

Brief Report

Rural Versus Urban Health Disparities in the COVID-19 Era Among Veterans With COPD

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Abstract

Individuals living in rural areas in the United States experienced disparities in COVID-19 incidence and mortality rates, and people with chronic obstructive pulmonary disease (COPD) are at high risk of poor outcomes. We sought to determine whether veterans with COPD living in rural areas experienced different perceptions and practices of COVID-19 mitigation strategies, access to care, and health disparities during the COVID-19 pandemic, compared to their urban-living counterparts. We performed a one-time survey of veterans with COPD, collecting COVID-19–related information including individual perceptions and practice of mitigation strategies, COVID-19 vaccination status, access to care, and respiratory symptoms stratified by rural-urban status. A total of 100 participants completed the survey with 47 living in rural areas and 53 living in urban areas. There were no significant differences in perceptions and practices related to COVID-19 mitigation strategies (including vaccination), access to care, or respiratory and mental health outcomes. This lack of disparity between rural and urban veterans with COPD might be explained by the strength of the Veterans Health Administration in telemedicine or by an increased uptake of mitigation practices in people with chronic respiratory illness.

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Abbreviations:

AECOPD=acute exacerbation of COPD; **BHLS**=Brief Health Literacy Screening tool; **CAT**=COPD Assessment Test; **COPD**=chronic obstructive pulmonary disease; **ED**=emergency department; **FEV₁**=forced expiratory volume in 1 second; **FVC**=forced vital capacity; **PHQ-4**=Patient Health Questionnaire 4; **PSS**=Perceived Stress Scale 4; **RUCA**=rural-urban community area; **SD**=standard deviation; **VA**=Veterans Affairs

Funding Support:

This research was supported by the National Institutes of Health's National Heart, Lung, and Blood Institute grant T32 HL007741-23 (CR) and the National Center for Advancing Translational Sciences' grants KL2TR002492 and UL1TR002494 (AKB). This material is the result of work supported with resources and the use of facilities at the Minneapolis VA Health Care System.

Citation:

Robichaux C, Zanutto A, Wendt CH, Michalik M, Gravely A, Baldomero AK. Rural versus urban health disparities in the COVID-19 era among veterans with COPD. *Chronic Obstr Pulm Dis*. 2024;11(5):538-543. doi: <https://doi.org/10.15326/jcopdf.2024.0521>

Publication Dates:

Date of Acceptance: August 19, 2024

Published Online Date: August 29, 2024

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Keywords:

COPD; cannabinoids; dyspnea; exercise tolerance; quality of life

Introduction

Prior to COVID-19, chronic obstructive pulmonary disease (COPD) was the fourth leading cause of death in the United States and continues to affect people living in rural areas disproportionately.¹ Rural counties have a higher prevalence of COPD, more COPD-related hospitalizations, and more deaths than urban counties.¹ Veterans are an important population in which to study rural disparities in COPD since they are twice as likely to suffer from COPD compared to the general U.S. population and more than 30% of Veterans Affairs (VA) patients reside in rural areas.² The health of

rural Veterans with COPD has not been assessed during the COVID-19 pandemic. Knowledge of how this high-risk population experienced the COVID-19 pandemic is important for future outbreaks and for understanding social factors that affect this group in relation to other infectious respiratory illnesses.

Individuals living in rural areas in the United States experienced disparities in COVID-19 incidence and mortality rates.³ The fourth wave of COVID-19 in the United States (June 2021 to March 2022) was the first wave with widespread access to vaccines across the United States, yet individuals in rural areas were more likely to be unvaccinated.⁴ Additionally, access to care may have been limited by a lack of access to broadband services and closures of health care systems in rural areas.⁵⁻⁶ Rural residents were less likely than urban residents to engage in prevention behaviors like masking, social distancing, and vaccination, but it is unclear if this was true for veterans with COPD.⁷

We sought to determine whether veterans with COPD living in rural areas experienced different perceptions and practices of COVID-19 mitigation strategies, access to care, and health disparities during the COVID-19 pandemic, compared to their urban-living counterparts.

Methods

Study Design

We performed a one-time telephone survey of rural and urban veterans with COPD between March 2021 and February 2022. We collected COVID-19–related information including individual perceptions and practice of mitigation strategies, COVID-19 vaccination status, access to care, and respiratory symptoms stratified by rural-urban status. We assessed these outcomes between March 2020 and March 2021. This study followed the Strengthening the Reporting of Observational Studies in Epidemiology reporting guidelines for cross-sectional studies.⁸

Participants

We identified veterans with COPD using the Minneapolis VA Spirometry Registry. We included veterans aged ≥ 40 years with spirometry-confirmed COPD (defined as forced expiratory volume in 1 second [FEV₁] to forced vital capacity [FVC] ratio of < 0.7). Because the majority of the obtained spirometry was prebronchodilator, we opted to use prebronchodilator spirometry measures for consistency. Potential participants were sent a letter explaining the study and an option to opt out of the survey. We offered \$10 for completing the survey. Those who did not opt out were called by a study personnel to complete the survey. Each participant's rural-urban status was determined using home address zip codes to assign a rural-urban commuting

area (RUCA) code from 1-10, with RUCA code 1 as urban and RUCA codes 2-10 as rural.⁹ Patients living in rural areas typically receive their primary care at satellite clinics associated with the Minneapolis VA that are situated in those rural regions. These clinics generally lack subspecialty care and services. In contrast, urban patients usually receive their care at the main Minneapolis VA facility, where both primary and extensive subspecialty services are readily available.

Data Collection Methods, Study Preparation, and Survey Administration

The survey consisted of 93 questions. We used validated health survey scales including the Brief Health Literacy Screening (BHLS) tool,¹⁰ COPD Assessment Test (CAT),¹¹ Patient Health Questionnaire (PHQ)-4,¹² and Perceived Stress Scale (PSS)-4.¹³ Nonvalidated questions were modeled from other COVID-19 publications and contained open-ended, Likert scale, and binary questions.

Our outcomes were divided into 4 categories. First, we assessed confidence in mitigation strategies (safety of vaccines and perception of the effectiveness of wearing a face mask, hand washing, avoiding sick contacts, and social distancing) and second, the likelihood of practicing mitigation strategies and receipt of COVID-19 vaccination. The third category was access to care including questions on difficulty making an appointment, canceled appointments, and receiving medications via mail delivery. Lastly, we evaluated health outcomes including COVID-19 diagnosis, COPD exacerbation, health care visits for respiratory symptoms, number of acute exacerbations of COPD (AECOPD) requiring an emergency department visit or hospital admission, CAT, PSS-4, and PHQ-4. Outcomes were assessed between March 2020 to March 2021.

Statistical Analysis

We compared survey results by rural versus urban status. We estimated that a total sample of 80 participants would provide 80% power to detect a 30% difference, assuming a 2-sided alpha of 0.05. We used Pearson's Chi-square test and independent *t*-test for categorical and normally distributed continuous variables, respectively; we used a nonparametric independent *t*-test equivalent for continuous measures that were not normally distributed.

Study Oversight

This study was reviewed and deemed exempt by the Minneapolis VA Health Care System Institutional Review Board (VAM-20-00653) due to its minimal risk to participants.

Results

Surveys were sent to 234 patients and 100 patients responded (42.7% response rate). Of the 100 participants who completed the survey, 47 lived in a rural area (Table 1). The mean age was 71 ± 7 years and 88.7% were of White race/ethnicity. Forty percent reported graduating from high school or obtaining a General Equivalency Diploma, 22.9% had trade or vocational training, and 31.3% graduated from college or received postgraduate degrees. The average number of flu vaccines received in the past 5 years was 3.7. The confidence in filling out forms was consistent with “inadequate or marginal health literacy,” but difficulty reading hospital materials and frequency of having someone help with reading hospital materials were not consistent with low health literacy. Overall, there was no significant difference in participant characteristics between rural and urban veterans.

There were no significant differences in perceptions and practices related to COVID-19 mitigation strategies which included vaccine confidence, wearing of face masks, hand washing, avoiding sick contacts, and social distancing between veterans with COPD living in a rural versus urban area (Table 2). Eighty-four patients received COVID-19 vaccination; there was no significant difference in COVID-19 vaccination rates between rural and urban veterans with COPD. Similarly, there was no significant difference in challenges in accessing care, such as making clinic appointments, canceled appointments, and receiving medications through mail delivery. Additionally, there were no significant differences in health outcomes including COVID-19 diagnoses (9% versus 13%), COPD exacerbations in the preceding 6 months (58% versus 49%), CAT scores (18 versus 17), PSS-4 scores (7 versus 5), and PHQ-4 scores (3 versus 2) between rural versus urban veterans with COPD.

Table 1. Participant Characteristics by Rural vs. Urban Status

	Total N=100	Rural N=47	Urban N=53	P-value
Demographics				
Age (mean±SD)	71±7	70±7	72±8	0.32
Race/Ethnicity (n,%)				0.43
American Indian or Alaska Native	5 (5.2)	3 (6.8)	2 (3.8)	
Black or African American	3 (3.1)	0 (0)	3 (5.7)	
Hispanic or Latino	2 (2.1)	1 (2.3)	1 (1.9)	
White	86 (88.7)	40 (90.9)	46 (86.8)	
Other	1 (1.0)	0 (0)	1 (1.9)	
N Missing	3.0	3.0	0.0	
Education (n,%)				0.77
Some High School	6 (6.2)	2 (4.4)	4 (8.0)	
High School Graduate or General Equivalency Diploma	38 (39.6)	19 (41.3)	19 (38.0)	
Trade or Vocational Training	22 (22.9)	10 (21.7)	12 (24.0)	
College Graduate	26 (27.1)	12 (26.1)	14 (28.0)	
Postgraduate Degree	4 (4.2)	3 (6.5)	1 (2.0)	
N missing	4.0	1.0	3.0	
Health Status				
Current Smoker (n,%)	21 (22.1)	11 (25.0)	10 (19.6)	0.53
Pack Years (mean±SD)	39.9±24.9	39.6±20.4	40.3±28.8	0.89
FEV₁ % Predicted				0.39
>70%	30 (30.3)	14 (29.8)	16 (30.8)	
60%–90%	14 (14.1)	4 (8.5)	10 (19.2)	
50%–59%	18 (18.1)	9 (19.2)	9 (17.3)	
35%–49%	27 (27.3)	13 (27.7)	14 (26.9)	
<35%	10 (10.1)	7 (14.9)	3 (5.8)	
Using Inhalers (n,%)	75 (78.1)	37 (82.2)	38 (74.5)	0.36
Number of Flu Vaccines in Past 5 Years (mean±SD)	3.7±1.8	3.5±1.9	3.9±1.7	0.40
Received Shingles Vaccine (n,%)	70 (70.7)	32 (69.6)	38 (71.7)	0.97
Received Pneumonia Vaccine (n,%)	80 (80.8)	38 (82.6)	42 (79.0)	0.86
Health Literacy (mean±SD)^a				
Confidence in Filling Out Forms	0.7±1.2	0.8±1.2	0.8±1.2	0.51
Someone Helps Read Hospital Materials	0.6±1.1	0.5±0.9	0.7±1.2	0.39
Difficulty Reading Hospital Material	0.7±1.1	0.4±0.8	0.8±1.2	0.08

^aHealth literacy was assessed using the Brief Health Literacy Screening tool, where confidence in filling out forms is: 0=not at all, 1=a little bit, 2=somewhat, 3=quite a bit, and 4=extremely; and help reading and difficulty reading hospital materials is: 0=never, 1=occasionally, 2=sometimes, 3=often, and 4=always.

SD=standard deviation; FEV₁=forced expiratory volume in 1 second

Table 2. Mitigation Strategies, Access to Care, and Health Outcomes by Rural vs. Urban Status

	Total N=100	Rural N=47	Urban N=53	p-value
Mitigation Strategies Perceived as Effective^a				
Vaccine Confidence (mean±SD)	8.1±1.8	8.0±1.8	8.2±1.9	0.67
Face Mask (n,%)	87 (87.9)	39 (84.8)	48 (90.6)	0.57
Hand Washing (n,%)	89 (90.8)	41 (89.1)	48 (92.3)	0.85
Avoid Sick Contacts (n,%)	95 (96.0)	42 (91.3)	53 (100.0)	0.09
Social Distancing (n,%)	87 (87.9)	40 (87.0)	47 (88.7)	1.00
Mitigation Strategies Being Practiced^b				
Face Mask (n,%)	85 (85.9)	38 (82.6)	47 (88.7)	0.57
Hand Washing (n,%)	84 (84.8)	37 (80.4)	47 (88.7)	0.39
Avoid Sick Contacts (n,%)	91 (91.9)	40 (87.0)	51 (96.2)	0.19
Social Distancing (n,%)	85 (87.6)	35 (79.5)	50 (94.3)	0.06
Received COVID-19 Vaccine (n,%)	84 (84.0)	39 (83.0)	45 (84.9)	0.79
Access to Care				
Difficulty Making an Appointment (n,%)	22 (22.2)	10 (21.7)	12 (22.6)	0.91
Number of Canceled Appointments (mean±SD)	0.6±1.1	0.5±1.0	0.6±1.18	0.59
Receive Meds Through Mail (n,%)	92 (92.0)	45 (95.7)	47 (88.7)	0.19
Health Outcomes				
COVID-19 Diagnosis (n,%)	11 (11.2)	4 (8.9)	7 (13.2)	0.50
COPD Exacerbation (n,%)	51 (53.1)	26 (57.8)	25 (49.0)	0.39
Required Care for Breathing (n,%)	34 (35.1)	17 (37.8)	17 (32.69)	0.60
ED/Hospitalization for COPD Exacerbation (mean±SD)	1.7±0.9	1.4±0.6	1.9±1.0	0.09
CAT (mean±SD)	17.8±7.9	18.0±7.7	17.7±8.0	0.89
PSS-4 (mean±SD)	6.0±3.1	6.7±2.6	5.5±3.4	0.05
PHQ-4 (mean±SD)	2.2±2.8	2.7±3.0	1.9±2.5	0.17

^aVaccine confidence was assessed by rating agreement with the statement "Vaccines are safe" where 0=strongly disagree and 10=strongly agree. Face masking, hand washing, avoiding sick contacts, and social distancing were assessed via Yes or No answers to "Which of the following actions help prevent catching an infection with the new coronavirus?"

^bMitigation strategies being practiced were assessed via Yes or No answers to "Of the following options what are you doing to prevent the spread of the infection?"

SD=standard deviation; COPD=chronic obstructive pulmonary disease; ED=emergency department; CAT=COPD Assessment Test; PSS-4=Perceived Stress Scale 4; PHQ-4=Patient Health Questionnaire

Discussion

Rural veterans with COPD experienced no difference from their urban-living counterparts in perceptions or practices of COVID-19 mitigation strategies, access to care, or respiratory outcomes.

This cohort is unique and differs from prior studies of urban-rural disparities in COVID-19 as all participants are veterans with COPD. VA health system attributes such as a long history of providing telemedicine, a mail-based outpatient pharmacy, and a single-payer system may help explain these findings.¹⁴ The benefits of these factors were manifested in the relatively low rates of difficulty accessing medical care reported in this survey. People with COPD and other chronic respiratory diseases may have been more likely than the general population to adopt protective behaviors. By the end of our study period in March 2021, 64% of Minnesota state residents who were 65 and older had received at least one dose of the COVID-19 vaccine, compared to 84% in our veteran COPD cohort, further supporting greater access to and motivation for preventative care in this group of patients with underlying lung disease.¹⁵ At the end of 2022, the Minnesota Department

of Health data showed marked disparities in COVID-19 vaccination rates between urban and rural residents, so the lack of disparities in our cohort cannot be explained solely by regional or state-specific factors.¹⁵

The strengths of our study are its broad assessment of health, including physical, mental, and respiratory health. This survey was easy to complete for participants (a one-time survey without the chance for loss to follow-up). The timing of survey administration during the fourth wave of the COVID-19 pandemic, a particularly lethal wave during which the vast majority of the U.S. population had access to vaccines, provided important information on vaccine acceptance. Our limitations include a modest sample size, a single-center setting, and a high percentage of White and male participants, as this is a veteran population. Additionally, this one-time interview may not comprehensively represent individual practices and viewpoints that may have fluctuated during the pandemic.

In conclusion, rural living veterans with COPD had similar mitigation practices, access to care, and health outcomes as their urban living counterparts.

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Acknowledgements

Author contributions: CR, AZ, CHW, and AKB conceived the current analysis. CR, AZ, CHW, and AKB designed the analysis. CHW obtained funding. AZ and MM acquired the data. AG performed the primary statistical analysis. CR and AZ drafted the manuscript. All authors provided critical input, revised the manuscript for important intellectual content, and approved the final manuscript. All authors take responsibility for the integrity of the data and the accuracy of the data analysis.

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Declaration of Interest

All authors declare that they have no conflict of interests related to this study.

References

1. Croft JB, Wheaton AG, Liu Y, et al. Urban-rural county and state differences in chronic obstructive pulmonary disease - United States, 2015. *Morb Mortal Wkly Rep.* 2018;67(7):205-211. <https://doi.org/10.15585/mmwr.mm6707a1>

2. Cowper Ripley D, Ahern J, Litt E, Wilson L. Chronic obstructive pulmonary disease. In: *Rural Veterans Health Care Atlas Series*. 1st ed. VHA Office of Rural Health, Department of Veterans Affairs;2014. Accessed December 2023. <https://www.ruralhealth.va.gov/aboutus/ruralvets.asp>

3. Sun Y, Cheng KJG, Monnat SM. Rural-urban and within-rural differences in COVID-19 mortality rates. *J Rural Soc Sci.* 2022;37(2):3. <https://egrove.olemiss.edu/jrss/vol37/iss2/3>

4. Sun Y, Monnat SM. Rural-urban and within-rural differences in COVID-19 vaccination rates. *J Rural Health.* 2022;38(4):916-922. <https://doi.org/10.1111/jrh.12625>

5. Ortega G, Rodriguez JA, Maurer LR, et al. Telemedicine, COVID-19, and disparities: policy implications. *Health Policy Technol.* 2020;9(3):368-371. <https://doi.org/10.1016/j.hlpt.2020.08.001>

6. Henning-Smith C, Tuttle M, Kozhimannil KB. Unequal distribution of COVID-19 risk among rural residents by race and ethnicity. *J Rural Health.* 2021;37(1):224-226. <https://doi.org/10.1111/jrh.12463>

7. Callaghan T, Lueck JA, Trujillo KL, Ferdinand AO. Rural and urban differences in COVID-19 prevention behaviors. *J Rural Health.* 2021;37(2):287-295. <https://doi.org/10.1111/jrh.12556>

8. von Elm E, Altman DG, Effer M, Pocock SI, Gotsche PC, Vandembroucke JP. Strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. *BMJ.* 2007; 335(7624): 806-808. <https://doi.org/10.1136/bmj.39335.541782.AD>

9. United States Department of Agriculture (USDA), Economic Research Service (ERS). Rural-urban commuting area codes. USDA-ERS website. Updated September 2023. Accessed December 8, 2023. <https://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes/>

10. Chew LD, Bradley KA, Boyko EJ. Brief questions to identify patients with inadequate health literacy. *Fam Med.* 2004;36(8):588-594.

11. Jones P, Harding G, Berry P, Wiklung I, Chen W, Kline Leidy N. Development and first validation of the COPD Assessment Test. *Eur Respir J.* 2009;34(3):648-654. <https://doi.org/10.1183/09031936.00102509>

12. Kroenke K, Spitzer R, Williams J, Bernd L. An ultra-brief screening scale for anxiety and depression: the PHQ-4. *Psychosomatics.* 2009;50(6):613-621. <https://doi.org/10.1176/appi.psy.50.6.613>

13. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav.* 1983;24 (4): 385-396. <https://www.jstor.org/stable/2136404>

14. Hill RD, Luptak MK, Rupper RW, et al. Review of Veterans Health Administration telemedicine interventions. *Am J Manag Care.* 2010;16 (12 Suppl HIT):e302-e310. <https://pubmed.ncbi.nlm.nih.gov/21322300/>

15. University of Minnesota (UMN). Study reveals disparities in Minnesota's COVID-19 vaccination rates. UMN website. Published August 2, 2023. Accessed December 8, 2023. <https://twin-cities.umn.edu/news-events/study-reveals-disparities-minnesotas-covid-19-vaccination-rates>