TOTS to Tweens Study: Evaluating the Dental Health Status of NW Tribal Children Age 11-13 Years

Northwest Tribal Dental Support Center Meeting
May 16, 2019
Tam se ne snat
TOTS, circa 2003

The Toddler Overweight and Tooth Decay Prevention Study implemented community and family-based interventions to improve breastfeeding and water consumption, and delay the introduction of sugared beverages to babies. AI/AN mothers were enrolled prenatally and followed until the baby turned two years old.
TOTS Goals

• To prevent early childhood obesity in American Indian children
• To prevent early childhood caries in American Indian children

Through changing behaviors of moms
Cohort Study Design

• The *intervention cohort* was children born in three communities during 12 months; expectant mothers were identified through prenatal visits and recruited by tribal coordinators

• The *local comparison cohorts* were children in those communities who were 18–30 months at study start

• A *control longitudinal cohort* consisted of annual samples of children aged 18–30 months in a fourth community, supplying secular trends
Two Intervention Approaches

• Community Wide (CW) interventions (3 tribes implemented)
  • raise awareness
  • change public health practice, tribal policy
  • provide health education
  • change environments
  \[ \uparrow \text{breastfeeding} \]
  \[ \downarrow \text{sugared beverages} \]
  \[ \uparrow \text{water consumption} \]

• Family intervention (2 tribes) included 8 home visit by lay health workers (LHW) who used motivational interviewing and goal setting to:
  • Increase breastfeeding initiation and duration
  • Limit the introduction of sugared beverages to infants and toddlers
  • Promote the introduction of water for thirst among toddlers
Specific Aims

Test Whether:

1. Community-based intervention alone (CW) leads to
   - Prevalence of Toddler Obesity
   - Prevalence of Tooth Decay

   compared to communities that have not received the intervention (control)

1 tribe
2 tribes
Specific Aims

Test Whether:

2. Family-based peer counselor + community-based intervention (CW + F) leads to

- Decrease in Prevalence of Toddler Obesity
- Decrease in Prevalence of Tooth Decay

compared to community-based interventions alone

2 tribes

1 tribe
TOTS Data Collection

- Dentist and hygienist recruited, trained in TOTS protocol
- Recruited mother / child pairs
- Height and Weight, breastfeeding measures obtained through WIC/MCH visits
- Study dental exams conducted in tandem with WIC/MCH visits (every 6 months)
- Teeth scored for presence, absence, missing to caries status
- Presence of incipient or carious lesions determined using $D_{1-2MFS}$ index
- For outcome analysis consolidate to tooth level measure $D_{1t}$ and $D_{2t}$, rating each tooth its worst surface, using last dental visit at 18-30 months
Community Interventions Implemented

• Resolutions passed to limit purchasing sugared-beverages for community events
• Strategic placement water in or by vending machines
• Subsidizing the sale of water
• Workplace policies to allow longer breaks to pump
• Peer Mom gathering to discuss breastfeeding
• Advocacy at local hospitals for mothers intending to breastfeed
• Creation of Tribal workplace breastfeeding rooms
• Community-wide baby showers
• Collaboration with daycares
• Local media
Outcomes

• Breastfeeding rates higher by 14% (CW), 15% (CW+F) at 6 months than national AI rates
• Breastfeeding rates comparable at 12 months
• Parents expressed confidence in ability to curtail family consumption of sugared beverages
• BMI Z scores at 24 months increased in all three intervention tribes
• BMI Z scores increased less in CW+F Tribes
• Difference in height and weight for age not significant
• Simple intervention can mitigate rapid increase in BMI without compromising toddler growth
## TOTS Impact Evaluation

### Table 5: Percent of participants expressing confidence and usefulness of the TOTS study in assisting with target behavior change

<table>
<thead>
<tr>
<th></th>
<th>Tribe A</th>
<th>Tribe B</th>
<th>Tribe C</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Confidence in implementing recommendations</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breastfeeding</td>
<td>64</td>
<td>54</td>
<td>56</td>
<td>57</td>
</tr>
<tr>
<td>Limiting sugar-sweetened beverages for the family</td>
<td>93</td>
<td>92</td>
<td>71</td>
<td>82</td>
</tr>
<tr>
<td>Serving water as the primary beverage at meal times</td>
<td>89</td>
<td>80</td>
<td>73</td>
<td>79</td>
</tr>
<tr>
<td>Serving water when family members are thirsty</td>
<td>73</td>
<td>48</td>
<td>63</td>
<td>62</td>
</tr>
<tr>
<td><strong>Usefulness of the TOTS study in helping change targeted behaviors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breastfeeding</td>
<td>40</td>
<td>65</td>
<td>43</td>
<td>49</td>
</tr>
<tr>
<td>Help family drink more water</td>
<td>96</td>
<td>92</td>
<td>81</td>
<td>90</td>
</tr>
<tr>
<td>Help family drink fewer sugar-sweetened beverages</td>
<td>88</td>
<td>89</td>
<td>80</td>
<td>86</td>
</tr>
</tbody>
</table>

A score of 4.0 or higher on a 5-point scale
Dental Results

• Overall levels of disease were high

• Significant secular rises for both incipient ($D_{1t}$) and carious lesions ($D_{2t}$) in the control communities

• In terms of presence of $D_{1t}$ or $D_{2t}$, there were statistically significant downward intervention effects in both CW and CW + F Tribes

• Children in intervention communities had fewer detectable carious lesion and those who developed carious lesions had incipient caries more often than cavitated decay
Table 3
Mean (SD) of fraction of affected toddlers in each community and time period

<table>
<thead>
<tr>
<th>Pre-intervention sample</th>
<th>Community A</th>
<th>Community B</th>
<th>Community C</th>
<th>Community D</th>
</tr>
</thead>
<tbody>
<tr>
<td>( d_{1t} )</td>
<td>0.448 (0.506)</td>
<td>0.128 (0.339)</td>
<td>0.656 (0.483)</td>
<td>0.444 (0.511)</td>
</tr>
<tr>
<td>( d_{2t} )</td>
<td>0.414 (0.501)</td>
<td>0.128 (0.339)</td>
<td>0.531 (0.507)</td>
<td>0.278 (0.461)</td>
</tr>
</tbody>
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</tr>
</thead>
<tbody>
<tr>
<td>( d_{1t} )</td>
<td>0.340 (0.479)</td>
<td>0.297 (0.463)</td>
<td>0.420 (0.499)</td>
<td>0.595 (0.497)</td>
</tr>
<tr>
<td>( d_{2t} )</td>
<td>0.234 (0.428)</td>
<td>0.000 (0.000)</td>
<td>0.340 (0.479)</td>
<td>0.429 (0.501)</td>
</tr>
</tbody>
</table>
# TOTS Dental Results

## Table 3
Mean (SD) of fraction of affected toddlers in each community and time period

<table>
<thead>
<tr>
<th></th>
<th>Community A CW + F</th>
<th>Community B CW</th>
<th>Community C CW + F</th>
<th>Community D Control</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-intervention sample</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incipient decay $d_{1t}$</td>
<td>0.448 (0.506)</td>
<td>0.128 (0.339)</td>
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<td>0.444 (0.511)</td>
</tr>
<tr>
<td>Cavitated decay $d_{2t}$</td>
<td>0.414 (0.501)</td>
<td>0.128 (0.339)</td>
<td>0.531 (0.507)</td>
<td>0.278 (0.461)</td>
</tr>
<tr>
<td><strong>Post-intervention sample</strong></td>
<td><strong>Less decay</strong></td>
<td><strong>Less decay</strong></td>
<td><strong>Less decay</strong></td>
<td><strong>Increase in decay</strong></td>
</tr>
<tr>
<td>Incipient decay $d_{1t}$</td>
<td>0.340 (0.479)</td>
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TOTS Goals Revisited

• Did we prevent early childhood obesity in American Indian children? – **No, but we staved off an increase**
• Did we prevent early childhood caries in American Indian children? – **Yes!**
• Did we change behaviors of moms? – **Yes, ↑ breastfeeding; - Yes, ↓ introduction of sugared beverages**
10 years later

TOTS to Tweens is a follow up to The TOTS Study to test whether interventions delivered in TOTS influence prevalence of oral caries in older children.

Children Born: 2003 - 2004
Wore 11 – 13 years old
In 2016-2017
They’re Back....

At the Helm
• **Tom Becker**, MD, PhD, Co-PI
• **Tam Lutz** (Lummi Nation) MPH, MHA, Co-PI

Co-Investigators – Experts in Oral Health
• **Gerardo Maupomé**, BDS, MSc, DDPH, PhD, **Maxine Brings Him Back Janis**, MPH, RDH
• Eli Schwarz, DDS, MPH, PhD

Co-Investigators – Experts in Biostatistics
• Jodi Lapidus, PhD
• **Nicole Smith**, MPH

Project Support with history of serving Tribes
• Candice Jimenez (Warm Springs), MPH, GRA
Goal of Follow up Study

Did TOTS have a lasting impact?

Aims:

• to test whether interventions delivered in TOTS influence the prevalence tooth decay in older children.

• to assess current community, environmental and familial factors that can influence oral health in children & to see if preventive family behaviors have continued.
Approach – The Social Ecological Model

Policy inputs
- Water fluoridation
- Access to dental clinic

Neighborhood/community
physical and social environments
- Water quality

School and
work environments
- School-based dental screenings
  or fluoride administration

Interpersonal and
household environments
- Household rules and practices around
  beverage choices and oral health

Individual choice
- Hygiene practices
  Sugared beverage consumption
Hypotheses

1. Children age 10.5-12.5 who received the TOTS intervention will have a 25% lower DMFT (decayed, missing, or filled teeth) score than children in the non-intervention sites.

2. TOTS children will have less decay than fellow tribal member children who did not participate in TOTS.

3. Children with the least decay at age 2 will have the least decay in the follow-up screening.

4. Mothers/caregivers who participated in TOTS will have more favorable knowledge, attitudes, and behaviors related to oral health than those who did not receive TOTS.
Methods

We conducted community and school-based screenings

We collected:

• Dental exams on children
• Child behavior questionnaires
• Anthropometric measures (height and weight)
• Parent/caregiver Knowledge Attitudes and Behavior questionnaires
• Follow-up qualitative research
Recruitment & Consent Methods

• Tribal site coordinators used TOTS enrollment lists to contact parents/guardians for consent for the child to participate

• At data collection, children who had participated in the TOTS study were age 11-13 years

• Coordinators used school enrollment lists to recruit children age 11-13 who did not participate in the TOTS study

• At the data collection event, we verified parental consent and obtained child’s assent to have teeth examined, measure height and weight and ask the child questions.
Examiner Methods

• Two dentists and one dental hygienist were trained prior to data collection and calibrated for agreement at the first event.
  • Two examiners collected data for TOTS

• We adapted the World Health Organization (WHO) oral health assessment form for children and collected tooth-level data for both primary and secondary teeth.
  • A tooth was scored as unerupted, sound, carries, filled (w/caries), filled (no caries), missing, sealed, or fixed dental prosthesis.

• In cases of severe decay, we used the PUFA index to record presence of pulpal involvement (P), ulceration (U), fistula (F), and abscess (A).
Child Questionnaire

• We measured each child’s height and weight and administered a questionnaire, adapted from WHO Oral Health Questionnaire for Children.

• We asked about hygiene practices, mouth pain, tobacco use, and beverage consumption.

• Collected on tablets via Epi Info app
Parent KAB Questionnaire

• Parents or guardians completed a self-administered questionnaire either when they gave consent for their child to participate in the study, if they brought their child to the examination, or at a follow-up after the child participated in the study.

• Questions were selected from TOTS KAB questionnaire or WHO Oral Health Questionnaire for Adults.
Statistical Methods

• The primary outcome was a count of decayed, missing, or filled secondary teeth in a child’s mouth (DMFT).

• Constructed negative binomial models to model DMFT count, offset by permanent teeth count and adjusted for child age and sex across the 3 TOTS intervention levels (control, community, community+family).

• All analyses were done in Stata version 15.
We examined 335 children from the 5 TOTS tribes.

Two tribes implemented community + family TOTS.

Children in darker circle received family intervention.

One tribe implemented community TOTS only.

Two tribes were control (comparison).
<table>
<thead>
<tr>
<th></th>
<th>Family + Community Intervention (n=82)</th>
<th>Community Intervention (n=167)</th>
<th>Control (n=86)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>n (%) or mean ± SD</strong></td>
<td><strong>n (%) or mean ± SD</strong></td>
<td><strong>n (%) or mean ± SD</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>34 (42%)</td>
<td>76 (46%)</td>
<td>17 (19%)</td>
</tr>
<tr>
<td>12</td>
<td>46 (56%)</td>
<td>69 (41%)</td>
<td>25 (29%)</td>
</tr>
<tr>
<td>13</td>
<td>2 (2%)</td>
<td>22 (14%)</td>
<td>43 (51%)</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boy</td>
<td>45 (55%)</td>
<td>85 (51%)</td>
<td>32 (37%)</td>
</tr>
<tr>
<td>Girl</td>
<td>37 (45%)</td>
<td>85 (49%)</td>
<td>54 (63%)</td>
</tr>
<tr>
<td><strong>Body Mass Index for Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthy (5th to &lt;85th percentile)</td>
<td>19 (23%)</td>
<td>51 (31%)</td>
<td>34 (40%)</td>
</tr>
<tr>
<td>Overweight (85th to &lt;95th percentile)</td>
<td>18 (22%)</td>
<td>29 (17%)</td>
<td>24 (28%)</td>
</tr>
<tr>
<td>Obese (&gt;= 95th percentile)</td>
<td>44 (54%)</td>
<td>86 (52%)</td>
<td>28 (33%)</td>
</tr>
</tbody>
</table>
Children from control tribes had a statistically significant higher mean DMFT score – meaning more decay experience in permanent teeth.
Adjusted Mean DMFT Scores by TOTS Group

Mean DMFT score remains statistically higher for control children after adjusting for child age and sex and accounting for the total number of permanent teeth in a child’s mouth.
H1: Children who received the TOTS intervention will have a 25% lower DMFT score than children in the non-intervention sites

DMFT risk by TOTS intervention group, adjusted for child age and sex and accounting for permanent teeth count

<table>
<thead>
<tr>
<th>TOTS Group</th>
<th>RR</th>
<th>95% CI</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community (vs control)</td>
<td>0.75</td>
<td>(0.55,1.02)</td>
<td>0.071</td>
</tr>
<tr>
<td>Community + family (vs control)</td>
<td>0.67</td>
<td>(0.46,0.96)</td>
<td>0.030</td>
</tr>
</tbody>
</table>

Compared to control, community intervention kids had less risk of decay. This was marginally significant.

C+F children had significantly less risk of decay than control children.

Results are similar when we look at mixed dentition.
Difference in DMFT Score is Fillings

Percent of children with untreated decay in permanent teeth, adjusted*

- Family Intervention (n=82): 38%
- Community Intervention (n=167): 37%
- Control (n=86): 46%

Percent of children with fillings in permanent teeth, adjusted*

- Family Intervention (n=82): 42%
- Community Intervention (n=167): 46%
- Control (n=86): 66%

*Adjusted for child age, sex, and permanent teeth count
Difference in DMFT Score is Fillings

Percent of children with untreated decay in permanent teeth, adjusted*

- **Family Intervention** (n=82): 38%
- **Community Intervention** (n=167): 37%
- **Control** (n=86): 46%

*Not statistically different*

Percent of children with fillings in permanent teeth, adjusted*

- **Family Intervention** (n=82): 42%
- **Community Intervention** (n=167): 46%
- **Control** (n=86): 66%

*Statistically different*

*Adjusted for child age, sex, and permanent teeth count*
Children with All Sound Teeth

Notice the stepping intervention effect on all the charts. Community intervention has the largest benefit. The family intervention has added value.

This is similar to TOTS findings.

Interestingly, in T2T, community intervention children are from 3 different tribes; in TOTS it was only one.
Sealants

Most children had one or more sealants on permanent teeth.

Percent of children with any sealants on permanent teeth was not different by TOTS group.
Reported behaviors were not different by TOTS group and were not related to DMFT score.

- 48% said they brush their teeth 2+ times per day.
- 36% said once a day.
- 47% said they have one or more beverage containing sugar each day.
- 62% said they use dental floss and 72% said they use mouthwash.
- 86% of children said they drink water everyday.
- 48% said they brush their teeth 2+ times per day.
- 36% said once a day.
- 47% said they have one or more beverage containing sugar each day.
- 62% said they use dental floss and 72% said they use mouthwash.
- 86% of children said they drink water everyday.
# Beverages

<table>
<thead>
<tr>
<th>Beverage</th>
<th>Several Times a Day</th>
<th>Everyday</th>
<th>Several Times a Week</th>
<th>Once a Week</th>
<th>Several Times a Month</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>48%</td>
<td>36%</td>
<td>11%</td>
<td>4%</td>
<td>2%</td>
<td>0.3%</td>
</tr>
<tr>
<td>Juice</td>
<td>8%</td>
<td>14%</td>
<td>24%</td>
<td>31%</td>
<td>14%</td>
<td>9%</td>
</tr>
<tr>
<td>Coffee/Tea w/ sugar</td>
<td>0.6%</td>
<td>5%</td>
<td>10%</td>
<td>17%</td>
<td>23%</td>
<td>44%</td>
</tr>
<tr>
<td>Pop/Soda</td>
<td>5%</td>
<td>7%</td>
<td>21%</td>
<td>28%</td>
<td>15%</td>
<td>23%</td>
</tr>
<tr>
<td>Diet Pop/Soda</td>
<td>0.6%</td>
<td>0.3%</td>
<td>2%</td>
<td>6%</td>
<td>5%</td>
<td>86%</td>
</tr>
<tr>
<td>Milk &amp; alternatives</td>
<td>13%</td>
<td>33%</td>
<td>25%</td>
<td>13%</td>
<td>5%</td>
<td>12%</td>
</tr>
<tr>
<td>Chocolate milk</td>
<td>2%</td>
<td>11%</td>
<td>10%</td>
<td>22%</td>
<td>13%</td>
<td>43%</td>
</tr>
<tr>
<td>Sports drinks</td>
<td>5%</td>
<td>16%</td>
<td>22%</td>
<td>28%</td>
<td>17%</td>
<td>13%</td>
</tr>
<tr>
<td>Energy drinks</td>
<td>0.6%</td>
<td>1%</td>
<td>2%</td>
<td>4%</td>
<td>9%</td>
<td>84%</td>
</tr>
</tbody>
</table>

*Not popular*
Behaviors
• 99% said they never use cigarettes, pipe, cigars, hookah, vape or ecigs

Pain
48% said they did not have a toothache in the past year; 34% said rarely; 8% occasionally; 5% often
• We noticed that kids who reported discomfort often had braces

PUFA
• Only 9 children had PUFA (severe conditions from untreated decay)
Dental Care

Where children receive dental care by TOTS group

- IHS/Tribal
  - Family Intervention (n=76): 68%
  - Community Intervention (n=122): 45%
  - Control (n=61): 48%

- Private
  - Family Intervention (n=77): 48%
  - Community Intervention (n=131): 32%
  - Control (n=61): 7%

- Both
  - Family Intervention (n=77): 2%
  - Community Intervention (n=131): 0%

When children last visited a dentist by TOTS group

- Family Intervention (n=77)
  - < 6 mo: 26%
  - 6-12 mo: 55%
  - 1+ years: 19%

- Community Intervention (n=131)
  - < 6 mo: 17%
  - 6-12 mo: 56%
  - 1+ years: 27%

- Control (n=61)
  - < 6 mo: 10%
  - 6-12 mo: 43%
  - 1+ years: 48%
117 parents said their children brush their teeth twice a day or more. Their KIDS said:

- Twice a day or more: 58%
- Once a day: 33%
- Several times a week: 6%
- Once a week: 3%
- Never: 0%
H2: TOTS children will have less decay than fellow tribal member children who did not participate in TOTS

We are not seeing this.

Partly, small numbers.

Mostly, community factors are just that important.
H3: Children with the least decay at age 2 will have the least decay in the follow-up screening.

We may or may not do this analysis.

We did not see as many TOTS kids as we hoped.

Same kids, different teeth. Not truly longitudinal.
H4: Mothers/caregivers who participated in TOTS will have more favorable knowledge, attitudes, and behaviors related to oral health than those who did not receive TOTS.

Analysis is forthcoming.
Qualitative themes from parents

**Facilitators**
- Appreciation for bringing dental health programming out into community: health fairs, school events, open houses
- School-based screenings for all ages
- Ease of receiving oral health products from dental program or buying these types of products in bulk for entire family

**Barriers**
- Loss of control over food available including school lunches, nearby stores, vending machines, energy drink presence, coffee stands
- Challenges in setting routine oral health appointments in a timely manner rather than months down the road (2 months seemed to be mentioned a lot)

**Context**
- Ability to let go of control as children reach adolescence with respect to watching over daily brushing, flossing (parents tend to assume it’s getting done)
- Many families provide water as a main beverage and have a good view of the drinking water quality

**Wish list**
- Would like to see more ‘kid friendly’ dental providers
- Need for more media related oral health content in community; newspapers, social media, clinic, early learning centers, community stores, etc.
Facilitators

• Benefit seen from collaboration across community centers including early learning centers, teen parent centers, elder centers, substance abuse programs, etc.

• Implementing ‘happy’ visits before more invasive visits especially with children or adults who’ve shared previous traumas associated with dental care

Barriers

• Some clinics see few children due to referring out for pediatric dentistry

• Breaking past stigma around tribal dentistry, i.e. past generations, parents, grandparents’ view

• Challenges of direct care vs. tribal care

Needs

• Need for more outreach events and support of oral health programs

• Need for orthodontic care based in community

Context

• Large chunk of community who come in for routine care vs. those who only come in when in dental trauma or high pain

Wish list

• Would like to see incentives for children and those with diabetes for recurrent visits

• Bigger clinic, more providers and more appointments offered to the community
Clinics are AWESOME

- Kids are receiving treatment for decay
- Preventive care is high – sealants
- Study is good news for public health – community level factors more important than individual level factors
Acknowledgements

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Makah Tribe

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Hy’shqeq Si’am – Thank You

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