DEPARTMENT OF VETERANS AFFAIRS

Geographic Isolation Shows Higher Risk for Chronic Obstructive Pulmonary-Disease Related Mortality: A Cohort Study

Thad E. Abrams, MD MS[1, 2]; Mary Vaughan-Sarrazin, PhD[1, 2]; Vince S. Fan, MD MPH[3]; Peter J. Kaboli, MD MS[1, 2]

[1]VA Office of Rural Health (ORH), Veterans Rural Health Resource Center—Central Region, Iowa City VAMC, Iowa City, IA and the Comprehensive Access and Delivery Research and Evaluation (CADRE) Center at the Iowa City VA Medical Center, Iowa City, IA, [2]The Department of Internal Medicine, University of Iowa, and [3]Veteran Affairs Puget Sound and the Department of Internal Medicine, University of Washington, Seattle, WA.

Introduction

Evidence suggests that among persons with chronic illnesses such as cardiovascular disease, patients living in rural areas suffer worse health outcomes due to factors including longer wait times, lower rates of percutaneous intervention (when admitted for acute myocardial infarction), and being seen at smaller volume hospitals.[1-4] Such patients may also experience reduced access to medical advances due to their relatively slow distribution to physicians in rural settings.[5]

Admissions for chronic obstructive pulmonary disease (COPD) are the fourth most common reason for acute medical hospitalization nationwide,[6-7] while research indicates that increasing rates of COPD mortality will constitute the third leading cause of death by 2020.[8] Studies of non-US countries with large rural populations have indicated higher COPD rates among rural populations, though to date few studies have sought to determine whether rural COPD patients in the US reflect these same disparities.

Key Findings

- Veterans with COPD living in isolated rural areas of the US are at a 42% greater risk for COPD exacerbation-related mortality than those living in urban areas.
- Mortality was not found to be increased for those living in non-isolated rural areas.
- Hospital characteristics (e.g., hospital COPD patient volume) had a very small effect on urban-rural disparity in COPD mortality.

This work is funded by the Veterans Administration Office of Rural Health (ORH).

For more information about this study, contact Thad Abrams (319) 338-0581, Ext.7681 or thad.abrams@va.gov

In light of increasing COPD mortality in the US and evidence that rural patients may experience poorer clinical outcomes in relation to urban patients, this study sought to 1) determine whether COPD-related mortality is higher among Veterans living in rural areas, and 2) assess whether urban-rural disparities in COPD mortality are affected by hospital characteristics.

Methods

Data sources

The Veterans Affairs (VA) Patient Treatment File was used to identify all consecutive COPD admissions in the VA system from October 2006 to September 2008.

Study Sample

The sample included patients identified with principal diagnoses of COPD exacerbation, acute or chronic bronchitis, chronic obstruction of the airway not diagnosed under another category, or acute and chronic respiratory failure. The final sample was n=26,591 admissions.

Data Elements and Outcome

The primary outcome measured was 30-day mortality from the day of admission, with the primary independent variable being rural residence, the latter being defined using a ZIP-code approximation of the Rural-Urban Commuter Area (RURC) codes. RURC codes create 30 discrete categories along the urban-rural spectrum which in this study were collapsed into 3 designations: *urban* (n=18,809), *rural* (n=1,919), and *isolated rural* (n=919).

Adjusted Risk for 30-day Mortality for Rural and Isolated Rural Veterans Compared with Urban Veterans, with Adjustment for Patient- and Hospital-level Characteristics*

Independent Variable	Odds Ratio (95% CI)	P Value
Patient rurality		
Urban	1.00 –	-
Rural	1.09 (0.90–1.32)	0.47
Isolated rural	1.42 (1.07–1.89)	0.016
Average patient composition of hospitals†		
Urban	1.00 –	-
Rural	1.39 (0.88–2.31)	0.145
Isolated rural	0.84 (0.32–2.50)	0.72
Hospital volume‡		
High	1.00 –	-
Medium	1.06 (0.88–1.27)	0.49
Low	1.28 (0.99–1.66)	0.059

* Patient characteristics include age, sex, race, individual comorbid conditions calculated by using Quan and Elixhauser methods (20), and all laboratory measures and ventilatory support measures.
† The mean proportion of patients coming from urban, rural, or isolated rural areas.
‡ The total number of all chronic obstructive pulmonary disease–related admissions to each hospital spanning the 3-y study period, classified as high (400 admissions), medium (236–399 admissions), or low (35–235 admissions).

Hospital-Level Variables

Two hospital variables having possible effects on the relation between a patient's rural status and COPD mortality were included: *hospital volume* and *hospital rurality.* The former was determined by the number of COPD-related admissions to each VA hospital over the three-year study period, with hospitals being divided into three tertiles: low admission (35-235), medium admission (236-399), and high admission (>400), each containing 43 hospitals. Rurality was calculated as mean COPD hospital admissions in RUCA-designated rural areas, categorized as *major urban* (1–15%) *rural* (16–38%), and *major rural* (<39%).

Patient-Level Variables

Race, gender, age, and admission source were gathered as variables. Five distance categories were also included, determined by travel time to the nearest VA hospital, as were six laboratory values: serum sodium, albumin, blood urea nitrogen, hematocrit, white blood cell count, an arterial $PaCO_2$.

Findings

Unadjusted Mortality

Unadjusted results show higher mortality for *isolated rural* and *rural* Veterans relative to *urban* Veterans, indicating that *isolated rural* Veterans are 42% more likely to die within 30 days of admission relative to *urban* veterans. Overall unadjusted mortality for Veterans from *isolated rural* areas was 5.0%, for those from *rural* areas was 4.0%, while for those from *urban* areas was 3.8%. Hospital characteristics had no effect on this result.

Adjusted Mortality

Adjusting only for illness severity, *isolated rural* Veterans were more likely to die after admission relative to *urban* veterans. Most prominently, mortality was increased in *rural hospitals* with lower volumes of COPD but remained similar among *major rural hospitals* with higher volumes. Surprisingly, longer travel distances were associated with lower 30-day mortality.

LIMITATIONS

This study consisted of a mostly male subject population with numerous co-morbid conditions, thus limiting its generalizability. The study's results were also based solely on administrative data that did not include certain physiologic variables (e.g., pulmonary function tests in relation to patient mortality).

Impact

- Workforce and policy leaders need to be aware that Veterans with COPD living in isolated rural areas suffer a higher mortality rate than do those living in other areas. This awareness is a first step toward establishing a more equitable distribution of resources across the urban-rural spectrum.

- More importantly, further research using spatial techniques is needed to substantiate these findings on a granular level and to determine specifically which resources are lacking for COPD patients in rural settings.

ORH
VHA Office of Rural Health

References

1. Hassan A, Pearce NJ, Mathers J, Veugelers PJ, Hirsch GM, Cox JL, et al. The effect of place of residence on access to invasive cardiac services following acute myocardial infarction. Can J Cardiol. 2009;25(4):207-12.
2. Abrams TE, Vaughan-Sarrazin M, Kaboli PJ. Mortality and revascularization following admission for acute myocardial infarction: implication for rural veterans. J Rural Health. 2010; 26(4):310-7.
3. Baldwin LM, MacLehose RF, Hart LG, Beaver SK, Every N, Chan L. Quality of care for acute myocardial infarction in rural and urban US hospitals. J Rural Health. 2004; 20(2):99-108.
4. Ross JS, Normand SL, Wang Y, Ko DT, Chen J, Drye EE, et al. Hospital volume and 30-day mortality for three common medical conditions. N Engl J Med. 2010;362(12):1110-8.
5. Tamblyn R, McLeod P, Hanley JA, Girard N, Hurley J., Physician and Practice Characteristics Associated with the Early Utilization of New Prescription Drugs. Medical Care, 2003; 41(8):895-908.
6. Roman J and Perez RL. COPD in VA hospitals. Clin Cornerstone 2003; 5(1):37-44.
7. Mannino DM, Homa DM, Akinbami LJ, Ford ES, Redd SC. Chronic obstructive pulmonary disease surveillance--united states, 1971-2000. Respir Care. 2002; 47(10):1184-1199.
8. Mannino DM. COPD: epidemiology, prevalence, morbidity and mortality, and disease heterogeneity. Chest 2002; 121(5):121S-126S.