Moving Mountains – An GIS Analysis of Mortality Rates and MTR Coal Mining in Appalachia

Appalachia remains one of the unhealthiest regions in the United States. The Appalachian region is characterized by higher mortality rates overall (Crossman et al. 2007), for heart disease (Barnett et al. 2000), for all-type cancer (Blackley, Behringer & Zheng 2012) and for breast cancer (Yao, Lengerich & Hillemeier 2012). However, scholars have not only found mortality disparities between Appalachian and non-Appalachian regions, they have begun to examine disparities within the Appalachian region between coal mining and non-coal mining communities. Growing scholarship in the last decade has pointed to the potential impact that coal mining may have on health inequality in the region (Hendryx 2008, Hendryx 2009). However, there is disagreement that coal mining has played a role in the health inequality of the region (Boark et al. 2012).

In this paper I will use GIS techniques to examine potential association between coal mining and county-level mortality in the Appalachian region. I will construct a population risk measure for mountaintop removal coal mining. Using geocoded mountaintop removal coal mining sites and census-tract population data I will create a measure to estimate the number of people within 1-mile, 2-mile and 5-mile distance that are potentially at risk for environmental pollution from MTR coal mining sites. I base my model on the work of Hendryx, Fedorko & Anesetti (2010), who use GIS techniques to estimate potential population exposure to coal mining facilities in West Virginia in 2006. They find that distance measure to coal mining facilities is associated with increased cancer mortality, those living closest to coal mining facilities have higher mortality rates.

In a preliminary analysis using county-level mortality data from 2001 to 2004 for eastern Kentucky, West Virginia and southwest Virginia I find significantly higher all-cause mortality rates in both coal mining and mountaintop removal coal mining counties. I test the means using a two-tailed t-test between coal mining and non-coal mining counties in Table 1 and between MTR coal mining counties and non-MTR coal mining counties in Table 2. Table 1 shows a significant ($p>.0001$) higher average county-level age-adjusted mortality rate for coal mining counties than non-coal mining counties. Table 2 shows MTR counties have significantly ($p>.0001$) higher mortality rates than non-MTR coal mining counties. These results suggest there is an association between coal mining, in particular MTR coal mining, and county-level age-adjusted mortality rates.

In the full model with the population risk measure I will construct a linear regression model to test the potential association with county-level mortality rates for all-cause mortality, all-cancers (ICD 10 – C00-D49), lung and bronchus cancer (ICD 10 – C34) and cardiovascular diseases (ICD 10 – I00-I99). I choose these four categories because they have been used most frequently by previous scholars (Hendryx 2008; Hendryx 2009; Hendryx, Fedorko & Anesetti 2010; Esch and Hendryx 2011; Boark et al. 2012).

Given my preliminary results and what other scholars have found (Hendryx, Fedorko & Ansetti 2010) I hypothesize my results will show a significant association between the population risk measure and mortality for all four categories.

Table 2: Two-sample T-Test for Age-Adjusted Mortality Rates between MTR and non-MTR Mining counties in Central Appalachia, 2001-2004						
Group	**Obervations**	**Mean**	**S.E.**	**S.D.**	**95% Confidence Interval**	
No MTR Mining	85	990	11	102	967	1012
MTR Mining	56	1061	18	135	1024	1097
Combined	141	1018	20	121	998	1038
Difference		-71	20		-111	-31
Ha: !=0 = p>.0012; Ha: diff<0 = .0006; Ha: diff>0 = .9994						

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