Prevention as a Focus of Dissemination and Implementation Research in Obesity

Deborah Young-Hyman, PhD, CDE, FTOS
Office of Behavioral and Social Sciences Research (OBSSR, OD, NIH)
Overview

Current rates of obesity in US.

Reasons to focus D&I research on obesity prevention:
- RCT Behavioral Interventions vs diet and physical activity behavior in free living conditions
- Evidence from pregnancy, infancy and early childhood indicating “early programming” of risk factors as a target for obesity prevention.

Evidence from D&I studies impacting early programing of risk factors

Challenges in D&I obesity prevention research:
- Tailoring proven methods to early programming,
- Unit of intervention and matching measures
- Special populations and circumstances
D&I Research Issues in Prevention Studies

1. When designing D&I prevention studies, are there distinct issues to be considered compared to intervention studies (either clinical or community based)?

2. When designing prevention studies, how does one weigh individual risk vs societal burden in choosing main outcomes or evaluating cost-benefit?

3. When designing D&I prevention research, how important is the generalizability of study outcomes?
Significant decrease in obesity in 2-5 year-olds.
Significant increase in obesity in women ≥60.

“Overall, there have been no significant changes in obesity prevalence in youth or adults between 2003-2004 and 2011-2012.” (pg. 806)

Behavioral methods - decrease caloric intake and increase physical activity (PA), that produce clinically meaningful weight loss

• tested in RCTs (Diabetes Prevention Program, Look AHEAD)
• implemented in community settings (YMCA - DEPLOY1)
• available through commercial programs (Weight Watchers2)

According to data from the National Weight Control Registry (Wing and Hill, 1994 – present; http://www.nwcr.ws) effective individual weight loss plans include reduction in dietary intake and increased PA.

Data from 2000 BRFSS indicates 39% of US adults are trying to lose weight and 57% are trying to keep from gaining.3
Caloric Reduction and PA Increase Sufficient to Produce Reduction in Body Weight and Incident Disease: T2D and CVD

Diabetes Prevention Program (DPP) Goals: Weight reduction of 7% and 150 minutes moderate PA/wk. Caloric reduction first prescribed through reduction in fat, and if not successful, overall caloric reduction. Case managers and tool box approach.
(Personal communication Dr. Rena Wing; DPP Research Group, 2002)

Look AHEAD Goals: ≥ 7% weight reduction (individual goal 10%) and 175 minutes per week of moderate to intense PA. 1200-1500 kcals for individuals less than 250lbs and 1500-1800 kcals for individuals greater than 250lbs. 30% reduction in fat. “Multiple diet and exercise approaches.”
(The Look AHEAD Research Group, 2006)
Figure 1. Mean energy intake for children and adolescents aged 2–19 years, by sex and age group, 1999–2010

1Significant linear trend.

SOURCE: CDC/NCHS, National Health and Nutrition Examination Survey.
Trends in Caloric Intake in US Adults

Macronutrients

Self reported Total Daily Caloric Intake
1971-75 = 1955 kcals
2003-04 = 2269 kcals
2009-11 = 2195 kcals

women = 1785 kcals
men = 2640 kcals

(Ford and Deitz, 2013)
Figure D.3. Reported Physical Activity by Adults in the USA: 1997-2006 The Healthy People 2010 Database

- No leisure-time physical activity
- Regular moderate or vigorous physical activity
- Muscle strength and endurance activities

<table>
<thead>
<tr>
<th>Year</th>
<th>%</th>
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<tbody>
<tr>
<td>1997</td>
<td>40</td>
</tr>
<tr>
<td>1998</td>
<td>39</td>
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<td>2005</td>
<td>32</td>
</tr>
<tr>
<td>2006</td>
<td>31</td>
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</tbody>
</table>

Slide from Sallis and Carlson, March 27th 2014, OBSSR, NIH
Trends in Childhood Physical Activity Measured by Accelerometer

Children and Adolescents Ages 6–19 Getting at Least 60 Minutes per Day of Physical Activity to meet Public Health recommendations: NHANES N = 6329 2003–2004

Light green = total
Dark green = boys
Grey = girls

Troiano et al., 2008
Population Indicators

Population indicators of caloric reduction in children and increases in adults, plus lack of change in PA appears to be a major driver of lack of success in reducing rates of obesity on the population level.

“Overall, there have been no significant changes in obesity prevalence in youth or adults between 2003-2004 and 2011-2012.” (pg. 806)

Obesity Related Disease

Higher rates of:

- Diabetes (2000-2050 165% increase in type 2 diabetes: 1 of 3 adults) (Boyle et al., 2001)
- CVD (Kumanyika et al., 2008)
- Asthma, Arthritis, Poor health (Kokdad et al., 2003)
- Sleep Disorders (Tasali et al., 2008)
- Cognitive Impairment (Yesavage et al., 2014)
- Dementia (Swedish Twin Registry; Xu et al., 2011)
- Autism spectrum disorders in children (Norwegian sample of 93000 children; Suren et al., 2014)
As a person ages, it is more likely they will be obese.

Dissemination and implementation of behavioral methods to reduce weight in non-research settings, have not, to date, increased their adoption or success in the free living state.

Reduction in caloric intake has not been sufficient to compensate for low levels of PA in kids; and increase in adult caloric intake compounds low levels of PA, which are major drivers of the development of obesity and increasing obesity with age (independent of genetic and environmental risk factors).

Waiting to intervene when obesity has been present since childhood is too late to prevent risk for weight related disease. (Gillman and Ludwig, 2013)
Are We "Stuck"?
Next Steps:

“There are several steps that must occur for an efficacious intervention to be effective in clinical practice; therefore, an efficacy trial can often overestimate an intervention’s effect when implemented in clinical practice. An efficacious intervention must be readily available, providers must identify the target population and recommend the intervention, and patients must accept and adhere to the intervention.”

(Sox and Greenfield, 2009)
Population-based prevention of obesity: the need for comprehensive promotion of healthful eating, physical activity, and energy balance: a scientific statement from American Heart Association Council on Epidemiology and Prevention, Interdisciplinary Committee for Prevention.

“..... Population-based approaches to obesity prevention are complementary to clinical preventive strategies and also to treatment programs for those who are already obese. This American Heart Association scientific statement aims: 1) to raise awareness of the importance of undertaking population-based initiatives specifically geared to the prevention of excess weight gain in adults and children; 2) to describe considerations for undertaking obesity prevention overall and in key risk subgroups; 3) to differentiate environmental and policy approaches to obesity prevention from those used in clinical prevention and obesity treatment; 4) to identify potential targets of environmental and policy change using an ecological model that includes multiple layers of influences on eating and physical activity across multiple societal sectors; and 5) to highlight the spectrum of potentially relevant interventions and the nature of evidence needed to inform population-based approaches. The evidence-based experience for population-wide approaches to obesity prevention is highlighted.

(Kumanyika et al., 2008)
When does risk for obesity begin: Early Programming

Too much or too little GWG leads to increased risk of child becoming overweight/obese. (Sridhar et al., 2014)

Accelerating growth and adiposity during the first 6 mos of life is predictive of risk for overweight/obesity throughout the lifespan. (Druet et al., 2012)

Reversing obesity once it is established is difficult under the best of circumstances and more difficult under free-living conditions.
## Maternal Gestational Weight Gain and Offspring Risk for Childhood Overweight or Obesity

ORs/95% CIs for childhood overweight/obesity @ 2-5yrs associated with maternal GWG (Sridhar et al., 2014)

<table>
<thead>
<tr>
<th>Pregnancy risk factor</th>
<th>Crude</th>
<th>Multivariable adjusted $^a$</th>
<th>Multivariable adjusted $^b$</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOM gestational weight gain recommendations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below</td>
<td>1.43 (1.06–1.92)</td>
<td>1.12 (0.82–1.53)</td>
<td>1.23 (0.88–1.71)</td>
</tr>
<tr>
<td>Met</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Exceeded</td>
<td>1.52 (1.24–1.86)</td>
<td>1.51 (1.23–1.87)</td>
<td>1.46 (1.17–1.83)</td>
</tr>
<tr>
<td>Rate of gestational weight gain, kg/wk</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Tertile 1 (–0.43 to 0.30)</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Tertile 2 (0.30-0.42)</td>
<td>0.93 (0.77–1.13)</td>
<td>1.32 (1.07–1.62)</td>
<td>1.27 (1.02–1.58)</td>
</tr>
<tr>
<td>Tertile 3 (0.42-0.99)</td>
<td>1.11 (0.92–1.34)</td>
<td>1.53 (1.25–1.88)</td>
<td>1.38 (1.10–1.72)</td>
</tr>
</tbody>
</table>
Upward crossing of major weight–for–length CDC percentiles, especially in the first 6mos of life is associated with higher rates of obesity @ 5 and 10 years of age: ranging from 11.5% to 34.6%.

(Taveras et al., 2011)
“Early Programming” Risk Factors Associated with Increased Rates of Pediatric Obesity

Pregnancy:
- Pre-pregnancy obesity
- Excessive GWG
- Smoking (estimated @ 1/5 women)

Eating Behavior:
- No or short duration breast feeding
- Formula feeding/overfeeding
- Early introduction of solid foods
- Low intake of fruit and vegetables
- High intake of energy dense foods
- Intergenerational transmission of unhealthy eating patterns: large portion sizes, snacking, eating out
- Parental feeding styles: restriction, indulgence

Sedentary Behavior:
- Too little sleep (infant)
- Screen time

(Siega-Riz AM, Viswanathan M, Moos MK, et al., 2009; Wojcicki and Heyman, 2012; Birch and Ventura, 2009)
D& I Prevention of Risk Factor Studies During Pregnancy, Infancy and Early Childhood

Risk Factor:

- Maternal pre-pregnancy obesity

- Gestational Weight Gain (GWG)
  (Streuling, Beyerlein and von Kries, 2010)

- Increasing adoption and duration of breastfeeding
  (Harroon et al., 2013)

- Intergenerational transmission of nutrition and physical activity patterns: Child diet, PA and screen time; BMI
  (Campell et al., 2013)

- Clinical practice: universal screening for and treatment of obesity in youth and teens
  (Coleman et al., 2012)

Intervention Outcomes:

- Reducing pre-pregnancy or inter-conception BMI through pre-conception counseling and behavioral methods (Strong Healthy Women Study). However, prior studies did not show positive results. **No child BMI data.**

- Preventing excess GWG through PA and diet counseling (meta-analysis). **No child BMI data.**

- Increasing breast feeding rates via individual and group education. (meta analysis) Effects lower in developed countries. **No child BMI.**

- Sweet snack and TV viewing BMI, F&V and H2O consumption

- Intervention to improve screening and treatment of all youth in contained health care setting (Kaiser) using a computer based decisional tool. **No BMI results reported.**
How are we going to tip the balance?
D&I Prevention Challenges

- How does one focus the primary aims of a prevention study? Risk in the individual vs population?
- Are there design considerations specific or unique to prevention studies?
- Do the same behavioral methods apply to prevention vs intervention approaches: duration, dose, drivers of change?
- When calculating cost-benefit of a prevention approach, where do the costs lie? How do you demonstrate benefit?
- Are there alternative study designs and measurements better suited than the RCT?
  Maybe a spork: hybrid approaches...
Once established, obesity is hard to reverse.

Primary prevention of risk for obesity is under-implemented in clinical practice targeting individual behavior, and in environmental and policy venues which have the potential to impact obesity on the population level; and are both understudied.

Use of methods proven to be efficacious in changing eating and physical activity patterns to reduce weight in controlled experiments need to be “unpacked” and tested as methods to prevent excess weight gain, preferably early in life when risk for obesity begins (early programming).

When conducting obesity prevention research in free living conditions or clinical settings, implementation and dissemination research designs will need to: define outcomes and use evaluation metrics appropriate to the context of the study; and tailor proven methods to special population needs and circumstances in order to maximize effectiveness and reach.
We can do better....