Explaining the rise in Obesity

Introduction

• Rapid increase in obesity since 1970
  – In 1970, 14% of the population was obese
  – Today, rates are around 30%
• Up through 1970s, long term trends are such that improvements in body size have been health improving (Fogel)
• Now the average BMI is in dangerous range
Definitions

- Obesity based on Body Mass Index
- \( \text{BMI} = \frac{\text{weight (kg)}}{\text{(height in cm)}^2} \)
- \( = \frac{703 \times \text{weight (pounds)}}{\text{(height in inches)}^2} \)
- \( \text{BMI} < 20 \) Underweight
- \( 20 \leq \text{BMI} < 25 \) Ideal
- \( 25 \leq \text{BMI} < 30 \) overweight
- \( 30 \leq \text{BMI} \) obese

Two primary sources of BMI data

- National Health Interview Survey
  - Annual survey of 160K people
  - Self reported health conditions (including height and weight)
  - Tend to overstate height, understate weight
- National Health Examination and Nutrition
  - Twice a decade surveys of 12K people
  - Give detailed physical exams (including blood tests)
  - Detailed source for many health conditions

Obesity Rates Over Time

<table>
<thead>
<tr>
<th>Group</th>
<th>Obesity 1971/74</th>
<th>Obesity 1999/00</th>
<th>Overweight 1971/74</th>
<th>Overweight 1999/00</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>14.6</td>
<td>30.9</td>
<td>47.7</td>
<td>64.5</td>
</tr>
<tr>
<td>Males</td>
<td>12.2</td>
<td>27.7</td>
<td>54.7</td>
<td>67.0</td>
</tr>
<tr>
<td>Females</td>
<td>16.8</td>
<td>34.0</td>
<td>41.1</td>
<td>62.0</td>
</tr>
<tr>
<td>Black F.</td>
<td>29.7</td>
<td>50.8</td>
<td>60.5</td>
<td>78.0</td>
</tr>
</tbody>
</table>
### Change in obesity rates

<table>
<thead>
<tr>
<th>Country</th>
<th>Years</th>
<th>Change obesity rate (% point changes)</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>76-94</td>
<td>12-20%</td>
<td>17-25%</td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td>78-88</td>
<td>7-9%</td>
<td>10-9%</td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>80-89</td>
<td>5-5%</td>
<td>9-9%</td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td>80-91</td>
<td>6-13%</td>
<td>8-15%</td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>76-93</td>
<td>1-2%</td>
<td>3-3%</td>
<td></td>
</tr>
</tbody>
</table>

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<tr>
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<tr>
<td>US</td>
<td>76-94</td>
<td>66%</td>
<td>47%</td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td>78-88</td>
<td>29%</td>
<td>-10%</td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>80-89</td>
<td>0%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td>80-91</td>
<td>117%</td>
<td>88%</td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>76-93</td>
<td>100%</td>
<td>0%</td>
<td></td>
</tr>
</tbody>
</table>

### % Obese for Different Groups

<table>
<thead>
<tr>
<th>Group</th>
<th>71-75</th>
<th>89-94</th>
<th>Δ (% change)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single male</td>
<td>8</td>
<td>19</td>
<td>8 (138%)</td>
</tr>
<tr>
<td>Mar. male, non working spouse</td>
<td>13</td>
<td>26</td>
<td>13 (100%)</td>
</tr>
<tr>
<td>Mar. male</td>
<td>11</td>
<td>24</td>
<td>13 (18%)</td>
</tr>
<tr>
<td>Working spouse</td>
<td>18</td>
<td>32</td>
<td>14 (78%)</td>
</tr>
<tr>
<td>S. female</td>
<td>16</td>
<td>36</td>
<td>19 (125%)</td>
</tr>
<tr>
<td>Mar. female, not working</td>
<td>13</td>
<td>33</td>
<td>21 (175%)</td>
</tr>
<tr>
<td>Mar. female, working</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>71-75</th>
<th>89-94</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elderly</td>
<td>19</td>
<td>32</td>
<td>12 (63%)</td>
</tr>
<tr>
<td>Male, &lt;HS</td>
<td>15</td>
<td>23</td>
<td>8 (53%)</td>
</tr>
<tr>
<td>Male, HS</td>
<td>13</td>
<td>24</td>
<td>11 (84%)</td>
</tr>
<tr>
<td>Male, College</td>
<td>8</td>
<td>21</td>
<td>13 (163%)</td>
</tr>
</tbody>
</table>

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Facts to explain

- Increase is recent (started in 1970s)
  - Comes at a time when almost all other health measures are improving
- Increase in all segments in the population
- Increase has not been as great in other developed countries

Usual suspects

- TV
- Lack of exercise
- Super-sized fast food meals
- Working moms
- Decline in smoking

- Can dispose of some of these right away

Why is this a difficult problem to disentangle?

- An increase in 100-150 calories/day would explain 10-12 pound increase in weight over past 20 years.
  - Equal to 3 Oreos
  - One can of Pepsi
Basics of the problem

- Cutler et al. show that the problem is a rise in calories consumed, not a fall in calories burned
- Data from a variety of sources
  - Food diaries
  - Time diaries
  - Physiological studies, calories burned by an activity

Note

- Meals have increased
- Calories per meal has stayed the same
- Big increase in snacks and calories from snacks
- How does these results eliminate the hypothesis that “Super sized” meals are the cause of the problem?
### Time use in minutes/day

<table>
<thead>
<tr>
<th></th>
<th>1965</th>
<th>1975</th>
<th>1985</th>
<th>1995</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paid wk</td>
<td>290</td>
<td>258</td>
<td>259</td>
<td>266</td>
</tr>
<tr>
<td>House wk</td>
<td>146</td>
<td>128</td>
<td>124</td>
<td>102</td>
</tr>
<tr>
<td>food prep</td>
<td>44</td>
<td>41</td>
<td>39</td>
<td>27</td>
</tr>
<tr>
<td>WatchTV</td>
<td>89</td>
<td>129</td>
<td>129</td>
<td>151</td>
</tr>
<tr>
<td>Exercise</td>
<td>27</td>
<td>37</td>
<td>43</td>
<td>47</td>
</tr>
</tbody>
</table>

### Energy

- Big drop in housework
- Slight drop in work
- Increase in exercise
- Increase in sedentary activity (TV)
- Convert into energy index

Therefore
- Problem is one of increased calories
- Not a reduction in calories consumed

### Energy used (Kcal per day)

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<tr>
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<td>16.4</td>
<td>13.5</td>
<td>14.7</td>
<td>12.6</td>
</tr>
<tr>
<td>Females</td>
<td>15.1</td>
<td>12.3</td>
<td>13.5</td>
<td>11.3</td>
</tr>
</tbody>
</table>

I am pretty sure the text in the Cutler et al. paper is in error about the units of Measure on this variable. The key is that since 1975, the measure of energy Has not fallen sharply. Since 1975m, calories burned have fallen by \((11.3-12.3)/12.3 = -0.081\) for females and \((12.6-13.5)/13.5=-0.067\)

### Cutler et al. theory

**Technological change in food production**

- Major advances in food preparation such vacuum packing, microwaves, freezing, preservatives, etc.
- Technology has reduced the time and direct cost of food preparation
- Evidence: time spent on food preparation among non-working mothers has fallen 50% in past 25 years
- Greatly reduced the costs of certain types of higher calorie food
Example – French fry

- Americans have always consumed lots of potatoes
- Until recently (post WWII), French fry consumption was limited
- High cost of preparation (peeling, cutting, frying)
- Innovations
  - allowed the fry to be cut, peeled, fried and frozen at central relocation
  - Reheated in oil or in oven
- From 1977-1995, potato use increased by 30% - all of it an increase in fries and chips

Implications

- Greater variety of foods. Therefore, more meals and less food per meal.

  Evidence
  - Increase in snack food
  - Increase in meals
  - Fall in the price of prepared food


- All consumer prices 137%
- Fresh fruit 276%
- Fresh vegetables 252%
- Dairy products 96%
- Frozen food 83%
- Frozen potatoes 93%
- Potato chips 77%
- Ground beef 90%
- Soda 53%

Implications

- Increase in food consumption should be greatest in foods with greater processing

  Evidence
  - Look at change in calories based on farm share of cost. Smaller farm share, less processing. We see the biggest increase in calories in those sectors with small farm share
  - Look at change in calories based on brand names. Brand names have more processing.
Implications

- Individuals that take advantage of technology should have biggest increase in obesity

- Evidence
  - Increase in single males compared to non-working married females
  - Some contrary evidence, big increase for highest educated
Schanzenbach

- National school lunch program
- Serves lunch to 30 million
  - 60% of kids in schools
  - 49% free
  - 9% reduced price
  - Served 187 billion lunches
- Costs
  - Feds pay $6 billion

Why worry about school lunches

- Broad based, impact lots of kids
- Growth follows time series in obesity
  - 7.1 million kids in 1946
  - ~ 30 million in 2003
- High in calories – maybe wrong calories
  - High in fat and saturated fat
- 1995 federal reform to increase RDA of vitamins/minerals, reduce fat, reduce soda (pop for people from the midwest)

My favorite dishes

- Fizzle burger w/ tater tots
- Pork pinwheel (followed by beef pinwheel, chicken pinwheel and turkey pinwheel)
- Gondola pizza boat
- Turkey imperial
- Anything with stuffing
- Ice cream sandwiches
Dishes I did not like

- Johnny Marzetti
- Spaghetti and meatballs
- What ever was the no-meat Friday meal
  - e.g., Fish sticks
- Chuckwagon steak sandwiches (when soy is considered steak)

RD Design

- School lunches subsidized by feds
  - Free is <130% of FPL
  - Reduced cost of 130-185% of FPL
    - Pay 40 cents/meal
  - > 185%, pay full price of $1.75
- Those just above and below 185% of FPL are functionally identical
- However, there is a sharp break in lunch use
- If impact of school lunch on obesity, should see change at 185% of FPL
Do the results make sense?

- $E =$ eat lunch at school
- $P =$ poverty status
- $O =$ obesity
- $\Delta E/\Delta P = 0.044$
- $\Delta O/\Delta P = 0.04$
- $[\Delta O/\Delta P]/[\Delta E/\Delta P] = \Delta O/\Delta E = 0.04/0.044 = 0.909$
- Eating school lunch increases chance of obesity by 91 percentage points. Too large to make sense – but, a great idea