



Short Communication

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A Comprehensive Look at Environmental Factors Affecting Chronic Health in Coal-Dependent Appalachian Communities

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Abstract

Health disparity and poverty are prevalent in central Appalachian communities. Literature on health in rural communities is sparse, yet a prolific group of researchers associated coal production with high prevalence rates of chronic conditions. The aim of this research was to provide a fair, comprehensive and thorough assessment of health in rural, coal dependent communities. A three-phase study was developed with the objective of identifying demographic, geographic, economic, and social determinants of health contributing to high rates of common chronic health conditions in regions of southern Virginia. A systematic data collection tool designed for objective evaluation allowed for assessment of published literature on coal, health, and Appalachia. Analysis of mortality records from the Virginia Department of Health generated chronic disease prevalence. For the third phase, a more granular, targeted approach employed a cross-sectional study to capture de-identified electronic medical record information.

Our findings from evaluation of published literature concluded the evidence for a cause-effect relationship was weak, unable to confirm a direct association of coal production with chronic health conditions. Study results assessing agency data confirmed known high mortality risk of non-malignant respiratory disease associated with residents living in Virginia coal-mining counties. The critical role of health access emerged as a major environmental factor in reducing health disparities. In-patient electronic medical records showed high rates of documentation for patient smoking and alcohol, but low rates of documentation for physical activity. Surveyed health care professionals and patient caregivers recognized the unique cultural elements of each community and prevailing personal attributes of area residents. The information produced from qualitative data may be the missing link in previous attempts by agencies to alleviating health disparities in Appalachia. Our findings will inform health professionals, policy makers and residents of the strengths, weaknesses and opportunities for well-being going forward for coal communities in southwest Virginia.

Keywords: Health; Disparity; Coal; Appalachia; Chronic; Electronic medical records; Environmental health; Qualitative; Quantitative

Rachel Mullins and Emily Carbaugh these coauthors made contributions to the research as students of the Edward Via College of Osteopathic Medicine or affiliated programs.



Introduction

Health disparity and poverty are prevalent in central Appalachian communities. The Appalachian Regional Commission, tasked over 50 years ago with alleviating health disparities throughout the area, serves an area typically characterized by rurality, poverty, high numbers of underserved communities and health disparities. Southwest Virginia is geographically nestled in the heart of mountainous Central Appalachia. The region produces a high quality coal that has been the mainstay of the regional economy for generations [1-6]. Although research literature on health in rural coal communities is sparse, a prolific group of researchers report coal production associated with high prevalence rates of chronic health conditions [7-29]. The conclusions were not supported by specific evidence to justify a direct cause-effect relationship, primarily due to limiting protocol designs, some relying on self-reported data [30-34]. The aim of this research was to provide a fair, comprehensive and thorough assessment of health in rural, coal dependent communities based on agency data and primary, individual level data. The findings inform health professionals, policy makers and residents of the strengths, weaknesses and opportunities for well-being going forward.

Our research team initiated a three-phase study with the overall objective of identifying demographic, geographic, economic, and social determinants of health contributing to the persistently high prevalence rates of common chronic health conditions in regions of southern Virginia. In the first phase, a detailed literature review was completed. A literature review methodology developed for evaluating data of publication quality on coal, health, and Appalachia allowed objective assessments of existing, relevant research. The second phase utilized county health data made available through various agencies, e.g., American Cancer Society, Health Resources and Services Administration, and the Robert Wood Johnson Foundation [35-40]. Additionally, mortality records from the Virginia Department of Health were assessed for chronic diseases as a cause of death in coal and comparison areas. Trends in mortality throughout health disparity regions in southern Virginia were graphically depicted over a 50-year period of time from primary level data [41].

For the third phase of the study, a more granular, targeted approach employed a cross-sectional study design to capture de-identified electronic medical record information. Again, primary, individual level data were available on disease conditions, family histories, medical histories, clinical results, laboratory findings, and physician notes. The quantifiable data provided descriptive and characterizing information on various social determinants of health. A human dimension depicted through information solicited from focus groups and individual interviews or provided through surveys complemented data reported in tables and graphs. Those with first-hand knowledge of health care in the region personalized

the situation, highlighted strengths within the community and offered suggestions for improving health outcomes and balancing perceptions of disparities in southwestern Virginia.

The extensive literature review revealed the limited number of independently authored publications on health in coal dependent residents in Appalachia. Often studies relied on epidemiological experimental methods, thus, the protocol design hampered the ability to draw substantive conclusions. Human or environmental exposures were difficult to confirm and led to contradictory conclusions. In summary, the evidence for a cause-effect relationship was weak for the inferred direct association of coal production with chronic health conditions [30-34].

Our analysis of agency data confirmed higher rates of chronic health conditions and poverty rates in coal producing communities, e.g., unemployment in West Virginia and chronic disease mortality in Virginia [45]. Revealed were positive trends for mortality due to heart disease and strokes in coal-dependent areas with prevalence rates declining over time. However, rates of cancers and diabetes mellitus were especially troubling, increasing overtime [46]. Our two-level hierarchical model allowed the estimation of health impacts of coal mining to vary by county level characteristics. Consistent with previous reports, we showed a high mortality risk of non-malignant respiratory disease associated with residents living in Virginia coal-mining counties. The model also affirmed the critical role of health access in reducing health disparities related to coal exposure. (44) A lack of improvement and increased prevalence in some chronic health conditions have been attributed to many environmental factors (rurality, income, unemployment, lack of access to care, lack of insurance, lower educational attainment) as well as personal factors (older population) and modifiable personal behaviors (poor diet, physical inactivity, substance abuse and smoking) [35-49].

The development of our survey tool to extract data from electronic medical records provided original, primary, individual level information to advance our understanding of health disparities in coal-dependent communities in Appalachia. Training for inter-rater reliability, efficient data extraction, and data recording enhanced objectivity, avoiding data based on personal interviews and self-reported findings. Our study on documentation of lifestyle factors indicated assessments occurred more frequently in records of in-patients in coal-dependent facilities compared to those in non-coal dependent areas. In-patient records revealed very high rates of documentation for patient smoking and alcohol use but poor documentation of physical activity, thus, inferring providers infrequently engaged patients in a discussion on the importance of physical activity for good health [50].

To enhance our understanding of providing care in coal communities our current research efforts surveyed health care professionals and patient caregivers for their perspectives on

improving health in southwest Virginia. By adding the personal dimension, we expand our understanding of a less tangible component in the health care system. Emerging was recognition of the unique cultural elements of each community and the common personal characteristics of area residents, e.g., resiliency, religiosity, and strong community and family relationships. Acknowledging and responding to the human factors may be the missing link that has harnessed health disparities in Appalachia for decades [51-54].

To conclude, the geographic specificity of quantitative results and qualitative findings will guide health care systems and stakeholders on ways to bend the persistent disparity trends. A comprehensive understanding is needed to provide a path forward and emerge from real factors and perceptions that are barriers to good health in rural, coal-dependent communities in central Appalachia. Culturally informed, evidence-based information will guide future health programs and policies.

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