COPD-RELATED HEALTH AND TREATMENT DISPARITIES IN RURAL COLORADO

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Learning Objectives

- COPD-related mortality in the Rocky Mountain West, including Colorado, is high and Coloradans living in rural areas have a higher mortality than their urban counterparts.

- Rural and urban groups differ in rates of certain medical and non-medical therapies provided to COPD patients, including specialized services such as ICU care and pulmonary rehab.
COPD

- 4th leading cause of death in the US
- Affects 24 million people
- Responsible for up to $37 billion annually in direct and indirect health care costs.

Colorado is one of six Rocky Mountain States with high COPD-related mortality (7th highest COPD mortality in US).

COPD patients residing in rural areas within Colorado have a higher mortality rate compared to urban areas.
Objective

- Determine whether population characteristics or treatment differences between rural and urban residents could provide insight into the increased mortality seen in rural populations.
Enrollment
• 511 subjects were enrolled between September, 2006 and August, 2007

Inclusion Criteria
• GOLD stage 3 or 4 COPD (FEV₁ ≤ 50% and FEV₁/FVC ≤ 70%), or a history of a COPD exacerbation within the past year.
• Colorado resident

Exclusion Criteria
• Asthma (by history or post-bronchodilator FEV₁ ≥ 80%)
• Diseases likely to result in death within two years
• Significant co-morbidities including, HIV infection, interstitial lung disease, end-stage liver or renal disease, or dementia.
Recruitment
Rural and Urban Enrollment Counties in Colorado
Methods

Measurements

- Prior-year self-reported healthcare utilization
- Clinical Data (vaccinations, medications, pulmonary rehabilitation)
- Personal Data (living arrangements, Medicaid enrollment)
- BODE Index and components: Body-mass index (BMI), Spirometry, MMRC Dyspnea Scale and 6-minute walk distance (6MWD)
- St. George’s Respiratory Questionnaire (SGRQ)
Methods

- Statistics
  - p-values obtained by t-test for continuous variables
  - chi-square for categorical values.
- * indicates $P \leq 0.05$ on subsequent graphs
### Results

#### Demographics

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>URBAN (N=403)</th>
<th>RURAL (N=108)</th>
<th>P-VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, (y)</td>
<td>68.3 ± 9.0</td>
<td>68.4 ± 8.8</td>
<td>0.87</td>
</tr>
<tr>
<td>Female, (%)</td>
<td>39</td>
<td>40</td>
<td>0.91</td>
</tr>
<tr>
<td>Non-caucasian, (%)</td>
<td>9</td>
<td>6</td>
<td>0.23</td>
</tr>
<tr>
<td>Education, (y)</td>
<td>13.6 ± 2.3</td>
<td>12.5 ± 3.0</td>
<td>0.00003</td>
</tr>
<tr>
<td>PackYears, (y)</td>
<td>58.1 ± 32.6</td>
<td>59.5 ± 33.9</td>
<td>0.72</td>
</tr>
<tr>
<td>FEV1, (L)</td>
<td>1.0 ± 0.5</td>
<td>1.1 ± 0.49</td>
<td>0.70</td>
</tr>
<tr>
<td>FEV1 (% predicted)</td>
<td>36.7 ± 13.2</td>
<td>37.1 ± 14.8</td>
<td>0.77</td>
</tr>
<tr>
<td>BODE Index, (u)</td>
<td>4.8 ± 2.0</td>
<td>4.8 ± 2.3</td>
<td>0.79</td>
</tr>
<tr>
<td>6MWD, (m)</td>
<td>272.9 ± 115.0</td>
<td>261.0 ± 123.1</td>
<td>0.35</td>
</tr>
</tbody>
</table>
Results
Results

![Bar chart showing percentage comparison between Urban (N=403) and Rural (N=108) groups for different categories: SABA, LABA, SAA, LAA, and ICS. The chart highlights significant differences with asterisks (*) for specific categories.](image)
Increased COPD-related mortality in rural patients may be due to a constellation of disparities.

Rural subjects
- less likely to have short-acting bronchodilator therapy
- less preventive or non-medical therapies
- lower socioeconomic status.
- Reduced access to specialized services (i.e. pulmonology referral, ICU care, mechanical ventilation and pulmonary rehabilitation)

Patients in both groups have relatively low rates of long-acting bronchodilator therapy given the severity of disease.
Thanks

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- Christine Kveton
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The Cancer, Cardiovascular Disease and Pulmonary Disease Grants Program at the Colorado Department of Public Health and Environment and the University of Colorado Hospital
What is the effect of continued smoking on COPD?

November 13, 2008

by Patricia Koff, MEd, RRT & Samay Dalal, MD
University of Colorado Hospital
Symptoms

Lung Function

Age (yrs)

Asymptomatic

Former Smoker

Smoker

Nonsmoker

Symptoms

30 45 60

Age (yrs)
Beyond Lung Function

• In what ways are they sicker?
• Have they given up?
• Has the healthcare system given up on them?
• Do they use medications as directed?
• Do they use more medical services?
eHealth Program Data

• At baseline, 511 patients were asked about their smoking histories/habits
• 108 patients or 21% of the 511 continued to smoke
• Heavily addicted group with severe to very severe COPD
Average Age

Average Age

<table>
<thead>
<tr>
<th>Age</th>
<th>Smokers</th>
<th>Non Smokers</th>
</tr>
</thead>
<tbody>
<tr>
<td>61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>62</td>
<td></td>
<td></td>
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<tr>
<td>63</td>
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<td>66</td>
<td>63.89</td>
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<tr>
<td>67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>68</td>
<td></td>
<td></td>
</tr>
<tr>
<td>69</td>
<td></td>
<td>69.51</td>
</tr>
<tr>
<td>70</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\( p < 0.0001 \)
% Patients Living Alone

% Single

- Smokers: 39.81%
- Non-Smokers: 26.55%

p = 0.007
% Residing in Rural Areas

% Patients Residing in Rural Areas

- Smokers: 26.85%
- Non Smokers: 19.60%

p = 0.1
Vaccination Rates

- **Smokers**
  - Influenza: 84.26%
  - Pneumococcal: 84.12%

- **Non-Smokers**
  - Influenza: 95.53%
  - Pneumococcal: 84.12%

- Significance:
  - Influenza: p < 0.001
  - Pneumococcal: p < 0.02
Cough and Sputum Production

% Symptoms

Cough

<table>
<thead>
<tr>
<th></th>
<th>Smokers</th>
<th>Non Smokers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>76.85%</td>
<td>52.11%</td>
</tr>
</tbody>
</table>

Sputum Production

<table>
<thead>
<tr>
<th></th>
<th>Smokers</th>
<th>Non Smokers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>75.00%</td>
<td>42.68%</td>
</tr>
</tbody>
</table>

p < 0.0001
Emergency Room Visits

- Smokers: 0.852
- Non-Smokers: 0.650

p = 0.08
Rehabilitation Usage

% Rehabilitation Use

Non Smokers 36.23%
Smokers 17.59%

p = 0.0002
Quality of Life

St. George's Respiratory Questionnaire

Smokers: 50.85
Non Smokers: 47.30

p = 0.048
COPD patients who continue to smoke have:

- Significantly increased symptoms
- Worse quality of life
- Lower utilization of appropriate medications
- Decreased non-pharmacologic care: lower rates of pulmonary rehabilitation and vaccinations
- Increased health care utilization as evidenced by increased ER visits
Future Directions

• What can we do to help?

1) Target this group for **smoking cessation programs**. A significant proportion of patients with severe COPD continue to smoke. Targeted, intensive smoking cessation programs directed towards this group may result in improved quality of life and fewer ER visits. Even brief counseling can result in a 5-10% cessation rate.

2) Target this group for **vaccinations**

3) Target efforts to improve the rates of **pulmonary rehabilitation** in this group.
“The Face of Addiction” by Norbert Voelkel, MD
Resources

• Colorado Quitline – www.coquitline.org
  • Individually tailored program
  • Nicotine replacement therapy
  • Support network
  • Free telephone coaching
  • 1-800 QUIT NOW

• AHRQ – www.ahrq.gov/path/tobacco
  – tobacco cessation materials. ... 1-800-358-9295
  – 24 hours a day, 7 days a week.
Thank you

- **Funding:**
  - Cancer, Cardiovascular Disease and Pulmonary Disease Program at the Colorado Department of Public Health and Environment
  - University of Colorado Hospital

- **COPD eHealth Team:** 720-848-7094  www.copdehealth.org
  - UCH: Tammie Freitag, Shannon James, Debora Diaz
  - UCHSC: Dr. Bill Vandivier, Sung-Joon Min, PhD, Dr. John Westfall
  - VA: Dr. Bob Keith
  - Kaiser-Permanente Denver: Dr. Tom Stelzner, Dr. Arne Beck, Christine Kveton, Stephanie Carwin, Debora Ritzwoller, David Brand
  - Jason Riley – Database specialist
  - Sharon “Skip” Coleman & Karen Flores – Health Hero Network
Advanced eHealth for COPD in Colorado
Take Home Message

- **Integrated self-management programs for COPD**
  - Improve quality of life
  - Decrease healthcare utilization
  - Decrease mortality

- **Rural COPD patients have**
  - More COPD risk factors
  - Insufficient medical and non-medical care

- **Continued smoking in COPD is associated with**
  - Worsened symptoms
  - Decreased preventative care
  - Increased use of the emergency department
Ugly Facts

USA... 2000

- 4th leading cause of death and disability
- Affects 24 million people
- Costs $37 billion per year

Colorado... 2007

- 3rd leading cause of death
- Affects >400,000 people
- Costs $70 million per year

Proportion of 1965 Rate

- Coronal Heart Disease: -59%
- Stroke: -64%
- Other CVD: -35%
- COPD: +163%
- All Other Causes: -7%

1965 - 1998
Advanced eHealth Goals

- A proactive system that integrates
  - 1) daily disease-specific education,
  - 2) self-management strategies,
  - 3) enhanced communication and
  - 4) remote disease monitoring

would improve outcomes in COPD patients
Integrated eHealth Program

eHealth System

At Home
COPD Patient

Proactive Self Management

Proactive Treatment

Healthcare Provider

Education Monitoring & Enhanced Communication

Early Warning & Education

Integrated

eHealth Coordinator
1 yr eHealth Evaluation n=270 n=130

Questionnaire Lung Function 6MWT SGRQ

SGRQ SGRQ SGRQ

HCU HCU HCU

0 m 3 m 6 m 9 m

Healthcare Utilization
Outcomes

- **Primary Outcome:**
  - Change in Healthcare Costs

- **Secondary Outcomes:**
  - Change in Healthcare Utilization
  - Change in QOL
### Baseline Characteristics that were Similar

<table>
<thead>
<tr>
<th>Baseline Characteristics</th>
<th>Evaluation Group</th>
<th>eHealth Group</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, yrs</td>
<td>68.4</td>
<td>68.3</td>
<td>0.99</td>
</tr>
<tr>
<td>FEV1, % predicted</td>
<td>36.7</td>
<td>36.7</td>
<td>0.96</td>
</tr>
<tr>
<td>6-min walk distance, m</td>
<td>272</td>
<td>274</td>
<td>0.88</td>
</tr>
<tr>
<td>Smoking history, pk -yrs</td>
<td>56.5</td>
<td>58.9</td>
<td>0.5</td>
</tr>
<tr>
<td>BODE index</td>
<td>4.69</td>
<td>4.76</td>
<td>0.75</td>
</tr>
<tr>
<td>Long-acting β2-agonist, %</td>
<td>51.5</td>
<td>58.2</td>
<td>0.21</td>
</tr>
<tr>
<td>COPD Hospitalizations (prior yr), mean per patient</td>
<td>0.47</td>
<td>0.54</td>
<td>0.17</td>
</tr>
</tbody>
</table>
## Completers vs Non-completers

<table>
<thead>
<tr>
<th>Baseline Characteristics</th>
<th>Completers</th>
<th>Non-completers</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Caucasian, %</td>
<td>7.3</td>
<td>14.3</td>
<td>0.04</td>
</tr>
<tr>
<td>Current Smoker, %</td>
<td>15.9</td>
<td>30.6</td>
<td>0.001</td>
</tr>
<tr>
<td>Sputum production, %</td>
<td>39.7</td>
<td>53.0</td>
<td>0.004</td>
</tr>
<tr>
<td>Pneumococcal vaccine, %</td>
<td>84.4</td>
<td>75.5</td>
<td>0.045</td>
</tr>
<tr>
<td>Congestive Heart Failure, %</td>
<td>13.6</td>
<td>29.6</td>
<td>0.0003</td>
</tr>
<tr>
<td>COPD Hospitalizations, mean per person</td>
<td>0.41</td>
<td>0.85</td>
<td>0.002</td>
</tr>
<tr>
<td>COPD ICU Hospitalizations, mean per person</td>
<td>0.12</td>
<td>0.22</td>
<td>0.03</td>
</tr>
<tr>
<td>COPD Hospital length-of-stay, mean per son</td>
<td>1.89</td>
<td>3.79</td>
<td>0.002</td>
</tr>
<tr>
<td>COPD Emergency Room Visits, mean per person</td>
<td>0.59</td>
<td>1.11</td>
<td>0.02</td>
</tr>
</tbody>
</table>

*Urban baseline characteristics of completers and non-completers*
Integrated Care Improved QOL
Integrated Care Decreased Healthcare Utilization

**ICU Hosp**
- Evaluation: 0.07
- eHealth: 0.06
- P = 0.045

**Vent Hosp**
- Evaluation: 0.04
- eHealth: 0.02
- P = 0.04

**Urgent Visits**
- Evaluation: 0.7
- eHealth: 0.6
- P = 0.009
# Clinical Improvements

<table>
<thead>
<tr>
<th>Guideline-based Therapy</th>
<th>Evaluation Group, Δ</th>
<th>eHealth Group, Δ</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 min-walk distance, m</td>
<td>4</td>
<td>50</td>
<td>0.0003</td>
</tr>
<tr>
<td>MMRC Dyspnea Scale</td>
<td>0.22</td>
<td>-0.03</td>
<td>0.02</td>
</tr>
<tr>
<td>BODE Index</td>
<td>0.19</td>
<td>-0.27</td>
<td>0.008</td>
</tr>
<tr>
<td>O₂ Saturation post-exercise</td>
<td>-0.01</td>
<td>0.32</td>
<td>0.06</td>
</tr>
<tr>
<td>O₂ liter flow post-exercise</td>
<td>-0.02</td>
<td>1.54</td>
<td>0.005</td>
</tr>
</tbody>
</table>
## Clinical Improvements from the eHealth Program

<table>
<thead>
<tr>
<th>Guideline-based Therapy</th>
<th>Evaluation Group, pre</th>
<th>Evaluation Group, post</th>
<th>eHealth Group, pre</th>
<th>eHealth Group, post</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking</td>
<td>18.4</td>
<td>18.4</td>
<td>14.4</td>
<td>11.2</td>
<td>0.08</td>
</tr>
<tr>
<td>Cough</td>
<td>56.1</td>
<td>57.9</td>
<td>57.5</td>
<td>47.9</td>
<td>0.08</td>
</tr>
<tr>
<td>Sputum Production</td>
<td>44.7</td>
<td>50.9</td>
<td>46.8</td>
<td>40.9</td>
<td>0.047</td>
</tr>
</tbody>
</table>
Integrated Care Decreased Mortality

Mortality (%)

- Urban Program: P=0.07
- Rural Program: P=0.44
- Combined Programs: P=0.046
Proactive Integrated Care

Summary

- Improves quality of life
- Decreases healthcare utilization
- Improves a variety of other clinical outcomes
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- Stephanie Carwin, RRT

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