and with mediating variables as predictors

Multiple linear regression if assumptions met, otherwise binary logistic regression
Juneau borough ended CWF in 1/2007 and claims are only available through 2012.

If we estimate the 0-18-year-old population at 25% and those living in poverty at 10% we have a possible sample of 800.

Using a standard sample size calculator with a 95% confidence interval, 5% margin of error and a 50% response rate, we need 260 individual patients with claims per year to assess the research questions.

Exceeded this minimum sample size needed. Secured ALL patients claims for the two study years.

Section 2: Participants and sample size estimates
Section 2: Summary of the Analysis Process

1. Research questions 1, 2, 3
2. Data collection tool: the Medicaid dental claims database CDT codes
3. Statistics: used SPSS for analytics after database was imported. Excel and access was used for data management
4. Assigned new Variable: level 1 (type of exam), 2 (prev), 3 (caries related), 4 (other inc. ext surg/fmr) to the data.
   Level 3 was for caries related procedures and costs. Number of procedures was summed per client, as was service cost
Total N = 1907

- 2012 Suboptimal CWF (< 0.1mg/L)
  1053, 55%

- 2003 Optimal CWF (0.7-1.2mg/L)
  854, 45%
Table 1: Descriptive Statistics by CWF Status of Juneau Study Sample (N = 1,907)

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>Optimal CWF Year 2003 (0.7-1.2mg/L)</th>
<th>Suboptimal CWF Year 2012 (&lt; 0.1mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>N</td>
<td>854</td>
<td>44.8</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>403</td>
<td>47.2</td>
</tr>
<tr>
<td>Male</td>
<td>451</td>
<td>52.8</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White/Non-Hispanic</td>
<td>319</td>
<td>37.5</td>
</tr>
<tr>
<td>Black/African American</td>
<td>19</td>
<td>0.02</td>
</tr>
<tr>
<td>American Indian or Alaskan Native</td>
<td>424</td>
<td>49.6</td>
</tr>
<tr>
<td>Asian or Pacific Islander</td>
<td>23</td>
<td>2.7</td>
</tr>
<tr>
<td>Hispanic or Latino</td>
<td>18</td>
<td>2.1</td>
</tr>
<tr>
<td>Native Hawaiian or Other Pacific</td>
<td>18</td>
<td>2.1</td>
</tr>
<tr>
<td>Unknown</td>
<td>33</td>
<td>3.9</td>
</tr>
</tbody>
</table>
Section 3: Race 0-18y; n = 1905

Race/Eth

- White: 56%
- Black: 32%
- AI/AN: 4%
- Hispanic: 4%
- NH/PI: 2%
- Unknown: 2%
Section 3: Interpretation of Findings - Caries

**RQ1** to what extent does CWF cessation impact the frequency of dental caries and caries related procedures among Medicaid eligible children and adolescents?

The results below demonstrate the mean of caries related procedures is significantly higher in the suboptimal group (2.02 vs. 2.35, \( p < 0.001 \)).

The binary logistic regression results adjusted for gender and race indicated the odds for patients ages of 0 to 18 years under optimal CWF conditions to receive dental caries procedures was \( 0.748 \) times (or 25.2%) less when compared to those in the suboptimal group,
Section 3: Interpretation of Findings - Costs

**RQ2**: To what extent does CWF cessation impact caries severity as measured by related treatment costs among Medicaid eligible children and adolescents ages 0-18y?

The results demonstrate the mean for caries related treatment costs was significantly higher in the suboptimal CWF group ($593.70 vs. $344.34, \( p < 0.0001 \)), without adjusting for inflation (between 2003 and 2012, the inflation rate increased an estimated 24.75% according to the U.S. Department of labor, 2017).

According to the binary logistic regression analysis adjusted for gender and race the odds, a patient aged 0 to 18 years under optimally fluoridated conditions would be billed for dental caries treatment was 0.749, or 25.1% less than the same aged patient living in suboptimal CWF conditions group.
Section 3: Interpretation of Findings, < 7y cohort

**RQ3** to what extent does CWF cessation impact caries attack rates for specific age cohorts among Medicaid eligible children and adolescents?

For the youngest age group (0 < 7 y) the analysis showed the mean caries related procedures per patient to be significantly higher in the suboptimal CWF group compared to the optimal group *(2.68 vs. 2.01, p<0.004)*

The results for binary logistic regression adjusted for gender and race were also significant (or = 0.70, 95% CI [0.52, 0.95], p<0.02) and indicate a protective effect of CWF exposure.

Caries treatment costs were also higher for the suboptimal group; $692.87 vs. $350.13, p < 0.0001), after adjusting for inflation *increase $255.60*

These results suggest weaker enamel among those with the least cwf exposure.
Section 3: Interpretation of Findings - Caries

Mean Caries Procedures experienced per client under Optimal and Suboptimal CWF conditions by Age Group

- Mean 2003 Optimal CWF
- Mean 2012 Suboptimal CWF
Section 3: Interpretation of Findings – Costs

Mean Caries Restoration Costs adjusted for inflation and compared under both Optimal and Suboptimal CWF conditions.
### Table 2
Mean (SD) Caries per Child Procedures in 2003 and 2012, and Bivariate and Binary Regression Analyses Summary

*Adjusted for gender and race. NS: Not Significant

<table>
<thead>
<tr>
<th>Age Group (years)</th>
<th>Mean (SD) Caries per Child Procedures 2003 Optimal CWF</th>
<th>Mean (SD) Caries per Child Procedures 2012 Suboptimal CWF</th>
<th>Mann-Whitney U p level</th>
<th>Logistic Regression* CWF Optimal OR, [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5.99</td>
<td>1.55 (3.89) n=194</td>
<td>2.52 (4.35) n=301</td>
<td>0.0001</td>
<td>0.488, [.33, .73]</td>
</tr>
<tr>
<td>0-6.99</td>
<td>2.01 (4.22) n=303</td>
<td>2.68 (4.57) n=461</td>
<td>0.004</td>
<td>0.699, [0.52, 0.95]</td>
</tr>
<tr>
<td>7-12.99</td>
<td>1.61 (3.38) n=352</td>
<td>1.64 (2.60) n=400</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>13-18</td>
<td>2.75 (4.73) n=198</td>
<td>3.04 (4.66) n=191</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>0-18</td>
<td>2.02 (4.05) n=853</td>
<td>2.35 (3.99) n=1052</td>
<td>0.001</td>
<td>0.748, [0.62, 0.90]</td>
</tr>
<tr>
<td>Age Group (years)</td>
<td>Mean (Dollars) 2012</td>
<td>Mean (Dollars) 2003</td>
<td>Mann-Whitney U p level</td>
<td>Cost Inc/ %Inc</td>
</tr>
<tr>
<td>-------------------</td>
<td>----------------------</td>
<td>----------------------</td>
<td>------------------------</td>
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</tr>
<tr>
<td>0-5.99</td>
<td>644.72</td>
<td>272.72</td>
<td>0.0001</td>
<td>372.00/136 %</td>
</tr>
<tr>
<td>0-6.99</td>
<td>692.87</td>
<td>350.13</td>
<td>0.0001</td>
<td>342.74/98%</td>
</tr>
<tr>
<td>7-12.99</td>
<td>382.44</td>
<td>241.52</td>
<td>0.001</td>
<td>140.92/58%</td>
</tr>
<tr>
<td>13-18</td>
<td>795.68</td>
<td>519.07</td>
<td>0.035</td>
<td>276.61/53%</td>
</tr>
<tr>
<td>0-18</td>
<td>593.70</td>
<td>344.34</td>
<td>0.0001</td>
<td>249.36/72%</td>
</tr>
</tbody>
</table>
Section: Limitations

Two comparison years, unable to perform trend analysis (forecasting, projections)

No medical history (extractions and surgeries) which means we may have under represented the impact of caries and costs in the data base.

No control group. Adding one could yield more rigor to the results.

Assume provider billing and treatment habits were similar during both years.
Section 3: Conclusions

The binary logistic regression results confirm the protective effect of CWF exposure OR <1

Expands what is known about caries distribution epidemiology under CWF cessation conditions

Mean caries procedures and costs results also confirm and increase for children living in suboptimal CWF. This punishes family budgets, tax payer funded programs and furthers suffering by vulnerable groups.

Larger tooth surface losses for children with least amount of CWF exposure. Emphasize the importance of pre-eruptive CWF exposure for development of resilient tooth enamel.

Support use of Medicaid dental claims data as a population oral health metric.
**Recommendations for Practitioners and Advocates:**

**Policy makers should re-evaluate current CWF cessation policies otherwise disparities in caries experiences by marginalized groups will continue and likely increase.**

State and Federal Medicaid program planners can use the study results for forecasting CWF cessation driven increases in caries treatment costs for their patient groups.

Dental providers serving children and adolescents in CWF ceased communities should plan for staffing increases to meet the greater needs of patients.
Section 4: Recommendations

Recommendations for researchers:

• Medicaid claims databases may also serve researchers well with longitudinal pre and post cessation study designs.
• Analysis over multiple years pre and post CWF cessation observing normal variability and trends.
• Expand the study to include other income groups and reveal if increases in dental caries is distributed across economic groups.
• Repeat the study in another CWF ceased Alaskan community.
Thank you and I now invite your questions


