Coffee & Conversation about Research
College of Health, Education & Human Development
Clemson University

Design and Implementation of Policy-Relevant Research

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Talk Outline

- Introduction
  - Background
  - Policy-relevant research
- Sample Research
  - Cost-effectiveness analysis
  - Dynamic population-based model
  - GIS
  - Multi-level modeling
Does my research address an important policy issue?

Does my research produce results that facilitate policy making?
Design of Policy– Relevant Research

- For observational research, “design” means
  - Formulate relevant research questions
  - Build relevant constructs and measures
  - Employ appropriate analytic methods
  - Produce results understandable and meaningful to policy debate

- For quasi–experimental research
  - All the above plus appropriate evaluation design
Sample Research

1. Tobacco control policies
2. Food and alcohol environment
Cost–Effectiveness Analysis of Tobacco Control Policy
Recommended Expansion Pathway (without cost offset) for Tobacco Control Policy

![Graph showing VND Millions vs. Thousand DALYs with points for Current practice, Graphic label, Tax (55% - 75%), Smoking ban (public), and Smoking ban (work).]
Critical Questions when Trying to “Intervene”

1. How bad if choose “Do nothing”? 
2. Is a new intervention or an alternative intervention worth doing?
3. What are the most cost-effective ways to control or address a particular health problem (e.g. cardiovascular disease)?
4. What are the most cost-effective combinations of all possible interventions?
Cost-Effectiveness Analysis (CEA) is a comparative analysis of alternative courses of action in terms of both their costs and consequences. Able to “compare apples to oranges” if using the same units for resources used and benefits gained.
Intervention is less effective and more costly

Less effective

Less effective and less costly

Intervention is less effective and more costly

More costly

Intervention is more effective and more costly

More effective

Intervention is more effective and less costly

Less costly
High willingness-to-pay

Cost

Effect

Anti smoking programs
A
A+B+C

X+Y+Z

Reproductive health programs
X+Y
X

THRESHOLD SLOPE 1
(never be on a slope that is steeper than these slope indicators)
Low willingness-to-pay

Cost

Effect

Anti smoking programs

A+B+C

A+B

A

X+Y+Z

X+Y

X

Reproductive health programs

THRESHOLD SLOPE 2 (never be on a slope that is steeper)
Dominated choices lie above the expansion path. They are possible to achieve but deliver less health at higher cost than other options.

“Expansion Path” Lines say what is possible to achieve at lowest cost per health gain.
Defining Interventions

- “Interventions” understood in broadest sense
  - Any use of resources aimed at improving health outcomes (preventive, promotive, curative, rehabilitative, palliative, clinical care, public health programs, and strategies)
  - Non-health interventions can be effective in delivering health benefits

- To measure costs and benefits of an intervention, need a precise definition of the intervention
Implementation Period and Time Horizon

- Depending on nature of interventions
  - Small-scale intervention: Fully account for all costs
  - Population-based policy: Suggested to estimate costs over a period of 10 years at full implementation

- Annual health effects may be identical or gradually increase each year

- Time-horizon for the analysis is longer
  - E.g. Interventions to cut teen smoking
    - Estimate interventions costs for 10 years
    - Expected impacts on smoking-related diseases would not begin to emerge for many years in future
  - Analysis involved modeling and simulation
Estimating Costs

- Include *opportunity costs*, defined as the cost of not selecting the "next-best" alternative
- Costs should be discounted at an annual rate of 3%
- Prices adjusted to a common year using the GDP deflator, or at least the Consumer Price Index
- Interventions interact in terms of costs: Costs of undertaking two interventions together is not necessarily additive, nor cost of joint production → Interacting interventions evaluated as a group
## Intervention Costs

### Table 4. Intervention cost

<table>
<thead>
<tr>
<th>Resource component</th>
<th>Tax increase</th>
<th>Graphic pack warning label</th>
<th>Mass media campaign</th>
<th>Smoking ban (public/work)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy development and evaluation</td>
<td>300</td>
<td>90</td>
<td>0</td>
<td>90</td>
</tr>
<tr>
<td>Human resource requirements</td>
<td>6,537</td>
<td>922</td>
<td>1,085</td>
<td>122,371</td>
</tr>
<tr>
<td>Media and advocacy</td>
<td>761</td>
<td>83</td>
<td>145,751</td>
<td>1,863</td>
</tr>
<tr>
<td>Program supplies</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>47,583</td>
</tr>
<tr>
<td>Rent, utilities, equipment, office supplies</td>
<td>4,214</td>
<td>397</td>
<td>723</td>
<td>41,943</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11,827</strong></td>
<td><strong>1,492</strong></td>
<td><strong>147,559</strong></td>
<td><strong>213,850</strong></td>
</tr>
</tbody>
</table>
Cost Offsets

- If a disease/complication is prevented by intervention, then no need for treatments that otherwise would have been necessary → ‘cost offsets’
- This is an economic cost but often not a financial cost saving!
- We tend to ignore costs of treating any other disease, e.g. when extending life (there is some controversy among health economists about this)
Defining health outcomes of interest
  › Non-fatal health outcomes (Applying disability weight)
  › Age-weighting
  › Years of life lost due to mortality

Estimating population effectiveness
  › Defining cluster of interrelated interventions
  › Defining epidemiological profile of the null (based on natural history models, RCT, observational data)
  › Constructing a population model

Estimating effectiveness of interventions
  › Expressed in DALYs
  › Data on efficacy of interventions comes from systematic reviews and individual studies
  › Health state valuations come from burden of disease study
Disability-Adjusted Life Years (DALYs)

- YLL: Years of Life Lost (due to death)
- YLD: Years of Life lived with Disability, weighted by the severity of disability

\[
\text{DALYS from a disease} = \text{YLL} + \text{YLD}
\]

- Using DALYs to measure benefits of an intervention: DALYs averted
Population Model

- Anchored in WHO–CHOICE (CHOosing Interventions that are Cost–Effective)
  - Utilize various external sources of data and studies to estimate costs (CostIt) and impacts on population health of key interventions
  - Apply population model (PopMod) to calculate cost–effectiveness of interventions for a standardized population
  - Use “Monte Carlo League” (MCLeague) to estimate uncertainty around costs and effects
Followed up population to analyse cost and health gains associated with four tobacco control interventions: excise tax increase; graphic cigarette pack warning labels; mass media campaigns; and smoking bans.

Model constructed such that interventions affect the smoking uptake and cessation behaviours of the age cohorts and the resulting smoking prevalence would define their health outcomes.

Intervention costs estimated for 10 years at full implementation.

Tracing benefits till youngest cohort’s death.
Application of GIS
Where you live affects your health?
Theories helpful to guide but novel empirical approach needed to shed light on any practically meaningful relationship

How to define “where” and its attributes?
  ◦ GIS employed as a tool to deal with measurement
  ◦ Exploratory approach results in thousands of pages of data analyses
Why GIS?

Various Definitions of Attributes

- Objective vs. Subjective
- Built/Physical vs. Social/Intangible
- Absolute vs. Relative
  - # alcohol outlets vs. # of outlets/1,000 pop
  - # convenience stores vs. # of stores/road miles
  - # fast food restaurants vs. # proportion of fast food restaurants to all food outlets
Various Definitions of Neighborhoods

- Conventional approach:
  - Neighborhoods proxied by census tracts
  - Administrative units used

- New Approach
  - Buffers around tracts
  - Circular buffers around home
  - Street network analysis
Urban vs. Rural

Urban setting
Aerial distance from A to B: 1,419m
Roadway: 2,090m

Rural setting
aerial distance from A to B: 1,419m
Roadway: 2,845m
Different Community Designs

AN urban school surrounded by alcohol outlets within 800m roadway

An urban school with the closest alcohol outlet more than 800m roadway distance away
## Disparities in Alcohol Environment around Homes in California

### Mean Number of All Alcohol Outlets Around Residences by Race/Ethnicity and Income

<table>
<thead>
<tr>
<th>Groups</th>
<th>0.1 mile radii</th>
<th>0.1-0.5 mile bands</th>
<th>0.5-1.0 mile bands</th>
<th>1.0-2.0 mile bands</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All Race/Ethnicity Groups</strong></td>
<td>0.30</td>
<td>6.97</td>
<td>19.20</td>
<td>61.55</td>
</tr>
<tr>
<td><strong>White (Ref. Grp)</strong></td>
<td>0.21</td>
<td>5.27</td>
<td>15.23</td>
<td>49.78</td>
</tr>
<tr>
<td>Black</td>
<td>0.24 ***</td>
<td>6.22 ***</td>
<td>17.50 ***</td>
<td>63.63 ***</td>
</tr>
<tr>
<td>Hispanic</td>
<td>0.39 ***</td>
<td>8.10 ***</td>
<td>21.79 ***</td>
<td>68.38 ***</td>
</tr>
<tr>
<td>Asian/Pacific Islander</td>
<td>0.33 ***</td>
<td>9.18 ***</td>
<td>24.04 ***</td>
<td>74.53 ***</td>
</tr>
<tr>
<td>Other races</td>
<td>0.36 ***</td>
<td>6.22 ***</td>
<td>19.15 **</td>
<td>62.44 **</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>All Income Groups</strong></th>
<th><strong>Lowest Income Quartile (Ref. Grp)</strong></th>
<th><strong>2nd Income Quartile</strong></th>
<th><strong>3rd Income Quartile</strong></th>
<th><strong>Highest Income Quartile</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.44</td>
<td>9.09</td>
<td>23.70</td>
<td>74.55</td>
</tr>
<tr>
<td>B</td>
<td>0.34 ***</td>
<td>7.03 ***</td>
<td>19.37 ***</td>
<td>59.81 ***</td>
</tr>
<tr>
<td>C</td>
<td>0.20 ***</td>
<td>5.66 ***</td>
<td>16.16 ***</td>
<td>52.52 ***</td>
</tr>
<tr>
<td>D</td>
<td>0.16 ***</td>
<td>5.21 ***</td>
<td>15.67 ***</td>
<td>54.54 ***</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>White</strong></th>
<th><strong>Lowest Income Quartile (Ref. Grp)</strong></th>
<th><strong>2nd Income Quartile</strong></th>
<th><strong>3rd Income Quartile</strong></th>
<th><strong>Highest Income Quartile</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>E Hispanic</td>
<td>0.30</td>
<td>8.41</td>
<td>21.46</td>
<td>78.42</td>
</tr>
<tr>
<td>F Asian/Pacific Islander</td>
<td>0.24 *</td>
<td>5.43 ***</td>
<td>16.84</td>
<td>60.48 *</td>
</tr>
<tr>
<td>G Other races</td>
<td>0.24 *</td>
<td>5.46 ***</td>
<td>16.17 *</td>
<td>57.63 **</td>
</tr>
</tbody>
</table>

| **Highest Income Quartile** | 0.10 ** | 4.29 **** | 12.58 ** | 48.16 *** |

### Note:
Sample includes Hispanic households with children ages 0-17.
* indicates significance at 5% level; ** at 1% level; *** at 0.1% level.
Reference group is in *Italic* in each panel. Statistics are weighted.
# Neighborhood Alcohol Retailers and Adolescent Drinking

## Results from Multivariate Logistic Regression

<table>
<thead>
<tr>
<th>Explanatory Variable</th>
<th>1 drink past 30 days</th>
<th>5 drinks past 30 days</th>
<th>Driving after Drinking</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>95% C.I.</td>
<td>OR</td>
</tr>
<tr>
<td>All licenses 0.5 mile radius</td>
<td>1.009</td>
<td>(0.90, 1.03)</td>
<td>1.027</td>
</tr>
<tr>
<td>All licenses 0.5-1.0 mile band</td>
<td>0.993</td>
<td>(0.98, 1.01)</td>
<td>0.982</td>
</tr>
<tr>
<td>All licenses 1.0-2.0 mile band</td>
<td>1.001</td>
<td>(1.00, 1.00)</td>
<td>1.000</td>
</tr>
</tbody>
</table>

*** indicates significance at 0.1% level.
More favorable alcohol environment could cut adolescent problem drinking by one-eighth to one-quarter.
Food Environment & Obesity
An application of GIS and Multilevel Modeling
InfoUSA: ~ 14 million private and public US companies, located by address geocoding
Socioeconomics of 7,049 census tracts in California from Census 2000
North American Industry Classification System (NAICS) used to identify and classify food outlet types
California Health Interview Survey: 43,020 adults aged 18 or higher
Defining Food Environment

This study proposes an alternative measure to the RFEI, called the ‘Physical Food Environment Indicator’ (PFEI), and tests its association with adult body mass index (BMI) and obesity in California. The predictive value of PFEI has been analysed at two levels: county and census tract. The PFEI is defined as:

\[
PFEI = \frac{F + C + S}{F + C + S + L + P}
\]

where F, C, S, L and P are the number of fast-food restaurants, convenience stores, small food stores, supermarkets and produce vendors, respectively. Including all outlet types in the denominator reduced the fraction of all tracts in California with an undefined food index measure to 15%. Small food
Much variation in unadjusted obesity rates due to population heterogeneity

After controlling for population heterogeneity, adjusted obesity still positively associated with the PFEI
Key Finding 2

- Relationship is statistically significant but not practically meaningful.
- PFEI has a minimal impact on individual BMI and obesity.
6.7% of the total variation in obesity occurs at tract level.

- This fraction reduced to 3.1% when including individual characteristics in model
- Reduced to 2.1% with the addition of tract-level sociodemographic characteristics
- To 1.9% with the addition of the PFEI.

Contextual effect of the physical food environment minimal relative to the compositional effect.
Thank you!