A Simulation Model for Designing Effective Interventions in Early Childhood Caries

Project Partners

After initially working separately on the utilization of Systems Dynamics to create a simulation for designing effective interventions in early childhood caries (ECC), Colorado's Department of Public Health and Environment (CDPHE) and the Children's Dental Health Project (CDHP) decided on an collaborative effort. This project was supported in part by a grant to Colorado – HRSA Targeted State MCH Oral Health Services System Grant Program HRSA 07-OS-001 CDHP's contribution to the project was made possible with funding from CDC Cooperative Agreement Grant Number 1510746-A.

Phase 1: Formal partnership developed and systems dynamics consultant identified for expert staff support.

Phase 2: CDHP convened a stakeholder group with expertise in ECC research (cariologists), reimbursement (insurance), medical pediatric health, state perspectives, and other areas. This group was directed to develop an approach to "test the parameters" of the model for the state.

Phase 3: Model was qualified with extensive data available from national sources (NHAMCS, MEPS) and at the state and county level (BRFSS, Child Health Survey).

About CDHPE and CDHP

Colorado Department of Public Health and Environment's 2010 Strategic Plan states that the Department serves the people of Colorado by providing high-quality, cost-effective public health and environmental services. The Health Services Division is part of the Prevention Services Division at CDHPE. For additional information visit:

www.cdphe.state.co.us/cdph/Health/Health.htm

The Children's Dental Health Project (CDHP) is a national non-profit organization with the mission of creating and advancing innovative solutions to achieve oral health for all children. CDHP works to eliminate the barriers to preventing dental disease to ensure that all children reach their full potential. For additional information on this project, visit at: www.cdphe.state.co.us or contact Manny Frosh at mannyfrosh@cdhp.org.

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Possible Interventions That Can Be Evaluated With the Model

• Education programs that reduce the consumption of sugary drinks and other harmful practices that contributes to the growth of S. mutans.
• Programs aimed at reducing the transmission of S. mutans from caregivers to children using xylitol gum, chlorhexidine, or other substances.
• Use of xylitol products directly with older children.
• Aggressive screening for and treatment of cavities (giving fluoridated products to newly erupted teeth) to reduce progression to cavities.
• Expanded use of fluoride varnish.
• Xylitol chewing gum and other products for education for children who already have cavities to reduce recurrence rates.
• Rigorous tooth brushing programs with fluoride toothpaste.
• Expansion of Community Water Fluoridation (CWF) to the entire population.
• Metabolic interviewing with a strong educational component.
• Contributions of the above.

Example:

1. Treatment of Mothers with Xylitol to Prevent Transmission of S. mutans

Assumptions:

• 98% reduction in age group 2 (6 months) and 99% reduction in age group 3 (5 years) in S. mutans colonization for children whose mothers were treated with xylitol.
• 70% reduction in development of cavities in children without S. mutans colonization.
• Interventions applied to mothers of children in age groups 1 (9 months) and 2 only: delayed effect on children in age groups 3 as children who did not benefit from treatment age out and these whose mothers were treated into that group.
• $190 average one time cost per mother.

Simulations:

1. Xylitol treatment for Moms of all kids in age groups 1 and 2
2. Xylitol treatment for all kids

Project Results

Interventions aimed at youngest children will be longer to affect the entire population, but will ultimately have a more profound effect in reducing prevalence as the impact propagates into other groups as younger age, high-risk income groups of children will have the greatest impact per dollar spent because of the greater relative risk of ECC in low population. Limited budgets are best spent on these groups.

Targeting children who already have cavities can also be effective because of the high rate of re-occurrence.

Combined interventions that target ECC on several stages of development the disease process are deeply the greatest impact. Primary prevention provides the greatest leverage, but it is also productive to limit disease progression.

Note: Information on this project and other simulation modeling for oral health is being developed into a series of articles by authors that include: Anselmo T, Edelstein B, Frosh M, Hirsch G, Maas W, Tate A.