Physical Activity:
Economic and Policy Factors

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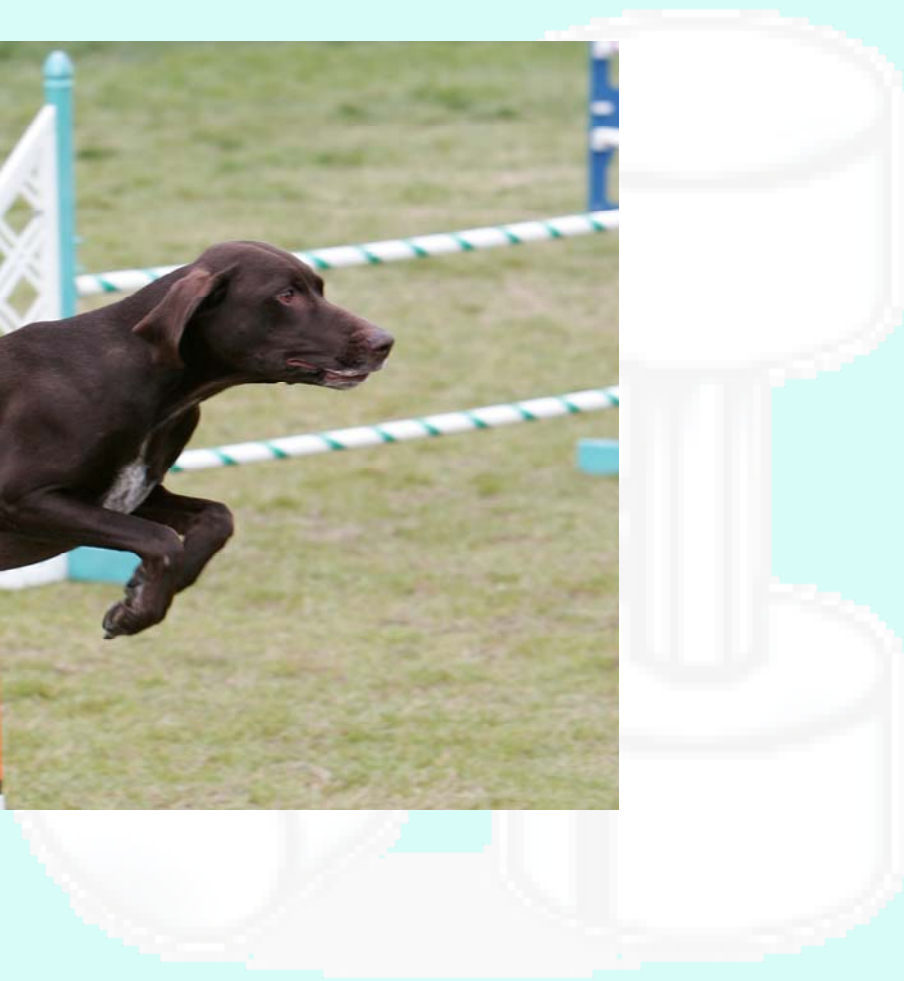County

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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?
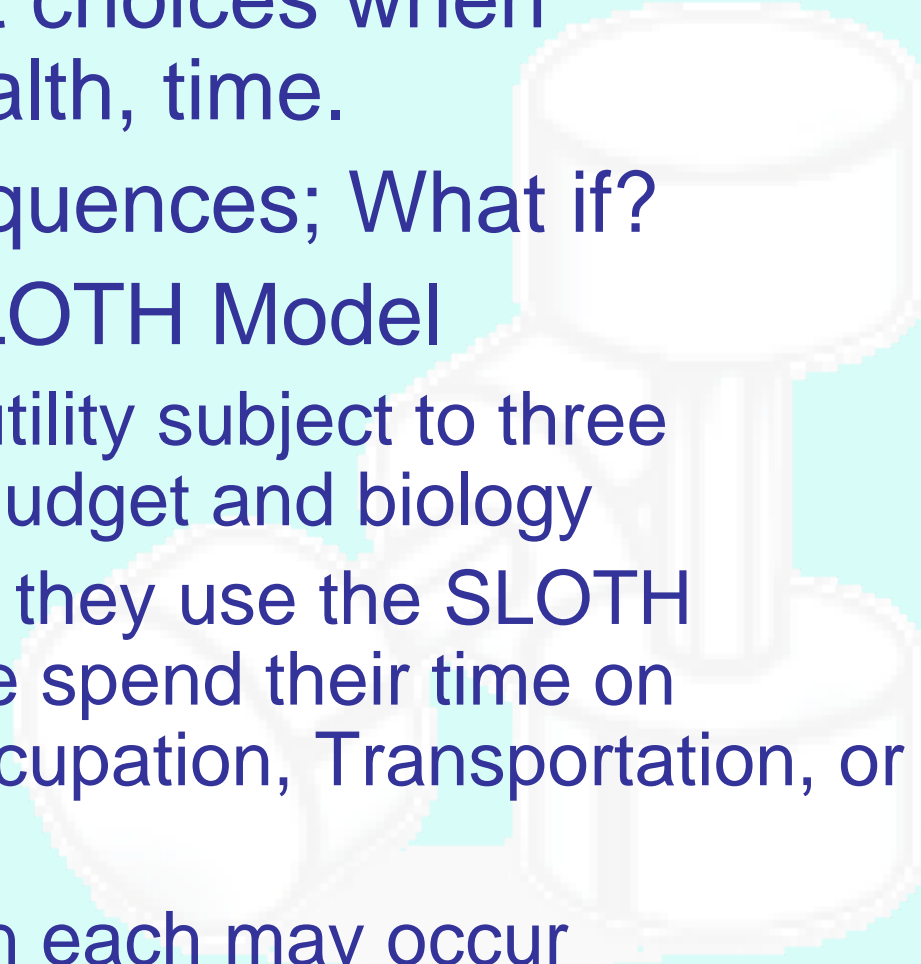- **Future research**

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).
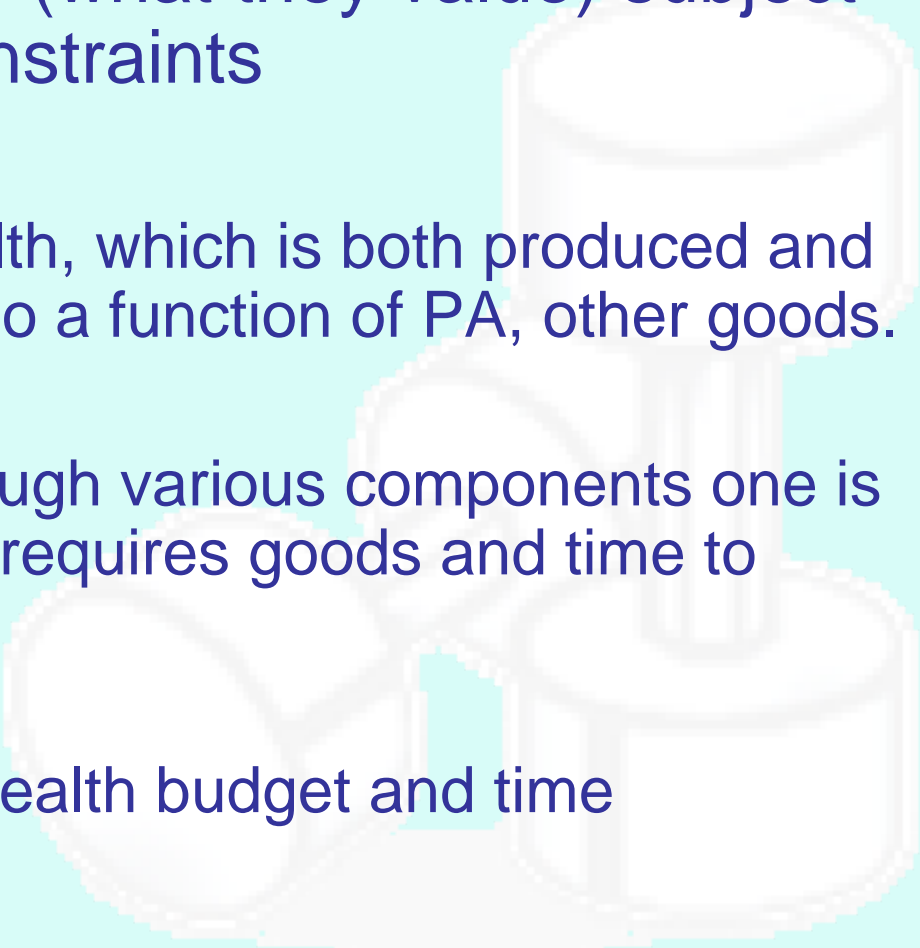
How does an economist look at the issue?

- 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
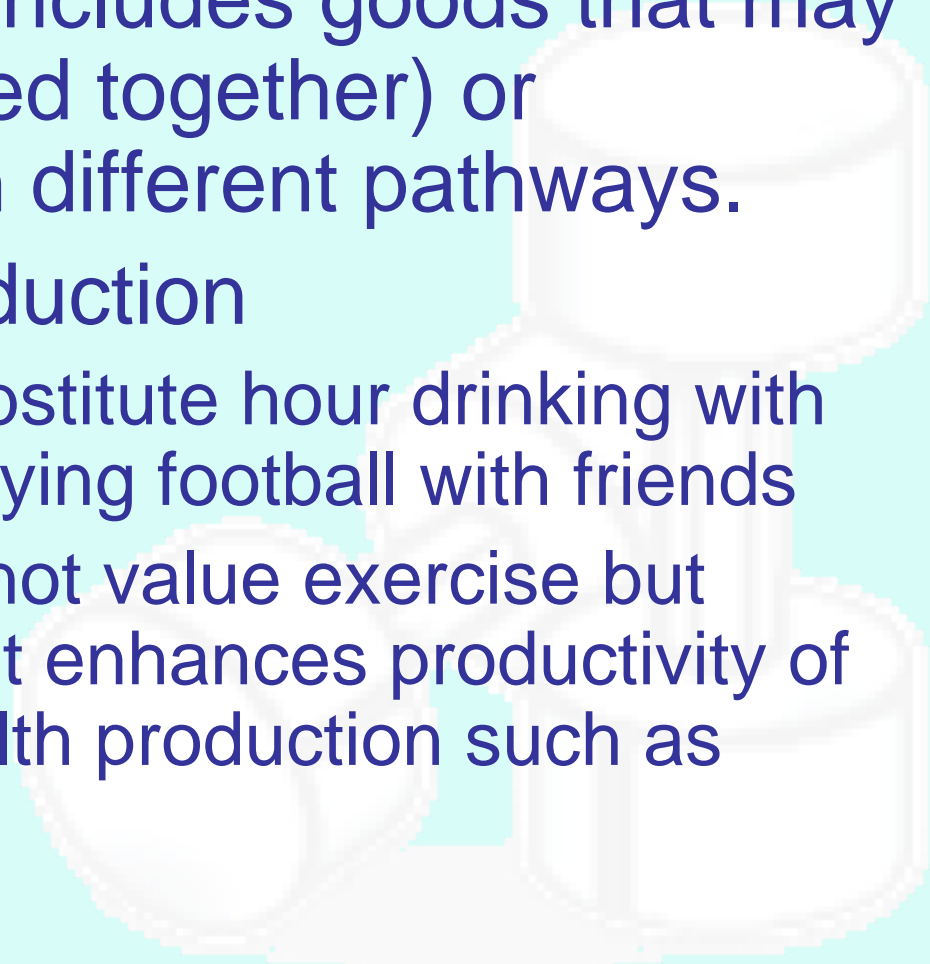
- People maximize utility (what they value) subject to income and time constraints

  - 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)

 - Constrainted 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 $U_H h_A$
- the full price of physical activity
  - the opportunity cost of time as well as the price of physical activity inputs.
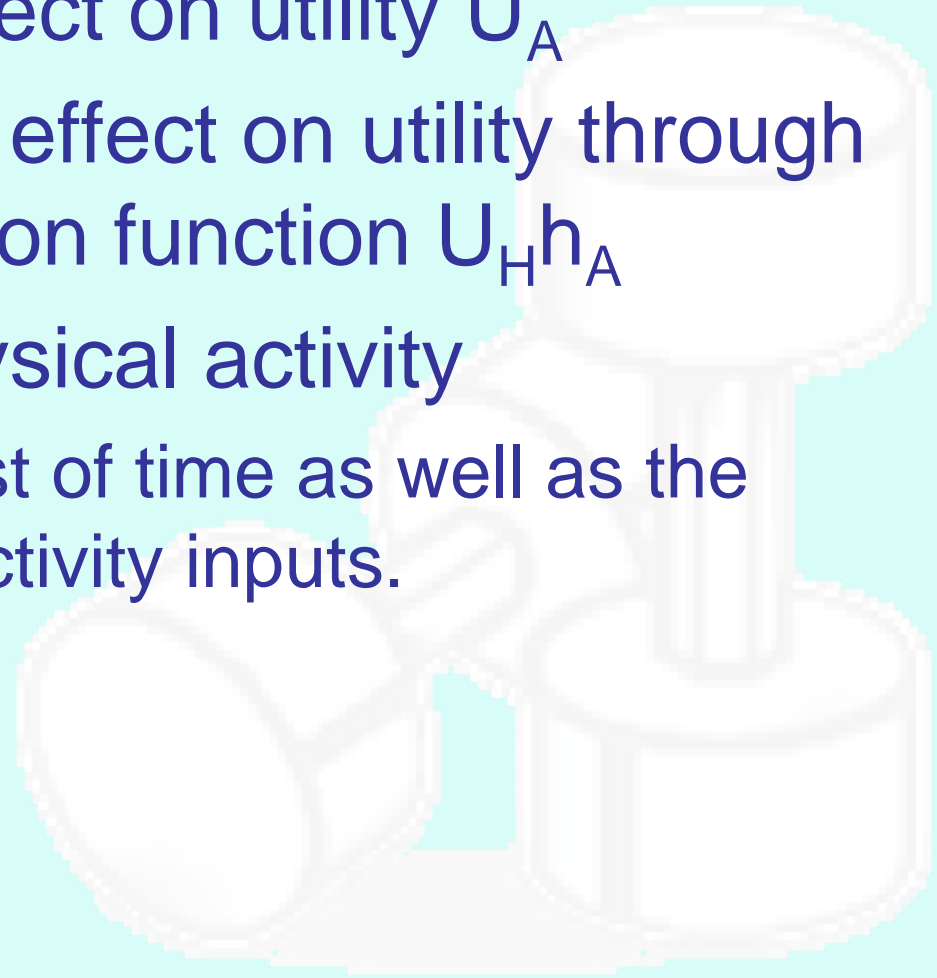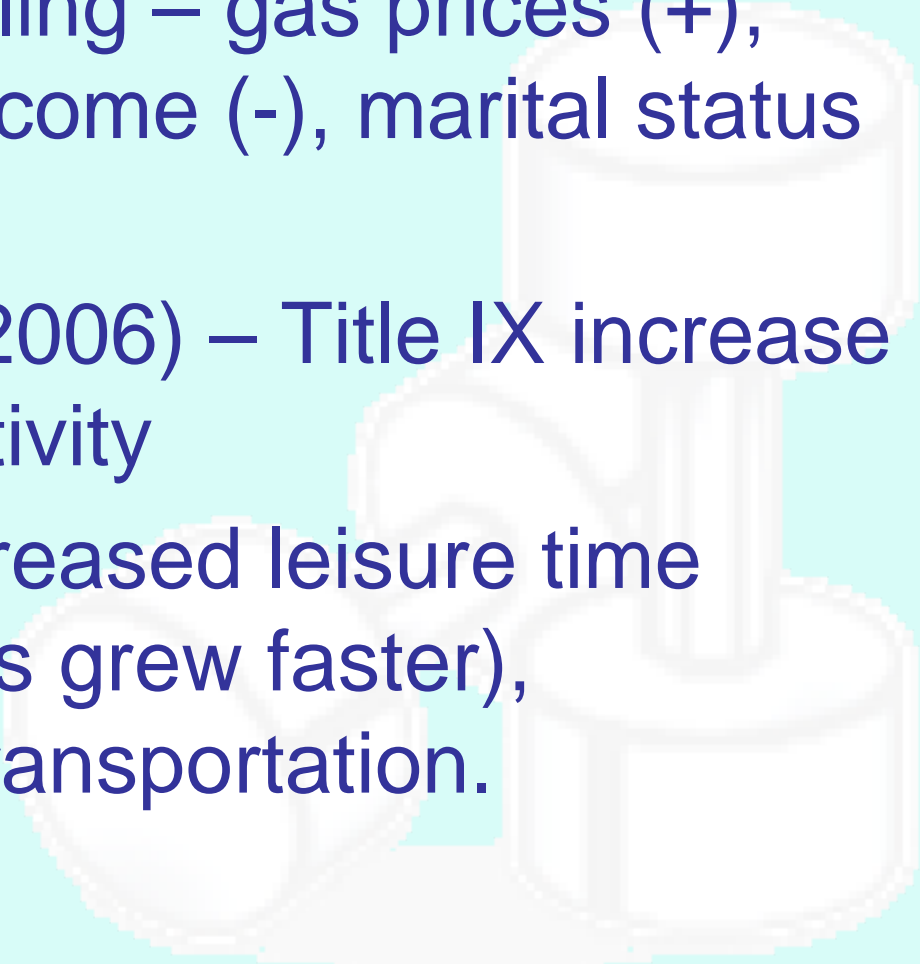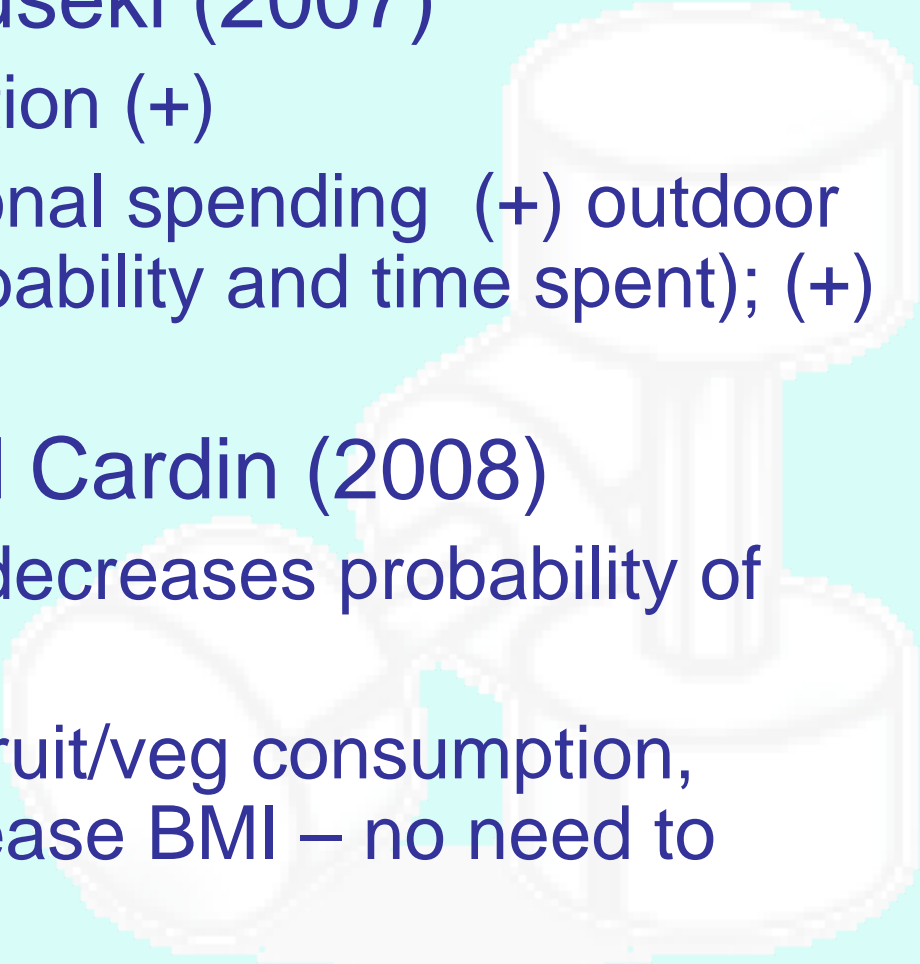
Background - Economics

- 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
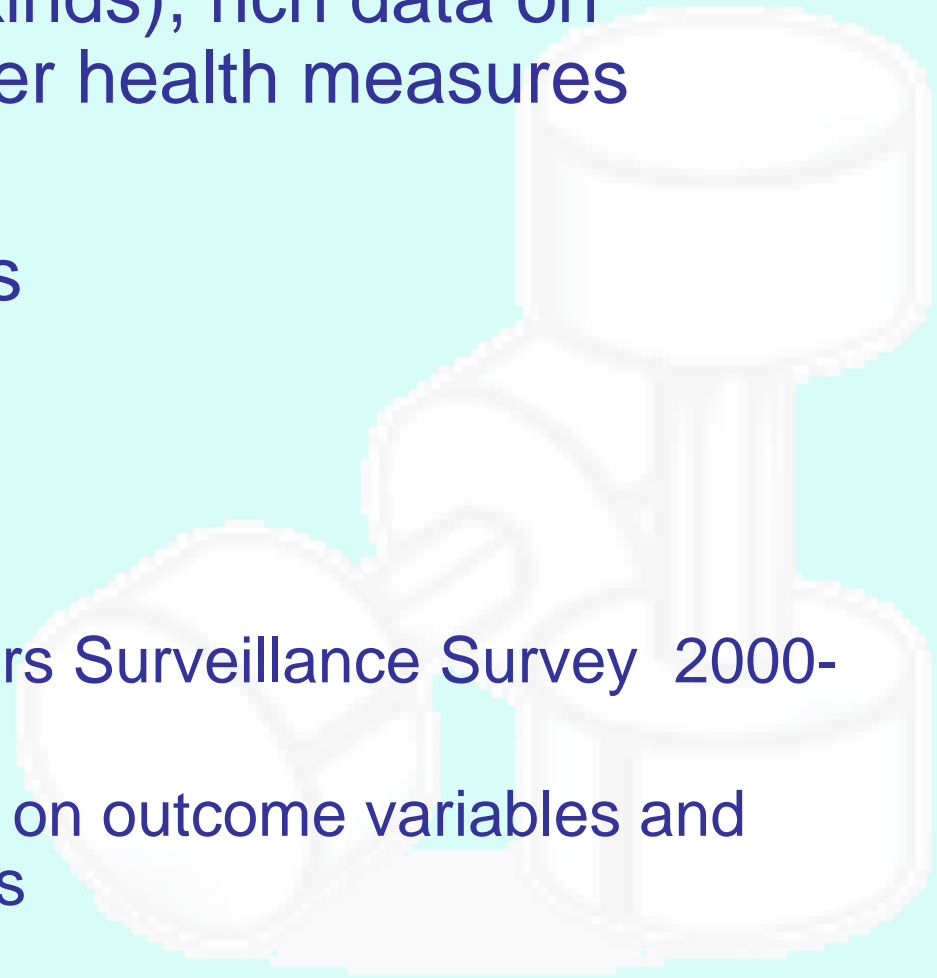 - Females less PA on weekend/holidays
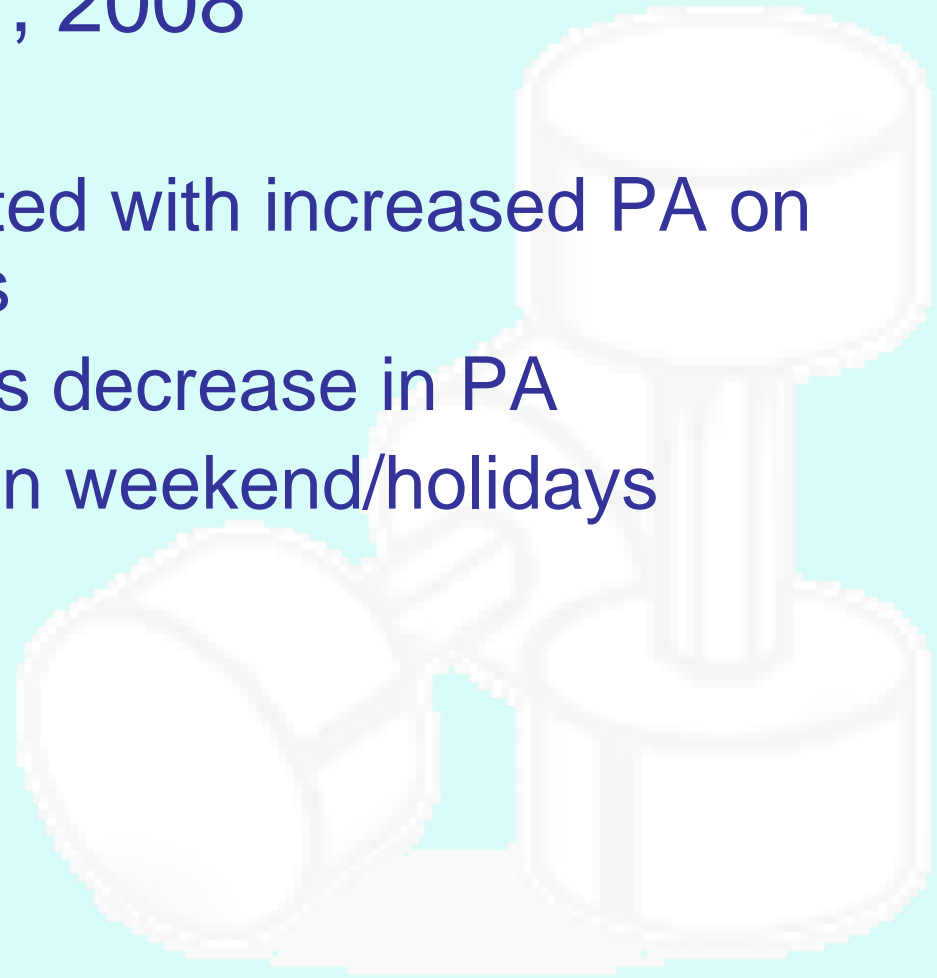
Data Issues

- 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

Percent of Adult Population

	2001	2002	2003	2004	2005
NHIS estimate inactive	29.9	30.1	29.5	30.4	29.3
BRFSS any exercise	75.88	76.94	77.2	77.26	77.64
BRFSS vigorous PA			25.01		24.53
BRFSS moderate or vigorous PA			45.56		45.71

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
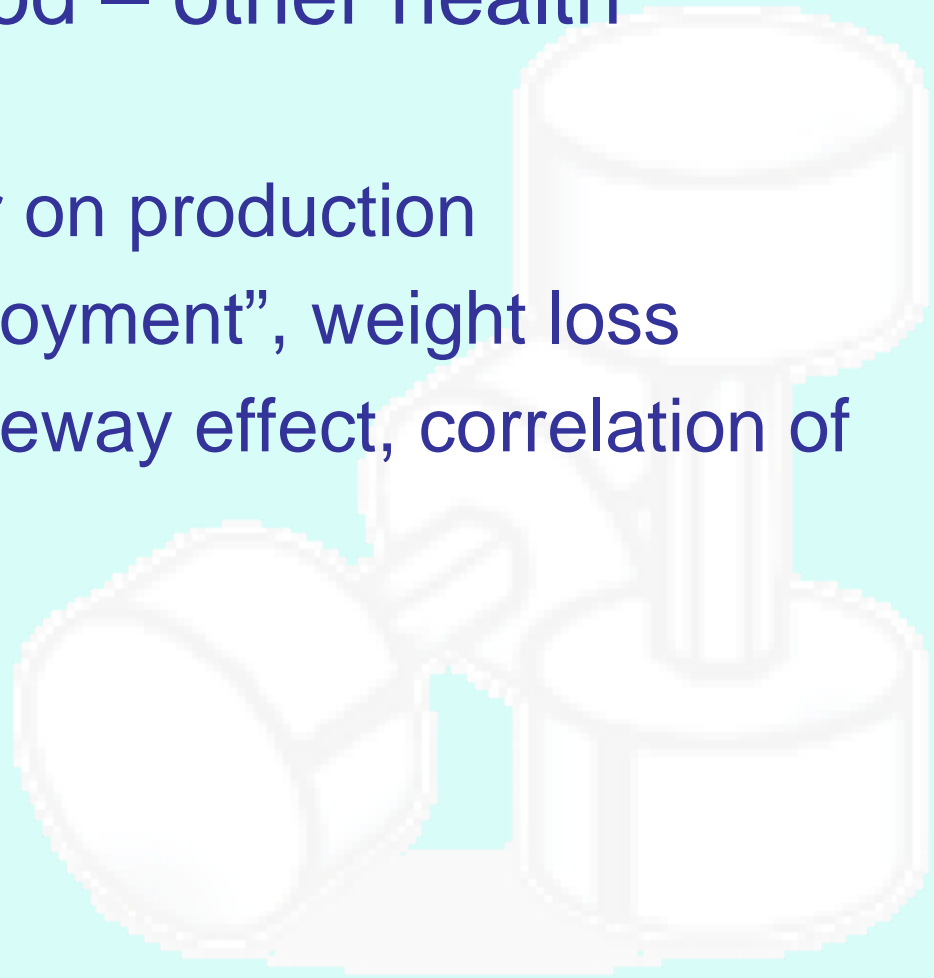
Key Measures

- 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
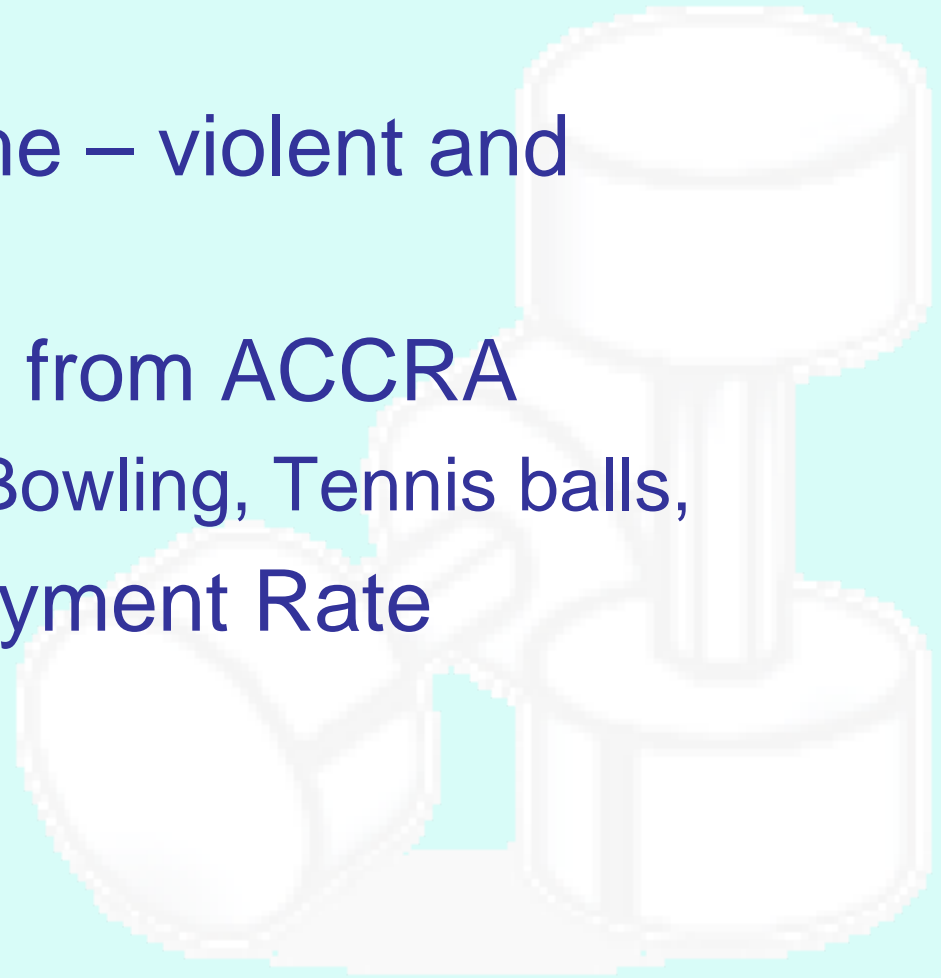
- Unobserved taste for prevention
  - Flu shot
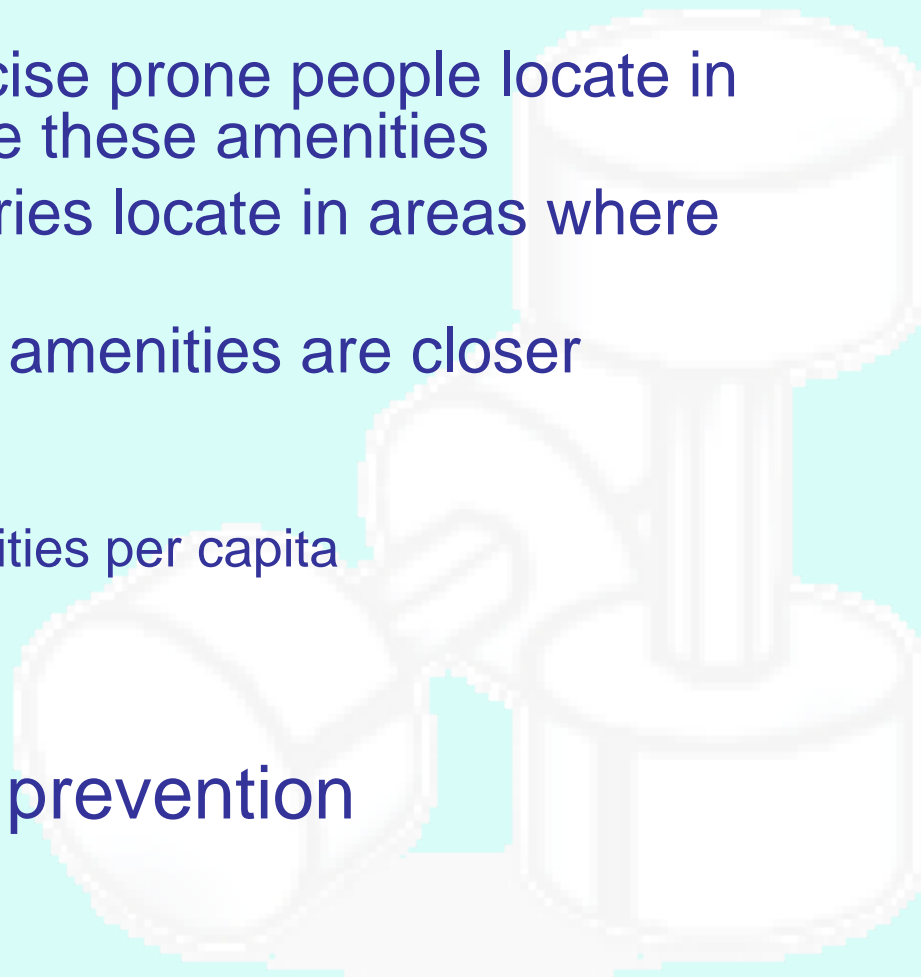
Key Measures

- 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
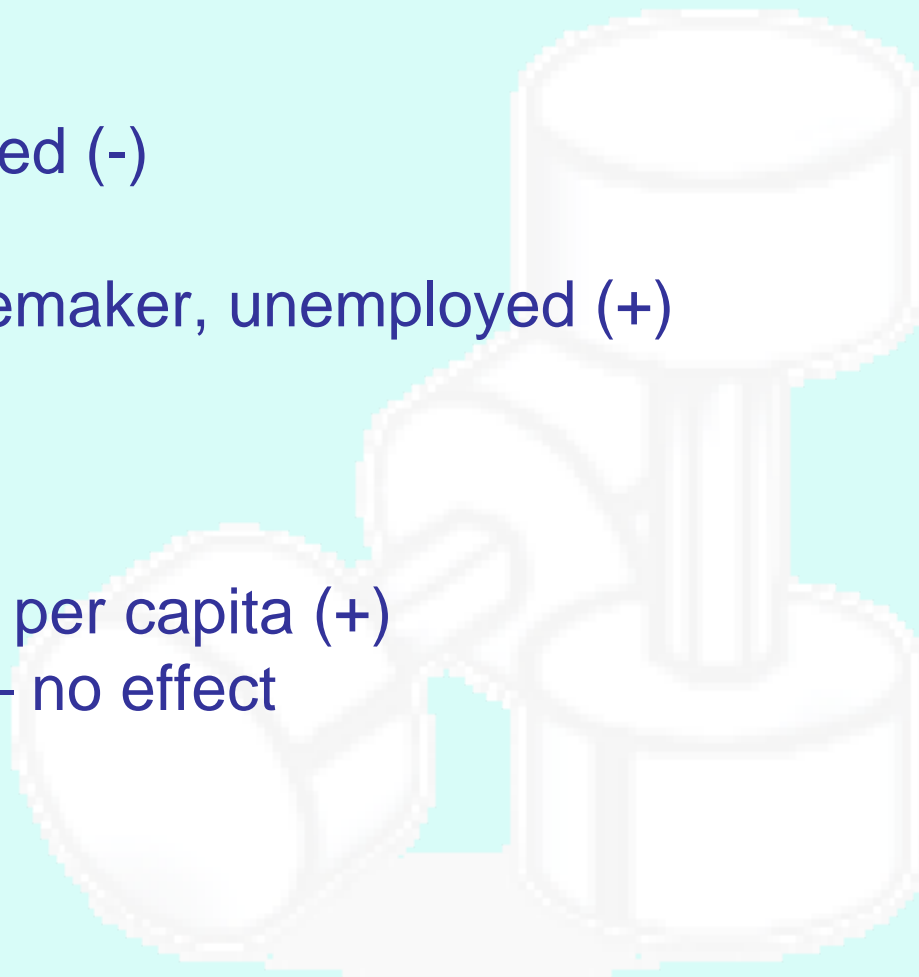 - Full model stratified by gender, income

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 (-)
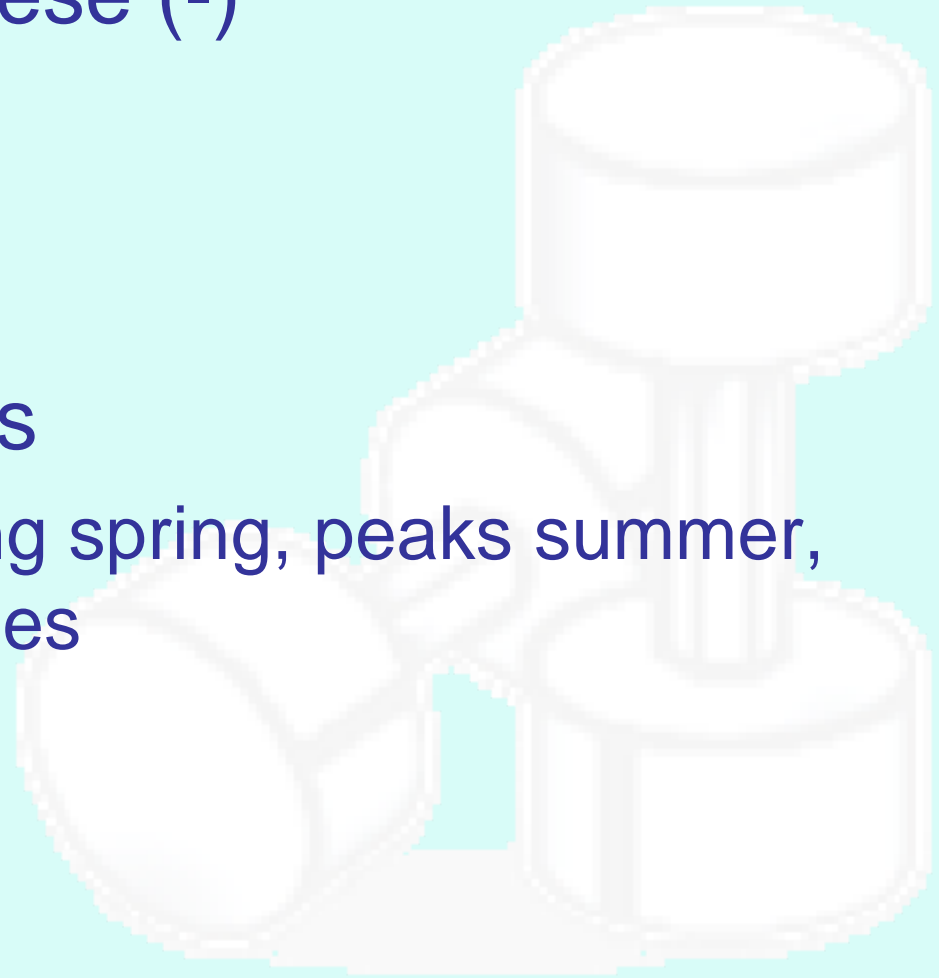 - Bus price (+)
  - Crime – no effect

Results-Any exercise

- Overweight (-), Obese (-)

- Flu Shot (+)

- Month Fixed effects
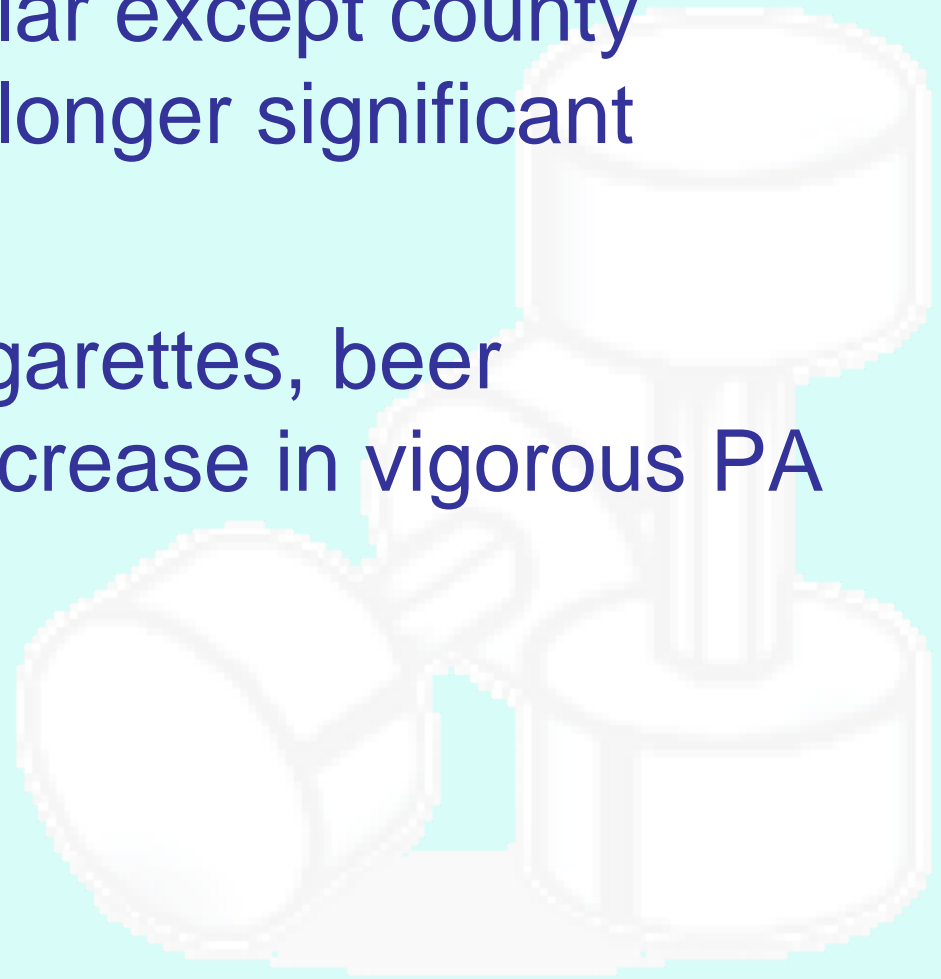 - PA increases during spring, peaks summer, fall and then declines
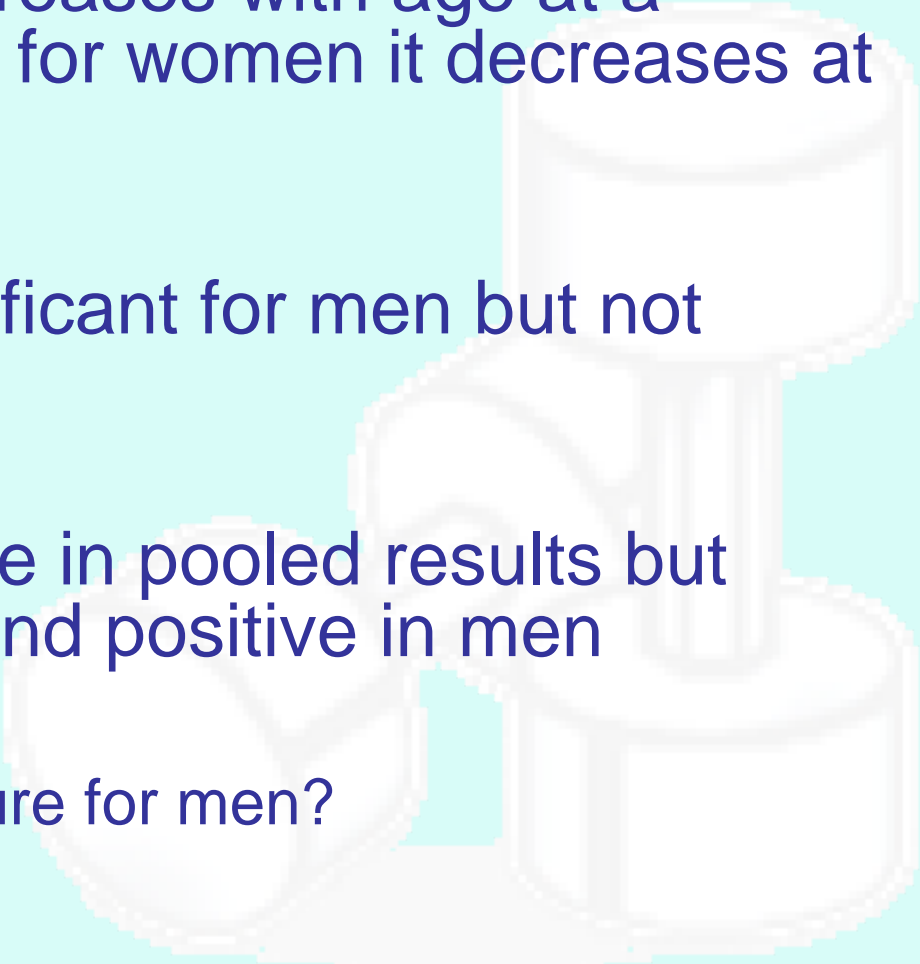
Results –Vigorous Exercise

- Area effects – similar except county unemployment no longer significant

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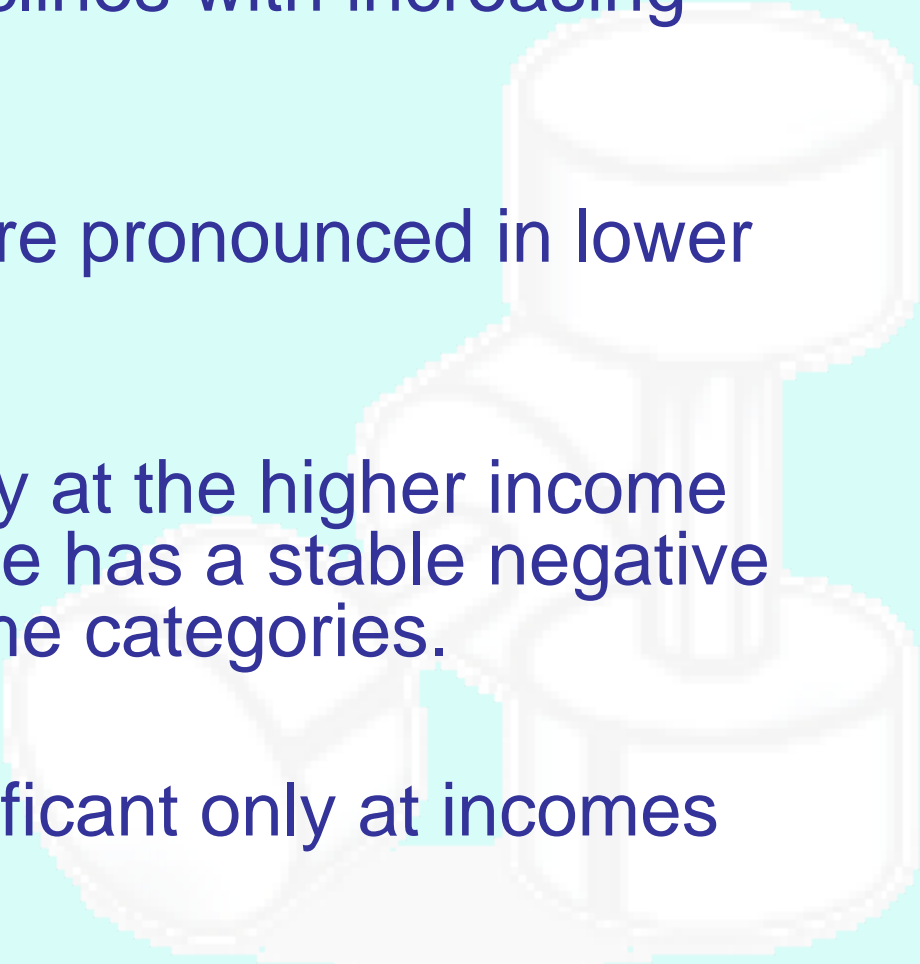
Stratified by Gender

- 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).
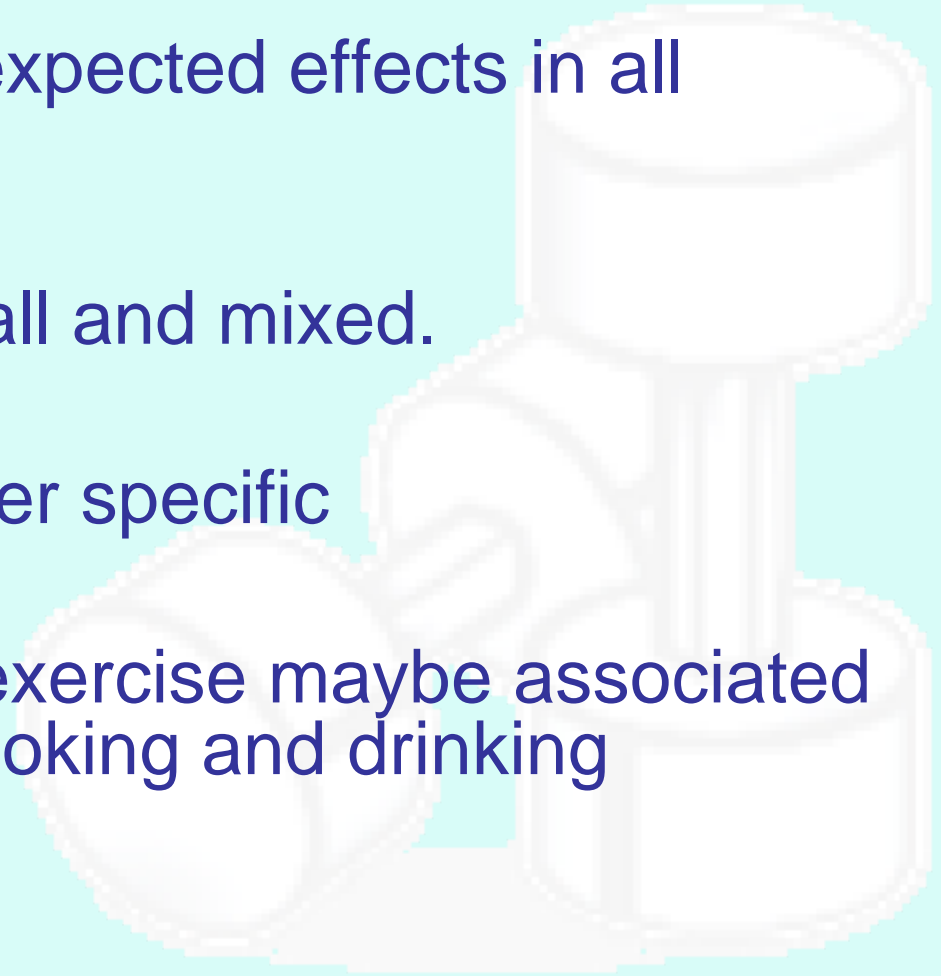
Future work
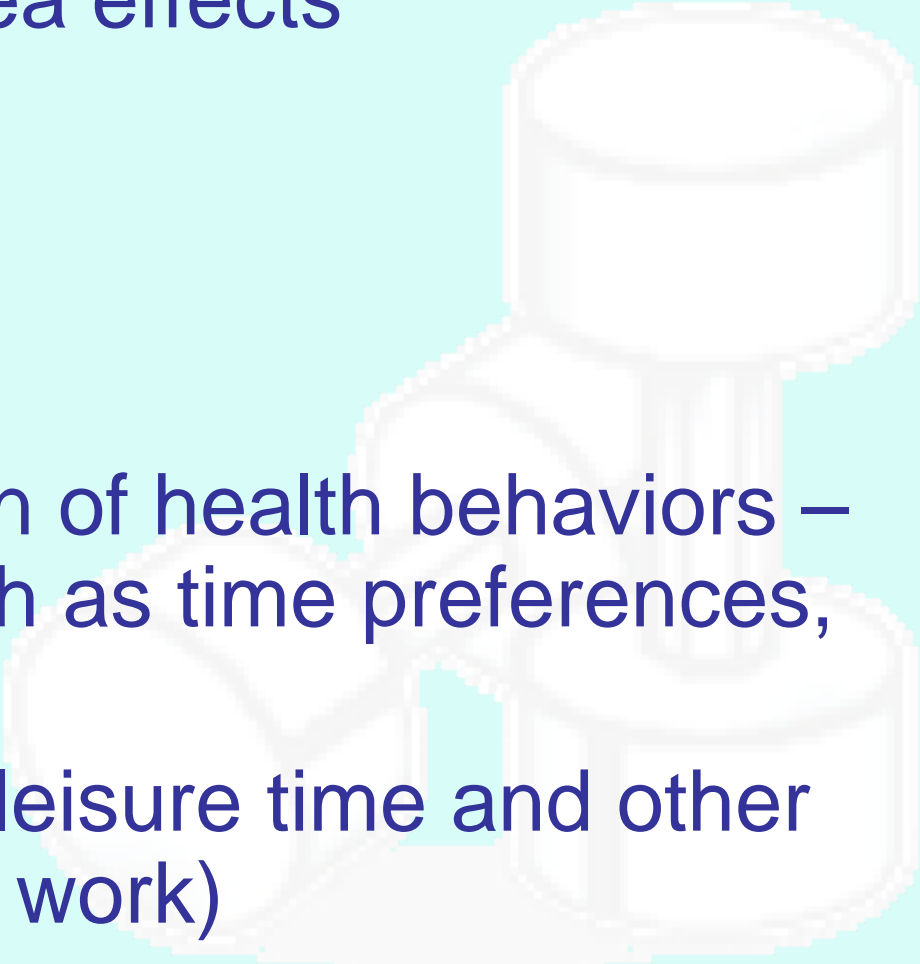
- Re-evaluate with other data – NHIS
- Examine other policies
  - Exposure to Title IX
  - No Child Left Behind
  - Access to play versus organized sports
  - Price measures

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

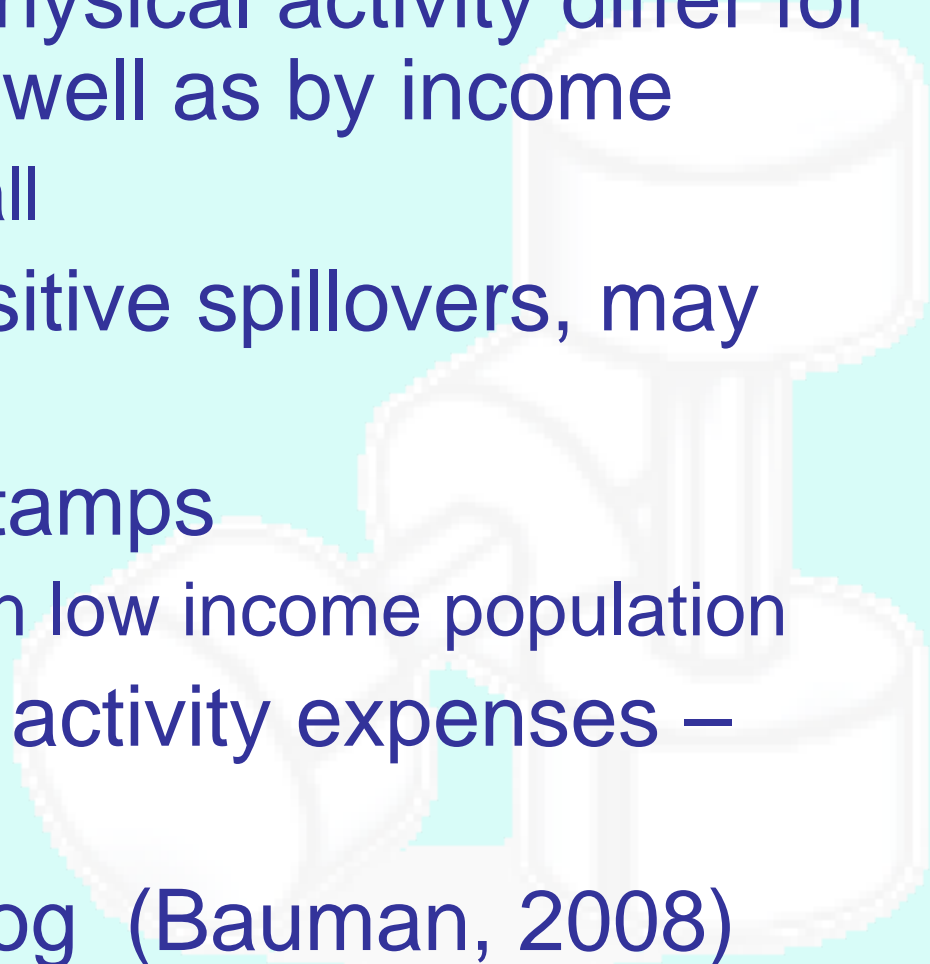- Factors affecting physical activity differ for males, females as well as by income
  - No one policy fits all
- Sin Taxes – no positive spillovers, may even be negative
- Physical Activity Stamps
  - Access no effect on low income population
- Deduct of physical activity expenses – FSA
- Give everyone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

My preference for dog

M. Nicole Fischer Photography

Unintended consequence

NHIS Data

Number of Office Visits in Past 12 Months

	Others	Regularly Active
0	20.1%	17.8%
1	15.5%	18.7%
2 to 3	23.5%	28.0%
4 to 5	13.8%	13.8%
6 to 7	7.1%	6.6%
8 to 9	4.0%	3.2%
10 to 12	6.5%	5.0%
13 to 15	2.6%	1.9%
16 or more	6.9%	5.0%

NHIS data

Number of Times in ER in past 12 months

Number of Visits	other	Regularly active
0	78.11%	81.81%
1	13.52%	12.81%
2 to 3	5.92%	4.23%
4 to 5	1.35%	0.65%
6 to 7	0.48%	0.21%
8 to 9	0.17%	0.09%
10 to 12	0.22%	0.10%
13 to 15	0.06%	0.03%
16 or more	0.15%	0.06%
	100.00%	100.00%

$p < 0.001$
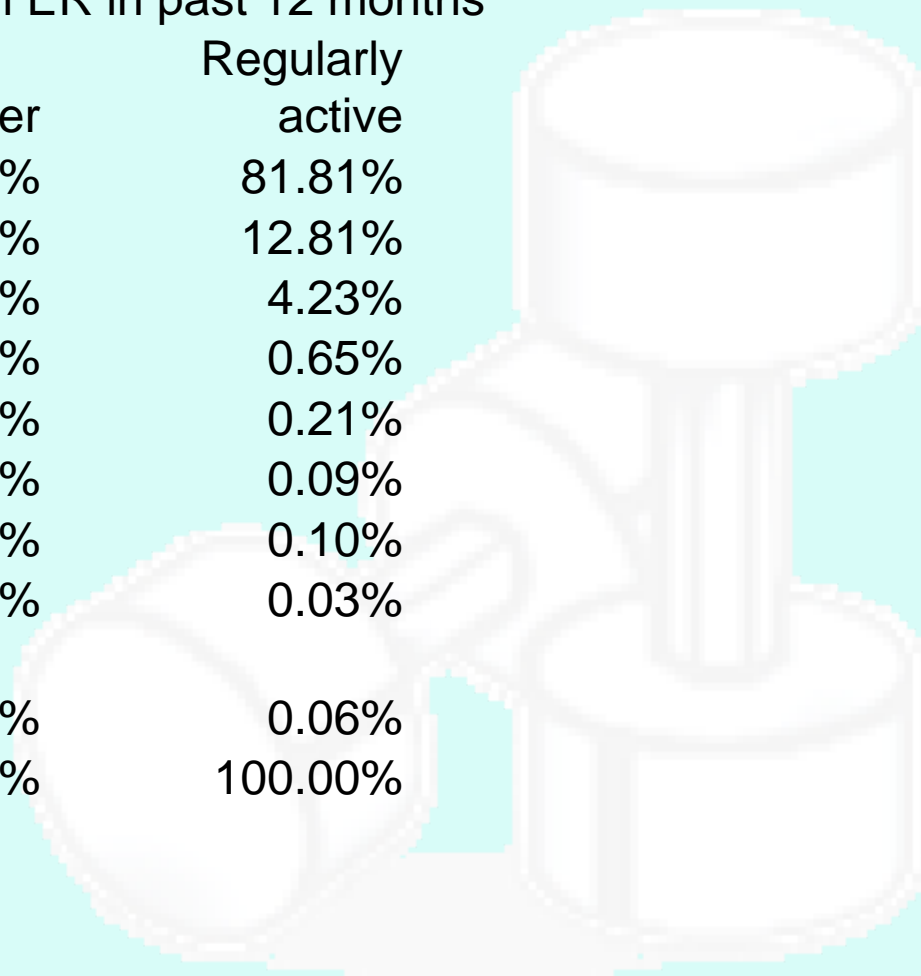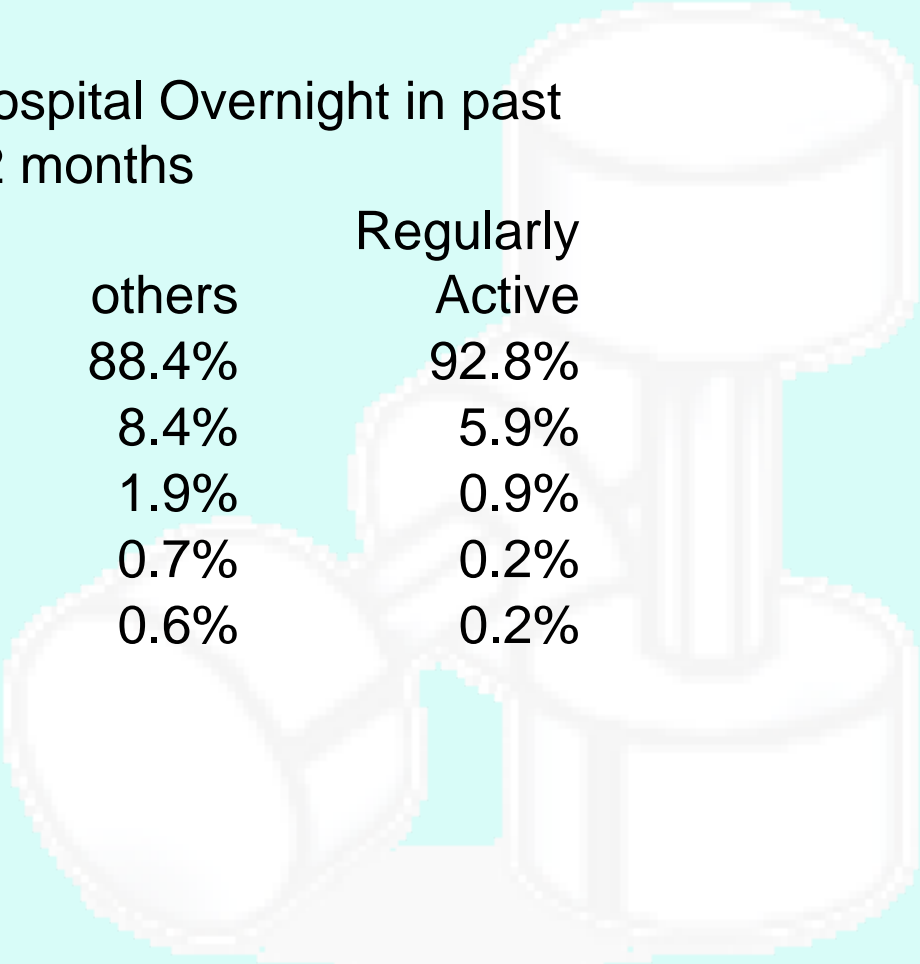
NHIS Data

No. of Times in Hospital Overnight in past 12 months

	others	Regularly Active
0	88.4%	92.8%
1	8.4%	5.9%
2	1.9%	0.9%
3	0.7%	0.2%
4 or more	0.6%	0.2%

reg_active	Coef.	z-value	P-value
age	-0.009	-8.820	0.000
age_sq	0.000	-0.990	0.320
male	0.130	21.570	0.000
married	-0.001	-0.060	0.950
famsize	-0.034	-14.670	0.000
white	0.013	0.830	0.404
black	-0.170	-9.700	0.000
asian	-0.167	-7.350	0.000
working	-0.026	-3.280	0.001
unemployed	0.107	6.050	0.000
poor	0.157	21.130	0.000
highschool	0.241	24.780	0.000
somecollge	0.479	48.710	0.000
college	0.678	61.080	0.000
graduate	0.797	61.120	0.000
uninsured	0.039	7.880	0.000
earnings	0.000	-0.290	0.773
year2001	0.000	-0.030	0.972
year2002	-0.006	-0.530	0.598
year2003	0.032	2.930	0.003
year2004	-0.041	-3.570	0.000
year2005	-0.058	-5.040	0.000
year2006	-0.038	-3.070	0.002
_cons	-0.653	-22.340	0.000