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Preconception Health Indicators: A Comparison Between Non-Appalachian and Appalachian Women

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Abstract

To compare preconception health indicators (PCHIs) among non-pregnant women aged 18–44 years residing in Appalachian and non-Appalachian counties in 13 U.S. states. Data from the 1997–2005 Behavioral Risk Factor Surveillance System were used to estimate the prevalence of PCHIs among women in states with ≥1 Appalachian county. Counties were classified as Appalachian (n = 36,496 women) or non-Appalachian (n = 88,312 women) and Appalachian counties were categorized according to economic status. Bivariate and multivariable logistic regression models examined differences in PCHIs among women by (1) Appalachian residence, and (2) economic classification. Appalachian women were younger, lower income, and more often white and married compared to women in non-Appalachia. Appalachian women had significantly higher odds of reporting <high school education (adjusted odds ratio (AOR) 1.19, 95 % confidence interval (CI) 1.10–1.29), fair/poor health (AOR 1.14, 95 % CI 1.06–1.22), no health insurance (AOR 1.12, 95 % CI 1.05–1.19), no annual checkup (AOR 1.12, 95 % CI 1.04–1.20), no recent Pap test (AOR 1.20, 95 % CI 1.08–1.33), smoking (AOR 1.08, 95 % CI 1.03–1.14),<5 daily fruits/vegetables (AOR 1.11, 95 % CI 1.02–1.21), and overweight/obesity (AOR 1.05, 95 % CI 1.01–1.09). Appalachian women in counties with weaker economies had significantly higher odds of reporting less education, no health insurance, <5 daily fruits/vegetables, overweight/obesity, and poor mental health compared to Appalachian women in counties with the strongest economies. For many PCHIs, Appalachian women did not fare as well as non-Appalachians.

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Interventions sensitive to Appalachian culture to improve preconception health may be warranted for this population.

Keywords

Preconception health; Appalachia; Disparities; Socioeconomic status; Behavioral Risk Factor Surveillance System; Rural populations

Introduction

Preconception health care, defined as a set of interventions that can improve a woman's health and/or pregnancy outcome through prevention and management of biomedical, behavioral, and social risks [1], is recognized as an important component of health care for reproductive-aged women. Unhealthy behaviors or chronic medical conditions during the preconception period may carry over into the prenatal period, increasing the risk for adverse pregnancy outcomes and other complications. For example, maternal smoking may cause placenta previa and abruption, premature rupture of membranes, preterm delivery, fetal growth restriction, and low birthweight [2, 3], while hypertension is associated with a higher risk of preeclampsia and eclampsia [4]. Therefore, maintaining a healthy lifestyle prior to pregnancy is important. However, given the high burden of chronic disease within the United States population generally, and that almost half of pregnancies in the United States are unintended (mistimed or unwanted) [5, 6], many women will enter pregnancy in less than optimal health.

In 2006, the Centers for Disease Control and Prevention (CDC), in partnership with other national experts and organizations, published ten recommendations for public health practitioners to enhance and monitor preconception health and health care [1]. In December 2007, a committee of seven states was convened by the Public Health Work Group (PHWG) of the CDC Preconception Health and Healthcare Steering Committee to define preconception health domains and propose currently measurable preconception health indicators (PCHI) at a state level that can be used to assess, monitor and evaluate preconception health in all states [7]. The workgroup identified 11 domains of preconception health including: general health status and life satisfaction, social determinants of health, health care access and utilization, reproductive health and family planning, tobacco, alcohol and substance use, nutrition and physical activity, mental health, emotional and social support, chronic conditions, infections and genetics/epigenetics [7]. Although no studies to our knowledge have examined geographic differences in PCHIs, general health status indicators are known to vary by geography, with individuals living in non-metropolitan statistical areas (MSA) more likely to report fair or poor health and less likely to report excellent/very good/good health compared to persons living in MSAs [8].

Appalachia is a region of the U.S. spanning 13 states following the spine of the Appalachian Mountains, from southern New York to northern Mississippi [9] (Fig. 1). In general, disparities in health status exist between Appalachian and non-Appalachian regions, with higher prevalence of adverse health outcomes in Appalachia related to low income, limited education, geographic isolation, lack of health insurance, and lack of health care facilities

and providers [10]. However, literature regarding the preconception and reproductive health of Appalachian women is limited. Geographic studies of preconception and reproductive health have focused primarily on comparing urban and rural women, with findings suggesting that rural women have less overall access to prenatal care [11], enter into prenatal care later in their pregnancy [12], and have elevated risk of delivery complications [13] and poor pregnancy outcomes, such as low birthweight [14] and preterm delivery [15]. Though Appalachian counties share some of the same challenges as other rural counties, such as geographic isolation and lack of health care providers, Appalachia is recognized as a distinct, cultural and geographic, region [16]. Further, while much of Appalachia is rural, it encompasses a diverse, heterogeneous geographic region with varying socioeconomic status. Therefore, the purpose of this study was to compare PCHIs between Appalachian and non-Appalachian women in the 13 states designated as Appalachia, and to examine PCHIs among Appalachian women by county economic status.

Methods

Data Source

We combined data from the Behavioral Risk Factor Surveillance System (BRFSS) from 1997 through 2005—years with county identifiers available for all counties. We were limited to the use of data through 2005 due to post-2005 restrictions on the release of county identifiers for counties with fewer than 10,000 adults. We restricted analyses to 124,808 non-pregnant women aged 18–44 years residing in states with at least one Appalachian county (Alabama, Georgia, Kentucky, Maryland, Mississippi, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Virginia and West Virginia). The BRFSS is an ongoing, state-based, random digit-dialed telephone survey of non-institutionalized U.S. adults aged 18 years or older. The survey collects information on health risk behaviors, preventive health practices, and health care access primarily related to chronic disease and injury. The BRFSS operates in 50 states, the District of Columbia, and three U.S. territories (Puerto Rico, U.S. Virgin Islands, and Guam). The median CASRO response rates for states included here ranged from 48.0 to 76.5 % over the 9 year study period. Further information on BRFSS, including information on survey data quality, question history, or module information is available from the survey website at: http://www.cdc.gov/brfss. Studies that use de-identified, publicly available data do not require CDC institutional review board approval.

Appalachia and County Economic Status Classification

State and county Federal Information Processing Standards (FIPS) codes were used to identify counties across the 13-state Appalachian region. The 2005 Appalachian Regional Commission (ARC) [9] designations were used to assign counties as Appalachian (n = 683) or non-Appalachian (n = 417). ARC classifications were also used to categorize the overall economy of Appalachian counties [17]. Annually, ARC creates a national index of county economic status by comparing a county's values on three economic indicators (three-year average unemployment rate, per capita market income, and poverty rate) to the national values on these indicators. The differences between county and national values are averaged to create a summary measure used to rank each county in the nation. Based on the

distribution of county ranks, Appalachian counties are classified as: (1) distressed (below the 10th percentile for the nation), (2) at-risk (between the 10th and 25th percentile), (3) transitional (between the 25th and 75th percentile, (4) competitive (between the 75th and 90th percentile), and (5) attainment (above the 90th percentile) [17]. For our study, the economic status designation for each Appalachian county was determined by its most common annual classification during our 9-year study period (Fig. 1).

Data Access

Public use 1997–2005 BRFSS datasets were downloaded from the BRFSS website. Because county codes were suppressed on the public use datasets for counties with<50 responses during our study period, we provided a list of Appalachian counties with corresponding economic status to CDC. In turn, CDC provided a dataset containing Appalachian designation (yes or no) and economic classification for each individual in the 1997–2005 BRFSS dataset. This data file was then merged with the 1997–2005 BRFSS public use datasets.

Socio-demographic Variables and Preconception Health Indicators

Socio-demographic characteristics included age, race/ethnicity, income and marital status. Age was coded as 18–24, 25–34, and 35–44 years. Race/ethnicity was coded as non-Hispanic black, non-Hispanic other, non-Hispanic white or Hispanic. Income was categorized as a five-level variable for annual household income, ranging from <$15,000 to ≥$50,000. Marital status was coded as married/cohabiting or other.

PCHIs were identified and defined by the state working group, and included measures of: education, general and mental health, health insurance, routine annual checkup, Papanicolaou (Pap) test, tobacco and alcohol use, fruit/vegetable consumption, body mass index (BMI), physical activity, diabetes, hypertension, asthma, and influenza vaccine uptake. Descriptions of each indicator are available at http://www.cste.org/dnn/ProgramsandActivities/ChronicDiseaseMCHandOralHealth/ToolsandResources/tabid/262/Default.aspx. Education level was coded as ≥high school or < high school. Self-rated health status was coded as good/very good/excellent or fair/poor. Smoking, health care coverage, routine checkup in the past year, Pap test within the past three years, diabetes, hypertension, asthma, and influenza vaccination within the past year were coded as yes or no. BMI was coded as a two-level variable: neither overweight nor obese (BMI = 18.5 – 24.9 kg/m^2) or overweight/obese (BMI ≥25 kg/m^2). Fruit and vegetable consumption was coded as ≥5 fruits and vegetables per day or <5 fruits and vegetables per day. Physical activity was coded as meets the recommended level of physical activity per week or does not meet the recommended level of physical activity per week (http://www.health.gov/paguidelines). Mental health was coded as not good for ≥ 14 of the past 30 days or not good for<14 of the past 30 days. Two alcohol consumption variables were coded separately as heavy (>1 drink per day in past 30 days) or none/light/moderate (≤1 drink per day in past 30 days) drinking, and binge (≥5 drinks on one occasion during the past month) or non-binge (<5 drinks on one occasion during the past month) drinking.

Statistical Analyses

The crude associations between demographic variables and each of the PCHIs and Appalachian region were determined using Chi-square tests and logistic regression. We assessed independent associations between PCHIs and Appalachian region through multivariable logistic regression. We examined differences in demographic characteristics with Chi-square tests and independent associations with PCHIs by county designation within Appalachia using multivariable logistic regression with attainment counties as the reference group. Multivariable logistic regression analyses were completed controlling for age, income, level of education, race/ethnicity and state of residence. Prevalence estimates and statistical tests used survey weights and accounted for design effects. A sensitivity analysis was performed to determine if results differed by survey year. All analyses were performed using software for survey data analysis SAS, version 9.2 (SAS Institute, Cary, NC).

Sample sizes differed for each PCHI because not all states asked the same questions each year. This is because the BRFSS questionnaire has both a core component, consisting of the fixed and rotating cores, and optional modules. All states must ask the core component questions without modification in wording. The fixed core is asked every year while the rotating core alternates two distinct sets of questions by year. In the years that rotating core questions are not used, they are supported as optional modules and states in this study varied in their use of those modules. Sample sizes for multivariable models assessing associations between Appalachian status and PCHIs ranged from n = 21,391 (PCHI = binge drinking) to n = 101,190 (PCHI = high school education). Sample sizes for multivariable models assessing associations between economic status of Appalachian counties and PCHIs ranged from n = 6,597 (PCHI = binge drinking) to n = 29,744 (PCHI = high school education).

Results

Approximately 29 % of women (n = 36,496) included in the analysis were considered Appalachian. Women residing in Appalachian counties were slightly younger and lower income, and more often white and married compared to women residing in non-Appalachian counties (Table 1). The majority of Appalachian women lived in counties designated as transitional (62.1 %, n = 22,666) (Table 1). Sociodemographic characteristics, including age, race/ethnicity, marital status, and annual income, differed significantly between the five types of counties. Specifically, women in distressed counties had the largest proportions of women aged 18–24 years and lowest incomes and women in attainment counties had the largest proportion of minorities and lowest proportion of married women (Table 1).

In crude analyses (Table 2), compared to non-Appalachian women, Appalachian women were at significantly higher odds of reporting <high school education, fair/poor health, no health care coverage, no routine checkup in the past year, last Pap test more than three years ago, consumption of <5 fruits and vegetables a day, smoking, overweight/obesity, and a history of hypertension compared to non-Appalachian women. Appalachian women were at significantly lower odds of reporting heavy and binge drinking and asthma compared to non-Appalachian women. There were no significant associations between Appalachian status and physical activity, mental health status, diabetes, or having received an influenza vaccination within the past year.

Findings remained the same after adjusting for age, race/ethnicity, income, education and state of residence, although results were no longer statistically significant for history of hypertension (Table 2). Findings remained the same after further adjusting for survey year (results not shown).

In multivariable analysis (Table 3), compared to women living in attainment counties, women who resided in counties with the four lowest economic classification levels were approximately two times more likely to report < high school education, no health insurance, consumption of <5 fruits and vegetables per day, being overweight or obese, and poor mental health compared to women who lived in attainment counties. Women living in distressed or at-risk counties were almost two times more likely to report fair/poor health and 70 % less likely to report heavy drinking compared to women living in attainment counties. Women living in distressed counties were almost 60 % less likely to report binge drinking compared to women living in attainment counties. Women living in at-risk counties were over 1.5 times more likely to report no Pap test in the past 3 years compared to women living in attainment counties.

Discussion

To our knowledge, this is the first study to compare preconception health status of women who live in the Appalachian region of the U.S. to women who live in non-Appalachian regions. Our study suggests that some disparities in preconception health status exist between Appalachian and non-Appalachian women, and that Appalachia residence in a county with a weak economy is associated with generally poorer preconception health. For many PCHIs, Appalachian women did not fare as well as non-Appalachian women. Women in Appalachia had less health insurance coverage, worse self-rated general health, and lower completion of preventive services including annual checkups and Pap smears. Risk factors for adverse pregnancy outcomes, such as smoking and low fruit and vegetable consumption, and overweight/obesity, were more prevalent in Appalachia. Many of these associations were only slightly confounded by individual factors, suggesting that disparities may be due to regional-level, rather than individual-level, factors. It is important to note that preconception health was less than ideal among the overall study population, not just among Appalachian women. The percentages of both Appalachian and non-Appalachian women who did not have health insurance, consumed ≤5 fruits/vegetables daily, did not meet the recommended level of physical activity and did not receive an influenza vaccine, were overweight/obese, smoked, and reported binge drinking were high.

Level of Education

It has been suggested that education is the dimension of socioeconomic status (SES) that most strongly and consistently predicts health [18]. Here, Appalachian women were less likely to have at least a high school education compared to non-Appalachian women; women living in counties with weaker economies reported less education than women in counties with stronger economies. Our results are supported by the ARC which reported that educational attainment among Appalachian adults aged 25 and older is generally lower (76.8

% high school completion rate) than other U.S. adults (80.4 % high school completion rate) [19].

Self-Rated General Health Status

Since the PCHIs cover a wide array of health conditions, and general health status is related to overall health, there is a strong association between general health status and preconception health status. Appalachian women may have had poorer self-rated general health status because of their lower receipt of health services, such as routine check-up and Pap test, and higher prevalence of unhealthy behaviors and chronic health conditions compared to non-Appalachians.

Access to and Utilization of Health Care

Health Care Coverage—Lack of health care coverage has been associated with decreased use of preventive health services, delay in seeking medical care, and poor health status [20, 21]. Routine preventive care, including gynecologic services and early diagnosis and management of chronic conditions, is needed to obtain optimal preconception health. Women who lived in Appalachia were less likely to have health care coverage than non-Appalachian women. Our results are as expected, for nationally, individuals living in rural areas generally have limited access to health care services and providers [10]. Poverty is more prevalent in rural areas and is often related to increased rates of uninsured citizens [22]. Further, health insurance may be less accessible in Appalachia due to limited job opportunities with medical benefits and/or higher rates of unemployment [23]. Indeed, in our study, economic status was significantly associated with lack of health insurance; women who lived in non-attainment designated counties were more likely to lack health insurance than those in attainment counties.

Routine Annual Checkup—An annual medical visit offers an opportunity to address such topics as smoking cessation, weight management, and dietary supplementation. Routine gynecological visits are especially important for women who might become pregnant since these visits provide the opportunity for women to be screened for cervical cancer and preconception risk factors. As shown here, Appalachian women were significantly less likely than non-Appalachian women to have had a routine annual checkup or Pap test within the past three years. The lack of Pap testing may be a result of fewer checkups and, hence, fewer opportunities for preventative health screenings. Appalachia is generally considered a medically underserved area with limited availability of health care professionals, including gynecological and obstetrical providers [24]. This, in addition to cultural values, beliefs, and attitudes about cervical cancer (i.e. cervical cancer has symptoms and screening tests cause worry) [24, 25], may contribute to the lower frequency in obtaining routine annual check-ups and gynecological care in this population.

Tobacco and Alcohol Use

Smoking during the preconception period is associated with decreased fertility, pregnancy complications, and poor fetal outcomes [26]. Our results show that significantly more Appalachian women were current smokers than non-Appalachian women. Given the high rate of smoking in the Appalachian region in general [10, 27], our results are expected. In

contrast, heavy and binge drinking were less prevalent among Appalachian women. Heavy drinking was also less common among women who lived in counties with lower economic status compared to women living in attainment counties. This is consistent with prior research which has shown that binge drinking is most common among persons with higher household incomes [28, 29]. However, this relationship has not always been found within rural areas [30]. In our study, the associations between Appalachian region and tobacco and alcohol use were independent of individual household income, suggesting the influence of other community or regional-level factors, such as culture or religion.

Nutrition and Physical Activity

Fruit and Vegetable Consumption—Good preconception nutrition status, including meeting fruit and vegetable recommendations, is necessary to ensure adequate early embryonic and fetal growth, even prior to the pregnancy being confirmed [31]. While Appalachian and non-Appalachian women did not differ in their odds of consuming 5 or more fruits and vegetables per day, within Appalachia, women living in non-attainment counties were less likely to consume the minimum recommended amount compared to women in attainment counties. This is consistent with other research which has found that neighborhood low-income status is independently associated with lower fruit and vegetable consumption [32, 33]. Lower consumption could be due to increased costs or limited access to fresh fruits and vegetables as large portions of Appalachia have limited healthy food outlets [34, 35].

Overweight and Obesity—Previous research indicates that obesity is a widespread issue in Appalachia [36] and our results indicate that Appalachian women were significantly more likely to be overweight/obese than non-Appalachian women. This could in part be due to poor nutrition among those living in Appalachia. Over 39 % of Appalachian women reported low levels of physical activity and 77 % reported suboptimal consumption of fruits and vegetables.

Mental Health

Although there was no difference between non-Appalachian and Appalachian women's mental health status, there was a difference within Appalachia [35]. Women living in counties with weaker economies reported poorer mental health. This may be due to the relationship between mental health status and stressors related to living in an economically distressed community with fewer resources or lack of access to mental health services [37].

Overall

Overall, we found significant differences in preconception health between Appalachian and non-Appalachian women, with Appalachian women faring worse on many indicators compared to non-Appalachian women. However, comparisons within the demographically diverse and geographically large Appalachian region demonstrated differences by community-level economic success. The ability to examine preconception health within Appalachia was a strength of our study. Other noteworthy strengths include using multiple years of data from a large, nationally representative sample of women and examining a large

number of PCHIs. Moreover, most of the PCHIs have moderate to high validity [38] and cover a range of health issues.

However, there are several potential limitations to consider when interpreting our results. First, the findings apply only to women aged 18–44 years. Although adolescents and older women can become pregnant, the PCHIs are intended for women 18–44 years of age, which represent the majority of women becoming pregnant [39]. Younger and older women may have different preconception health profiles which should be examined separately. Second, BRFSS data are self-reported, and perhaps, cultural differences may have inclined some women to be more or less reluctant to disclose certain behaviors (e.g., smoking). Third, the specific response rate among Appalachian women is not captured in BRFSS; however, the proportion of Appalachian respondents mirrors the portion of U.S. adults living in Appalachia. Fourth, post-2005 restrictions on county identifiers limited the timeliness of our data. Fifth, the PCHIs presented here are a subset of those identified; BRFSS is one of five PCHI data sources. Still, BRFSS includes indicators from 10 of the 11 domains identified by the state working group. Lastly, while there was statistical significance for some comparisons, the absolute differences in prevalence were often quite small and results should be interpreted as such.

Notwithstanding these limitations, our results provide information on region-specific needs and disparities, and could be used to determine state and national priorities for public health programs and interventions aimed at improving preconception health among women of reproductive age. Additionally, these results are useful to establish a baseline of preconception health among Appalachian women, and can be used for tracking trends over time.

Conclusion

Strategies to improve preconception health should recognize geographic, sociodemographic and cultural differences to improve their effectiveness [40]. Evidence-based, culturally-appropriate interventions should be implemented to improve preconception health among women living in poorer regions of the U.S., including Appalachian counties with weak economies. Future studies should examine PCHIs in this population using data from other sources, such as the Pregnancy Risk Assessment Monitoring System (PRAMS), to further understand potential preconception health disparities that may exist among and between Appalachian women.

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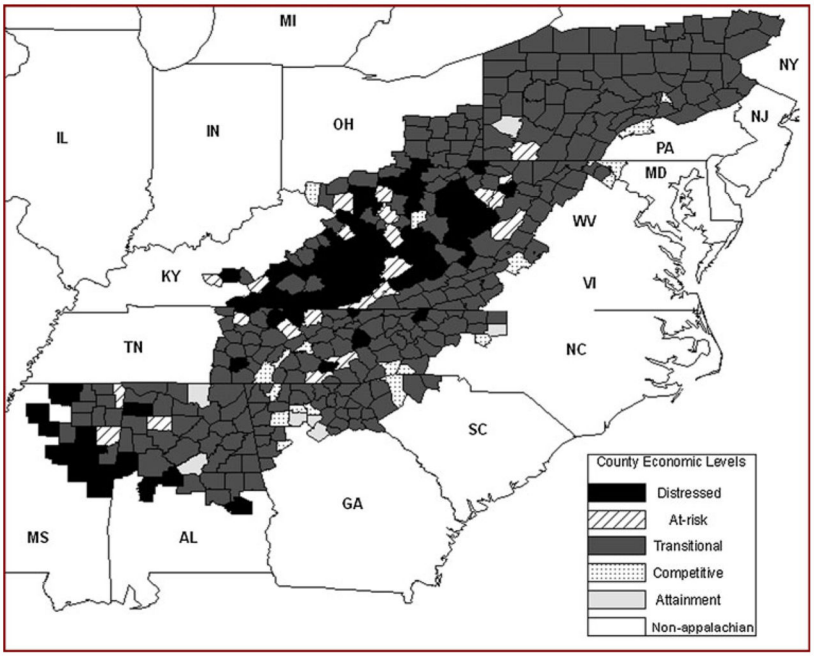

Fig. 1.

County economic status in Appalachia. Appalachian counties are classified as: (1) *distressed* (below the 10th percentile for the nation), (2) *at-risk* (between the 10th and 25th percentile), (3) *transitional* (between the 25th and 75th percentile, (4) *competitive* (between the 75th and 90th percentile), and (5) *attainment* (above the 90th percentile)

Table 1

Weighted estimates of demographic characteristics by county status, Behavioral Risk Factor Surveillance System, 1997–2005

Characteristic	County type			Appalachian county economic classification[a]					
	Appalachian n = 36,254 Weighted % (SE)	Non-Appalachian n = 88,312 Weighted % (SE)	*p* value[b]	Distressed n = 5,819 Weighted % (SE)	At-Risk n = 2,082 Weighted % (SE)	Transitional n = 22,666 Weighted % (SE)	Competitive n = 2,740 Weighted % (SE)	Attainment n = 2,947 Weighted % (SE)	*p* value[b]
Age (years)									
18–24	24.8 (0.4)	23.7 (0.3)	0.02	26.0 (1.1)	19.6 (1.6)	25.6 (0.5)	24.0 (1.4)	21.4 (1.2)	0.003
25–34	34.4 (0.4)	35.2 (0.2)		33.1 (1.0)	34.6 (1.8)	34.2 (0.6)	36.0 (1.3)	35.3 (1.1)	
35–44	40.8 (0.4)	41.1 (0.2)		40.2 (1.1)	45.7 (1.9)	40.2 (0.5)	40.0 (1.4)	43.3 (1.2)	
Race/Ethnicity									
Black, Non-Hispanic	8.6 (0.2)	21.2 (0.2)	< 0.0001	10.3 (0.7)	3.7 (0.6)	7.0 (0.2)	12.9 (1.1)	15.9 (0.9)	< 0.0001
Other, Non-Hispanic	2.8 (0.1)	5.4 (0.1)		1.7 (0.4)	2.1 (0.5)	2.5 (0.2)	2.4 (0.5)	5.4 (0.6)	
White, Non-Hispanic	85.8 (0.3)	65.0 (0.3)		86.1 (0.8)	92.7 (0.9)	88.0 (0.3)	80.8 (1.2)	73.9 (1.1)	
Hispanic	2.8 (0.1)	8.4 (0.1)		1.9 (0.3)	1.5 (0.5)	2.5 (0.2)	3.9 (0.6)	4.8 (0.6)	
Marital status									
Married	58.1 (0.4)	51.8 (0.3)	< 0.0001	59.8 (1.1)	62.3 (1.8)	57.9 (0.5)	60.0 (1.4)	55.7 (1.2)	0.01
Unmarried	41.9 (0.4)	48.2 (0.3)		40.2 (1.1)	37.7 (1.8)	42.1 (0.5)	40.0 (1.4)	44.3 (1.2)	
Annual income									
< $15,000	12.0 (0.3)	9.9 (0.2)	< 0.0001	20.6 (1.0)	15.4 (1.5)	12.0 (0.3)	8.1 (1.1)	8.2 (0.8)	< 0.0001
$15,000–$24,999	21.3 (0.3)	17.8 (0.2)		27.2 (1.0)	30.2 (2.0)	21.9 (0.4)	16.5 (1.1)	14.4 (0.9)	
$25,000–$34,999	17.4 (0.3)	15.3 (0.2)		16.7 (0.9)	16.3 (1.5)	18.0 (0.4)	16.9 (1.1)	14.5 (0.9)	
$35,000–$49,999	20.0 (0.3)	18.9 (0.2)		17.8 (1.0)	17.3 (1.5)	20.7 (0.4)	20.8 (1.3)	17.9 (1.0)	
≥$50,000	29.3 (0.4)	38.0 (0.3)		17.7 (1.0)	20.6 (1.7)	27.4 (0.4)	37.7 (1.4)	45.0 (1.2)	

SE = standard error

[a] As defined by the Appalachian Regional Commission

[b] Chi-square *p* value

Table 2

Weighted estimates of demographic characteristics and preconception health indicators and the odds ratios for the association between Appalachian designation and those indicators among non-pregnant women aged 18–44 years, Behavioral Risk Factor Surveillance System, 1997–2005

Preconception health indicator	Total sample size N = 124,808	Appalachian n = 36,496 Weighted % (SE)	Non-Appalachian n = 88,312 Weighted % (SE)	OR (95 % CI)	AOR[a] (95 % CI)
Level of education					
< High school	124,719	9.6 (0.2)	8.2 (0.2)	1.19 (1.11–1.27)*	1.19 (1.10–1.29)*
General health status and life satisfaction					
Self-Rated health					
Fair/Poor	124,629	10.1 (0.2)	8.9 (0.2)	1.15 (1.08–1.22)*	1.14 (1.06–1.22)*
Health care					
Access to and utilization of health care					
No current health care coverage	124,571	19.0 (0.3)	16.6 (0.2)	1.18 (1.12–1.24)*	1.12 (1.05–1.19)*
No routine checkup in the past year	64,389	28.5 (0.5)	24.9 (0.3)	1.20 (1.13–1.28)*	1.12 (1.04–1.20)*
Reproductive health care					
No pap test within the past 3 years	81,202	6.7 (0.2)	4.6 (0.1)	1.48 (1.34–1.63)*	1.20 (1.08–1.33)*
Tobacco and alcohol use					
Smoking					
Currently smokes every or some days	103,918	31.3 (0.4)	26.0 (0.3)	1.30 (1.24–1.36)*	1.08 (1.03–1.14)*
Alcohol consumption					
Participated in heavy drinking at least once in the past month	63,883	4.2 (0.2)	5.1 (0.2)	0.80 (0.70–0.92)*	0.72 (0.63–0.84)*
Participated in binge drinking at least once in the past month	34,517	8.9 (0.5)	12.1 (0.4)	0.71 (0.62–0.82)*	0.69 (0.59–0.81)*
Nutrition and physical activity					
Fruit and vegetable consumption					
Consumes < 5 fruits and vegetables daily	64,028	77.5 (0.6)	74.9 (0.4)	1.17 (1.08–1.27)*	1.11 (1.02–1.21)*
Overweight and obesity					
Overweight or obese	116,776	45.3 (0.4)	44.2 (0.3)	1.04 (1.01–1.08)*	1.05 (1.01–1.09)*
Exercise/Physical activity					
Does not meet recommended level[b]	47,821	52.6 (0.6)	42.8 (0.4)	1.02 (1.00–1.07)	1.02 (0.97–1.08)

Preconception health indicator	Total sample size N = 124,808	Appalachian n = 36,496 Weighted % (SE)	Non-Appalachian n = 88,312 Weighted % (SE)	OR (95 % CI)	AOR[a] (95 % CI)
Mental health					
General mental distress					
Poor mental health ≥14 of past 30 days	59,807	25.0 (0.5)	24.7 (0.3)	1.02 (0.96–1.08)	0.94 (0.88–1.01)
Chronic conditions					
Diabetes					
History of diabetes[c]	124,745	5.0 (0.2)	4.8 (0.1)	1.04 (0.95–1.13)	1.03 (0.94–1.13)
Hypertension					
History of hypertension[c]	60,636	13.7 (0.4)	12.2 (0.2)	1.14 (1.05–1.24)*	1.07 (0.98–1.17)
Asthma					
Currently has asthma	98,197	13.3 (0.3)	14.1 (0.2)	0.93 (0.88–0.99)*	0.88 (0.82–0.93)*
Infections					
Immunizations					
No influenza vaccination within the past year	91,755	82.5 (0.4)	82.5 (0.2)	1.04 (0.98–1.10)	1.02 (0.96–1.09)

OR = odds ratio

[a] AOR = adjusted odds ratio; Adjusted for age, race/ethnicity, income, education and state of residence; Sample sizes for multivariable models ranged from 21,391 to 101,190

[b] Per week

[c] Including gestational

* Statistically significant at $p < 0.05$; SE = standard error

Table 3

Weighted estimates of demographic characteristics and preconception health indicators and the odds ratios for the association between economic classification of county of residence and those indicators among non-pregnant Appalachian women aged 18–44 years, Behavioral Risk Factor Surveillance System, 1997–2005

	County economic classification[a]									
	Distressed n = 5,819		At-risk n = 2,082		Transitional n = 22,666		Competitive n = 2,740		Attainment n = 2,947	
	%[b] (SE)	AOR[c] (95 % CI)	%[b] (SE)	AOR[c] (95 % CI)	%[b] (SE)	AOR[c] (95 % CI)	%[b] (SE)	AOR[c] (95 % CI)	%[b] (SE)	AOR[c]
Social determinates of health										
Level of education										
< High school	14.5 (0.7)	2.0 (1.51–2.65)*	13.3 (1.3)	2.13 (1.48–3.07)*	9.5 (0.3)	1.50 (1.16–1.96)*	10.3 (1.1)	2.25 (1.55–3.27)*	5.4 (0.6)	1.00
General health status and life satisfaction										
Self-Rated health										
Fair/Poor	16.3 (0.8)	1.74 (1.36–2.23)*	15.8 (1.4)	1.77 (1.29–2.43)*	1.8 (0.3)	1.24 (1.00–1.54)	10.4 (1.1)	1.32 (0.97–1.80)	6.4 (0.6)	1.00
Health care										
Access to and utilization of health care										
No current health care coverage	30.9 (1.0)	2.02 (1.65–2.48)*	26.2 (1.7)	1.74 (1.34–2.26)*	18.5 (0.4)	1.23 (1.05–1.50)*	17.8 (1.1)	1.46 (1.13–1.89)*	12.9 (0.9)	1.00
No routine checkup in the past year	32.8 (1.5)	0.99 (0.80–1.23)	31.4 (2.8)	1.00 (0.71–1.38)	28.4 (0.6)	1.02 (1.01–1.03)	25.2 (1.9)	0.89 (0.68–1.15)	27.8 (1.5)	1.00
Reproductive health care										
No pap test within the past 3 years	9.0 (0.7)	1.34 (0.92–1.93)	11.3 (1.6)	1.68 (1.05–2.69)*	6.7 (0.3)	1.18 (0.86–1.64)	6.0 (0.8)	1.37 (0.89–2.10)	4.7 (0.6)	1.00
Tobacco and alcohol use										
Smoking										
Currently smokes every or some days	35.1 (1.1)	1.08 (0.91–1.29)	37.0 (2.1)	1.18 (0.93–1.50)	32.0 (0.5)	1.13 (0.99–1.31)	29.6 (1.4)	1.08 (0.88–1.33)	24.8 (1.1)	1.00
Alcohol consumption										
Heavy drinking at least once in the past month	1.8 (0.5)	0.30 (0.16–0.57)*	1.9 (0.6)	0.32 (0.16–0.64)*	4.3 (0.3)	0.72 (0.53–1.00)	3.9 (0.7)	0.65 (0.41–1.04)	5.8 (0.8)	1.00
Binge drinking at least once in the past month	5.7 (1.0)	0.42 (0.25–0.71)*	4.8 (2.4)	0.38 (0.12–1.23)	9.4 (0.6)	0.79 (0.54–1.16)	7.2 (1.4)	0.62 (0.35–1.01)	10.3 (1.5)	1.00
Nutrition and physical activity										
Fruit and vegetable consumption										
Consumes < 5 fruits and vegetables daily	81.2 (1.9)	1.68 (1.21–2.35)*	82.6 (2.5)	2.00 (1.28–3.13)*	78.2 (0.7)	1.53 (1.20–1.96)*	77.7 (2.2)	1.53 (1.08–2.17)*	69.1 (2.3)	1.00

	County economic classification[a]									
	Distressed n = 5,819		At-risk n = 2,082		Transitional n = 22,666		Competitive n = 2,740		Attainment n = 2,947	
	%[b] (SE)	AOR[c] (95 % CI)	%[b] (SE)	AOR[c] (95 % CI)	%[b] (SE)	AOR[c] (95 % CI)	%[b] (SE)	AOR[c] (95 % CI)	%[b] (SE)	AOR[c]
Overweight and obesity										
Overweight or obese	54.9 (1.2)	1.75 (1.50–2.03)*	52.2 (2.0)	1.49 (1.22–1.83)*	44.8 (0.5)	1.24 (1.11–1.40)*	43.2 (1.4)	1.20 (1.02–1.42)*	40.6 (1.2)	1.00
Exercise/Physical activity										
Does not meet recommended level[d]	42.0 (1.3)	1.22 (0.97–1.53)	35.7 (2.3)	1.11 (0.82–1.50)	38.8 (0.6)	1.02 (0.85–1.23)	39.9 (1.8)	1.21 (0.94–1.56)	41.3 (1.5)	1.00
Mental health										
General mental distress										
Poor mental health for ≥14 of past 30 days	35.5 (1.5)	1.91 (1.51–2.43)*	30.0 (2.5)	1.42 (1.03–1.94)*	24.8 (0.6)	1.26 (1.03–1.55)*	25.0 (1.8)	1.39 (1.04–1.85)*	18.9 (1.3)	1.00
Chronic conditions										
Diabetes										
History of diabetes[e]	4.8 (0.4)	1.07 (0.78–1.46)	6.6 (1.0)	1.43 (0.93–2.20)	5.2 (0.2)	1.25 (0.95–1.63)	4.3 (0.5)	1.11 (0.78–1.59)	4.2 (0.5)	1.00
Hypertension										
History of hypertension[e]	17.4 (1.3)	1.30 (0.94–1.80)	19.7 (2.6)	1.53 (0.99–2.35)	13.6 (0.5)	1.15 (0.88–1.51)	11.1 (1.4)	0.84 (0.58–1.22)	11.3 (1.2)	1.00
Asthma										
Currently has asthma	15.1 (0.9)	0.89 (0.71–1.13)	13.5 (1.4)	0.83 (0.61–1.14)	13.0 (0.4)	0.87 (0.72–1.06)	14.7 (1.1)	1.02 (0.79–1.31)	13.1 (0.9)	1.00
Infections										
Immunizations										
No influenza vaccination within the past year	83.7 (1.0)	0.96 (0.76–1.21)	82.9 (1.9)	0.98 (0.70–1.35)	82.4 (0.4)	0.95 (0.79–1.12)	81.9 (1.1)	0.96 (0.76–1.21)	82.3 (1.1)	1.00

[a] As defined by the Appalachian Regional Commission

[b] Weighted prevalence

[c] AOR = adjusted odds ratio; Weighted estimates of demographic characteristics and preconception health indicators and adjusted odds ratios for the association between economic status classification and those indicators among women living in Appalachian counties and adjusted for age, race/ethnicity, income, education level, and state of residence

[d] Per week

[e] Including gestational

* Statistically significant at $p < 0.05$; SE = standard error; Sample sizes for multivariable models ranged from 6,597 (binge drinking) to 29,744 (high school education)