1-1-2007

The Association of Lung Cancer Mortality with Income and Education in Kentucky Counties

David Gross
University of Kentucky, dagros3@email.uky.edu

MPA student
Eastern Kentucky University
Department of Government
Master of Public Administration program
Richmond, KY

The Association of Lung Cancer Mortality with Income and Education in Kentucky Counties

David A. Gross

Director of Research, Marketing and Community Engagement
750 Morton Blvd.
Hazard, KY
dagros3@email.uky.edu

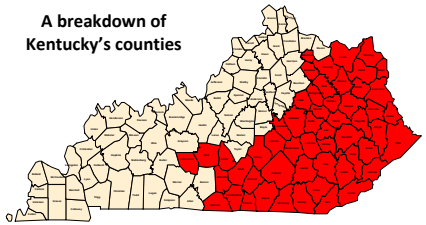
Abstract

Lung/bronchus cancer is the primary cause of cancer death in the United States, with more than 160,000 deaths attributed to the disease during the year 2007 alone. The predominant risk factor for this type of cancer is tobacco smoking. With the nation's highest rate of adult smokers (at 28.3 percent), the disease is particularly problematic in Kentucky. The state's lung/bronchus cancer mortality rate – 80 deaths per 100,000 population – is much higher than the national average of 55. Indeed, each of Kentucky's 120 counties has a lung cancer death rate that exceeds the national average.

This research project examines the lung/bronchus cancer death rates in Kentucky's 54 Appalachian counties (primarily those in the eastern and southern regions of the state) compared to rates in its 66 non-Appalachian counties (those located in the central, northern and western regions). Most (38) of the state's Appalachian counties have been designated as "distressed" by the Appalachian Regional Commission based on their multi-year rates of low per capita income and elevated rates of poverty and unemployment.

This project analyzes whether relationships exist between county-level lung/bronchus cancer death rates and counties' high school graduation rates, per capita personal income, adult smoking rates and designation as an Appalachian county.

A breakdown of Kentucky's counties



Non-Appalachian counties (n = 66) Appalachian counties (n = 54)

Literature Review

Deaton (2002) has noted that "one of the clearest messages from the literature is that health and wealth are mutually determined." Of particular relevance to this project is the fact that smoking rates generally are higher among the poor and less educated.

Gorey and Vena (1995) tracked New York State Cancer Registry data for nearly 42,000 cases and found that near poverty status, in and of itself, is a cancer risk factor. For instance, the lung cancer rate for women living in high-poverty areas – those with census tracts in which more than half of residents were below 200 percent of the federal poverty level – was approximately twice that observed among women living in areas with lower poverty rates.

Hemminki and Li (2003) analyzed approximately 760,000 invasive cancer cases in Sweden, with subjects identified according to educational attainment. While overall cancer risks showed only minimal differences based on education, some site-specific cancers varied significantly depending upon educational group. Lung cancer, for instance, was much less common in those who were university educated (standardized incidence ratio of 0.47) as opposed to those with less than nine years of education (standardized incidence ratio of 1.00).

Hypotheses

1) **The lower a county's high school graduation rate, the higher its lung/bronchus death rate will be.**

2) **The lower a county's per capita personal income, the higher its lung/bronchus cancer death rate will be.**

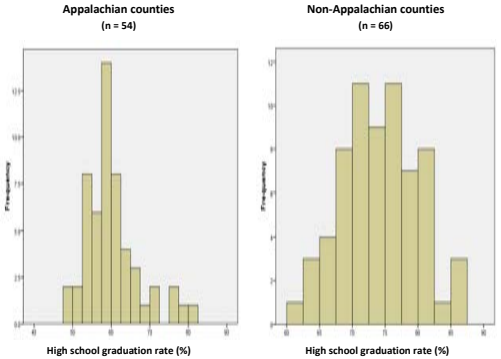
Data and Methods

The primary data source for this study was the Kentucky Institute of Medicine's 2007 report, "The Health of Kentucky: A County Assessment." This document analyzed Kentucky counties' health status based on 25 different health-related measures, which were used to produce a 1-120 ranking. Because of variation in the number of deaths each year, data were combined for multiple years (1997-2004) to produce more stable rates for some measures.

The variables examined here are: lung/bronchus cancer, deaths per 100,000 population, with data derived from the Kentucky Cancer Registry Inquiry System; high school graduation (percentage of adults 25 years or older who have graduated from high school), from the U.S. Census Bureau and Kentucky State Data Center; per capita personal income, or the "mean income computed for every man, woman and child in a particular group," from the Bureau of Economic Analysis, U.S. Department of Commerce; and prevalence of smoking (percent of adult population), from the Kentucky Behavioral Risk Factor Surveillance Survey. Appalachian counties in Kentucky were designated by the Appalachian Regional Commission.

The data were analyzed using the Statistical Package for the Social Sciences (SPSS). Independent samples *t* tests determined whether the means for the study variables differed to a statistically significant degree between Kentucky's Appalachian and non-Appalachian counties. Correlation coefficients were calculated to determine whether statistical relationships exist between the dependent variable (lung/bronchus cancer death rate) and the independent variables (high school graduation rate, per capita personal income and adult smoking rate). Simple and multiple regression analyses were carried out to predict counties' lung/bronchus cancer death rates as a function of each independent variable.

Figure 1: A Comparison of Kentucky's High School Graduation Rates by Region



Source: Author analysis of Kentucky Institute of Medicine data, 2007

Findings

Table 1: Differences Between Kentucky Counties for Various Health Indicators

	Type of county			
Health indicator	Appalachian	Non-Appalachian	*t* score	Significance
Lung cancer deaths (per 100,000)	86.4	76.8	4.413	*p* = .000*
Per capita personal income	$19,693	$25,339	-7.521	*p* = .000*
High school graduation rate	60.1%	74.0%	-11.862	*p* = .000*
Adult smoking rate	28.9%	27.5%	1.775	*p* = .078
	(*n* = 54)	(*n* = 66)		

Note 1: County means are not weighted by population.

Note 2: The *t* distribution was used to examine the statistical significance of the difference between the types of counties for each health indicator. A given *t* score corresponds with the probability (or *p* value) that both samples could come from the same population. An * denotes statistically significant differences (alpha was set at $p \leq .05$).

Source: Author analysis of Kentucky Institute of Medicine data, 2007

Table 2: Correlation Results for Predictors of Lung Cancer Deaths

Appalachian variable combinations	Correlation coefficient	Significance
Lung cancer death rate with high school graduation rate	-.393	.002**
Lung cancer death rate with per capita personal income	-.185	.090
Lung cancer death rate with adult smoking rate	.103	.458
Non-Appalachian variable combinations		
Lung cancer death rate with high school graduation rate	-.187	.066
Lung cancer death rate with per capita personal income	-.077	.270
Lung cancer death rate with adult smoking rate	.245	.048*
Statewide variable combinations		
Lung cancer death rate with high school graduation rate	-.470	.000**
Lung cancer death rate with per capita personal income	-.302	.001**
Lung cancer death rate with adult smoking rate	.210	.021*

Note 1: An alpha of .05 was used as the upper threshold for rejecting a null hypothesis of no statistically significant correlation between each variable combination. For **, the correlation is significant at the .01 level; for *, the correlation is significant at the .05 level.

Note 2: The correlation coefficient is a number between -1 and +1 that indicates the strength and direction of the association between two variables. 0 = no relationship; +/- .20 = a weak relationship; +/- .40 = a moderate relationship; +/- .60 = a strong relationship; +/- .80 = a very strong relationship; +/- 1 = a perfect relationship).

Source: Author analysis of Kentucky Institute of Medicine data, 2007

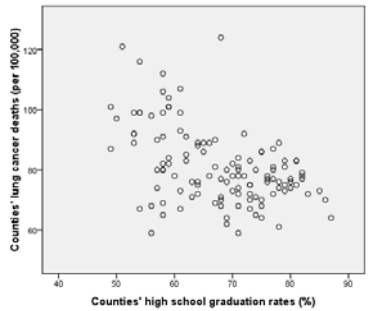
Table 3: Statewide Ordinary Least Squares Regression Results – Lung Cancer Death Rates

Variable	B Coefficient	Std. Beta Coefficient	*t* score	Significance
Constant	115.706		9.750	.000
B1 Adult smoking rate	.276	.093	1.102	.273
B2 High school graduation rate	-.760	-.565	-4.386	.000
B3 Per capita personal income	.000	.157	1.229	.222
Adjusted R Square = .218; F = 12.042 (.000)				

Source: Author analysis of Kentucky Institute of Medicine data, 2007

Findings (continued)

Figure 2: Kentucky's Lung Cancer Mortality as a Function of High School Graduation Rates



Source: Author analysis of Kentucky Institute of Medicine data, 2007

Conclusions

1. **This study found associations in the hypothesized direction for lung cancer death rates with each independent variable, as well as statistically significant differences between Kentucky's Appalachian and non-Appalachian counties for each variable except adult smoking rates.**

2. **Adult smoking rates were similar in Appalachian and non-Appalachian counties in Kentucky and were not significantly associated with counties' lung cancer death rates in multiple regression analyses that included high school graduation rates and per capita personal income. In the context of similar adult smoking rates, lower high school graduation rates were significantly associated with increased lung cancer mortality rates.**

3. **Appalachian counties had significantly lower high school graduation rates, and graduation rates showed the strongest statistical association with lung cancer mortality rates, which may be the explanation for higher lung cancer mortality in Appalachian counties. Among other things, education level can influence occupation, amount of disposable income, adherence to healthy behaviors and participation in health promotional and screening programs. This finding suggests that Kentucky's emphasis on improving graduation rates (resulting in a 6.2 percentage point gain during a recent 5-year period) may reduce lung cancer mortality overall and has the potential to address health disparities between Appalachian and non-Appalachian counties if graduation rates in Appalachian Kentucky catch up with the rest of the state.**

Works Cited

Deaton, A. (2002). Policy implications of the gradient of health and wealth: An economist asks, would redistributing income improve population health? *Health Affairs*. Vol. 21 (2), pp. 13-30 (p. 16).

Gorey, K. M., & Vena, J. E. (1995). The association of near poverty status with cancer incidence among black and white adults. *Journal of Community Health*. Vol. 20 (4), pp. 359-366.

Hemminki, K., & Li, X. (2003). Level of education and the risk of cancer in Sweden. *Cancer Epidemiology, Biomarkers & Prevention*. Vol. 12, pp. 796-802.

Kentucky Institute of Medicine. (2007). The Health of Kentucky: A County Assessment. Lexington, KY. Available at http://www.kyiom.org/assessment. html.