Why I love PA
Where I am going?

• Describe how economists think about physical activity
• Review economic studies on physical activity
• Present preliminary results from our study
  – What factors are associated with physical activity?
  – What is the effect of area level characteristics on physical activity?
  – How do policies targeted towards other health behaviors interact with physical activity?
  – Does adding measure of preventive behavior affect estimates?
• Future research
Why Physical Activity?

- Cost of illness study finds inactivity cost one health plan $86 million (Garret et al, 2004).
- Inactivity accounts for ~11 percent of the attributable fraction of medical expenditures (Shinogle, 2008).
- Walking may improve blood pressure, lower % body fat, decrease BMI (Murphy et al, 2007).
- Physical Activity, even at low doses improves Cardiorespiratory fitness no matter what weight (Church et al, 2007).
How does an economist look at the issue?

- Economists look at choices when constrained by wealth, time.
- Unintended consequences; What if?
- Cawley, 2004 – SLOTH Model
  - People maximize utility subject to three constraints: time, budget and biology
  - For time constraint they use the SLOTH framework. People spend their time on Sleep, Leisure, Occupation, Transportation, or Household work.
  - Trade-offs between each may occur
Another (Our) Model

• People maximize utility (what they value) subject to income and time constraints
  
  – Utility is function of health, which is both produced and consumed. Utility is also a function of PA, other goods.
  
  – Health is produced through various components one is physical activity (which requires goods and time to produce)
  
  – Constrained by a full wealth budget and time
Model

- Health production includes goods that may complement (utilized together) or substitute for PA in different pathways.

- Consumption, Production
  - Consumption – substitute hour drinking with friends for hour playing football with friends
  - Production – may not value exercise but increase activity if it enhances productivity of other inputs to health production such as medications.
Model

- PA has a direct effect on utility $U_A$
- PA has an indirect effect on utility through the health production function $U_{Hh_A}$
- the full price of physical activity
  - the opportunity cost of time as well as the price of physical activity inputs.
Background - Economics

• Rashad (2007) cycling – gas prices (+), urban sprawl (-), income (-), marital status (-).

• Kaestner and Xu (2006) – Title IX increase female physical activity

• Sturm (2004) – increased leisure time (sedentary activities grew faster), increased time in transportation.
Background - Economics

• Humphreys and Ruseki (2007)
  – Income and education (+)
  – Park and Recreational spending (+) outdoor activities (both probability and time spent); (+) individual sports

• Courtemanche and Cardin (2008)
  – Regular Wal-Mart decreases probability of regular exercise
  – But they increase fruit/veg consumption, decrease fat, decrease BMI – no need to exercise?
Background - Economics

• Mullahy and Rober, 2008
  – ATUS 2005, 2006
  – Education associated with increased PA on weekends/holidays
  – Males with spouses decrease in PA
  – Females less PA on weekend/holidays
Data Issues

- Measures of PA (all kinds), rich data on individual, family, other health measures
- Longitudinal data
- Geographic identifiers
- Exogenous shock
- Prefer national data
- We settle with:
  - Behavioral Risk Factors Surveillance Survey 2000-2005
  - Years utilized depend on outcome variables and years of area variables
Dependent Variable

- Any leisure time exercise in past 30 days. (2000-2005)
- Vigorous leisure time activity (2003, 2005)
  - Vigorous Activity 3 or more times a week for at least 20 minutes
- Vigorous or Moderate leisure time activity (2003, 2005)
  - Light to Moderate Activity for 5 or more times a week for at least 30 minutes
# Trends

## Estimates of Physical Activity from Various Data Sources

<table>
<thead>
<tr>
<th>Percent of Adult Population</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>NHIS estimate inactive</td>
<td>29.9</td>
<td>30.1</td>
<td>29.5</td>
<td>30.4</td>
<td>29.3</td>
</tr>
<tr>
<td>BRFSS any exercise</td>
<td>75.88</td>
<td>76.94</td>
<td>77.2</td>
<td>77.26</td>
<td>77.64</td>
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<tr>
<td>BRFSS vigorous PA</td>
<td></td>
<td></td>
<td>25.01</td>
<td></td>
<td>24.53</td>
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<tr>
<td>BRFSS moderate or vigorous PA</td>
<td></td>
<td></td>
<td>45.56</td>
<td></td>
<td>45.71</td>
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</table>
Key Measures

• Price of related good – other health behaviors
  – Offsetting behavior on production
  – Substitutes for “enjoyment”, weight loss
  – Compliments – gateway effect, correlation of risks
  – Smoking laws
    • cigarette tax
  – Drinking laws
    • beer tax
Key Measures

- **Area effects**
  - Selection effect - exercise prone people locate in areas where they have these amenities
  - Supply effect – Industries locate in areas where demand is high
  - Lowers time costs – if amenities are closer
    - Parks per capita
    - Gyms per capita
    - Other recreational facilities per capita

- **Overweight, Obese**

- **Unobserved taste for prevention**
  - Flu shot
Key Measures

• Area level data
  – County level crime – violent and property
  – Price information from ACCRA
    • Gas, Bus Fare, Bowling, Tennis balls,
  – County Unemployment Rate
Methods

• Linear Probability Models
• State and year fixed effects
• Models
  – Demographics only
  – Add area variables
  – Add weight (obese, overweight) variables
  – Add flu shot
  – Add month fixed effects
  – Full model stratified by gender, income
Results- Any exercise

• Demographic
  – Males, White (+)
  – Age, Married, Uninsured (-)
  – Income, Education (+)
  – Retired, Student/homemaker, unemployed (+)

• Area variables
  – Unemployment (-)
    • Ruhm finds opposite
  – Both Parks and Gyms per capita (+)
  – Beer, cigarette taxes – no effect
  – Gas price (-)
  – Bus price (+)
  – Crime – no effect
Results-Any exercise

- Overweight (-), Obese (-)
- Flu Shot (+)
- Month Fixed effects
  - PA increases during spring, peaks summer, fall and then declines
Results – Vigorous Exercise

• Area effects – similar except county unemployment no longer significant

• Higher taxes on cigarettes, beer associated with decrease in vigorous PA
Stratified by Gender

- Men participation decreases with age at a diminishing rate while for women it decreases at an increasing rate.

- Gyms per capita significant for men but not women

- Overweight is negative in pooled results but becomes significant and positive in men
  - BMI not a good measure for men?
Income Stratification

- Marriage (-) effect declines with increasing income

- Out of work effect more pronounced in lower incomes

- Overweight (-) sig only at the higher income categories while obese has a stable negative effect across all income categories.

- Gyms per capita significant only at incomes >$35,000
Preliminary Conclusions

• Demographics have expected effects in all models
• Own price effects small and mixed.
• Area effects are gender specific
• Declines in vigorous exercise maybe associated with a decrease in smoking and drinking (compliments).
Future work

• Re-evaluate with other data – NHIS
• Examine other policies
  – Exposure to Title IX
  – No Child Left Behind
  – Access to play versus organized sports
  – Price measures
Other areas of research

• Disentangle the area effects
  – selection effects,
  – supply effects,
  – time cost
  – unobservables

• Examine correlation of health behaviors – unobservables such as time preferences, risk preferences

• Trade off between leisure time and other PA (transportation, work)
Policy Implications

• Factors affecting physical activity differ for males, females as well as by income
  – No one policy fits all
• Sin Taxes – no positive spillovers, may even be negative
• Physical Activity Stamps
  – Access no effect on low income population
• Deduct of physical activity expenses – FSA
• Give everyone a dog (Bauman, 2008)
My preference for dog
Unintended consequence
### NHIS Data

#### Number of Office Visits in Past 12 Months

<table>
<thead>
<tr>
<th>Number of Visits</th>
<th>Others</th>
<th>Active</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>20.1%</td>
<td>17.8%</td>
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<tr>
<td>1</td>
<td>15.5%</td>
<td>18.7%</td>
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<td>2 to 3</td>
<td>23.5%</td>
<td>28.0%</td>
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<tr>
<td>4 to 5</td>
<td>13.8%</td>
<td>13.8%</td>
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<tr>
<td>6 to 7</td>
<td>7.1%</td>
<td>6.6%</td>
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<tr>
<td>8 to 9</td>
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<td>10 to 12</td>
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<td>13 to 15</td>
<td>2.6%</td>
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</tr>
<tr>
<td>16 or more</td>
<td>6.9%</td>
<td>5.0%</td>
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# NHIS data

<table>
<thead>
<tr>
<th>Number of Visits</th>
<th>other (%)</th>
<th>active (%)</th>
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<tbody>
<tr>
<td>0</td>
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<td>1</td>
<td>13.52%</td>
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<td>2 to 3</td>
<td>5.92%</td>
<td>4.23%</td>
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<td>4 to 5</td>
<td>1.35%</td>
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<td>6 to 7</td>
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<td>0.15%</td>
<td>0.06%</td>
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100.00% 100.00%

p<0.001
## NHIS Data

No. of Times in Hospital Overnight in past 12 months

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<tr>
<th></th>
<th>Regularly others</th>
<th>Active</th>
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<tr>
<td>1</td>
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<tr>
<td>2</td>
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<td>3</td>
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