The Obesity Epidemic: An Historical Perspective from North America

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Outline

Definitions of Overweight and Obesity

Long-term Trends in Canada and the United States
  - Adults
  - Children and Youth

Special Considerations for Modeling Obesity Trends
Background
### Classification of Body Weight Status in Adults

<table>
<thead>
<tr>
<th>BMI (kg/m²)</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;18.5</td>
<td>Underweight</td>
</tr>
<tr>
<td>18.5-24.9</td>
<td>Normal Weight</td>
</tr>
<tr>
<td>25-29.9</td>
<td>Overweight</td>
</tr>
<tr>
<td>≥30</td>
<td>Obesity</td>
</tr>
</tbody>
</table>

Variation in Human Physique

BMI = 15.4 kg/m²

BMI = 33.0 kg/m²
**Venus of Willendorf**  
c. 24,000-22,000 BCE  
11.1 cm  
BMI > 40 kg/m²

**Marilyn Monroe**  
1926-1962  
166 cm, 128 lbs  
BMI: 21.1 kg/m²

**Kate Moss**  
1974-  
170 cm, 105 lbs  
BMI: 16.5 kg/m²
Classification of Body Weight Status in Children and Youth

Boys

- Overweight
- Obesity

Girls

- Overweight
- Obesity

Classification of Body Weight Status in Children and Youth

CDC Growth Charts: United States

Body mass index-for-age percentiles:
Girls, 2 to 20 years

CDC Growth Charts: United States

Body mass index-for-age percentiles:
Boys, 2 to 20 years
Obesity Trends Among Canadian and U.S. Adults

1994

2007

< 10%  
10-14%  
15-19%  
≥20%
An Important Consideration

Prevalence of Obesity in Canada, 2005

- Self-reported Height and Weight: 15.5%
- Measured Height and Weight: 24.2%
Measured and Self-reported Obesity Trends Among Canadian Adults
Where is the Burden?

Percentage distribution of household population aged 18 or older, by body mass index (BMI), Canada excluding territories, 1978/79 and 2004.

Data sources: 1978/79 Canada Health Survey; 2004 Canadian Community Health Survey: Nutrition

Tjepkema, Health Reports, 2006.
The Canadian Obesity Epidemic: An Historical Perspective

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A) Men

B) Women
Changes in Extreme Obesity

Katzmarzyk and Mason, CMAJ. 2006.
Obesity in 1953?

THE CANADIAN WEIGHT-HEIGHT SURVEY

BY L. B. PETT AND G. F. OGILVIE

Nutrition Division, Department of National Health and Welfare
Ottawa, Canada

The standard of living and way of life of Canadians is similar in many respects to that of citizens of the United States. Both population groups are endowed with an abundance of foodstuffs and are therefore exposed to the hazards of overnutrition. Before launching or endorsing a campaign against overweight in Canada, a critical study was made of the standards for weight and the criteria used to diagnose obesity. Many sets of tables were in use as “standards” but none had the valid mathematical basis that was desired. Confusion existed over the definition of “overweight” and “obesity” and no objective data were available on different body types.
The Canadian Obesity Epidemic: An Historical Perspective

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Abdominal Obesity in Canada and USA

(*Waist Circumference >88 cm in women or >102 cm in men)

Waist Circumference: Means and Prevalence

Data from U.S. NHANES. Means and prevalences have been age-adjusted to the 2000 Census. High waist circumference defined as >102 cm in men and >88 cm in women.

Table 1. Results of multivariate modeling of BMI and WC controlling for age

<table>
<thead>
<tr>
<th>Survey year</th>
<th>Intercept (95% CI)</th>
<th>Slope (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Black men</td>
<td>White men</td>
</tr>
<tr>
<td>NHES-I (1950 to 1962)</td>
<td>85.2 (84.7, 85.7)</td>
<td>87.7 (87.5, 87.0)</td>
</tr>
<tr>
<td>NHANES-III (1988 to 1994)</td>
<td>87.8 (87.7, 88.1)</td>
<td>91.6 (91.4, 91.8)</td>
</tr>
<tr>
<td>NHANES (1999 to 2000)</td>
<td>87.9 (87.6, 88.2)</td>
<td>92.1 (91.6, 92.6)</td>
</tr>
<tr>
<td>NHANES (2001 to 2002)</td>
<td>88.3 (87.6, 89.0)</td>
<td>92.5 (91.9, 93.1)</td>
</tr>
<tr>
<td>NHANES (2003 to 2004)</td>
<td>88.9 (88.4, 89.4)</td>
<td>92.9 (92.4, 93.4)</td>
</tr>
</tbody>
</table>

WC, waist circumference; CI, confidence interval; NHES, National Health Examination Survey of Adults; NHANES, National Health and Nutrition Examination Study.

(Very) Long-Term Temporal Changes in BMI

Katzmarzyk. In press.
Science and Obesity: Cause and Effect?

![Graph showing the increase in obesity prevalence and scientific publications over time.](image-url)
Prevalence of Overweight and Obesity in Canadian Children and Youth

Data Source: CCHS 2004: Nutrition Component, ages 2-17 y.
Temporal Trends in U.S.

Note: Overweight is defined as BMI >= gender- and weight-specific 95th percentile from the 2000 CDC Growth Charts. Source: National Health Examination Surveys II (ages 6-11) and III (ages 12-17), National Health and Nutrition Examination Surveys I, II, III and 1999-2004, NCHS, CDC.
Conversion of Child to Adult Obesity

The majority of obese children become obese adults.

A minority of obese adults were obese as children.

There are opportunities to gain weight and become obese throughout the lifespan.

12-year partial inter-age correlations, controlling for age and length of follow-up.

<table>
<thead>
<tr>
<th></th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI</td>
<td>0.65</td>
<td>0.59</td>
</tr>
<tr>
<td>FM</td>
<td>0.59</td>
<td>0.64</td>
</tr>
<tr>
<td>FFM</td>
<td>0.65</td>
<td>0.57</td>
</tr>
<tr>
<td>%BF</td>
<td>0.50</td>
<td>0.57</td>
</tr>
<tr>
<td>SF6</td>
<td>0.66</td>
<td>0.44</td>
</tr>
<tr>
<td>(\text{TER}_{\text{adj}})</td>
<td>0.41</td>
<td>0.47</td>
</tr>
</tbody>
</table>

## Stability of Obesity from Childhood to Adulthood

Odds (95% CI) of being obese in young adulthood based on childhood and parental obesity.

<table>
<thead>
<tr>
<th>Age</th>
<th>Obese as a Child yes vs no</th>
<th>No. of Obese Parents 1 vs 0</th>
<th>2 vs 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>1.3 (0.6-3.0)</td>
<td>3.2 (1.8-5.7)</td>
<td>13.6 (3.7-50.4)</td>
</tr>
<tr>
<td>3-5</td>
<td>4.7 (3.5-8.8)</td>
<td>3.0 (1.7-5.3)</td>
<td>15.3 (5.7-41.3)</td>
</tr>
<tr>
<td>6-9</td>
<td>8.8 (4.7-16.5)</td>
<td>2.6 (1.4-4.6)</td>
<td>5.0 (2.1-12.1)</td>
</tr>
<tr>
<td>10-14</td>
<td>22.3 (10.5-47.1)</td>
<td>2.2 (1.2-3.8)</td>
<td>2.0 (0.8-5.2)</td>
</tr>
<tr>
<td>15-17</td>
<td>17.5 (7.7-39.5)</td>
<td>2.2 (1.1-4.3)</td>
<td>5.6 (2.5-12.4)</td>
</tr>
</tbody>
</table>

Implications of the Childhood Obesity Epidemic for Modeling

The majority of obese adults today grew up in a different environment, one in which the prevalence of childhood obesity was low.

The high prevalence of childhood obesity today is “pre-loading” the next generation for a high future adult obesity prevalence.

Models designed to project the future prevalence of obesity should take changes in the childhood obesity prevalence into account.
One Potential Model
A modest proposal to meet our Kyoto commitments: The answer lies within

Approximately 8855 tonnes of excess body fat was stored in Canada in 2000.

If unleashed as electricity, this would provide power to all of Canada for 5 hours.

2. Special consideration must be used when modeling obesity trends in children due to age and maturation effects.

3. Models of adult trends should consider changes in the prevalence of childhood obesity.

4. Care should be taken to differentiate between models using self-reported versus measured indicators of obesity, and more subtle influences such as changes in the age, sex, and ethnicity distribution in the population.
Thank You!

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