

19. Perrem L, Stanojevic S, Shaw M, Jensen R, McDonald N, Isaac SM, *et al*. Lung clearance index to track acute respiratory events in school-age children with cystic fibrosis. *Am J Respir Crit Care Med* 2021;203:977–986.
20. Green K, Kongstad T, Skov M, Buchvald F, Rosthøj S, Marott JL, *et al*. Variability of monthly nitrogen multiple-breath washout during one year in children with cystic fibrosis. *J Cyst Fibros* 2018;17:242–248.
21. Voldby C, Green K, Kongstad T, Ring AM, Sandvik RM, Skov M, *et al*. Lung clearance index-triggered intervention in children with cystic fibrosis - a randomised pilot study. *J Cyst Fibros* 2020;19:S1569-1993(20)30755-4.

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8 The Role of Individual and Neighborhood Factors on Racial Disparity in Respiratory Outcomes Won't You Be My Neighbor?

Racial disparity is not new. Although usually considered within the context of the criminal justice system (1), it has also recently been brought to the fore in relation to the coronavirus disease (COVID-19) pandemic (2). Although often associated with discrimination, it is not the same thing; by definition, disparity highlights a *difference* in experience, with racial disparity being defined as that usually associated with biology, linked with physical characteristics such as skin color or hair texture, and certainly racial discrimination and segregation have biological effects (3). Additionally, there is an evidence base around health disparities and “weathering” as a risk factor (4). So, although the discussion around racial disparity and health care is not new (5), it is important to understand how far we have come, so that we can learn what we can do better. Implicit in that is appreciating what we can and cannot change.

In this issue of the *Journal*, Ejike and colleagues (pp. 987–997) investigate to what extent both individual and neighborhood socioeconomic status (SES) factors contribute to racial disparities in chronic obstructive pulmonary disease (COPD) outcomes (6). They included more than 2,500 current and former smokers, with and without COPD, recruited to SPIROMICS (Subpopulations and Intermediate Outcomes in COPD Study) (7) and assessed whether racial differences in symptoms, functional and imaging outcomes, or exacerbation risk could be explained by individual and/or neighborhood SES factors. They separately and sequentially adjusted for individual-level SES (income and education) and neighborhood SES (poverty rate, educational attainment, unemployment rate, median household income, Area Deprivation Index, and food access) in the models. Individual-level information was obtained at baseline enrollment into the SPIROMICS cohort. Neighborhood-level data were obtained from the 2010 U.S. Census Bureau American Community Survey and SPIROMICS AIR, with food access information from U.S. Department of Agriculture food stores at census-tract level. Each model provided a measure of association between race and the outcome of interest, and then the difference in strength of the measures was evaluated using the difference method (8). Following this, mediation proportion

(proportional reduction in exposure-outcome from before and after adjustment with mediators by both neighborhood and individual level) was tested.

It is important to note that very few people in the original data set were mixed or other race, and in fact only 529 Black people were included. People of mixed race, those of “other” race, and those not reporting race or having missing data around race were all excluded from the analyses, and yet they may have been the most important to include to understand in this setting. Although the paper may have been easier to follow if only those with COPD had been included, it is worth noting that Black individuals were less likely to have a COPD diagnosis before enrollment, perhaps due in part to access to health care or insurance access, and in these analyses, people needed to have a 20 pack-year smoking history to have a diagnosis of COPD.

The authors found that Black individuals were younger and less educated, had lower income, were more likely to be current smokers, lived in areas with worse poverty, had lower household income and higher unemployment, and were more likely to have limited food access than white individuals. With respect to outcomes, Black individuals had worse symptoms and quality of life, were at higher risk of exacerbation, and had more air trapping on computed tomographic imaging than white individuals.

The authors reported that individual-level SES contributed up to 35% of the racial disparities seen, with the largest explanatory effect for 6-minute-walking distance (6MWD) and quality of life (St. George’s Respiratory Questionnaire). When considering neighborhood SES, associations between race and outcomes were generally attenuated, and neighborhood SES explained more of the variance compared with individual SES alone for 6MWD and rate of hospitalization. In the models including both individual and neighborhood SES, the associations between race and dyspnea, quality of life, and 6MWD were no longer statistically significant. Overall, combined individual and neighborhood SES accounted for up to 69% of the race outcome association with COPD health-related outcomes, with individual-level and neighborhood-level SES explaining 12–35% and 26–54% of the racial disparities in respiratory outcomes, respectively. Additional neighborhood factors were considered in sensitivity analyses, including urban/rural status and region. The influence of SES on healthcare coverage was also briefly discussed.

The relationship between race and individual and neighborhood SES with respect to COPD outcomes is complex. Although there have been some studies investigating racial

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disparities in COPD previously (9), none have combined individual and neighborhood SES factors in this way. However, most have included some determinant of SES (such as index of multiple deprivation). Race as an explanation itself for health differences is controversial. Here, the authors state that there may still be other societal and personal factors that require further investigation, particularly as in this study, the measures of neighborhood-level SES focused mainly on material deprivation, rather than dependency, crime, or residential instability. In addition, the outcomes mainly focused on clinical and humanistic aspects, but there is an important precursor outcome ahead of these outcomes, the use of healthcare resources, which, although briefly touched upon as a limitation, was not included in this study.

It is not always clear how missing data was handled. Around 20% of individuals did not answer the income question. Few Black people earned more than \$35,000, preventing the obvious stratified analysis with separate models for each stratum and thus making the question “Do Blacks have worse outcomes than whites in the same bracket based on education, income, and area SES?” impossible to answer. In addition, the data presented in this paper are cross-sectional, and thus, no causality can be inferred or temporal relationships investigated. There were clinically and statistically significant differences between the white and Black individuals included in terms of age, socioeconomic status, and so on, and although acknowledged, it is possible covariate adjustment was insufficient. The authors tested the variance inflation factor to assess potential collinearity of exposures, and although appropriate, there is no directed acyclic graph (10), and overadjustment or inclusion of variables on the causal pathway is not inconceivable here. For example, data on education and income were obtained from both individual- and neighborhood-level information and both were included. It is likely they are related or possibly one source is more accurate than the other; however, this is not discussed. Of course, racial discrimination has well-documented biological effects, and the fact that inclusion of both individual- and neighborhood-level information in the SPIROMICS analysis did not completely eliminate racial disparities does not mean that there is a genetic basis for the disparities.

Perhaps most importantly, however, is the concept of ethnicity and culture relative to race here. Ethnicity itself implies both SES and culture and can include the health beliefs of the individual, attitudes toward complementary/alternative medicines, styles of seeking health care, language barriers, and sense of community. Ethnicity is not the same as race. Culture in the context of health behavior may even be more important than ethnicity and may be directly or indirectly associated with a health-related behavior, or even influence acceptance and adoption of a health education message (11).

So what can we take home from this? As other studies have found, both person-level and area-level SES are important. These data cannot explain away all the associations between SES and outcomes, and given the complexity around race, it is unlikely that race itself explains very much. What is key is that this paper gives us pause for thought. It is not just who you are and how you live but where you live that is important. Racial, ethnic, and cultural disparities are rife, and understanding modifiable and nonmodifiable factors is essential if we

are to improve society. After all, we can but strive to have “a beautiful day in the neighborhood” (12). ■

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References

1. The Sentencing Project. Report to the United Nations on racial disparities in the US Criminal Justice System [accessed 2020 Oct 20]. Available from: <https://www.sentencingproject.org/publications/un-report-on-racial-disparities/>.
2. Golestaneh L, Neugarten J, Fisher M, Billett HH, Gil MR, Johns T, et al. The association of race and COVID-19 mortality. *EClinicalMedicine* 2020;25:100455.
3. National Geographic. Race and ethnicity, explained [accessed 2019 Feb 23]. Available from: <https://www.nationalgeographic.co.uk/history/2019/02/race-and-ethnicity-explained>.
4. Forde AT, Crookes DM, Suglia SF, Demmer RT. The weathering hypothesis as an explanation for racial disparities in health: a systematic review. *Ann Epidemiol* 2019;33:1–18, e3.
5. Egede LE. Race, ethnicity, culture, and disparities in health care. *J Gen Intern Med* 2006;21:667–669.
6. Eijike C, Woo H, Galiatsatos P, Paulin LM, Krishnan JA, Cooper CB, et al. Contribution of individual and neighborhood factors to racial disparities in respiratory outcomes. *Am J Respir Crit Care Med* 2021; 203:987–997.
7. Couper D, LaVange LM, Han M, Barr RG, Bleecker E, Hoffman EA, et al.; SPIROMICS Research Group. Design of the subpopulations and intermediate outcomes in COPD study (SPIROMICS). *Thorax* 2014;69: 491–494.
8. Preacher KJ, Hayes AF. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behav Res Methods* 2008;40:879–891.
9. Mamary AJ, Stewart JI, Kinney GL, Hokanson JE, Shenoy K, Dransfield MT, et al. Race and gender disparities are evident in COPD underdiagnoses across all severities of measured airflow obstruction. *Chronic Obstr Pulm Dis* 2018;5:177–184.
10. Lederer DJ, Bell SC, Branson RD, Chalmers JD, Marshall R, Maslove DM, et al. Control of confounding and reporting of results in causal inference studies: guidance for authors from editors of Respiratory, Sleep, and Critical Care Journals. *Ann Am Thorac Soc* 2019;16:22–28. [Published erratum appears in *Ann Am Thorac Soc* 16:283.]
11. Pasick RJ, D’Onofrio CN, Otero-Sabogal R. Similarities and differences across cultures: questions to inform a third generation for health promotion research. *Health Educ Q* 1994;23:S142–S161.
12. Mister Rogers’ Neighborhood [accessed 2020 Oct 13]. Available from: <https://www.misterrogers.org/>.

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