

Coal Tattoo: an aerial interpolation model of surface and mountaintop removal coal mining and mortality in Appalachia, 1990-2010.

The Appalachia region lags the nation in improvements in health-related outcomes. Appalachia has high rates of cardiovascular and heart diseases (Barnett et al. 2000; Halverson, Barnett & Casper 2002; Michimi 2010), as well as high rates of health-related risk factors such as smoking (Mensch et al. 2005; King, Dube, & Tynan 2012). Prior research on the region has focused on the link between low socioeconomic status and health. However, scholars increasingly are examining the role coal mining may play in the health status of people in the area. Several studies have found that mortality rates for all causes are increased in the Appalachian region (Hendryx 2008), while others have found no significant associations between coal mining and health (Borak et al. 2012; Buchanich et al. 2014).

In this paper, I use a GIS-based aerial interpolation model to test the association between coal mining and mortality in the Appalachian region from 1990 to 2010. Prior work has used dummy or categorical variables to measure the impact of coal mining using coal production levels from federal and state regulatory agencies. These measures can be crude and do not measure exposure below the county-level. The risks posed by coal mining for population health reside in air pollution from surface and mountaintop removal mining sites, exhaust from trucks, trains and equipment and water contamination. Much of the pollution from these sites contains particulate matter (PM10 & PM2.5) (Knuckles et al. 2012; Kruth et al. 2014), which has been associated with increases in hospitalization and mortality from respiratory and cardiovascular diseases in urban air pollution studies (e.g. Zeka et al. 2005; Zanobetti et al. 2009, Miller et al. 2007, Thundiyil & Stolbach 2011). Thus using a GIS-based technique allows for a more refined approach than the prior exposure measures utilized.

I create my measure by using the National Land Cover Survey from the U.S. Geologic Survey in 1992, 2001, 2006 and 2011 along with mine permit data from state regulatory agencies and standardized US Census Bureau's Census blocks from the 1990, 2000, 2010 US Census and the 2005 American Community Survey. Using the census blocks, I will construct an aerial interpolation model that calculates the total number of people within a defined distance (.5, 1, 5, 10 miles) of the surface mining site. I will use mortality rates from 1990 to 2010 for five ICD classifications: All-cause mortality, all-cancers (ICD 10 – C00-D49), lung and bronchus cancer (ICD 10 – C34), cardiovascular diseases (ICD 10 – I00-I99), and mental and neurological diseases (ICD 10 – F00-F99; G00-G99) mortality rates. I will include additional covariates for county-level socio-economics, demographics, and smoking rates. I plan to construct an initial linear regression model to test the GIS-model. I will construct a random-effects and a fixed-effects model to test for association between coal mining and health over time. I hypothesize that my GIS model will be more predictive for all five mortality categories than prior coal exposure measures (coal production). Additionally changes in the GIS measure will be significantly associated changes in mortality over-time.