Obesity: How Science Approaches Weighty Matters

Meg Freeland
Kaitlin Samocha
Mary Haas
Overview

• Meg
  – Epidemiology: the big picture
• Kaitlin
  – Genetics: little genes, big consequences
• Mary
  – New topics in obesity research
Disclaimer

• Graduate students are qualified to share science
  – Ask me about my research!

• Medical doctors are qualified to give personal health advice
  – Please talk to them!
Obesity: The Big Picture

Meg Freeland
Obesity: The Big Picture

• What is obesity

• Epidemiology: how did we get here

• Metabolism: balancing the body’s budget

• Targeting obesity: present, past, and future
What do We Mean When We Say Obesity?

• A Body Mass Index (BMI) of over 30
  – Overweight 25-30
  – Based on weight and height

• Population based measure
  – Individual measurements more complicated
Obesity in the News

• Talk about weight is everywhere
  – Our food choices
  – Our exercise plans
  – Our fashion magazines & newspapers

• The modern world is obsessed with weight
The History of Obesity

• Since ancient times across cultures
• Rates low (1890 about 3.5%)
What Has Changed?

• If obesity has always been around, why worry about it now?
  – The war on obesity
  – The obesity epidemic
    • A disease which spreads rapidly over a large population
Epidemiology

- An epidemiologist’s eye view
- First step towards identifying the problem
- Relevance for other science
1985

Map showing BMI data for the United States in 1985. The map uses different shades to indicate BMI categories, with green indicating BMI > 30.

Source: Wikimedia Commons: CDC
What does this mean for us?

• It’s not just a matter of appearances
• Increases risk of
  – Diabetes
  – Heart disease
    • #1 cause of death in the US
  – Certain types of cancer
    • Breast, colon, kidney, esophagus
  – Reproductive problems
  – Depression
Correlation vs. Causation

• Correlation: the bigger the fire, the more fire fighters present
• Causation: matches start fires
• Important differences!
  – Firemen do not cause fires
How Did We Get Here: 
Food Theories

• Diet
• Portion Size
  – 1984-1994: 340 Calories more per day
  – (That’s 7 oreo cookies!)
  – …in 10 days 1lb of fat

Open Clipart Library: gnokii, Flickr: Torben Hansen
How Did We Get Here: Lifestyle Theories

• Television
  – Decreasing TV time decreases BMI
  – TV boom 1960’s, obesity boom 1970’s-1990’s
• Cars, desk jobs, the internet....

(Raw data from Dietz & Gortmaker, 1985)
Obesity: The Big Picture

• What is obesity

• Epidemiology: how did we get here

• Metabolism: balancing the body’s budget

• Targeting obesity: present, past, and future
Obesity in the Individual

- An imbalance of energy intake and expenditure
  - And much, much more
- Energy in
- Energy out
- Metabolism in between
Calories

• Unit: calories
  – The heat needed to raise 1 liter of water 2°F

• How do we measure this?
  – Body heat

• 1,000 calories = 1 kcal = 1 Calorie
  – Or, a celery stick
Metabolism

Soda, meat, bread, cheese

Mechanical breakdown

Intestine

Bloodstream

Sugars

Fat

Work

Flickr: gerald_g, tebu.an
Wikimedia: Mikael Häggström
Let’s Do the Math

- Balancing the body’s budget
  - The average 154 lb male
  - 2,500 Calories intake
Let’s Do the Math

+500

• 3,000 calories intake

• The equation must balance!

• Where do the other 600 Calories go?
  – FAT

<table>
<thead>
<tr>
<th></th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise</td>
<td>-100</td>
</tr>
<tr>
<td>Daily activities</td>
<td>600</td>
</tr>
<tr>
<td>Shivering</td>
<td>100</td>
</tr>
<tr>
<td>Body heat</td>
<td>1600</td>
</tr>
<tr>
<td>Urine</td>
<td>50</td>
</tr>
<tr>
<td>Stool</td>
<td>50</td>
</tr>
</tbody>
</table>

Open Clipart Library: gnokii. Lecture: Zolt Arany
Targeting Obesity:

- “Cures” that never quite got off the ground
- Modern approaches
- Ideas that are just starting to take off
Questionable Cures

• 300 BC: Honey & almonds
• 100 BC: Bathing with soap
• 1694: Vinegar & lead body rubs
• 1900: Tape worms

• …We’re still looking for a “cure”
Sizzling Side Effects

• Dinitrophenol
  – **What is it?** An insecticide/explosive
  – **How:** Overproduction of body heat
  – **Success?** Well, yes
  – **Side Effects:** fever, cataracts, death due to overheating

1933-1938
Modern Approaches

• Dieting
  – How? fewer Calories in
  – Success? Health- YES!
    Weight- Not long term

• Exercise
  – How? more calories out
  – Success? Health- YES!
    Weight- Not really
Exercise and Healthy Food Choices are Important!

- Can lower your risk of heart disease & diabetes
- Muscle is heavier than fat and burns more calories

VS.

Flickr: LOLren_ektogamat
Surgical Treatments

- Lap Band
- Gastric bypass surgery
  - Can be successful

**SIDE EFFECTS:** Leakage, ulcers, malnutrition, vomiting, death

- Last resort for the morbidly obese
Where to Next?

• Can we treat obesity with fat?

• Are your bacteria making you fat?

• Role of genetics
Obesity: The Big Picture

• What is obesity

• Epidemiology: how did we get here

• Metabolism: balancing the body’s budget

• Targeting Obesity: present, past, and future