Modernization: The Children’s Healthy Living Program for Remote Underserved Minority Populations of the Pacific (CHL) from the US Affiliated Pacific Region

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PhD & Training course: Urban Spaces – new opportunities for community action promoting better food & health, August 29-31, 2016, Copenhagen
Modernization - Urbanization
Epidemiologic Transition- Nutrition Transition

- As countries develop economically, they modernize and tend to urbanize, and this tends to involve changed structures to farming and transportation
  - More mechanized, less human labor (physical activity)
  - More processed food
  - Less active transportation
- Diseases shift from infectious to chronic diseases, accompanied by less undernutrition and more obesity

Developmental Origins of Health Status
or
“The circumstances in which women are pregnant and children develop”
“Babies come from society”
“Babies are record keepers of societal decisions”
(Winett, Wulf and Wallack 2016 AJPH 106:8:1369-73)

- Critical periods of growth
  - Early undernutrition predisposes to metabolic programming that results in overweight and obesity later in life (“Barker hypothesis”)  
  - Important for modernizing countries
- Focus on the community & environment/context for intervention
- Growth indicators useful
U.S. Affiliated Pacific Region

- Jurisdictions have varied affiliation with US (states, territories, commonwealth, “free association”)
- Larger geographic area than continental US (7 time zones - 2 days)
- Obesity among the highest in the world among adults (about 70%) though data are limited
- Fewer data on child obesity
  - U.S. National Health and Nutrition Examination Survey (NHANES) does not cover the region
  - CHL fills this gap
CHL Program
11 Jurisdictions of the US Affiliated Pacific
a modernizing region of lower middle income to high income
which have ties to the US

Classification of Jurisdiction Income by World Bank
Income Classification
(http://chartsbin.com/view/2438)

- Lower middle income (LMI): Federated States of Micronesia (Yap, Chuuk, Pohnpei, Kosrae)
- Upper middle income (UMI): American Samoa, Marshall Islands, Palau
- High income (HI): Guam, Northern Mariana Islands, US states (Hawaii and Alaska)
CHL Program
in 11 jurisdictions of the US Affiliated Pacific Region
5 jurisdictions in intervention program
Rachel Novotny, Principal Investigator

• 11 jurisdictions collected prevalence survey
• 5 jurisdictions in CHL intervention trial (all are UMI except AM Samoa which is UMI)- prevalence survey was baseline survey
  – Hawaii – University of Hawaii
  – Guam – University of Guam
  – Alaska – University of Alaska at Fairbanks
  – American Samoa – American Samoa Community College
  Commonwealth of the Northern Mariana Islands – Northern Marianas College

United States Department of Agriculture, National Institute of Food and Agriculture, Grant 2011-68001-30335 (Novotny PI)
CHL Community-Randomized Intervention Trial in 5 Jurisdictions (27 communities), Wilken et al 2013

Key

- Jurisdiction (n=5)
- Matched pair 1 Communities (n=10)
- Matched pair 2 Communities (n=8)
- Temporal Communities (n=9)

Community is the Unit of Analysis for the intervention trial
## CHL

**Engagement of the Randomized Communities**

Community Leaders meet in CNMI

### Table 1. Steps and Activities in the ANGELO Model as Modified by the Children’s Healthy Living (CHL) Program

<table>
<thead>
<tr>
<th>Step</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1. Engage communities to identify and prioritize preferred intervention strategies</strong></td>
<td>A local advisory committee was established in each jurisdiction. Multiple key informant meetings were held to learn about community-specific resources targeting young children, to help develop a shared vision of CHL’s community involvement, and to guide work with the communities. Four community meetings were held in each of five jurisdictions to identify community-preferred intervention strategies. These strategies were collated by jurisdiction. Three inventories (programs, data, and policies) were compiled for each of four communities in each jurisdiction. Collated lists of preferred intervention strategies and inventory findings were shared in a second series of community meetings in each jurisdiction. Strategies on these lists were prioritized by community participants based on their perceived importance and feasibility.</td>
</tr>
<tr>
<td><strong>Step 2. Review scientific literature</strong></td>
<td>Intervention team conducted a systematic literature review of effective environmental strategies to prevent and control childhood obesity.</td>
</tr>
<tr>
<td><strong>Step 3. Merge findings from the community and literature</strong></td>
<td>CHL Coordinating Center merged findings from the community meetings and literature. The intervention team reviewed, discussed, and finalized the intervention activity grid.</td>
</tr>
<tr>
<td><strong>Step 4. Formulate CHL multilevel intervention</strong></td>
<td>The region-wide CHL intervention was formulated at week-long annual meeting with representatives from all jurisdictions. Jurisdiction-specific meetings were held to plan how the CHL intervention would be specifically operationalized in the jurisdiction’s communities.</td>
</tr>
</tbody>
</table>

Braun et al. (ANGELO model- Analysis Grid for Environments/Elements Linked to Obesity)
“Social Ecologic Model” of multiple multilevel influences on child obesity

- **POLICY** – Community, State, Federal, Regional, Global
- **ENVIRONMENT** – School/Park...
- **INDIVIDUAL** – Diet, Physical Activity change...
  - (ADULT)
  - (CHILD)
CHL Program
Multilevel Multicomponent Multijurisdiction
A Social Ecologic Model

Environmental Changes

Social/Cultural Env.
- Family, teachers, church leaders, other respected role models setting example of healthy living

Political/Economic Env.
- Influence SSB awareness

Physical/Built Env.
- Ensure water fountains are available & maintained

Promote

Healthy Food Intake
- Decrease in sugar-sweetened beverage intake
- Increase in water intake
- Increase in fruit and vegetable intake

Physical Activity
- Decrease in recreational screen time
- Increase in sleep
- Increase in physical activity

Outcomes

Obesity Prevention

Overall Outcome: Healthy Young Child

Training/Education

Data Systems
**CHL MLMC Intervention Template: 4 Cross-Cutting Functions, 19 Activities & 6 Behavioral Targets**

<table>
<thead>
<tr>
<th><strong>Policy:</strong> Review Assessment Data for Policy &amp; Physical Environment related to the 6 CHL behaviors</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Review preschool wellness policy assessment data to identify training needs</td>
</tr>
<tr>
<td>b. Review community assessment data to identify areas for advocacy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Environment:</strong> Community Partnership and Advocacy for Environmental Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Work with coalitions to advocate for</td>
</tr>
<tr>
<td>i. Better access to parks that are safe &amp; inviting</td>
</tr>
<tr>
<td>ii. Better access to clean water</td>
</tr>
<tr>
<td>iii. Safer environments for walking &amp; biking</td>
</tr>
<tr>
<td>iv. Better food placement in stores</td>
</tr>
<tr>
<td>v. Gardens &amp; hydroponics</td>
</tr>
<tr>
<td>b. Partner with existing entities to purchase or obtain sponsorship for</td>
</tr>
<tr>
<td>i. Water in the preschools</td>
</tr>
<tr>
<td>ii. Gardening supplies for preschool kids</td>
</tr>
<tr>
<td>iii. Sports equipment for preschool kids</td>
</tr>
<tr>
<td>iv. Campaigns &amp; messages</td>
</tr>
</tbody>
</table>

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<th>** Messaging:** Promote the CHL Message to Community</th>
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</thead>
<tbody>
<tr>
<td>a. Support role models to deliver CHL messages in various venues</td>
</tr>
<tr>
<td>b. Enhance existing social marketing campaigns related to 6 CHL behaviors</td>
</tr>
<tr>
<td>c. Advertise CHL or other activities that promote 6 CHL target behaviors</td>
</tr>
</tbody>
</table>

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<tr>
<th><strong>Capacity Building:</strong> Train the Trainers /Role models</th>
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<tbody>
<tr>
<td>a. Train individuals to promote gardening in preschools &amp; communities</td>
</tr>
<tr>
<td>b. Train individuals to lead interactive, hands-on, &amp; family-based sessions</td>
</tr>
<tr>
<td>c. Train preschool providers on wellness policies</td>
</tr>
<tr>
<td>d. Train preschool providers in curricula related to 6 CHL target behaviors</td>
</tr>
<tr>
<td>e. Train role models (community champions, role celebrities, role models)</td>
</tr>
</tbody>
</table>
Development of the CHL Intervention

Community Based Participatory Research process to find “environments” (intervention foci) to support in Pacific communities to achieve intervention targets

Photo: Luana Busby-Neff

CHL Hilo Hawaii Family Gardening
CHL MLMC Community Selection Criteria for Intervention Program

- 27 communities were selected in 5 jurisdictions (in 2011) – 1 jurisdiction is UMI
  - 2000 US census data were used to inform selection of communities to be
    - >25% of the population of indigenous/native descent of each jurisdiction
    - >10% of the population under age 10 years, our target group
    - >1000 population size
    - Relatively accessible locations
- Communities were matched and randomized to intervention and control (community randomized)
- Some communities were also selected temporal assessment (BMI and waist)
CHL Intervention Implementation Approach

- Partnered with, supports (funds), and “adds value” to existing programs that are conducting activities related to CHL’s 6 behavioral targets (positive deviance).
- Built local capacity and coalitions to sustain programs and policy changes.
- Promoted a common CHL message.
- Collected process information on the implementation strategies, duration, and reach.

Braun K et al 2014 Childhood Obesity
Community readiness (CR) for change for intervention planning and analysis

• Method
  – Participants: Minimum of 5 key informants knowledgeable of the food and physical activity environment of each of the 4 intervention and control communities in each of 5 intervention jurisdictions, baseline and post-intervention (18 – 24 months)
  – The CR survey: assessed 6 dimensions of CR -self-administered (online or paper).
  – Scoring: Range 1 (No Awareness) to 9 (High Level of Community Ownership). Each dimension totaled and divided by the number of participants per community. Total for all dimensions divided by 6 (number of dimensions) to determine overall CR score for each community.

• Result
  – Average CR scores remained relatively consistent post-intervention from baseline at 5.

• Analysis
  – Community CR will be used to interpret the results of the intervention and to examine modification of effects.

CR Tool based on OPIC study using the Tri-ethnic Center tool adapted for the Pacific (Plested, Edwards and Thurman)
CHL Process Data Components: Monthly Intervention Implementation Grid

<table>
<thead>
<tr>
<th>Table 2 - Community Activity Ratings</th>
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<td>1. Review Assessment Data for the Policy and Physical Environment related to the 6 CHL behaviors</td>
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<tr>
<td>a. Review preschool wellness policy assessment data to identify training needs</td>
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<td>b. Review CAT (community assessment toolbox) data related to the physical environment to identify areas for advocacy</td>
</tr>
<tr>
<td>2. Partner and Advocate for Environmental Change</td>
</tr>
<tr>
<td>a. Work with existing community organizations and coalition and/or form new coalitions to advocate for</td>
</tr>
<tr>
<td>i. Better access to parks that are safe and inviting</td>
</tr>
<tr>
<td>ii. Better access to clean water</td>
</tr>
<tr>
<td>iii. Safer environments for walking, biking, etc (e.g., bike lanes/racks, sidewalks, greenways)</td>
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<td>iv. Better food placement in stores</td>
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<td>v. Gardens and Hydroponics</td>
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<td>viii. Campaigns and messages</td>
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Tafuna Elementary, American Samoa, April 2013
CHL Measures by MLMC Level

- Individual Children - 2-8 yo, child race/ethnicity
  - Anthropometry (Height, Weight, and Waist)
  - Acanthosis Nigricans (Back of the neck)
  - Accelerometry (6 days)
  - Food and Activity logs (2 days)
  - Sleep Questionnaire
  - Screen Time

- Parent/Caregiver - Acculturation, Household SES, Household Food Insecurity

- Community – Readiness (Leaders), Environment (Store, Park, Walkability)

- Jurisdiction - Food & Utility cost survey & World Bank Income Level
Acanthosis Nigricans Screening Scale


**Instructions:** Rate and circle using a black/blue pen the severity of acanthosis nigricans on the back of the neck using the screening scale below.

<table>
<thead>
<tr>
<th>Neck Severity Rating</th>
<th>Neck Severity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Absent</td>
<td>Not detectable on close inspection.</td>
</tr>
<tr>
<td>1</td>
<td>Present</td>
<td>Clearly present on close visual inspection, not visible to the casual observer, extent not measurable</td>
</tr>
<tr>
<td>2</td>
<td>Mild</td>
<td>Limited to the base of the skull, does not extend to the lateral margins of the neck (usually &lt;3 inches in breadth).</td>
</tr>
<tr>
<td>3</td>
<td>Moderate</td>
<td>Extending to the lateral margins of the neck (posterior border of the sternocleidomastoid) (usually 3-6 inches), should not be visible when the participant is viewed from the front.</td>
</tr>
<tr>
<td>4</td>
<td>Severe</td>
<td>Extending anteriorly (&gt;6 inches), visible when the participant is viewed from the front.</td>
</tr>
</tbody>
</table>

Coded as present or absent for this presentation
Household Food Insecurity Core Question, from US Department Agriculture

- **Food insecurity** classified **yes** if household money for food ran out before the end of the month **sometimes, most times or always** (Nord, et al., 2002; USDA Core Food Security Module)
<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Consented</th>
<th>Anthropometry</th>
<th>FAL*</th>
<th>Acticals*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guam – 24 month</td>
<td>908</td>
<td>858</td>
<td>705</td>
<td>404</td>
</tr>
<tr>
<td>CNMI – 24 month</td>
<td>1,011</td>
<td>1,001</td>
<td>653</td>
<td>485</td>
</tr>
<tr>
<td>Am. Samoa – 24 month</td>
<td>950</td>
<td>950</td>
<td>569</td>
<td>360</td>
</tr>
<tr>
<td>Hawaii – 24 month</td>
<td>1,034</td>
<td>1,016</td>
<td>423</td>
<td>408</td>
</tr>
<tr>
<td>Alaska – 24 month</td>
<td>782</td>
<td>741</td>
<td>340</td>
<td>247</td>
</tr>
<tr>
<td><strong>24 Month Intervention Total</strong></td>
<td><strong>4,685</strong></td>
<td><strong>4,566</strong></td>
<td><strong>2,690</strong></td>
<td><strong>1,904</strong></td>
</tr>
<tr>
<td><strong>Baseline Intervention Total</strong></td>
<td><strong>4,488</strong></td>
<td><strong>4,443</strong></td>
<td><strong>2,614</strong></td>
<td><strong>2,032</strong></td>
</tr>
<tr>
<td>FAS Prevalence Study</td>
<td>1,287</td>
<td>1,227</td>
<td>1,149</td>
<td>554</td>
</tr>
<tr>
<td><strong>CHL Total</strong></td>
<td>10,460</td>
<td>10,236</td>
<td>6,454</td>
<td>4,490</td>
</tr>
</tbody>
</table>

*target was 150 for FAL (food and activity log) and 100 for Actical accelerometers per community

Building native walking trails in Hawaii
Anthropometric Measurement and Classification

- Child’s height, weight and waist were measured (n=5463) by trained and standardized staff with 99% reliability obtained (Li et al 2015, Am J Hum Bio).
- **Obesity** status was categorized using BMI based on CDC’s 2000 reference data (the norm used in the region) for 2-8 year olds.
  - **Obese** ≥95th BMI percentile for age and sex
  - Cutoff values for biologically implausible values were defined according to CDC as <-4 or >5 SD according to BMI z scores and removed.
- **Underweight** was defined categorized based on CDC’s 2000 reference data
  - Underweight < 5th percentile for age and sex
  - Cutoff values for biologically implausible values were defined and removed according to CDC as <-4 or >5 SD according to BMI z scores.
- **Stunting** was defined as current height-for-age z score (HAZ) <-2 SDs below the mean of CDC reference data (n=5461).
  - Cutoff values for extreme z scores for HAZ were <-6 or >6 SD from the mean and were removed from the analysis.
CHL Baseline Prevalence of Obesity* by Jurisdiction (2 – 8 year olds)

Intervention Jurisdictions in Green

* BMI ≥ 95th percentile, weighted for population size and adjusted for community clustering.

14.1% overweight (85th to 94th percentile) overall

Novotny et al Medicine in press
CHL Young Child Obesity Estimates


CHL Systematic Review Obesity Prevalence US Affiliated Pacific 2001-2014 (Novotny et al. 2015, AJPH)
Prevalence* of Acanthosis Nigricans by Sex and Age Group

* Any presence of AN, weighted for population size and adjusted for community clustering.

Novotny et al Medicine in press
Prevalence* of Acanthosis Nigricans by Jurisdiction

* Any presence of AN, weighted for population size and adjusted for community clustering. Novotny et al Medicine in press
CHL Overall Intervention Impact Analysis

• Mixed Model testing each outcome (BMI, waist and each of 6 target behaviors) accounting for Clustering (Communities) in a Group (Community) Randomized Trial.
CHL Preliminary MLMC Intervention Impact Analysis

• Regression models
  – Adjust for clustering of communities within jurisdiction and age distribution of children
  – Intervention effect is represented by interaction between type of community (intervention, control, temporal) and time (baseline, 24 month)
  – Child Outcomes (powered on BMI)
    • BMI z-score, Waist circumference, Screen time, Acanthosis nigricans
  – Conservative analysis on community differences only, which is the randomization unit

Start of the day in Yap
CHL Hypothesized Intervention Impact Measures
(6 behavioral outcomes, 3 health outcomes)

**Primary**

1. Sleep by 15 min/day
2. Moderate to Vigorous Physical Activity by 10 min/day
3. Fruit & Vegetable intake by 1 serving/day (1/2 c/day)
4. Water intake by ½ cup/day
5. Sedentary behavior (screen time) by 10 min/day
6. Sugar Sweetened Beverage intake by ½ cup/day

**Secondary**

1. Prevalence of obesity by 8% (0.10 kg/m², BMI z-score)
2. Waist circumference by 2% (1.12 cm)
3. Acanthosis nigricans by 5%
Use of dose of intervention in analysis

• Secondary analyses will use dose of intervention
  – Association of changes in outcomes to intervention activities based on quantitation
• Examine activity implementation for communities with biggest changes
  – For example, did activities targeting SSB lead to the change in SSB consumption?
  – Did the community with the biggest change do something that the others did not?
Complexity, Interaction and Attribution

- Planned principal component analysis (PCA) of intervention activities to identify clusters of activities that were implemented together.

- Planned reduced rank regression of change in target (e.g., obesity) on intervention activities to identify clusters of activities that affected target together.
Data Analysis of MLMC Intervention

• **Primary Analysis**
  – Randomized Community Trial degrees of freedom adjustment is too conservative
    • Methods for adjusting to an “effective sample size”
    • Develop random bootstrap comparison group as alternative
  – Transformations needed for some variables
    • Difficult to interpret
  – Use Categorical outcomes
    • BMI category, Meeting PA and diet compared to recommendations

• **Secondary analysis**
  – Examine change among communities that have need for change
  – Identify activities influencing change where change occurred overall (SSB, Water, Sleep changed in intervention and control)
  – Look at exposure to intervention where change occurred overall

Ready for Waist Circumference Measurement, Yap
CHL Important Lessons Learned

• Community Engagement
  – Relationship building
  – Readiness of communities

• Process Measures
  – Definitions – Fidelity, Dose, Reach, Exposure
  – For Monitoring
  – For Analysis measure

• Impact Measures
  – Definitions
  – Effectiveness approaches
    • Total Impact (embrace complexity) and Component analyses
    • Statistical methods – unit of analysis, implementation measures

• Sustainability/Maintenance
  – Plan from beginning- approach of supporting those relationships
  – Adoption
  – Coalitions
  – Policy change
Discussion/Implications/Policy

• Use additional metrics to capture other aspects of food security, especially of the subsistence population
• Countries in economic growth (nutrition transition) are vulnerable to the “dual burden of malnutrition”
• Policies that balance economic development with protection of health are needed to address inequities and protect a healthy local food system
  – In development of markets
  – Support small farmers
  – Support postharvest processes to prevent loss
Ongoing CHL Initiatives

• **Training** - CHL Summer Institute, and other ongoing child obesity prevention training initiatives, including anthropometric measurement and standardization

• **BMI/Health Monitoring** - Building and Sustaining from the CHL base

• **Maintaining the CHL PSC & partnership** - USDA Land Grant multistate project, other grants, PacTrac3 Diet analysis Software Coordination, Accelerometry Coordination, manuscript and data use approvals

• **CHL Data Coordination** - Continue to analyze and use the CHL data- publish, make data available for research, program and policy planning & advocacy
Disseminating CHL via the CHL web site
http://www.chl-pacific.org/