What Works to Prevent Obesity in Children? Findings from a Comparative Effectiveness Review and Meta-Analysis

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Effective Health Care Program
Agenda

- AHRQ and the Effective Health Care Program
- What Works to Prevent Obesity in Children? A review of findings from Dr. Wang
- Questions and Answers
Web Conference Logistics

- Audio lines have been muted to minimize background noise.
- To ask a question:
  - **Use the WebEx Q&A function:** You may ask a question for the presenter at any time. Questions will be answered midway through and at the very end of the presentation.
  - If you are experiencing technical issues, you may also use the WebEx Q&A function to request help.
- Let us know what you think! Complete the evaluation form at the conclusion of the presentation. Look for the “Evaluation” pop-up.
Agency for Healthcare Research and Quality (AHRQ)

- **Mission:** To improve the quality, safety, efficiency, and effectiveness of health care for all Americans
- **Research:** ~80 percent of AHRQ's budget is invested in grants and contracts focused on improving health care
- **The AHRQ Effective Health Care (EHC) Program:**
  - Provides current, unbiased evidence on clinical effectiveness of health care interventions
  - Focuses on patient-centered outcomes
  - Helps consumers, providers, and policy-makers make informed choices
  - Does not make treatment recommendations
  - Long-term goal: Improve health care quality and patient health outcomes through informed decision making by patients, providers, and policymakers
What is Comparative Effectiveness Research (CER)?

- Comparative effectiveness research — a type of patient-centered outcomes research — compares drugs, medical devices, tests, surgeries, or ways to deliver health care, so that patients and their families can make more informed choices.

- Findings are descriptive, not prescriptive, and are intended as tools for informed decision making, not recommendations.

- Findings highlight current evidence about effectiveness, risks, and side effects.
What Works to Prevent Obesity In Children?

Findings from a Comparative Effectiveness Review and Meta-Analysis

Effective Health Care Program
Some of what will be presented is not included in the original 800-page AHRQ report.

Some is based on further analysis, unpublished results.
Outline

- Introduction
- Objectives
- Methods
- Results
- Conclusions

Conclusions/Take Home Message

- Obesity is a serious public health problem

- The evidence is moderate about the effectiveness of school-based interventions for childhood obesity prevention

- Physical activity interventions in a school-based setting with a family component or diet and physical activity interventions in a school-based setting with home and community components have the most evidence for effectiveness

- More research is needed to test interventions in other settings, such as policy, environmental, and consumer health informatics strategies
I. Background: Prevalence of Childhood Obesity

- Childhood overweight and obesity are highly prevalent in the United States and many other countries.
- The risk of obesity is higher among minority and underserved populations in the U.S.
Worldwide Prevalence of Combined Prevalence of Overweight and Obesity in Children and Adolescents*

* The prevalence estimates were calculated as the arithmetic mean of the age-specific estimates (Data Source: Pigeot et al. 2011)
Trends in the prevalence (%) of obesity (BMI $\geq$ 95th percentile) in US children and adolescents, by age: 1971-74 to 2009-10*

* Based on national data collected in NHANES. (Wang and Beydoun, 2007; Ogden et al, 2012)
What prevalence may not show—U.S. adolescents:
Yearly average change in BMI (kg/m²), WC (cm) and TST (mm) by their percentile distributions: 1988-94 to 1999-04

* OLS estimate of average yearly shift within percentile groups based on NHANES III and 1999-2004 data (Beydoun and Wang, IJPO 2010)
The Biological Basis of Obesity
Many factors interact to contribute to obesogenic environments, and affect children’s weight, e.g.,

- Genetic and other individual factors
- Home influences
- School environment
- Local community
- Regional, national policy
- Globalization
- More …
IOTF Causal Web of Societal Processes Influencing the Population Prevalence of Obesity

Physical Activity and Eating Behaviors Are Affected By Many Factors
Childhood Obesity Prevention

- Obesity is difficult to treat, and prevention of childhood obesity is key.

- It’s been of debate who should play a more important role, e.g., individual/parents vs. society/government.

- Leading health organizations have recommended comprehensive interventions to fight obesity, and argue that government should play an important role.
How to Prevent Childhood Obesity?

Intervention strategies
Population-oriented  Individually-oriented

Environmental and Policy Approaches

Educational, High Risk and Clinical Preventive Services Approaches

Treatment

Upstream  Downstream

U.S. National Initiatives

- *Let’s Move!*
- Childhood Obesity Task Force
- HHS Healthy Weight Task Force
- National Action Plan for Physical Activity
- Healthy People 2020
- Dietary Guidelines for Americans 2010
- Communities Putting Prevention to Work (CPPW)
- Child Nutrition Reauthorization – Healthy Hunger-free Kids Act
- Surgeon General’s Call to Action on Breastfeeding
- FTC Guidelines for Foods Marketed to Children

(Dietz, 2011.2)
II. Objectives of Our Review/Study

- Assess the effectiveness of childhood obesity prevention programs conducted in high-income countries
- All kinds, in any of the following settings:
  - School
  - Home
  - Primary care clinic
  - Childcare center
  - Community setting
  - Consumer health informatics
  - A combination of the above
Key Questions (KQ) Addressed

- **KQ1.** What is the comparative effectiveness of *school-based interventions* for the prevention of obesity or overweight in children?
- **KQ2.** What is the comparative effectiveness of *home-based interventions* for the prevention of obesity or overweight in children?
- **KQ3.** What is the comparative effectiveness of *primary care-based* interventions for the prevention of obesity or overweight in children?
- **KQ4.** What is the comparative effectiveness of *childcare setting-based* interventions for the prevention of obesity or overweight in children?
- **KQ5.** What is the comparative effectiveness of *community-based or environment-level* interventions for the prevention of obesity or overweight in children?
- **KQ6.** What is the comparative effectiveness of *consumer health informatics* applications for the prevention of obesity or overweight in children?
- **KQ7.** What is the comparative effectiveness of *multi-setting interventions* for the prevention of obesity or overweight in children?
III. Methods

- The study was conducted following the standard process of the AHRQ EHC Program

- A wide range of experts and stakeholders from academic institutions, government agencies, and parent stakeholders provided feedback throughout the study process
Study Process

- Topic (study protocol) refinement
- Literature search & data abstraction
- Data analysis
- AHRQ research report development
- Public review/comment
- Revisions of report
- Publication(s)—report and papers
Figure 1. Analytic framework: Evaluation of Childhood Obesity Intervention Programs

**Settings**
- KQ1 - School-based
- KQ2 - Home-based
- KQ3 - Primary care-based
- KQ4 - Child care-based
- KQ5 - Community-based
- KQ6 - Environment-level
- KQ7 - Consumer health informatics
- KQ8 - Multi-setting interventions

**Intermediate Outcomes**
- Nutrition Knowledge, Attitudes, Beliefs (child and caregivers)
- Food purchasing Behaviors (child and caregivers)
- Dietary Intake (energy, nutrients, foods)
- Food access
- Physical Activity
- Sedentary behavior

**Primary Outcomes (at the population and individual level)**
- Change in overweight and obese status
- Prevalence of overweight and obese
- Body mass index (BMI) or other adiposity measures

**All children age 2-18 yrs**

**Adverse effects of intervention**
- Eating disorders
- Psychosocial outcomes such as stigma
- Impact on growth and development
- Injury
- Cost

**Obesity-related Clinical Outcomes**
- Cardiovascular outcomes
- Metabolic outcomes
- Psychosocial outcomes
Data sources. We searched MEDLINE®, Embase®, PsycInfo®, CINAHL®, clinicaltrials.gov, and the Cochrane Library through August 11, 2012.

Randomized controlled trials, quasi-experimental studies, or natural experiments conducted in high-income countries enrolling healthy children aged 2-18 and following participants for at least one year (or six months for school-based studies) were included.
Two reviewers independently reviewed each article for eligibility. For each study, one reviewer extracted the data and a second reviewer verified the accuracy.

Both reviewers assessed the risk of bias for each study.

Together, the reviewers graded the strength of the evidence (SOE) supporting interventions—diet, physical activity, or both—in each setting for the outcomes of interest.
SOE was classified into four broad categories:

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>High</td>
<td>Further research is very unlikely to change the confidence in the estimate of effect.</td>
</tr>
<tr>
<td>Moderate</td>
<td>Further research may change the confidence in the estimate of effect and may change the estimate.</td>
</tr>
<tr>
<td>Low</td>
<td>Further research is likely to change the confidence in the estimate of effect and is likely to change the estimate.</td>
</tr>
<tr>
<td>Insufficient</td>
<td>Evidence either is unavailable or does not permit a conclusion.</td>
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When >=3 comparable studies were available for a given intervention and setting(s), we conducted meta-analyses

- Using STATA (version 11.0; Stata Corp.)

We used random effect models with the method of DerSimonian and Laird due to heterogeneity among studies

Outcomes:
- BMI—report
- BP
- blood lipids
QUESTIONS & ANSWERS
Results

- We identified 34,545 unique citations and included 131 articles describing 124 interventional studies.

- The majority of the interventions (104 studies) were school-based, although many of them included components delivered in other settings.

- Most were conducted in the United States and in the past decade.
Total: 131 (124 studies)

KQ1 - School-based – 110 (104 studies)
KQ2 - Home-based – 6 (6 studies)
KQ3 - Primary care-based – 1 (1 study)
KQ4 - Child care-based – 5 (4 studies)
KQ5 - Community- Env – 9 (9 studies)

KQ6 - Consumer health informatics
KQ7 - Multi-setting interventions
Figure 3. Meta-analysis: Change in BMI between the control and combined diet and physical activity intervention groups in school-only settings

<table>
<thead>
<tr>
<th>Studyid</th>
<th>WMD (95% CI)</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barbeau, 2007</td>
<td>-0.60 (-0.71, -0.49)</td>
<td>14.16</td>
</tr>
<tr>
<td>Gutin, 2008</td>
<td>-0.20 (-0.23, -0.17)</td>
<td>15.08</td>
</tr>
<tr>
<td>Howe, 2011</td>
<td>-0.60 (-0.67, -0.53)</td>
<td>14.79</td>
</tr>
<tr>
<td>Llargues, 2012</td>
<td>-0.74 (-0.88, -0.60)</td>
<td>13.69</td>
</tr>
<tr>
<td>Lubans, 2012</td>
<td>-0.18 (-0.20, -0.16)</td>
<td>15.14</td>
</tr>
<tr>
<td>Magnusson, 2012</td>
<td>0.60 (0.44, 0.76)</td>
<td>13.32</td>
</tr>
<tr>
<td>Neumark-Sztainer, 2011</td>
<td>-0.50 (-0.63, -0.37)</td>
<td>13.83</td>
</tr>
<tr>
<td>Overall (I-squared = 98.3%, p = 0.000)</td>
<td>-0.32 (-0.49, -0.16)</td>
<td>100.00</td>
</tr>
</tbody>
</table>

NOTE: Weights are from random effects analysis

WMD = weighted mean difference
Figure 4. Meta-analysis: Change in BMI between the control group and combined diet and physical activity interventions in a school setting with a home component

<table>
<thead>
<tr>
<th>Studyid</th>
<th>WMD (95% CI)</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burke, 1998</td>
<td>0.00 (-0.16, 0.16)</td>
<td>12.49</td>
</tr>
<tr>
<td>Burke, 1998</td>
<td>0.10 (-0.05, 0.25)</td>
<td>12.51</td>
</tr>
<tr>
<td>Dzewaltowski, 2010</td>
<td>-0.10 (-0.18, 0.02)</td>
<td>12.67</td>
</tr>
<tr>
<td>Siegrist, 2011</td>
<td>0.10 (0.06, 0.14)</td>
<td>12.71</td>
</tr>
<tr>
<td>Story, 2012</td>
<td>0.34 (0.15, 0.53)</td>
<td>12.36</td>
</tr>
<tr>
<td>Hatzis, 2010</td>
<td>1.00 (0.80, 1.20)</td>
<td>12.34</td>
</tr>
<tr>
<td>Mihas, 2010</td>
<td>-1.20 (-1.32, -1.08)</td>
<td>12.59</td>
</tr>
<tr>
<td>Llargues, 2011</td>
<td>-1.60 (-1.80, -1.40)</td>
<td>12.33</td>
</tr>
<tr>
<td>Overall (I-squared = 99.1%, p = 0.000)</td>
<td>-0.17 (-0.57, 0.23)</td>
<td>100.00</td>
</tr>
</tbody>
</table>

NOTE: Weights are from random effects analysis
Evidence for the Benefits of School-Based Interventions (1 of 3)

- **School-Based Interventions Only**
  - School-based diet or physical activity interventions prevent obesity or overweight in children.  
    
    **Strength of Evidence: Moderate**
  - School-based combination diet and physical activity interventions prevent obesity or overweight in children.
    
    **Strength of Evidence: Insufficient**

- **School-Based Interventions With a Home Component**
  - Physical activity interventions within school-based settings with a home component prevent obesity or overweight in children.
    
    **Strength of Evidence: High**
  - Combined diet and physical activity interventions in a school-based setting with a home component prevent obesity or overweight in children.
    
    **Strength of Evidence: Moderate**
School-Based Interventions With a Community Component

- Combined diet and physical activity interventions in a school-based community setting prevent obesity or overweight in children. □

**Strength of Evidence: Moderate**

School-Based Interventions With a Home and Community Component

- Combined diet and physical activity interventions in a school-, home-based community setting prevent obesity or overweight in children. □

**Strength of Evidence: High**
School-Based Interventions With a Consumer Health Informatics Component

- Evidence is insufficient to determine if physical activity or combined diet and physical activity interventions in a school setting with a consumer health informatics component prevent childhood obesity or overweight.

Strength of Evidence: Insufficient
Home-Based or Childcare-Based Interventions

- **Home-Based Interventions Only**
  - Home-based combination (diet and physical activity) interventions prevent obesity or overweight in children.
  
  **Strength of Evidence: Low**

- **Childcare Center-Based Interventions Only**
  - Combined diet and physical activity interventions in a childcare center setting showed no beneficial effect on childhood obesity or overweight prevention.

  **Strength of Evidence: Low**
Community-Based or Primary Care-Based Interventions

- **Community-Based Interventions With a School Component**
  - Combined diet and physical activity interventions in a community setting with some school involvement prevent childhood obesity or overweight. 

  **Strength of Evidence: Moderate**

- **Primary Care-Based Interventions Only**
  - Evidence is insufficient to determine if combined diet and physical activity interventions in a primary care setting prevent obesity or overweight in children.

  **Strength of Evidence: Insufficient**

- This does not mean that interventions do not work in the primary care setting, but more research is needed.
Additional Results—Unpublished

- Effects of the intervention on **blood pressure**
- Effects of the intervention on **blood lipids**
Conclusions

- A large number of intervention studies have been conducted, but the majority are school-based, and are in the U.S.

- School-based programs involving dietary or physical activity interventions are effective in preventing childhood obesity.

- Combining a home or community component with a school-based program also works.

- Evidence is limited regarding the effectiveness of interventions in other settings, more research is needed.
A lack of research on the effectiveness of the following types of obesity interventions:

- Environment-based and policy-based interventions
- Interventions tested in the primary care or childcare settings
- Consumer health informatics interventions
Gaps in Knowledge (2 of 2)

- Lack of good understanding of the contexts and challenges associated with implementing prevention programs in different settings
- A paucity of information on the effects of various interventions in preventing childhood obesity in populations stratified by gender, age, ethnicity, demographic, or socioeconomic status
- System-science guided interventions
- Cost effective analysis
What to Discuss with Your Patients and Their Caregivers (1 of 2)

- The patient’s BMI and how to diagnose overweight/obesity in children
- Health consequences of overweight/obesity in children
- The possible factors contributing to obesity in children
  - e.g., Lack of physical activity, sedentary/screen time, unhealthy diet, inappropriate use of food rewards, eating when not hungry, portion size
- The importance of monitoring total daily caloric intake as opposed to total daily food intake
- Important things that can be done at home
- That clinicians are concerned about childhood obesity and care patients
What to Discuss with Your Patients and Their Caregivers (2 of 2)

- Effectiveness of the various prevention programs

- The programs and resources that help children maintain a healthy weight that are available at school or in the community

- What can be done if healthy food or safe locations for physical activity are not easily accessible to patients and their families

- Take actions today (e.g., A B C D...)
  - CLOCC's: 5-4-3-2-1 Go!
Acknowledgements - Key collaborators in the AHRQ project

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- **AHRQ:** Christine Chang
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U.S. Department of Agriculture
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<td>Centers for Disease Control and Prevention (CDC)</td>
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<td>Shiriki Kumanyika, Ph.D., M.P.H.</td>
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<td>University of Pennsylvania</td>
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Resources

- **Original Report**: Wang et al., *Childhood Obesity Prevention Programs: Comparative Effectiveness Review and Meta-Analysis*

- **New!**
  - Clinician and Consumer Summaries
  - CME/CE activity, and
  - Slide talk

- All can be found on AHRQ Effective Health Care Program’s Website: [http://www.effectivehealthcare.ahrq.gov](http://www.effectivehealthcare.ahrq.gov)
AHRQ’s Health Care Innovations Exchange

- The Health Care Innovations Exchange contains more than 800 searchable innovations and 1500 quality tools. Visit us at www.innovations.ahrq.gov.

Questions and Comments?