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Urban–Rural Mortality Disparities from Chronic Lower Respiratory Diseases in the United States, 1999–2019

To the Editor:

Chronic lower respiratory diseases, including chronic obstructive pulmonary disease (COPD) and asthma, comprised the fourth leading cause of death in the United States in 2018 (1). Total age-adjusted mortality rates (AAMRs) from chronic lower respiratory

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Table 1. Regression Coefficients for Annual Change in AAMRs and AAMR Ratios for Chronic Lower Respiratory Diseases in the United States Stratified by County-Level Urbanization, 1999–2019

	Coefficient for Annual Change in AAMR per 100,000 Population (95% CI)	AAMR Ratio (95% CI)	
		1999	2019
Overall	−0.24 (−0.32 to −0.16)	Reference	Reference
Large central metro*	−0.49 (−0.56 to −0.41)	1.01 (1.00 to 1.03)	1.16 (1.14 to 1.18)
Large fringe metro*	−0.36 (−0.44 to −0.29)	1.10 (1.08 to 1.12)	1.35 (1.33 to 1.37)
Medium metro†	−0.24 (−0.31 to −0.16)	1.18 (1.16 to 1.20)	1.56 (1.54 to 1.59)
Small metro‡	−0.08 (−0.17 to 0.00)	1.17 (1.15 to 1.20)	1.76 (1.72 to 1.79)
Micropolitan (nonmetro)§	0.20 (0.11 to 0.30)	1.16 (1.14 to 1.19)	1.83 (1.79 to 1.86)
Noncore (nonmetro)¶	0.41 (0.29 to 0.53)		

Definition of abbreviations: AAMR = age-adjusted mortality rate; CI = confidence interval; MSA = metropolitan statistical area

*Large central and large fringe metropolitan counties were in MSAs with a population of at least 1 million. Large metro counties were assigned to either of these two categories using a discriminant model incorporating multiple factors, including population density and housing type and distribution.

†Medium metropolitan counties were in MSAs with a population in the range of 250,000 to 999,999.

‡Small metropolitan counties were in MSAs with a population below 250,000.

§Micropolitan counties were in micropolitan statistical areas. These include an urbanized area with a population of 2,500 to 49,999.

¶Noncore counties are the most rural, as they do not qualify as metropolitan or micropolitan areas.

diseases declined between 2000 and 2011, although geographic differences across the United States have been reported (2). Higher mortality rates from chronic lower respiratory diseases and higher prevalence of COPD have been observed in rural compared with urban areas (2, 3). However, temporal patterns related to urbanization in mortality rates for chronic lower respiratory diseases have not been assessed. The NHLBI and the Health Resources and Services Administration recently convened a workshop to discuss the COPD National Action Plan. The resulting plan established several priorities, including the need to quantify the burden of COPD and focus on community-level interventions in

rural areas in the United States (4). To inform population-level prevention and policy strategies, we evaluated trends in chronic lower respiratory disease mortality between 1999 and 2019 in the United States stratified by county-level urbanization.

We obtained data from Multiple Cause of Death 1999–2019 on CDC WONDER, which aggregates all death certificates filed in the United States (5). We queried for deaths and AAMRs (standardized according to the 2000 U.S. population) with chronic lower respiratory diseases as the underlying cause (J40–J47). Deaths classified using International Statistical Classification of Diseases and Related Health Problems (ICD)-9 codes prior to local ICD-10 implementation were

Figure 1. Age-adjusted mortality rates for chronic lower respiratory diseases stratified by 2013 National Center for Health Statistics (NCHS) county-level urbanization categories in the United States, 1999–2019.

adjusted internally by the CDC using ICD-10 codes for the CDC WONDER database. We stratified deaths by six county urbanization categories according to the 2013 National Center for Health Statistics Urban–Rural Scheme for Counties (6). Four categories contain metropolitan areas classified from most to least urban: large central, large fringe, medium, and small. Two categories describe rural areas: micropolitan areas may contain an urban cluster and noncore areas are the most rural. We characterized temporal trends in AAMRs by fitting linear regression models using R version 4.0.2. We calculated AAMR ratios and respective 95% confidence intervals (CIs) to represent the number of deaths in less urbanized counties for every 1 death in the large central metro counties per 100,000 population. This study was exempt from institutional review board approval.

Between 1999 and 2019, there were 2,911,392 deaths from chronic lower respiratory diseases, including 669,637 in large central metropolitan, 630,341 in large fringe metropolitan, 643,229 in medium metropolitan, 328,634 in small metropolitan, 355,925 in micropolitan, and 283,626 in noncore counties. Total AAMRs (SE) declined from 45.4 (0.1) to 38.2 (0.1) from 1999 to 2019. AAMRs (SE) in large central metro areas were lowest in 1999 (42.3 [0.2] per 100,000) and declined the fastest (regression coefficient for annual change in AAMR, -0.49 ; 95% CI, -0.56 to -0.41) compared with all other urbanization categories (Table 1 and Figure 1). In contrast, micropolitan and noncore counties had higher AAMRs in 1999 and experienced increases in AAMRs (coefficients: 0.20 [0.11 to 0.30] and 0.41 [0.29 to 0.53], respectively). AAMR ratios increased in a dose-dependent relationship for all less urbanized counties when compared with large central metro counties, with the greatest increase among noncore counties between 1999 and 2019 (1.16 [95% CI, 1.14 to 1.19] to 1.83 [95% CI, 1.79 to 1.86]).

Disparities in mortality from chronic lower respiratory diseases widened in a dose-dependent manner between more rural compared with more urban counties in the United States from 1999 to 2019. Limitations include the use of death certificate data, which may be subject to miscoding but represent the most comprehensive national assessment of mortality statistics. Potential contributing factors to these findings include different smoking rates, environmental air quality, socioeconomic factors, or occupational exposures between more or less urbanized counties over time (7, 8). Investigations focused on the main drivers of our findings are needed to identify opportunities for interventions at the community level to decrease the burden of deaths from chronic lower respiratory diseases in rural areas within the United States. ■

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Prone Position Reduces Spontaneous Inspiratory Effort in Patients with Acute Respiratory Distress Syndrome: A Bicenter Study

To the Editor:

Prone position reduces mortality in severe acute respiratory distress syndrome (ARDS) (1). Although the benefit of prone position is well-established during passive mechanical ventilation (2), the effects of prone position on the determinants of lung injury under spontaneous breathing have not been evaluated yet in ARDS. Turning to prone position is known to have the similar effects of recruiting lung and improving gas exchange as higher positive end-expiratory pressure (PEEP) conditions (3), which in supine position, lessens the strength of spontaneous inspiratory effort and reduces propensity to injury (4).

Based on this reasoning, we hypothesized that prone position would attenuate spontaneous inspiratory effort.

Clinical trial registered with www.clinicaltrials.gov (NCT03768154).

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