ARTP

Association for Respiratory Technology & Physiology

# POSITION STATEMENT

## RACE-NEUTRAL SPIROMETRY REFERENCE VALUES

June 2025

# Position Statement on race-neutral spirometry reference equations
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The Global Lung Function Initiative (GLI) Network is a European Respiratory Society Clinical Research Collaboration that aims to improve how lung function tests are interpreted. The network published GLI multi-ethnic spirometry reference equations in 2012, and those equations were subsequently endorsed by all the major respiratory societies including the ARTP. At the time it was the most comprehensive set of lung function reference data and aimed to present a unified and global approach for the interpretation of spirometry measurements. Over this past decade, the GLI network has continued to work on improving lung function interpretation.

In the 2012 GLI publication, the limitations of self-reported race/ethnicity were acknowledged, as were the limitation of the categories. At the time, these were considered better than using an all-White reference population. More recent evidence has shown that the role of social and environmental determinants of lung function differences between ethnic groups had been previously underestimated, such that applying reference equations for different ethnic groups may, in fact, negatively impact assessment of disease severity. A new “GLI Global” reference equation, which eliminates the use of ethnicity as a factor in interpreting lung function, has now been published. The use of this race-neutral approach is a first step towards mitigating health inequalities in lung function between ethnic groups.

The GLI Global equations have already been endorsed by the European Respiratory Society and the American Thoracic Society but are not yet widely established in the UK. The ARTP have given careful consideration and recognise this is a contrast to years of a race specific approach. The re-evaluation is not unique to respiratory medicine; other societies and professional bodies are recognising that race used elsewhere in clinical algorithms may have perpetuated health inequalities and are revising guidance where possible. With this in mind, and after careful deliberation, the ARTP are endorsing the use of the 2022 GLI Global reference equations.

A switch to GLI Global requires more thoughtful consideration of the inherent uncertainty and limitations to any reference equation. The use of GLI Global to interpret spirometry requires consideration of an individual’s symptoms and clinical history, and it should be remembered that spirometry is not the only part of a diagnosis or clinical decision making. Further information on the considerations when switching to these equations and some of the frequently asked questions are discussed further within the statement.

## Key Messages

- **Self-identified race/ethnicity will no longer be required for lung function interpretation.**
- **GLI Global reference equations are currently for spirometry only, lung volumes and gas transfer predicted equations remain unaffected.**
- **Interpretation methods remain the same.**
- **Retrospective reference data will need to be recalculated to allow for longitudinal monitoring however measured/best values will be unchanged.**
- **Manufacturers have confirmed availability of the new reference values however its availability on equipment will vary according to device age and service agreements.**
- **Where GLI Global is unavailable, GLI Other can be utilised.**

## Context and Background

In 2012 the GLI Task Force published "Multi-ethnic reference values for spirometry for the 3–95-year age range: the global lung function 2012 equations". Their seminal work addressed many of the previous limitations in reference equation research, pooling spirometry data from 74,187 asymptomatic non-smokers across twenty-six countries to develop international spirometry reference equations (1).

The approach to create multi-ethnic equations was done with the best intentions, as there were concerns that measured values from the non-White population were being mis-interpreted. It is now understood that the observed differences amongst different populations/ethnicities cannot simply be attributed to differences in body proportions. The impact of social and environmental determinants may have been underestimated, such that the multi-ethnic equations have potentially furthered health inequalities in non-White populations (2). Therefore, an updated, race-neutral approach to interpreting lung function was developed and published in 2022 (3,4).

The ARTP endorse the use of the GLI network's race-neutral equations, GLI Global. These equations were derived from the same data as the 2012 equations, with equal weighting for each of the four ethnic groups, such that application does not require race/ethnicity as an input in spirometry interpretation. The use of a single race-neutral spirometry equation reflects the wide range of lung function observed within and between populations. Nonetheless, given the inherent limitations of any reference equation, the use of GLI Global to interpret spirometry requires careful consideration of an individual's symptoms and medical history when used to make clinical decisions.

## Considerations when changing to GLI Global equations

- Self-identified race/ethnicity will no longer be required for lung function interpretation.
- Health inequalities in non-White populations will have a greater chance of being identified and mitigated.
- Interpretation methods remain the same, i.e. use of the ratio for $FEV_1$/FVC to define obstruction.
    - NB patients may change severity categories (based on $FEV_1$) and may move from "within the normal range" to a "restrictive pattern" (or vice versa).
- Tracking (longitudinal data) remains the same. However, retrospective data will need to be recalculated using the new equations to aid interpretation of updated trend reports.
    - NB software will require the capability to recalculate retrospective data.
- There are expected to be limited differences to the number of people classified as having an 'obstructive' pattern. The practical impact on patient diagnosis will be small because spirometry is not the only test for lung health; clinicians use it alongside clinical observations and other tests.
- Healthcare professionals should make service users aware of the change in reference equations and where needed provide appropriate explanations to patients.
- The new equations/publications have created an opportunity to discuss the misuse and misinterpretation of spirometry and reference equations, allowing us to evolve our thinking.

## Summary

Spirometry is the most commonly used respiratory function test. Appropriate interpretation requires appropriate reference data and should be reviewed in the context of the medical history and other clinical investigations. This may include monitoring over time where the effective reference is an individual's own baseline used to identify changes in z scores and absolute values. Raising awareness on the inherent variability in spirometry, and the overlap between health and disease, is vital in considering the whole picture before making any clinical decisions. For many the overall interpretation will not change, and in those where it does, it is more important to understand why. The GLI Global equations are the best reference equations to date, but further updates and refined approaches are required.

## Authors

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## Addressing Frequently Asked Questions

- **Is GLI race neutral the same as the "Other" category on GLI-2012?**

  *The two are similar. The predicted values are almost identical, but the LLN is slightly lower for GLI Global than for 'other' from GLI-2012. The magnitude of the differences will depend on the individual. Older women for example will have a bigger difference because there were fewer data in non-White older women.*

- **It is difficult that we have spent years promoting GLI-2012 to then switch and state otherwise for race neutral equations – who knows when the next set of data will come out and maybe that will pivot in a different direction altogether? Should we just wait until the final recommendations are made?**

  *The GLI network have been working on improving lung function interpretation for the past 20 years and will continue to do so as more data and evidence become available. In 2012, they presented the largest set of reference equations to date and at the time, with the best intentions, attempted to improve interpretation for non-White populations. It is now understood that the observed differences amongst different populations/ethnicities are not simply due to differences in body proportions and in fact adjusting for ethnicities may perpetuate health inequalities. We should therefore encourage education and clinical practice to be open to updates and improvements as they arise.*

- **People working in primary care are currently struggling with mixed messages re GLI (2012) and GOLD 2 (2025) and reference equations. I fear if another set of equations are presented there may be confusion.**

  *The race-neutral approach should simplify the situation as those performing spirometry will no longer be required to enquire regarding ethnicity. The proportion of people identified as having obstruction based on the LLN is similar. Be clear for those working in primary care that obstruction does not change, it is defined by $FEV_1$/FVC ratio, and that this robust measure should be used. Those near the LLN should be treated carefully and remember that spirometry is not the only part of a diagnosis.*

- **Are patients likely to change severity category if new equations are applied?**

  *Interpretation methods remain unchanged. Obstruction is still defined by $FEV_1$/FVC. Patients may change severity categories or move from within the normal range to a suggestion of restrictive pattern (or vice versa). A normal FVC may rule out restriction, but those near the LLN should be treated carefully and measurement of lung volumes would be needed to confirm the presence of restriction.*

  *McCormack et al recently reviewed 8798 spirometry results from the NHANES study to compare the GLI 2012 equations to the race neutral equations and found differences of 0.6 z-scores or 7% predicted (5). Another study reviewing the extent of restrictive lung impairment (i.e. FVC below the LLN) on 45,587 subjects found that more Black and Asian patients moved to the restrictive category when using the race-neutral equation. Initially 24.1% of Black patients were categorised as "restrictive" using race-specific equations, this changed to 38.4% of patients when using the race-neutral approach. For Asian subjects it was 14.8% in the race-specific equation and 22.5% in the race-neutral equations (6). These changes need to be considered when interpreting lung function results. Brems et al looked at associations between change in severity classification from race-specific to race-neutral with COPD exacerbations. They found proportions of Black and White individuals whose severity was reclassified were similar using z-score thresholds, and changes in severity corresponded to clinical risk with z-score i.e. using a race neutral equation, a decreased severity classification was associated with lower risk of exacerbation and an increased severity classification with an increased risk of exacerbation (7). Patients will need to be informed of the changes to avoid any distress.*

- **Are you not concerned about under reporting restrictive lung disease in white subjects by moving across?**

  *There are expected to be limited differences to the number of people classified as having an 'obstructive' pattern.* ***Particular care should be taken for people who were previously close to the lower limit of normal (LLN).*** *The practical impact on patient diagnosis will be small because spirometry is not the only test for lung health and clinicians use it alongside clinical observations and other tests. The Guidot et al paper found more classification of a potential restrictive pattern in White patients when using race-specific equations. The authors acknowledge they cannot infer that because a patient's FVC classification changed this would translate to a change in diagnosis (6). There will be some White patients that will be moved from 'restriction' to above the LLN using the new race-neutral approach, GLI authors acknowledge that wider limits of normal for GLI Global reflect greater uncertainty and may label pathological reductions in lung function as healthy (3). Patients who sit near the LLN should be monitored and diagnosed using all the available clinical tools. As this is likely to include static lung volume measurement to confirm restriction there may be discordance between reporting GLI Global spirometry and static lung volumes (derived from populations of European ancestry). GLI acknowledge the need to expand static lung volume data sets to include more diverse populations. Whilst there are slight changes in the LLN using race-neutral equations, these equations are the most appropriate equations to use to date.*

- **Why shouldn't we use white GLI 2012 for white population and "other"/GLI neutral for everyone else?**

  *While an equation for a regional population may be suitable, the GLI Global offers a common way of expressing results for everyone to better compare populations. Using "White" or "other" would mean a two-tier system and may further perpetuate health inequalities. Ancestral heritage may be uncertain, such that, even if you think a patient is "White" they could have ethnic admixture. Even when ancestral heritage is clear, there may be other exposures and contributing factors to differences in lung function.*

- **GLI paper in 2012 contained >1,500 males and >2,000 females in the Black American category. The data showed they had a $FEV_1$ and FVC which was 14-15% less than Caucasians from the study so why should I use the GLI neutral equation if I am testing a Black African American?**

  *Using ethnic-specific equations may negatively impact assessment of disease severity, normalising reductions in lung function. The demonstrated differences in $FEV_1$ and FVC between ethnicities has previously been suggested to be due to inherent biology. More recent evidence suggests there are additional factors associated with ethnic differences in lung volumes that are not purely down to an individual's biology and are likely to be due to the social and environmental influences over many generations.*

- **The GLI Global 'race neutral' equations are not currently available on the software we use. Unfortunately upgrading our equipment to allow these references to be installed is a laborious and time-consuming process. Are there any recommendations for an interim measure, as the GLI Other is similar to GLI Global, would applying this to all patients be a valid approach?**

  *The GLI 2012 'Other' equations are similar to GLI Global and avoid using race-specific approach (see answer to Q1). Using GLI 2012 'Other' should be discussed locally, and users should be aware of the minor differences between this and GLI Global. Manufacturers should be encouraged to make these equations available, and the ARTP Manufacturer's Liaison Committee (MLC) will be encouraging implementation.*

- **Are there changes to the TLCO or Lung volumes GLI reference equations?**

  *TLCO and Lung volumes equations (GLI and any other) are based on White people. There are limited data to suggest there are any ethnic differences in these outcomes, or the determinants of the differences. Given the limitations of the data for static lung volumes we need to better understand if there are differences and need to include a more diverse populations in research contributing to data sets.*

- **Would the change restrict patient access to care/medications?**

  *Spirometry is just one data point and should not be the only data point for decision making. Results may need to be reviewed on an individual basis.*

This statement is endorsed by the Association of Respiratory Nurses (ARNS)

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