Economic and Health Factors in Coal Production Regions in Appalachian Southwest Virginia and Comparison Areas

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The MISSION of the Edward Via College of Osteopathic Medicine (VCOM) is to prepare globally-minded, community-focused physicians to meet the needs of rural and medically underserved populations and promote research to improve human health.
VCOM Study

Our MISSION with this project, as health care workers, is to identify opportunities to improve the health and well-being of rural communities.

Why have chronic disease rates persisted over time in Central Appalachia?

Previously reported on our 3 phase study:

I. Literature Review –
   Numerous articles, unsupported methods, single author driven not-evidence based
VCOM Study

II. Government/Agency data - national, regional; secondary
Appalachian Regional Commission (ARC) – county
Virginia Department of Health (VDH) – county
Robert Wood Johnson Foundation – County Health Rankings and Roadmaps

III. Primary data –
Individual VDH death records and
Rural hospital electronic medical records (EMR)
### Appalachian County Economic Status 2016-2017

<table>
<thead>
<tr>
<th>Category</th>
<th>AL</th>
<th>GA</th>
<th>KY</th>
<th>MS</th>
<th>SC</th>
<th>TN</th>
<th>VA</th>
<th>WV</th>
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</thead>
<tbody>
<tr>
<td>Distressed</td>
<td>5</td>
<td>5</td>
<td>69</td>
<td>50</td>
<td>19</td>
<td>24</td>
<td>12</td>
<td>15</td>
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<tr>
<td>At-risk</td>
<td>32</td>
<td>35</td>
<td>22</td>
<td>38</td>
<td>46</td>
<td>18</td>
<td>32</td>
<td>27</td>
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<tr>
<td>Transitional</td>
<td>60</td>
<td>54</td>
<td>9</td>
<td>13</td>
<td>35</td>
<td>10</td>
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<td>Competitive</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Attainment</td>
<td>3</td>
<td></td>
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Map created by the Appalachian Regional Commission
Today’s Outline

Why have chronic disease rates persisted over time in Central Appalachia?

A 3 phase study has lead from:
Coal → Health → Environment → Economy

“Agency” data:
Appalachian Regional Commission (ARC) – county
Virginia Department of Health (VDH) – county
Robert Wood Johnson Foundation – County Health Rankings and Roadmaps

VCOM health study:
VDH Records, 1960-2012 - individual
VCOM Electronic Medical Records – individual, de-identified
VA health disparities areas

5-6 wealthiest counties in VA, and US, in Northern VA

(Forbes Magazine, 2015)

Southwest, Mt. Rogers, Southside and Eastern VA

(Virginia Rural Health Data Portal, 2012, discontinued)
Appalachian and Health Disparity Areas Across Southern VA

Buchanan County – At-risk
Dickenson County – At-risk
Lee County - Distressed
Russell County – At-risk
Tazewell County - Transitional
Wise County, Norton City – At-risk

No Coal Production (1 county)
Scott County – At-risk

Coal Dependent Counties
Geographic Comparison Counties
Economic Comparison Counties
Rurality Comparison Counties
Virginia Appalachian Region

Data Source: Appalachian Research Initiative for Environmental Science (2016); Appalachian Counties from Appalachian Regional Commission (2013)
This study assessed health outcomes determined by:

- health behaviors (30%),
- clinical care (20%),
- social and economic factors (40%),
- physical environment (10%)
All cause age-adjusted mortality rates for males and females in SW and SS VA plotted for each decade, 1960-2012 (95% CI)(VCOM, VDH, UPITT).

What went ‘right’ in Southside VA counties?
All heart disease mortality, age-adjusted
Males and females in SW, Mt Rogers and SS VA plotted by decade from 1980-2012 (95% CI)(VCOM, VDH, UPITT).

<table>
<thead>
<tr>
<th>% Improved</th>
<th>Southwest</th>
<th>Southside</th>
<th>Mt. Rogers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>31</td>
<td>39</td>
<td>50</td>
</tr>
<tr>
<td>Female</td>
<td>28</td>
<td>33</td>
<td>31</td>
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</tbody>
</table>
Diabetes trends in US, VA and Appalachian VA

Diabetes age-adjusted mortality rates for males and females in SW and SS VA plotted for each decade, 1960-2012 (95% CI) (VCOM, VDH, UPITT).

US Adults (%) Diagnosed Diabetes, 1980–2011, CDC (change, doubled, 4-8%)

Adult(%) Diagnosed Diabetes, 1994 – 2011, CDC (change, doubled, ~4-8%)

Appalachian VA 13.9%

Non-Appalachian VA 7.4%
## Virginia Environmental Factors, 2015

Note: incomplete data and large standard deviations (means ± SD)

<table>
<thead>
<tr>
<th>Distressed SES Areas</th>
<th>Southwest (N=8)</th>
<th>Mount Rogers (N=12)</th>
<th>Southside (N=12)</th>
<th>Eastern VA (N=12)</th>
<th>VA Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Quality (#)</td>
<td>13.0 ± 0.1</td>
<td>12.9 ± 0.1</td>
<td>12.5 ± 0.2</td>
<td>12.2 ± 0.2</td>
<td>12.7</td>
</tr>
<tr>
<td>Water Violations % pop</td>
<td>9.1 ± 11.4</td>
<td>1.9 ± 2.1</td>
<td>14.7 ± 7.7</td>
<td>353 ± 945</td>
<td>2</td>
</tr>
<tr>
<td>Poor Mental Health Days</td>
<td>5.5 ± 1.2</td>
<td>4.4 ± 1.1</td>
<td>3.7 ± 0.6</td>
<td>3.44 ± 1.1</td>
<td>3.1</td>
</tr>
<tr>
<td>Mental Health Provider Ratio</td>
<td>1601 ± 1195</td>
<td>8075 ± 14221</td>
<td>3836 ± 3463</td>
<td>4694 ± 6137</td>
<td>724</td>
</tr>
<tr>
<td>Motor Vehicle Crashes Deaths</td>
<td>23.7 ± 5.1</td>
<td>19.1 ± 3.9</td>
<td>23.9 ± 9.4</td>
<td>22 ± 5</td>
<td>11</td>
</tr>
<tr>
<td>Deaths Due to Injury</td>
<td>110.7 ± 6.9</td>
<td>91.3 ± 13.5</td>
<td>73.6 ± 11.6</td>
<td>77 ± 15</td>
<td>52</td>
</tr>
</tbody>
</table>
VCOM Preliminary Health Study Results

- Confirm higher rates of chronic conditions in coal counties of WV and VA
- Cancer rates not declining in medically underserved communities; not meeting measurable goals to improve cancer death rates in VA.
- Heart diseases, strokes declined, like national trends, but still higher than comparison areas
- Obesity, diabetes, smoking, higher in coal counties – highest among women
- Chronic kidney diseases higher in Southside VA – ethnicity factor
- Deaths due to injuries and mental illnesses higher in SWVA, and again, in women
VCOM EMR Review - Recent Findings

- Electronic medical records from 6 facilities in southern VA, total reviews 1770
- Systematic randomization from 2012 adult inpatient admissions
  Oversampled in 1 SWVA facility, 480 record reviews
- Year of Birth – 1914 – 1993, No data on 2%
- Gender – Male 45%, Female- 53%, No data on 2%
- Occupation - Disabled – 30%  Retired – 29%  Unknown/Missing – 31%
  Coal miners – 29%,
  all but one male,
  almost all retired, disabled, unknown
VCOM EMR Review - Recent Findings

Social/Economic, 40% of National Model of Health Factors

VCOM information from EMR:

- Physical Activity - 85% of records no data
- Prescription and Illicit Drug Abuse – little data
- Alcohol Use – some data
- Tobacco Use in 59% or records
  - Reported as “PPD” (packs per day),
    - also cigarettes per day, cans per day-
      - reporting up to 5 PPD for 5, 15, 20 yrs
- Chews – 27 records (0.56%) as cans per day
- Reports of “Quit” – 65 records (0.14%)
VCOM EMR Review - Recent Findings

Other Health Factors – Blood pressure, CWP, mental illness, etc. ...

Body Mass Index (BMI) – in 86% records –

Range in BMI - 8.03 to 74.46

BMI less than 20 = underweight 12%
20-25 = normal 23%
25-30 = overweight 20%
greater than 30 = obese 25%,
with over 40 = 10%

No data 14%
Economic Measures in Health Disparity Areas

**Coal production** - units of measure were in thousands of short tons, reported annually for years 1990 to 2013

*(Energy Information Agency 2014; VA Center for Coal and Energy Research 2014)*

**Poverty** - percent of the population for all persons with a status below the poverty threshold of a given family size; Single member US household poverty threshold - $6,652 in 1990; $11,888 in 2013

*(Appalachian Regional Commission 2014)*

**Children in poverty** - percent of individuals 0 to 17 years of age, reported annually 1993 to 2013 (except, 1994, 1996)

*(US Census Bureau 2014)*

**Unemployment** percentage data were recorded annually for years from 1990 to 2013 and included persons who had no employment but were available for work and persons laid off regardless of whether they were seeking employment.

Percentage of households below poverty thresholds in Scott county, in coal producing counties in southwest VA and the state of VA aggregated by decade, from 1990-2000, then reported at five year averages from 2005 to 2012 (Appalachian Regional Commission, 2015).

**Poverty 1990 - 2012**

Poverty - differences existed between the coal producing counties, Scott County, and the state of VA when controlling for coal production ($p = 0.007$); no change in poverty rates over time.

Northern VA has 5-6 of wealthiest counties in US.

Percentage of households below poverty thresholds in Scott county, in coal producing counties in southwest VA and the state of VA aggregated by decade, from 1990-2000, then reported at five year averages from 2005 to 2012 (Appalachian Regional Commission, 2015).
Percentage of children in poverty in Scott county, coal counties in southwest VA, and the state of VA reported annually for years 1993, 1995, 1997 to 2013. Children in poverty increased significantly over time ($p < 0.001$). Regionally, rates were unaltered between the coal producing counties, Scott County, and the state of VA ($p = 0.5$).
Percent of persons unemployed in Scott county, in coal producing counties in southwest VA, Scott County, and the state of VA annually from 1990 to 2013. Unemployment changed over time, with a significant interaction between Scott county, coal counties, and VA ($p = 0.0001$).
Chart 17. Unemployment rates for persons 25 years and older by educational attainment
Seasonally adjusted, 1992–2016

Percent

16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0

Less than a high school diploma
High school graduates, no college
Some college or associate degree
Bachelor degree or higher

Note: Shaded areas represent recessions as determined by the National Bureau of Economic Research (NBER). Data online at http://data.bls.gov/timeseries/LNS140276598series_id=LNS140276608series_id=LNS140276898series_id=LNS14027662.

VA Department of Health Data

Suicide Rates, By Region

Suicide Rates per 100,000 Residents

Discussion of Economic and Health Factors

Statewide,
- Good news - cardiovascular conditions – going down
- Mixed - cancer going down in most areas, but going up in SES
- Bad news - suicide – all areas rising and/or not improving

Implications that economic factors, not environmental factors, having a substantial impact on mining region of Southwest VA, consequently on health, consistent with the national model (40%).

Other factors, such as loss of high paying jobs, loss of health insurance benefits for retirees, etc. impact community health care access, ‘eco-stress’, and are difficult to assess, yet likely impacting mental health as well as chronic disease.
Many attempts being made to diversify economic opportunities in the region.

The nation-wide rise in unemployment was reflected in the region with the 2008 recession, yet recovery in SW VA has not mirrored US improvements, possibly lacking capacity to ‘rebound’ due to deep job cuts.

VDH data by health district indicates that over the past 10 years stark disparities in health status continue, highest in distressed SES areas vs Northern VA.
National Health Study

County Health Rankings & Roadmaps
Building a Culture of Health, County by County
A Robert Wood Johnson Foundation program

This study assessed health outcomes determined by:

- health behaviors (30%),
- clinical care (20%),
- social and economic factors (40%),
- physical environment (10%)
What’s next?

Ongoing collaborations:
- Agricultural economists at VT and VCOM collaboration
- Biocomplexity Institute at VT, Geospacial mapping lat/long chronic diseases with environmental and economic factors
- Using VDH mortality data, 1960-2012, >775,000 records

Suggested next directions:
- VCOM Bioinformatics and Clinical Genetics
- UNC Schools of Medicine and Public Health

VCOM Outreach and Applications:
- Promote low cost efforts to improve health; prevention (no smoking, diet, exercise)
- Promote education and health careers in regions of need
- VCOM-Carolinas has received major ARC funding
VCOM’s D.O. Alums Concentrate in Appalachia

More than 2,000 alumni 2007-2016
11% practice in rural areas
22% practice in Appalachia
37% practice in underserved areas
VA 2016 >70% mission-focused careers

VCOM-VA-ARIES student involvement
8 Publications and Book Chapter
> 39 Posters/Presentations, 13 venues
> 420 students/yr data in lectures

VCOM Hospital Residency Program
collaborating in training in research in rural hospitals
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