Marriage, Income and BMI
How social sorting contributes to the poverty-obesity paradox

Daniel Hruschka
Social Networks, Social Media and the Economics of Food
May 30, 2014
The Worldwide BMI Reversal

~500,000 Women 20-49 y from 47 low- and middle-income countries; low education, breastfeeding, non-pregnant, . Hruschka in press
The Poverty-Obesity Paradox

Also,

Hunger-Obesity Paradox

Food insecurity-Obesity Paradox

Figure from Drewnowski and Specter 2004; Dietz 1995, Sobal and Stunkard 1989...
Traditional Hypotheses about Income

• Resources drive weight
  – *Nutrition* Dietz 1995, Drewnowski and Specter 2004

• Mechanisms & Policy Implications
  – Consuming costly, thinning foods: low energy density fruits, veggies and low fat dairy
  – Easier access to leisure exercise
  – Feast-famine microcycles
  – Increases personal demand for thinness
An Alternative Hypothesis

• Social Sorting via Marriage Markets
  – A preference for spouses with lower BMI
  – A preference for spouses with higher income and wealth
  – Thinner individuals are matched with spouses (and households) with higher income and wealth
  – This creates a reverse income-BMI gradient

Chiappori, Oreffice, and Quintana-Domeque 2012, Oreffice and Quintana-Domeque 2010
Outline of Talk

• Body mass index and body fat
• A tour of the worldwide BMI reversal
• Two kinds of theory for the poverty-obesity paradox
• Empirical tests of contrasting predictions
I. Obesity

• Excess body fat
• Indicators
  – Total body fat
  – % body fat
  – Visceral body fat
• Measures
  – Body mass index (BMI)
  – Waist circumference
  – Skinfolds
  – Direct measures
Body Mass Index

\[ \text{BMI} = \frac{Wt}{Ht^2} \]

Advantages:
- Easy to measure
- Lots of data

Disadvantages:
- A fallible proxy

BMI = 31.97
Obese
Overweight and Obesity

Body Mass Index (BMI) vs. Proportion in population

Overweight
Obese
Gender

Camhi et al. 2011, Obesity
BMI, body fat and ethnicity

Wells 2009

Difference in BMI (kg/m²)

Ethnic group

Black
Ethiopian
Chinese
Indonesian
Thai
Polynesian
Basal body mass

- Unrelated to
  - Diabetes
  - Childhood Illness
- Arises early in development
- Genetic affinity accounts for most variation

Hruschka et al. 2013, Voytyuk and Hruschka in prep, Hadley, Hruschka and Brewis 2014
Tread with caution

• Compare same gender
• Need to standardize for ethnic background.
• Age-standardized comparisons
2. Worldwide BMI Reversal

Women 20-49 y from 47 low- and middle-income countries, Hruschka et al. 2013
The Worldwide BMI Reversal

Women 20-49 y w/ low education from 47 low- and middle-income countries, Hruschka in press
But, not for men

Men 20-49 y from 19 low- and middle-income countries, Hruschka in press
Moving on up

Women

Men

Adjusting for Age and Education. Values for 30-35 y with highest degree = high school
In Global Perspective

Poverty-Obesity Paradox

BMI change with 50% increase in economic resources

Wealth per capita (USD 2005 PPP)
3. Two accounts for the poverty-obesity paradox

• Resource-driven
  – Nutrition Dietz 1995, Drewnowski and Specter 2004
  – Social Science Sobal and Stunkard 1989, McLaren 2007

• Social sorting
  – Economics
    • Marriage and Labor markets
Two accounts

• Resource-driven
  – Consumption of thinning foods
  – Greater opportunity for leisure exercise
  – Greater personal demand for thinness

• Social sorting
  – Sorting in into households of different incomes via marriage markets
Strategy

• Crude BMI by household income can’t discriminate between these two accounts
  – Identify contrasting predictions and assess with finer-grained data
  – Non-experimental data can never definitively establish causality, but we can show which hypotheses are most plausible and which ones can be thrown out (or at least have to be revised)

• Focus on group where paradox is consistently found—U.S. White, non-hispanic women
## 4. Contrasting Predictions

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4a. Heterosexual Married Households

**Resources reduce BMI via consumption**
- Total household income should reduce a wife's BMI, and the effect should be strongest for the income she controls.

**BMI reduces resources via marriage markets**
- A wife's BMI should be negatively correlated with husband's income but not with her own income.

![Graph showing change in BMI from 50% increase in income](image)
4b. Married vs. Never Married

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Hruschka in press, Arcuri & Hruschka in prep
Effect of income—married women

White, non-Hispanic women (20-49). Arcuri & Hruschka in prep
But for never married?

Interactions for NHANES 1, 3 & 2003-2012 are significant at alpha = 0.05, Arcuri & Hruschka in prep.

Interactions for NHANES 1, 3 & 2003-2012 are significant at alpha = 0.05, Arcuri & Hruschka in prep.
Conclusions

• Current data is more consistent with two predictions of social sorting
  – Within-household correlations between BMI and gender-specific income
  – Comparisons of gradients among married and never-married women

• These same data show little support for current articulations of resource-driven theories
A simple dual process model

- Green line: Combined effects of both processes
- Blue line: More resources lead to bigger bodies
- Red line: Markets sort bigger bodies into lower incomes
Open Questions

• Markets for lean and fat mass
  – Dual x-ray absorptiometry measures of body composition from NHANES

• Do we see the same effects in other ethnic groups?

• What effect do marriage markets have on income-BMI relationships in low resource settings.
  – Future work in Bangladesh, Bolivia
Implications

• Theoretical
  – Social process can shape biology, but biology can also shape social process.
  – Need to open dialogue between alternative theories and develop discriminating predictions.

• Practical
  – Myth of personal agency in weight reduction
  – Policies related to the poverty-wealth paradox
  – Turns attention to broader structural inequality
Thank you

- Symposium organizers
- Alexandra Brewis
- Craig Hadley
- Alesandro Arcuri
- Mariya Voytyuk
- NHANES
- DHS Measure, participating countries, and survey participants
## Sample sizes

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<tr>
<th>Sample</th>
<th>Married women</th>
<th>Never Married women</th>
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<tr>
<td>NHANES (2003-2012)</td>
<td>1238</td>
<td>542</td>
</tr>
<tr>
<td>NHANES 3</td>
<td>1004</td>
<td>219</td>
</tr>
<tr>
<td>NHANES 2</td>
<td>3960</td>
<td>1128</td>
</tr>
<tr>
<td>NHANES 1</td>
<td>3992</td>
<td>557</td>
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Apportioning Household Wealth

- DHS asset factor score provides ranking of individuals on wealth.
- Gini coefficient gives us approximate function of how much of total wealth is allocated to the ith person.
- Total wealth is wealth per capita estimated from Davies et al. 2009 multiplied by number of people in distribution.
Notable studies with kids

• NHANES 3. No significant effect of food insufficiency on childhood or adolescent overweight after controlling for other factors (Alaimo et al. 1999).

• Recent
Null Model

• Outcome—body mass index (kg/m²)
• Fixed Effects
  – Age (y)
  – Education
  – Ln(household budget per cap per day)
• Random Effects
  – Subdistricts
• Split samples by HH budget
  – < 2, 2-6, & > 6 USD

Hruschka, Rush & Brewis, AJPA, 2013
Hruschka & Brewis, EHB, 2012
Hruschka, Hadley & Brewis, submitted
## BMI and fatness

<table>
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<tr>
<td>Total Body Fat</td>
<td>0.90-0.96</td>
</tr>
<tr>
<td>% Body Fat</td>
<td>0.80-0.85</td>
</tr>
<tr>
<td>Visceral Body Fat</td>
<td>0.61-0.69</td>
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Two theories for the reversal

- **Resource-driven Theories.** Income and wealth reduce female body size through a direct effect on food consumption and exercise behavior. Specifically, women with more household economic resources are more able to achieve the slim body ideal in a high wealth society.

- **Body size-driven Theories.** Women with thinner bodies are able to achieve greater household income and wealth through marriage and labor markets where lower BMI is given a premium.
"People . . . are going to economize, and as they save money on food they will be eating more empty calories or foods high in sugar, saturated fats and refined grains, which are cheaper. Things are going to get worse. Obesity is a toxic result of a failing economic environment."

A. Drewnowski quote in Jan. 2009 Reuters article
Slide showing how wealth is allocated.
Hruschka et al. 2013, Hadley, Hruschka and Brewis 2014, Hruschka et al. submitted
Fig. 2. Average annual changes in BMI before and after the 2008 downturn. Error bars are 95% confidence intervals for change estimates.

Hruschka 2012, data from BRFSS
Longitudinal studies

- **Low-income**: post-Soviet Cuba (Franco et al. 2007)
- **Middle-income**: post-Soviet eastern Europe (Silventoinen et al. 2004)