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## U.S. Occupational Historical Perspective on Race and Lung Function

*To the Editor*:

Several articles (1–4) have recently been published in the *Journal* on the topic of race and lung function. However, an important part of the history of this issue has not been addressed in these or other articles published to date. There is an extensive public record of the "Informal Public Hearing on Proposed Standard for Exposure to Cotton Dust" held in 1977 before the U.S. Occupational Safety and Health Administration (OSHA) Cotton Dust Standard was finalized in 1978, and these comments are relevant to the current general discussion as well as to the purposes of occupational spirometry testing in the United States (5, 6). As Lapp stated in 1974, " … differences [between Blacks' and Whites' lung volumes] are of more than academic and anthropological interest [because of] the recently introduced practice of performing preemployment spirometry in workers … " (7). The OSHA public comments, as Lapp anticipated, give insight into the origins of the use of a scaling factor for testing African Americans and its purpose in occupational and clinical settings, as well as the problem that false positives cause.

Comments in the OSHA Cotton Dust Docket recognized that reference values used in the 1970s (derived almost exclusively from White males) were preventing Black job applicants from being hired when pre-employment spirometry tests were required. As the Docket indicates, with those reference values in place, cotton processing mills attempted to expand the definition of "normality" to allow more job applicants to be hired. Dr. Harold Imbus evaluated job applicants being turned away by Burlington Industries and documented that 80% of them were Black, though Black individuals comprised only 35% of the applicant pool. It was not until the 1990s that the NHANES III provided race-specific reference equations based on thousands of self-identified African Americans, Whites, and Mexican Americans in the United States (8). Because the spirometry reference values used in 1977 were drawn from studies of primarily White individuals, OSHA determined that a scaling factor must be applied to the available White predicted values when assessing Black workers to avoid discriminatory hiring in the workplace. The Cotton Dust Standard was updated in 2019 and now requires workers to be evaluated using race-specific equations developed by the NHANES III, with a scaling factor applied for Asian- Americans (9).

Clearly the causes of the difference between self-reported Blacks and Whites are of great importance, particularly to determine whether another variable can be used to group individuals instead of self-identified race. NHANES III White predicteds and LLNs exceed Blacks' by about 0.6 L when working-age men of the same ages and heights are compared (10). While poor living conditions and other socioeconomic factors most likely affect non-White individuals' lung function, consideration must also be paid to possible differences in body build, which is likely ancestry-related, in addition to "modifiable social risk factors." We surely need to investigate all possible explanations for observed differences before deciding that "modifiable social risk factors" fully explain differences that have been observed in current times since the 1970s, and for 100 years prior to that.

Our greatest concern is that practitioners, as they read papers questioning the value of race-specific reference values, will abandon use of self-identified race when evaluating individuals in occupational and clinical settings before a valid and practical substitute has been identified. Simply omitting self-identified race in interpretation practice would be premature before causes of differences have been carefully studied and clearly identified. Otherwise, we run the risk of returning to the era preceding the cotton dust standard, when non-White workers could be unfairly excluded from qualifying to wear a respirator or be denied hire in occupations for which personal respiratory protection is required. ■

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## Race/Ethnicity and Reference Equations for Spirometry

*To the Editor*:

We read with interest two papers in the *Journal* arguing that lung-function prediction equations should be neutral with regard to race and ethnicity. We agree that race is a socio-political construct and we must eliminate racial biases in health care, but we disagree with the approach of McCormack and colleagues (1) and of Elmaleh-Sachs and colleagues (2) who redefine normal values for spirometry to address this issue.

By ignoring a subject's ancestry when evaluating lung function, McCormack and colleagues (1) found spirometry better correlated with subsequent overall mortality in National Health and Nutrition Examination Survey (NHANES) III data. In NHANES III, those of African ancestry were on average younger but had an age-adjusted mortality that was worse than that for people of European ancestry, which fits with Centers for Disease Control and Prevention data (3). In the United States, the small proportion of total deaths related to chronic lower respiratory disease differ significantly between people of African versus European ancestry (3.3% vs. 6.4%, respectively) (4), but the authors attempt to account for all of the difference in all-cause mortality by manipulating lung function data. Using global prediction equations (Global Lung Function Initiative "other" [5]) that combine all ancestries makes the lung function for those of African ancestry appear worse and for those of European ancestry appear better. The resultant improvement in the correlation of $FEV_1$ *z*-score with overall mortality is used to justify using global prediction equations. However, the great majority of overall mortality differences are not related to lung function. The different disease spectrum and limitations in both the access to and the delivery of health care for people of African ancestry, that are not accounted for by socio-economic adjustments (6), are not addressed by the authors. Because there are different numbers in the two groups being compared in the study, the probability distribution graphs in the study should use percentage of people rather than numbers of people, as demonstrated in Figure 1, which shows both groups had *z*-scores approximately centered around unity, which is to be expected from a general population cohort compared with a healthy reference population. Using geographic ancestry-specific equations (5) does not produce a bias between the two groups with the distributions of initial *z*-scores for $FEV_1$ in the two groups being remarkably similar.

However, using globally based *z*-scores that combine all geographic ancestries skews the two groups in different directions. The European ancestry group are shifted to higher and the African ancestry group are shifted to lower $FEV_1$ *z*-scores, making the general population of African ancestry cohort appear to have $FEV_1$ lower than the reference African ancestry cohort (suiting the authors' thesis), while the general population of European ancestry cohort then appear to have $FEV_1$ higher than the reference European ancestry cohort, which is highly improbable. As the authors note, using global reference equations for spirometry is potentially prejudicial to patient care for both people of African ancestry and European ancestry with a risk of overdiagnosis of respiratory disease in the former and underdiagnosis in the latter.

Elmaleh-Sachs and colleagues (2) also looked at survival- and event-related data in NHANES III data to make a conclusion that race–neutral lung-function prediction equations are the best way forward. Their analysis not only suffers from the problems outlined above, but they also used percentage of predicted lung function values in their analysis. This is a flawed methodology that is not supported by the American Thoracic Society or European Respiratory Society in making assessments about lung function (7). It retains sex, age and size bias and assumes a proportionality in severity which is not proven. Because it retains a size bias, it will include a geographic ancestry bias. Percentage of predicted also ignores the degree of scatter found in normal subjects which varies with sex and geographic ancestry (8).



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