

MEDICINE AND SOCIETY

Reform and Remedy for Imprecision and Inequity — Ending the Race-Based Evaluation of Occupational Pulmonary Impairment

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The use of race as a variable in clinical and administrative algorithms has increasingly been questioned by medical trainees, patients, clinicians, researchers, and policymakers.¹⁻³ In May 2025, federal regulations under Section 1557 of the Affordable Care Act began requiring that all covered health care entities, including clinicians and health systems, demonstrate “‘reasonable efforts’ to identify and mitigate discrimination caused by the use of patient care decision support tools.”⁴ In the guidance underlying these regulations, the Department of Health and Human Services (HHS) explicitly identifies adverse outcomes associated with the use of race-based equations for interpreting pulmonary-function tests (PFTs).⁵

Race-based PFT guidelines were taught to clinicians for decades, even as questions arose about their validity and the implications of their use. Social scientists and historians were among the first to recognize that racial differences in measured lung capacity had been used as justification for the enslavement of Black people and for claims of racial hierarchy.⁶ Within medicine, a growing consensus gradually emerged that the field should end inaccurate and imprecise uses of race as a standalone proxy for biologic or genetic traits.⁷ Pursuant to a 2023 consensus statement from the American Thoracic Society (ATS) and endorsed by the European Respiratory Society (ERS),⁸ health care systems have now begun shifting to the race-neutral Global Lung Function Initiative (GLI) PFT reference equation.

Significant gaps persist, however, in the implementation of race-neutral PFT equations in the United States and worldwide, because race has long been embedded in PFT interpretation. Moreover, the isolated replacement of race-based reference equations in individual PFT laboratories does not address specific and long-standing challenges associated with assessing work-related

pulmonary impairment for disability compensation.^{9,10} Understanding the historical, clinical, and regulatory contexts that led to imprecise and inequitable evaluations of occupational pulmonary-function impairment can help identify implicated stakeholders and next steps to remedy the measurable health and economic consequences of race-based PFT equations.^{11,12}

HISTORICAL LEAPS IN LOGIC

Pulmonary impairment evaluation has gradually evolved over time. By the mid-20th century in the United States, the Social Security Administration (SSA) had deemed tests of aerobic exercise capacity to be the best way to assess a person’s remaining capacity to work. Faced with the challenge of performing thousands of exercise tests, the SSA validated equations for estimating the maximum volume of oxygen consumption during exercise (VO_2max) from resting measures of ventilatory capacity, or the ability of the lungs to move air.¹³ To assess ventilatory capacity, clinicians measured the forced expiratory volume in 1 second (FEV_1) with the use of spirometry.¹⁴ Yet, a deeper examination of the relationship between FEV_1 and VO_2max reveals unclear evidence of accuracy, precision, or validity regarding whether low values for these proxy measures correspond to clinically relevant impairment in activities of daily living or job-related tasks.⁹ For example, early validation studies identified substantial overlap in VO_2max measurements between people applying for pulmonary impairment-related disability benefits and employed people, as well as differences as large as 150% between FEV_1 -estimated VO_2max and measured VO_2max .¹⁵

In the 1950s, the U.K. Medical Research Council’s new goal of compensating miners for *partial* respiratory impairment further amplified the use

of spirometry in evaluating respiratory disorders worldwide.¹⁶ The imperfect correlation between cough or breathlessness and radiographic findings, medical evaluators' frequent dismissal of patient-reported symptoms as malingering, and difficulty in standardizing and expediting the interpretation of chest radiographs all hindered the quantification of partial impairment.¹⁷ Spirometry offered a solution, providing reproducible numbers and aligning with the medical establishment's broader focus on "objective" physiological measurements.¹⁸ But the comparison of measured values with reference values (what would be expected in healthy populations) in order to quantify partial impairment brought about further uncertainties.

In 1965, the American Medical Association (AMA) published the first edition of a guide for the evaluation of occupational respiratory impairment, which used a combination of grades for dyspnea, chest radiography findings, spirometry measures, and oxygenation.¹⁹ Partial impairment ratings were based on the FEV₁ and forced vital capacity (FVC), expressed as percentages of the average values in a reference population, with adjustment for sex, age, and height. No rationale was provided, nor validation cited, for grading someone's ability (or lack thereof) to perform activities of daily living or work on the basis of FEV₁ or FVC; indeed, the authors of the guide later acknowledged that impairment ratings are not a proxy for disability.²⁰

Some physicians and scientists criticized the assumption that relative reductions in spirometric values (as compared with focused assessments of job-specific activities) reflected meaningful declines in a person's functional capacity.²¹ This criticism, however, went unanswered in all subsequent editions of the AMA's *Guides to the Evaluation of Permanent Impairment* (including the most recent version of the sixth edition, published in 2024), which instead have progressively diminished the weight given to patient-reported symptoms in impairment ratings relative to PFTs.²²⁻²⁷ A 1986 ATS update on the assessment of respiratory-disorder-related impairment made similar jumps in logic without sufficient evidence, introducing spirometry-driven partial impairment categories based on FEV₁ and FVC.²⁸

The original studies relating spirometry to exercise capacity did not report the racial composition of their participant population. A 1974

study of 244 asymptomatic male asbestos-exposed workers found no evidence of racial differences in the ventilatory capacity needed to achieve a standardized VO₂max during exercise.²⁹ Although this finding suggests that race-specific spirometry interpretation is not needed to determine work-related impairment or job eligibility (hence the race-neutral SSA tables for determining total disability³⁰), the same study also showed lower average spirometric reference values among its healthy Black participants than among their healthy White counterparts.²⁹ By emphasizing biologic explanations for this racial difference in normal ranges (e.g., measured differences in chest size), Rossiter and Weill's 1974 cohort study was highly influential in promoting deployment of race-adjusted reference equations rather than exploring environmental or sociostructural underpinnings. Indeed, the authors concluded that "it is possible that social or economic factors may have contributed to the differences observed, but the consistency with which the finding of a large ethnic difference in lung function occurs suggests that these factors may be unimportant."²⁹ By 1984, the second edition of the AMA *Guides* had introduced a fixed percentage adjustment for spirometry measurements in Black persons.²³ The 1986 ATS update on respiratory impairment and disability evaluations similarly recommended a new fixed Black race adjustment.²⁸

A race-specific approach to assessing pulmonary impairment also proved to be financially beneficial for employers and insurance companies. In the 1990s, a lawsuit in Baltimore brought public attention to this issue: Black workers at the Owens Corning asbestos manufacturing plant were denied the opportunity to join a class-action lawsuit over asbestos-related pulmonary-function impairment, with the company arguing that they didn't meet race-specific criteria for impairment.³¹ The company's lawyers relied heavily on scientific standards (ATS and AMA consensus guidelines) and invited leading pulmonology specialists to highlight mainstream support for race-specific reference standards. In a surprising rebuke, Maryland Circuit Court Judge Joseph H.H. Kaplan eventually sided with social scientists and clinicians who argued against the use of race as a biologic variable and challenged the medical establishment, overruling his own previous guidance and denying race-based limitations.³² Despite the reversal of the Owens Corning motion in March 1999, thousands

of additional asbestos-exposure-related cases were awaiting determination in the Baltimore area alone,⁶ and it took nearly 25 years for ATS–ERS consensus recommendations to begin advocating for a race-neutral reference equation.

ACKNOWLEDGING THE HARM

Past authors of *AMA Guides* have acknowledged that the *Guides* do not provide a method for assessing disability but rather should be used to grade impairment severity as “one component of the ‘disability evaluation process.’”²⁰ Measured physiological impairment relative to healthy reference ranges does not necessarily correspond to job-specific disability, which may depend more on other individual characteristics and the physical demands of a particular job. Yet, the majority of U.S. states (Fig. 1), U.S. federal employee compensation programs,³³ and multiple multinational corporations and international government agencies identify editions of the *AMA Guides* as a “gold standard” for worker’s compensation evaluations and, thus, disability payment determinations. Eleven states have no specific pulmonary rating schedule and have statutes, regulations, or case law precedent that support consideration of *AMA Guides*–based impairment ratings. Only four states (Florida, Minnesota, New York, and Wisconsin) have a distinct pulmonary impairment rating system that explicitly supersedes consideration of an *AMA Guides* rating. The most recent edition of the *Guides* continues to recommend race-based spirometry reference equations.²⁷ The pulmonary chapter also recommends a race-adjusted reference equation for diffusing capacity for carbon monoxide and does not acknowledge the now-recognized limitations of pulse oximetry for patients with darker skin pigmentation.^{8,34} In addition, the *Guides*’ pulmonary “whole-person impairment” rating system explicitly weights “objective tests” as the stand-alone “key impairment factor” — meaning that PFTs are the primary determinant of impairment class and supersede consideration of history or physical examination findings.

The economic consequences of overreliance on these outdated recommendations may be profound: estimates suggest that a universal transition to race-neutral reference equations could change the impairment-severity ratings of millions of workers and lead to the reallocation of

millions of dollars in annual disability payments to U.S. veterans.^{12,35} Beyond financial implications, a growing body of evidence demonstrates that race-neutral PFT equations better predict clinically meaningful end points, including respiratory symptoms and risk of hospitalization.^{8,36}

With these concerns in mind, three of us (R.K., S.S., and N.R.B.) presented a proposal that was adopted by the *AMA Guides* Editorial Panel in July 2024 and awaits integration into the next update to the sixth edition of the *Guides*. An updated pulmonary chapter will explicitly recommend alignment with ATS–ERS standards (including the use of GLI-Global reference equations^{8,37}), explain the rationale for ending race-based PFT interpretation,^{12,35,36} educate clinicians about the limitations of pulse oximetry when assessing hypoxemia in patients with darker skin,³⁴ and use person-centered descriptors in lieu of stigmatizing or disease-centered descriptors.³⁸

THE PATH TOWARD REFORM AND REMEDY

A switch to race-neutral PFT reference equations might seem to be the simplest solution to correct an obvious inequity that has tremendous financial consequences. Yet, irrespective of the choice of reference equation, existing guidance on occupational impairment has failed to acknowledge the inherent deficiencies of spirometric categories and impairment-rating cutoffs — which have been criticized as representing “legal fiction, not medical reality.”³⁹ The weak evidence connecting spirometric impairment to disability, lack of evidence for rating partial impairment on the basis of spirometry, sudden inclusion of race with limited supporting evidence, and overreliance on purportedly “objective” testing combined with devaluation of clinically meaningful symptoms make it clear that occupational pulmonary impairment evaluations are neither grounded in science nor sufficiently validated.³⁹ Concerningly, an internal AMA committee that published similar criticisms of the *Guides* in 2000 was disbanded before the fifth edition was published in 2001.⁴⁰

The quest for simple formulas that relate physiological impairment to work-related disability has fallen short.¹⁰ Complex solutions may be needed to ensure that occupational pulmonary impairment evaluation prioritizes precision and equity in the future.

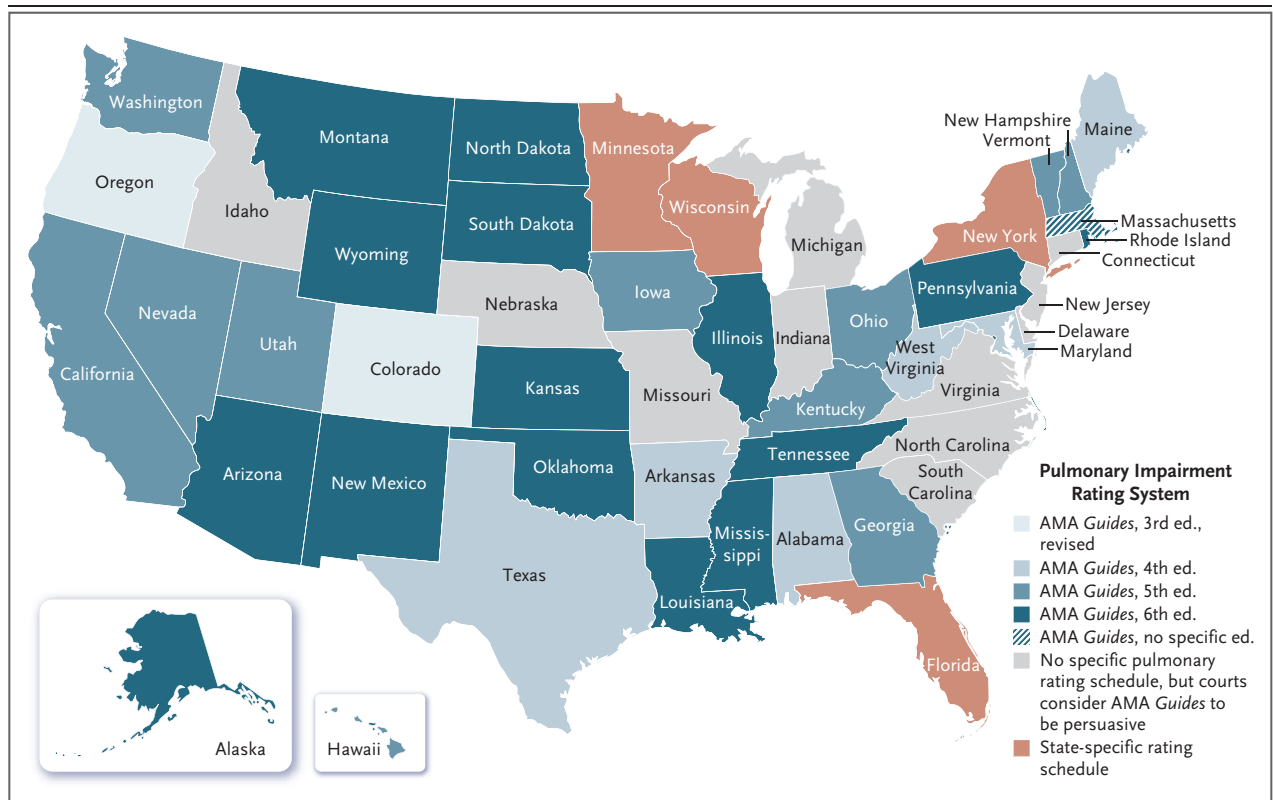


Figure 1. Differences in Pulmonary Impairment Rating Systems According to State.

The map shows states that encourage or statutorily require the use of various editions of the American Medical Association's *Guides to the Evaluation of Permanent Impairment* (AMA Guides), state-specific impairment rating schedules, or clinician discretion when conducting occupational pulmonary impairment evaluations. Each state was assigned to one primary category on the basis of our review of a state's relevant legislation, case law, regulatory statutes, and worker's compensation guidance documents as of July 2025.

First, new grading systems for occupational impairment can grow beyond reliance on categorical PFT thresholds to prioritize global assessment of function and respiratory system-attributable impairment. Pulmonary-function measurements can vary among people and among tests in the same person. A single measurement of pulmonary function cannot be treated as the “ground truth,” given the numerous reasons for individual variation in measured spirometry values and the relationship between those values and symptom control or occupation-relevant functional status. Current spirometry thresholds for “abnormal” values rely on percentages of predicted values, which also bias the determination of “normal” ranges by failing to consider variation according to age and sex, disproportionately categorizing pulmonary function in older adults and women as “abnormal.”³⁷

Additional modifications could include relying

on alternate parameters that are less influenced by racial stratification or parameters that don't require any reference equations.^{41,42} Cutoff-based impairment classes can be deemphasized by instead stressing clinically relevant “objective” criteria, such as the need for supplemental oxygen or incidence of clinically significant respiratory events.⁴³ Similarly, considering pulmonary function as a continuous (rather than categorical) variable could lessen the effect of small changes that currently push people from one whole-person impairment grade to another. Given the need for revalidation of methods for assessing occupational pulmonary impairment in general and the limitations of any individual measure, federal agencies and research funders could support the development of diverse, large, representative research data sets to clarify relationships among “objective” spirometry values, “subjective” patient-reported symptoms, and real-world functional impairment.

Second, it is worth considering how heterogeneity in worker's compensation regulations could be ameliorated. Multiple state-level statutes still explicitly require the use of outdated versions of the *AMA Guides* or call for spirometric techniques and thresholds that no longer reflect clinical standards of care. Regulatory statutes from the Occupational Safety and Health Administration,⁴⁴ the Department of Veterans Affairs,⁴⁵ and the National Institute for Occupational Safety and Health⁴⁶ currently require the use of race-based reference equations in certain programs. While occupational respiratory impairment rating systems are overhauled and new research evidence is generated, existing standards can be used to mitigate variability in clinical practice. Implementation networks, such as the New York City Health Department's Coalition to End Racism in Clinical Algorithms⁴⁷ and the Council of Medical Specialty Societies' Encoding Equity initiative,⁴⁸ can help disseminate educational resources and create peer-accountability mechanisms for policymakers, health systems, and clinicians. Even if future downstream changes remain uncertain, state laws, regulatory agencies, and health systems can align their current practices with national standards of care — in the case of PFTs, the most up-to-date ATS recommendations.^{8,37}

Third, if adequately enforced by the HHS Office of Civil Rights, the mandate created by Section 1557 rulemaking to mitigate discriminatory clinical algorithms⁴ — coupled with efforts from the HHS Office of the National Coordinator for Health Information Technology to advise algorithm developers about equitable data standards⁴⁹ and the Food and Drug Administration to regulate algorithms classified as medical devices⁵⁰ — can play a key role in closing implementation gaps. More specifically, recent Section 1557 rules indicate that covered health care entities may risk noncompliance if they failed to deimplement race-based PFT reference equations by May 2025, though it remains to be seen how the current administration plans to enforce these regulations.⁵

Fourth, in addition to overhauling impairment ratings, and especially given the material implications of race-based evaluations to date, the medical community should shift our focus toward remedy.⁵¹ In a system where threshold-based cutoffs can directly determine disability

payments, race-based PFT reference equations have had direct implications for worker's compensation for decades.^{6,12,31} Individual clinicians, health care organizations, national medical societies (especially the AMA and the ATS), and government agencies alike could actively encourage disadvantaged patients to seek re-ratings of impairment severity. This approach could mirror reparative efforts by the national Organ Procurement and Transplantation Network, which responded to shifts from race-based to race-neutral kidney-function estimation by mandating that transplant centers implement new equations and retroactively grant disadvantaged Black patients “backdating” of their potential accrued waitlist time.⁵² A similar combination of proactive and retroactive approaches to rectifying delayed access to services and undercompensation will be paramount as PFT reference equations are updated. Future federal rulemaking could consider leveraging civil rights statutes and existing regulatory frameworks to explicitly empower patients to seek redress of this nature.⁴

Finally, the negative effect of lower impairment severity ratings after a change to race-neutral equations and, thus, reduced disability compensation for some workers deserves thoughtful consideration. It should be made clear to patients and clinicians that this challenge originated in a system that incorporated race-specific reference equations without sufficient evidence or precision and that the previous status quo was not more “correct,” accurate, or precise than new guidelines. A phased change in which race-specific reference equations are accepted for a limited time could help prevent sudden disruptions to ongoing evaluations and allow stakeholders to gradually adjust their expectations.

CONCLUSIONS

Updated ATS–ERS guidelines and pending modifications to the *AMA Guides* mark important first steps on a decades-long journey toward truth, reconciliation, and healing from the underrecognized harms of race-based pulmonary-function testing. Rather than localizing accountability solely at the level of individual clinicians, many of whom may have struggled to navigate mixed evidence and opted to follow consensus guidelines, a closer examination of historical and regula-



An interview with
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is available at
[NEJM.org](https://www.nejm.org)



tory contexts reveals a broader structural ecosystem that reinforced the practice of race-based medicine despite ongoing criticism and adverse implications. The path to universally equitable evaluation of occupational pulmonary-function impairment — and to remedying the harms of previous race-based approaches — will benefit from further engagement with patients, medical societies, regulatory bodies, payers, researchers, and clinicians. The medical field is poised to critically reevaluate the whole ecosystem surrounding pulmonary-function testing and occupational impairment evaluation — including and beyond the choice of reference equations.

The views expressed in this article are those of the authors and do not necessarily represent the official position of the U.S. Centers for Disease Control and Prevention, the National Institute for Occupational Safety and Health, the American Thoracic Society, or the authors' respective institutions.

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