Economics of obesity, energy intakes, and physical activity among adults in Appalachia

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1. Introduction

- Obesity is a major health problem and 34% of the U.S. adult population are obese

- With the current trend 50% will be obese in 2030

- The epidemic of obesity absorbs increasingly greater health care budgets

- Four major categories of economic impacts associated with obesity: direct medical costs, productivity costs, transportation costs, and human capital costs

- The overall annual cost of being obese is $2,646 for an obese man and $4,879 for an obese woman

BMI is generally defined as the individual's body weight divided by the square of his/her height and produces a unit measure of kg/m^2.

| BMI	Classification
< 18.5	underweight
18.5–24.9	normal weight
25.0–29.9	overweight
30.0–34.9	class I obesity
35.0–39.9	class II obesity
≥ 40.0	class III obesity

2. Objectives

To examine the potentials of less energy intakes and more physical activity in controlling obesity among individuals in Appalachia.

The Appalachian Region

- Consists of 420 counties in 13 states

- Home for nearly 24.8 million people, and its population growth from 2000 to 2008 was slower than the national rate (ARC, 2010).

- The region's economy is highly dependent on mining, forestry, agriculture, chemical industries, professional service, and manufacturing (ARC, 2011).

- Exhibits high economic distress with high poverty, poor healthcare services, and high educational disparities (ARC, 2011).

- Lack of human, financial, and technical resources due to its geographic isolation, disproportionate social and economic distress, low household incomes, and a declining tax base.

- High unemployment rates, low per capita personal income, low per capita investment income, low education level

- As a whole, Appalachia reports higher rates of serious disease and mortality rates than national levels

- Nearly 44 percent of the Appalachian population is obese with the highest rate reported in southeast Appalachia
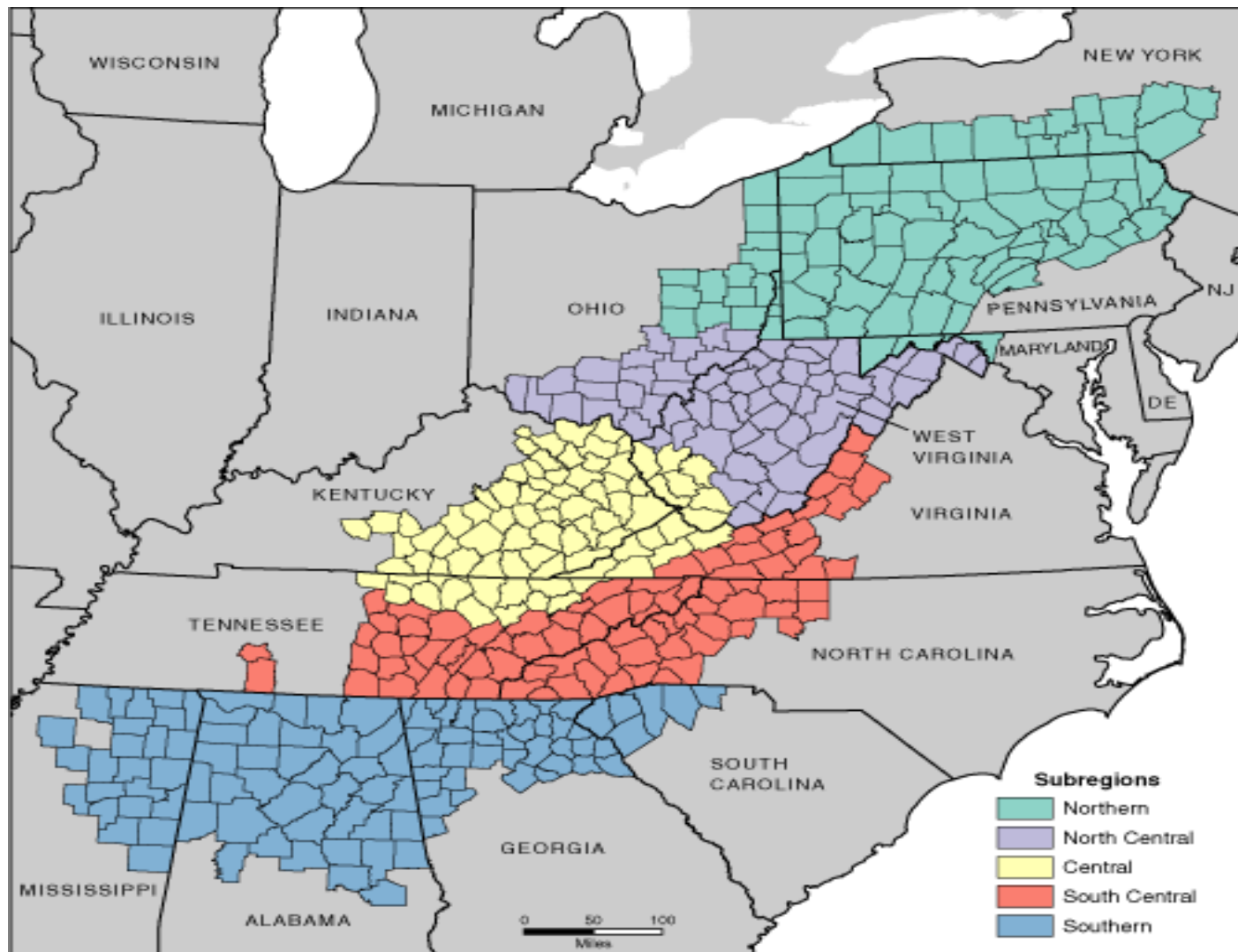
Map by: Appalachian Regional Commission, November 2009.

3. Methods and data

- Obesity is a function of an individual's energy balance, which is the difference between calorie intake and energy expenditure for a particular time period.

- Becker's (1965) household production theory of consumer behavior supplies a framework for examining the issues of energy intake and energy expenditure.

- Energy intakes, physical activity, and obesity are interdependent

- A simultaneous equations approach

- 3SLS analysis - based on individual-level data of the region

- Behavior Risk Factor Surveillance Systems (BRFSS) survey - 2009.

- Bureau of Economic Analysis, and the U.S. Census Reports

(1) $CIT_i = f(BMI_i, PAC_i, D_{ji}, SF_i, EF_i, BF_i)$

(2) $PAC_i = g(BMI_i, CIT_i, D_{ji}, SF_i, EF_i, BF_i)$

(3) $BMI_i = h(CIT_i, PAC_i, D_{ji}, SF_i, EF_i, BF_i)$

CIT_i = decision to reduce energy intakes

PAC_i = minutes engaged in physical activity

BMI_i = value of the body mass index

4. Results and discussion

a) Descriptive Analysis

Variable	Description and unit	Mean	Std. Dev.
CIT	1 if decided to reduce calorie intake; 0 otherwise	0.74	0.44
PAC	Total minutes of physical activity per week	262.12	509.05
BMI	Body Mass Index	29.87	6.69
AGE	Number of years	61.16	13.72
MARRIED	1 if married; 0 otherwise	0.53	0.49
EDU	1 if some college or more; 0 otherwise	0.46	0.49
EMP	1 if employed; 0 otherwise	0.29	0.45
INC	Annual household income in dollars	36,098	23,623
GENDER	1 if male; 0 otherwise	0.38	0.48
RACE	1 if white; 0 otherwise	0.88	0.32
NMBRADULT	Number of adults in household	1.75	0.72
NMBRKIDS	Number of children in household	0.27	0.69
ANYDISEASE	1 if has any of 6 obesity-related diseases; 0 otherwise	0.38	0.48
DRADVICE	1 if gets diet advice from doctor or any other health professional ; 0 otherwise	0.60	0.49
SMOKES	1 if smokes; 0 otherwise	0.19	0.39
DRINKS	1 if drinks alcohol; 0 otherwise	0.24	0.43
SLEEP	Number of sleepless days in previous month	9.02	11.08
HLTHCRFAC	Access to healthcare facilities (per 100,000 county population)	56.29	24.69
RECREATION	Access to recreation facilities (number of facilities per 100,000 county population)	8.05	4.23
NORTH	1 if lives in northern Appalachia; 0 otherwise	0.21	0.41

Table 3. Results for system of equations for obesity prevention analysis*

Variable	CIT Coefficient	P>|Z|	PAC Coefficient	P>|Z|	BMI Coefficient	P>|Z|
CIT			-0.9661***	0.00	-0.1273***	0.00
PAC	-0.0261***	0.05			-0.2569***	0.00
BMI	0.6323***	0.00	-1.7702***	0.02		
AGE	-0.0020***	0.01	-0.0365***	0.00	-0.0481***	0.00
MARRIED			-0.0011	0.98		
EDU	-0.0028	0.80	0.1365***	0.03	0.0059	0.28
EMP			0.3830***	0.00		
INC	0.0001**	0.04	0.0001***	0.00	0.0001*	0.06
GENDER	-0.0615***	0.00	0.3911***	0.00	-0.3304***	0.00
RACE					-0.0203***	0.00
NMBRADULT	0.0144	0.03				
NMBERKIDS	-0.0144***	0.03				
ANYDISEASE	-0.0212	0.13	-0.1732**	0.03	0.0627***	0.00
DRADVICE	0.2247***	0.00				
SMOKES					-0.0759***	0.00
DRINKS					-0.0429***	0.00
SLEEP			-0.0170***	0.00		
HLTHCRFAC					-0.0001	0.29
RECREATION			0.0247***	0.00		
NORTH			-0.4711***	0.00		
Intercept	-4.5919	0.00	20.0165	0.00	8.2741	0.00

Number of Observations = 7,267.
R^2 value: CIT = 0.17; PAC = 0.55; BMI = 0.54.
Chi^2 value: CIT = 628.83; PAC = 714.35; BMI = 1023.13.
*** , ** , * are significant at 1%, 5% and 10% respectively.

5. Conclusions and policy suggestions

- Overall, results show that people with a higher BMI are more likely to reduce energy intakes but spend less time physical activity. Thus, encouraging more physical activity is important

- Males are less likely to reduce energy intakes but engage more in physical activity and are less likely to be obese. Thus, men could be advised to reduce energy intakes along with engaging in physical activity.

- Women, who are more likely to be obese, should not only be supported in their energy reduction decision, but needed be encouraged to spend more time on physical activity.

- Availability of more jobs, education facilities as well as access to recreation facilities and diet advice from healthcare professionals, appear to have positive effects on controlling obesity in Appalachia

Thank you