VARIABILITY IN HIGH FRUIT AND VEGETABLE CONSUMPTION ACROSS WORLD REGIONS

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June 8, 2009
OUTLINE

- Background
- Methods
- Results
- Conclusions
- Implications for Policy and Practice
HEALTH EFFECTS

- High fruit and vegetable consumption decreases risk of obesity, coronary heart disease, stroke, type 2 diabetes, hypertension, macular degeneration, cataracts, and various cancers

- Increasing dietary intake of fruit and vegetables to 400 grams/day (5 servings) could prevent...
  - 31% of ischaemic heart disease
  - 20% of oesophageal cancer
  - 19% of ischaemic stroke
  - 19% of gastric cancer
  - 12% of lung cancer

Lock, Pomerleau, Causer, & McKee (2004); WHO (1990); WHO/FAO (2003)
Little data exists with respect to regional-level fruit and vegetable consumption patterns, particularly with respect to trends in developing countries.
METHODS

• 2002–2003 World Health Survey
• Self-reported observations from 52 countries (n=160,862)
• High fruit and vegetable intake (HFV) defined as consuming five or more servings of fruit and/or vegetables daily
• Does world region moderate the association of income with high fruit and vegetable consumption?
INDEPENDENT VARIABLES

- Income – centered on country mean
- Education – “years of schooling” country-centered
- Age – continuous country-centered
- Urbanicity
- Sex
- World regions – Asia, Middle East/North Africa, Africa, South America, Europe (referent)
STATISTICAL ANALYSIS

• Multilevel Logistic Regression Model
  – Random Intercepts Model
    • Country (group) intercepts allowed to vary for countries
    • Accounts for the clustering of individuals within countries

• 3 Models
  – Null Model: ICC
  – Model 1: individual variables (within country)
  – Model 2: regional context and income interaction

• Likelihood Ratio Tests
RESULTS

• Global prevalence of HFV = 25.1%
  – Age-adjusted and included sampling weights

• Income positively associated with high fruit and vegetable consumption across all regions; strength varied by region
<table>
<thead>
<tr>
<th>Variables</th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income</td>
<td>1.36 (1.32-1.39)***</td>
<td>1.30 (1.22-1.39)***</td>
</tr>
<tr>
<td>Education</td>
<td>1.01 (1.01-1.02)***</td>
<td>1.01 (1.01-1.02)***</td>
</tr>
<tr>
<td>Age</td>
<td>0.996 (0.995-0.997)***</td>
<td>0.996 (0.995-0.997)***</td>
</tr>
<tr>
<td>Sex</td>
<td>0.98 (0.96-1.01)</td>
<td>0.99 (0.96-1.01)</td>
</tr>
<tr>
<td>Urbanicity</td>
<td>0.82 (0.79-0.84)***</td>
<td>0.82 (0.79-0.84)***</td>
</tr>
<tr>
<td>Africa</td>
<td>---</td>
<td>1.42 (0.68-2.96)</td>
</tr>
<tr>
<td>Middle East/North Africa</td>
<td>---</td>
<td>0.55 (0.20-1.52)</td>
</tr>
<tr>
<td>South America</td>
<td>---</td>
<td>1.48 (0.57-3.84)</td>
</tr>
<tr>
<td>Asia</td>
<td>---</td>
<td>0.53 (0.24-1.17)</td>
</tr>
<tr>
<td>Europe (referent)</td>
<td>---</td>
<td>1.00</td>
</tr>
<tr>
<td>Africa * Income</td>
<td>---</td>
<td>1.05 (0.98-1.14)</td>
</tr>
<tr>
<td>MENA * Income</td>
<td>---</td>
<td>1.19 (1.06-1.35)***</td>
</tr>
<tr>
<td>South America * Income</td>
<td>---</td>
<td>0.90 (0.83-0.98)*</td>
</tr>
<tr>
<td>Asia * Income</td>
<td>---</td>
<td>1.10 (1.02-1.18)*</td>
</tr>
<tr>
<td>$\sigma^2$</td>
<td>1.04</td>
<td>0.96</td>
</tr>
<tr>
<td>LR Test</td>
<td>1112.24***</td>
<td>60.98***</td>
</tr>
</tbody>
</table>

* $p<0.05$; ** $p<0.01$; *** $p<0.001$
REGION MODIFIES ASSOCIATION OF INCOME WITH HFV CONSUMPTION
CONCLUSIONS

• Inequalities in fruit and vegetable consumption exist across geographical regions
• Recognizing these regional differences will facilitate effective design, implementation, and evaluation of public health interventions and cross-national policies to reduce the global burden of chronic disease
• Establish regional, national, and international food and nutrition policies to ensure that all people at all times have equitable and dignified access to sufficient, safe, healthy, and culturally appropriate food including adequate fruit and vegetables.

• Engage influential and diverse stakeholders and provide infrastructure support.
In May 2004, the 57th World Health Assembly (WHA) endorsed the World Health Organization (WHO) Global Strategy on Diet, Physical Activity and Health. The Strategy was developed through a wide-ranging series of consultations with all concerned stakeholders in response to a request from Member States at World Health Assembly 2002 (Resolution WHA55.23).
• Global public health programs and policies should target lower income groups
• Introduce FV subsidies
• Levy tax on foods of low nutritional value
• Increase nutrition education
• Stricter controls on the marketing of foods
  – Development of regional marketing and communication strategies
ACKNOWLEDGEMENTS

- Co-investigators: Spencer Moore, PhD, MPH; Sam Harper, PhD; and John Lynch, PhD
- Research on the WHS was made possible by a research grant from the CIHR – Institute of Population Health, WHO-Analysis of the World Health Survey, #162602
• The estimated ICC is calculated as:

$$\rho_I = \frac{r_0^2}{r_0^2 + \pi^2/3},$$

where $\rho_I$ is the ICC value, $r_0^2$ is the intercept variance, and $\pi$ is 3.14159.

• ICC is fraction of total variability that is due to the group level.