Choix des valeurs de référence spirométriques en Afrique

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06 Novembre 2024

Objectifs

- Choisir les équations de référence de façon adaptée
- Considérer les limites des valeurs de référence utilisées

Plan

1. Le problème
2. Equations de référence disponibles
3. Le Z-score
4. Comparaison des équations en ASS
5. Recommandations

Conclusion

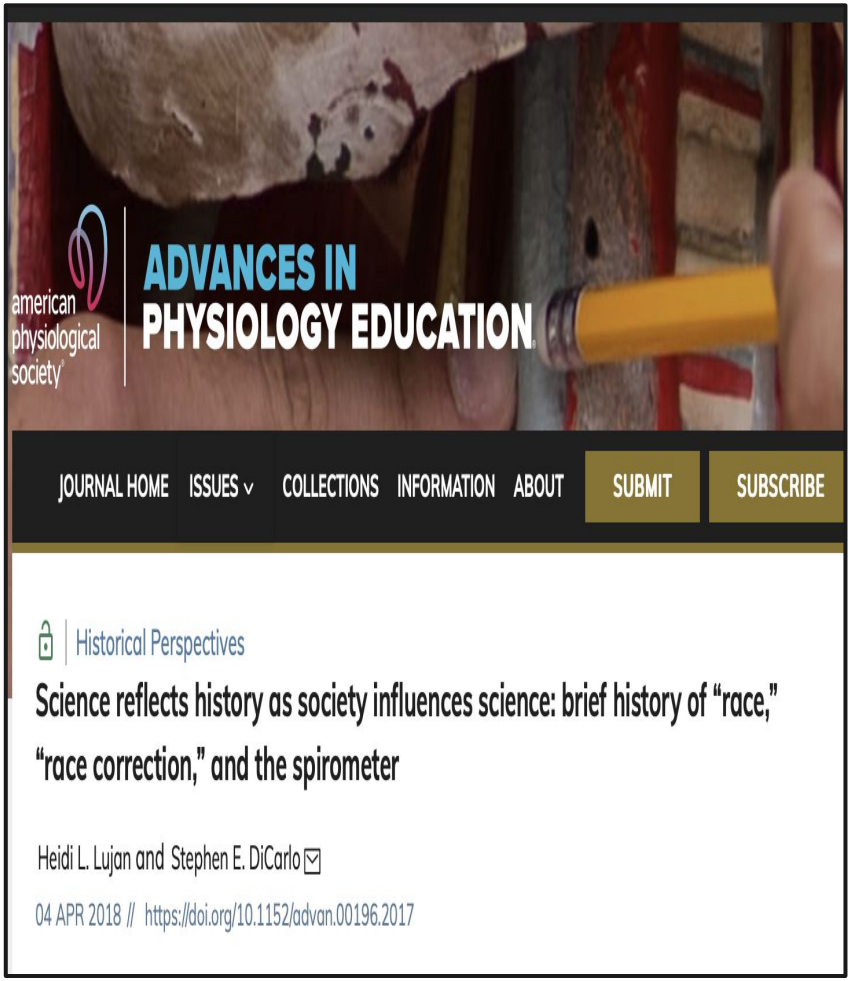
1. Le problème

Race et ethnie

- Construction socio-culturelle
- Traits visibles (couleur de la peau, zones géographiques…)
- Trait ou background génétique difficile à faire émerger
- Généalogie: estimation des proportions d'ascendance (par exemple, 30 % européenne, 20 % africaine, 50 % asiatique)
- Autodétermination dans les études

1. Le problème

Historique de la fonction pulmonaire et race/ethnie



- "Race correction" :10–15% for individuals labeled "Black" and 4–6% for people labeled "Asian"
- Belief that black and white people have innate differences in pulmonary functions has a long and disturbing past
- History suggests that race corrections may represent an implicit bias, discrimination, and racism

1. Le problème

Influence négative de la construction raciale/ethnique

Annals of the American Thoracic Society

Home > Annals of the American Thoracic Society > List of Issues > Volume 21, Issue 8

Use of Race-Specific Equations in Pulmonary Function Tests Impedes Potential Eligibility for Care and Treatment of Pulmonary Fibrosis

- **Objectif** : Étudier l'impact des équations neutres en race sur l'éligibilité aux traitements pour diverses origines ethniques
- **Méthodologie** : Comparaison des équations spécifiques à la race (Hankinson 1999) avec des équations agnostiques et neutres (GLI-2012, GLI-2022) pour calculer la CVF% prédite
- **Résultats principaux** : L'équation Hankinson 1999 provoque des erreurs de classification pour les patients noirs et hispaniques/latinos
- **Avantage de GLI-2022** : Améliore précision et équité en soins pulmonaires, sans biais racial
- **Conclusion** : Adopter des méthodes neutres pour des soins équitables pour tous les patients

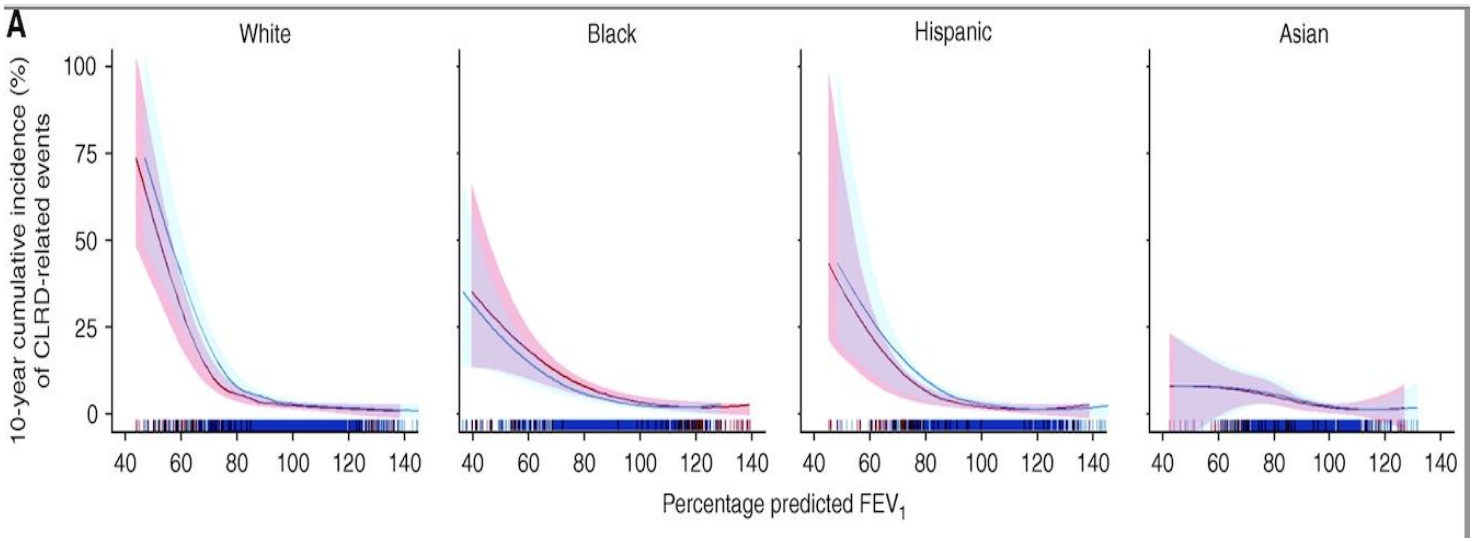
1. Le problème

Influence négative de la construction raciale/ethnique

Home > American Journal of Respiratory and Critical Care Medicine > List of Issues > Volume 205, Issue 6

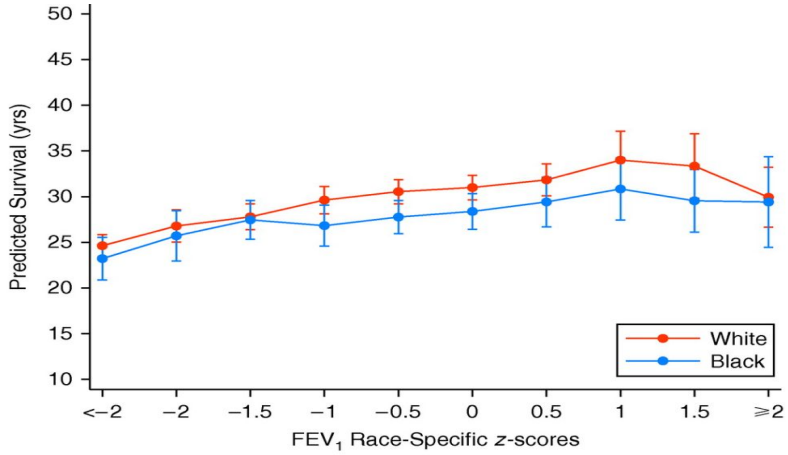
Race/Ethnicity, Spirometry Reference Equations, and Prediction of Incident Clinical Events: The Multi-Ethnic Study of Atherosclerosis (MESA) Lung Study

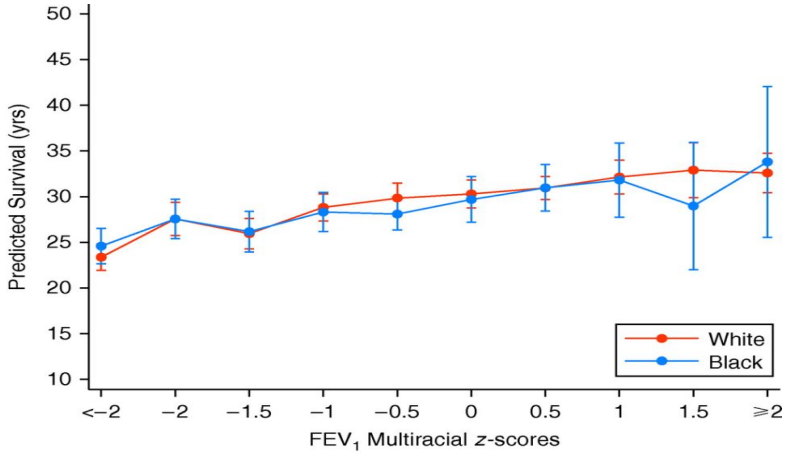
Arielle Elmaleh-Sachs [1], Pallavi Balte [1], Elizabeth C. Oelsner [1], Norrina B. Allen [2], Aaron Baugh [3], Alain G. Bertoni [4], John L. Hankinson [5], Jim Pankow [6], Wendy S. Post [7], Joseph E. Schwartz [8], Benjamin M. Smith [1], Show All...

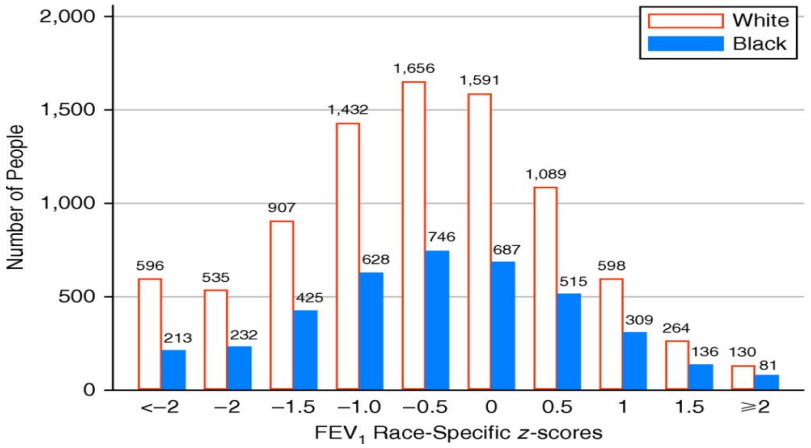


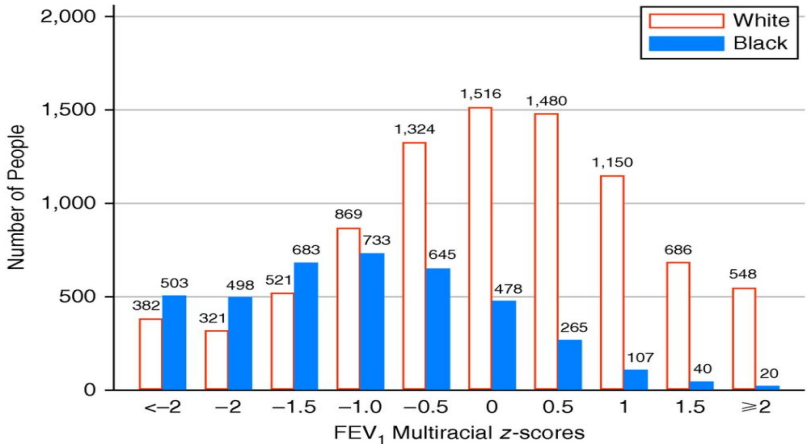
1. Le problème

Influence négative de la construction raciale/ethnique









NHANES III

https://doi.org/10.1164/rccm.202104-0822LE **PubMed:** 34597248

2. Equations de référence disponibles

> Am J Respir Crit Care Med. 1999 Jan;159(1):179-87. doi: 10.1164/ajrccm.159.1.9712108.

Spirometric reference values from a sample of the general U.S. population

J L Hankinson [1], J R Odencrantz, K B Fedan

Affiliations + expand

PMID: 9872837 DOI: 10.1164/ajrccm.159.1.9712108

Abstract

Spirometric reference values for Caucasians, African-Americans, and Mexican-Americans 8 to 80 yr of age were developed from 7,429 asymptomatic, lifelong nonsmoking participants in the third National Health and Nutrition Examination Survey (NHANES III). Spirometry examinations followed the 1987 American Thoracic Society recommendations, and the quality of the data was continuously monitored and maintained. Caucasian subjects had higher mean FVC and FEV1 values than did Mexican-American and African-American subjects across the entire age range. However, Caucasian and Mexican-American subjects had similar FVC and FEV1 values with respect to height, and African-American subjects had lower values. These differences may be partially due to differences in body build: observed Mexican-Americans were shorter than Caucasian subjects of the same age, and African-Americans on average have a smaller trunk:leg ratio than do Caucasians. Reference values and lower limits of normal were derived using a piecewise polynomial model with age and height as predictors. These reference values encompass a wide age range for three race/ethnic groups and should prove useful for diagnostic and research purposes.

2. Equations de référence disponibles

Multi-ethnic reference values for spirometry for the 3-95-yr age range: the **global lung** function 2012 **equations**.

Quanjer PH, Stanojevic S, Cole TJ, Baur X, Hall GL, Culver BH, Enright PL, Hankinson JL, Ip MS, Zheng J, Stocks J; ERS Global Lung Function Initiative.

Eur Respir J. 2012 Dec;40(6):1324-43. doi: 10.1183/09031936.00080312. Epub 2012 Jun 27.

PMID: 22743675 **Free PMC article.**

The aim of the Task Force was to derive continuous prediction **equations** and their lower limits of normal for spirometric indices, which are applicable **globally**. Over 160,000 data points from 72 centres in 33 countries were shared with the European Respiratory Societ ...

distribution family. After discarding 23,572 records, mostly because they could not be combined with other ethnic or geographic groups, reference equations were derived for healthy individuals aged 3-95 yrs for Caucasians (n=57,395), African-Americans (n=3,545), and North (n=4,992) and South East Asians (n=8,255). Forced expiratory value in 1 s (FEV(1)) and forced vital capacity (FVC)

2. Equations de référence disponibles

PubMed®

spirometric reference equations in Africa

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RESULTS BY YEAR

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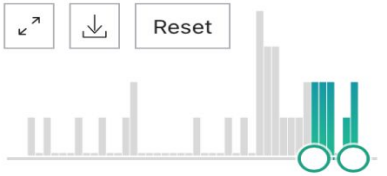

2019-2024

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1 Cite Share

Spirometric reference equations and lung function testing in adults from Southwestern Tanzania.

Wenzel R, Siyame E, Ivanova O, Bakuli A, Lalashowi J, Zekoll FC, Hoelscher M, Sabi I, Rachow A, Ntinginya NE.

IJTLD Open. 2024 Oct 1;1(10):473-479. doi: 10.5588/ijtldopen.24.0339. eCollection 2024 Oct.

PMID: 39398437 **Free PMC article.**

BACKGROUND: The increasing relevance of lung function testing in diagnosing and treating pulmonary diseases globally requires adequate **spirometric reference equations**. However, locally derived **reference** standards from African countries are widely missi ...

2 Cite Share

Spirometric reference equations for Cameroonians aged 4 to 89 years derived using lambda, mu, sigma (LMS) method.

Pefura-Yone EW, Balkissou AD, Poka-Mayap V, Djenabou A, Massongo M, Ofimboudem NA, Mayoh-Nguemfo CF, Tsala AG, Hadjara H, Amougou F.

BMC Pulm Med. 2021 Nov 3;21(1):344. doi: 10.1186/s12890-021-01705-1.

PMID: 34732174 **Free PMC article.**

BACKGROUND: **Spirometric reference** values are well known in several ethnic groups but the normative **spirometric** values of blacks living in **Africa** have been less studied. ...METHODS: **Spirometric** data from healthy Cameroonians aged 4-89 years rando ...

2. Equations de référence disponibles

Pefura-Yone *et al. BMC Pulm Med* (2021) 21:344
https://doi.org/10.1186/s12890-021-01705-1

BMC Pulmonary Medicine

RESEARCH Open Access

Spirometric reference equations for Cameroonians aged 4 to 89 years derived using lambda, mu, sigma (LMS) method

Eric Walter Pefura-Yone[1,2,3*†], Adamou Dodo Balkissou[3,4†], Virginie Poka-Mayap[2,3], Amadou Djenabou[2,3], Massongo Massongo[1,2], Nguetsa Arsene Ofimboudem[5], Catherine Fanny Mayoh-Nguemfo[1], Antoinette Ghislaine Tsala[6], Halidou Hadjara[1] and Francine Amougou[7]

Results: A total of 625 children and adolescents (290 males and 335 females) and 1152 adults (552 males and 600 females) were included in the study. The prediction equation for spirometric index was written as: M = Exp[a0 + a1*ln (Height) + a2*ln (Age) + Mspline, Mspline was age related spline contribution]. Applying the GLI standards for African Americans resulted in overall values

2. Equations de référence disponibles

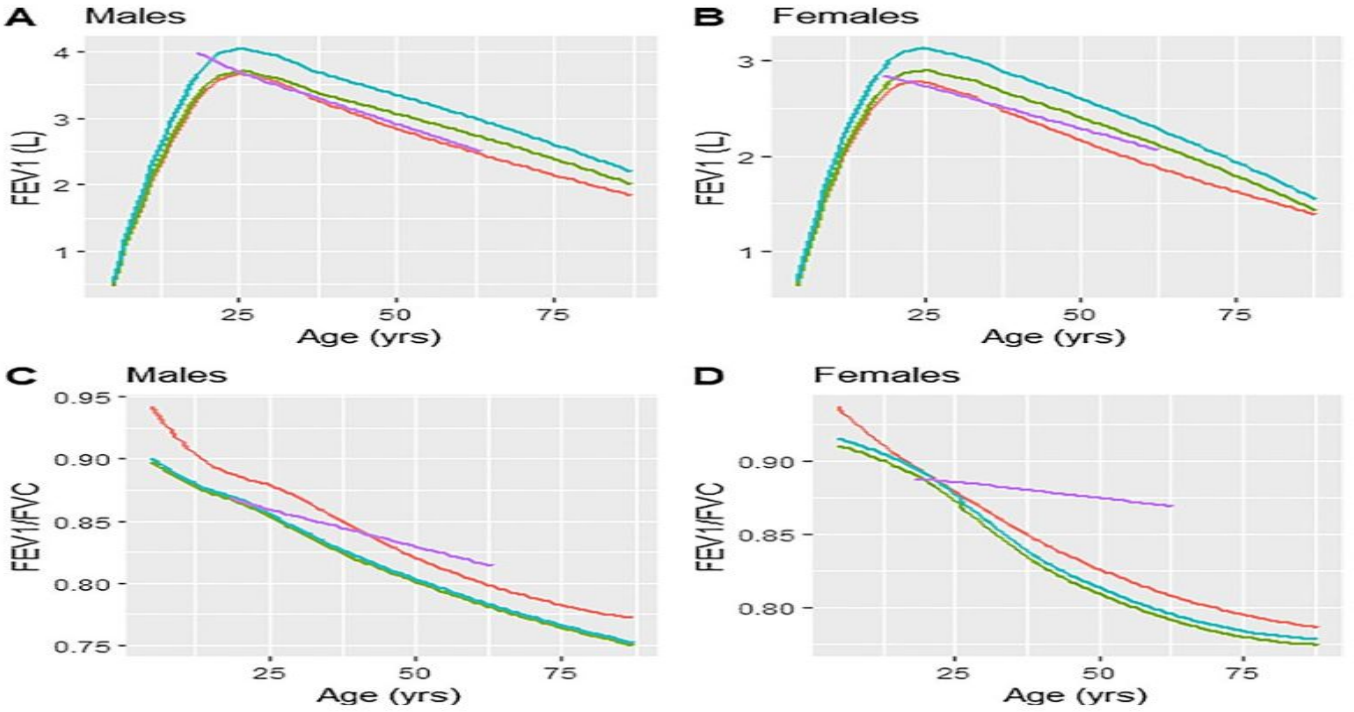


Fig. 3 Comparison of our prediction equations of FEV1 and FEV1/FVC ratio with other reference equations using mean height for each age group. FEV1, forced expiratory volume in 1 s (FEV1); FVC, forced vital capacity. Equations 1 orange line, 2 green line, 3 blue line, 4 violet line. 1, current study; 2, GLI 2012 African Americans; 3, GLI 2012 other ethnic groups; 4, Fawibe et al. Nigerian equations

Pefura-Yone et al. doi: 10.1186/s12890-021-01705-1.

2. Equations de référence disponibles

> Am J Respir Crit Care Med. 2023 Mar 15;207(6):768-774. doi: 10.1164/rccm.202205-0963OC.

A Race-neutral Approach to the Interpretation of Lung Function Measurements

Cole Bowerman [1] [2], Nirav R Bhakta [3], Danny Brazzale [4], Brendan R Cooper [5], Julie Cooper [5], Laura Gochicoa-Rangel [6], Jeffrey Haynes [7], David A Kaminsky [8], Le Thi Tuyet Lan [9], Refiloe Masekela [10], Meredith C McCormack [11], Irene Steenbruggen [12], Sanja Stanojevic [2]

Affiliations + expand

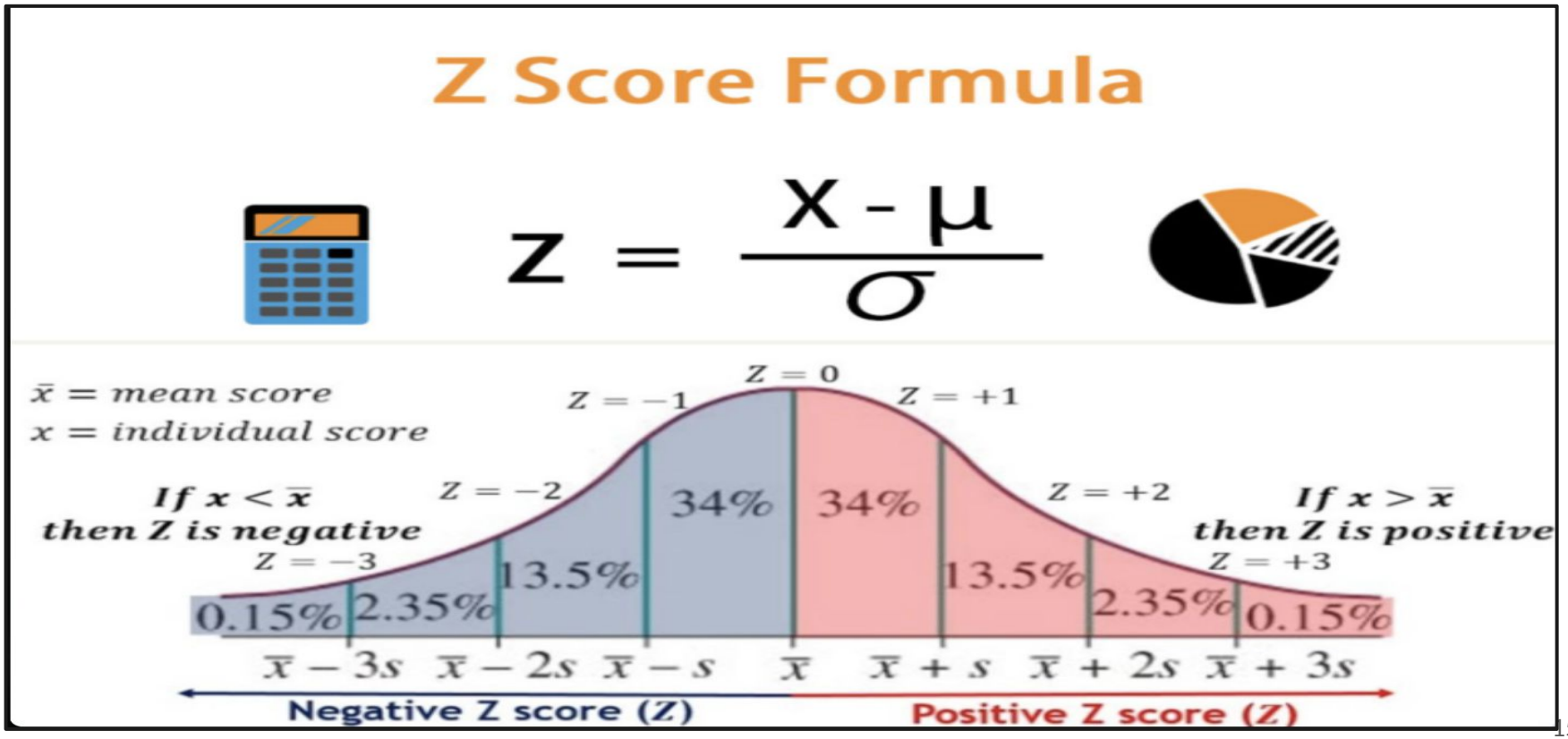
PMID: 36383197 DOI: 10.1164/rccm.202205-0963OC

Abstract

Rationale: The use of self-reported race and ethnicity to interpret lung function measurements has historically assumed that the observed differences in lung function between racial and ethnic groups were because of thoracic cavity size differences relative to standing height. Very few studies have considered the influence of environmental and social determinants on pulmonary function. Consequently, the use of race and ethnicity-specific reference equations may further marginalize disadvantaged populations. **Objectives:** To develop a race-neutral reference equation for spirometry interpretation. **Methods:** National Health and Nutrition Examination Survey (NHANES) III data (n = 6,984) were reanalyzed with sitting height and the Cormic index to investigate whether body proportions were better predictors of lung function than race and ethnicity. Furthermore, the original GLI (Global Lung Function Initiative) data (n = 74,185) were reanalyzed with inverse-probability weights to create race-neutral GLI global (2022) equations

3. Le Z-score

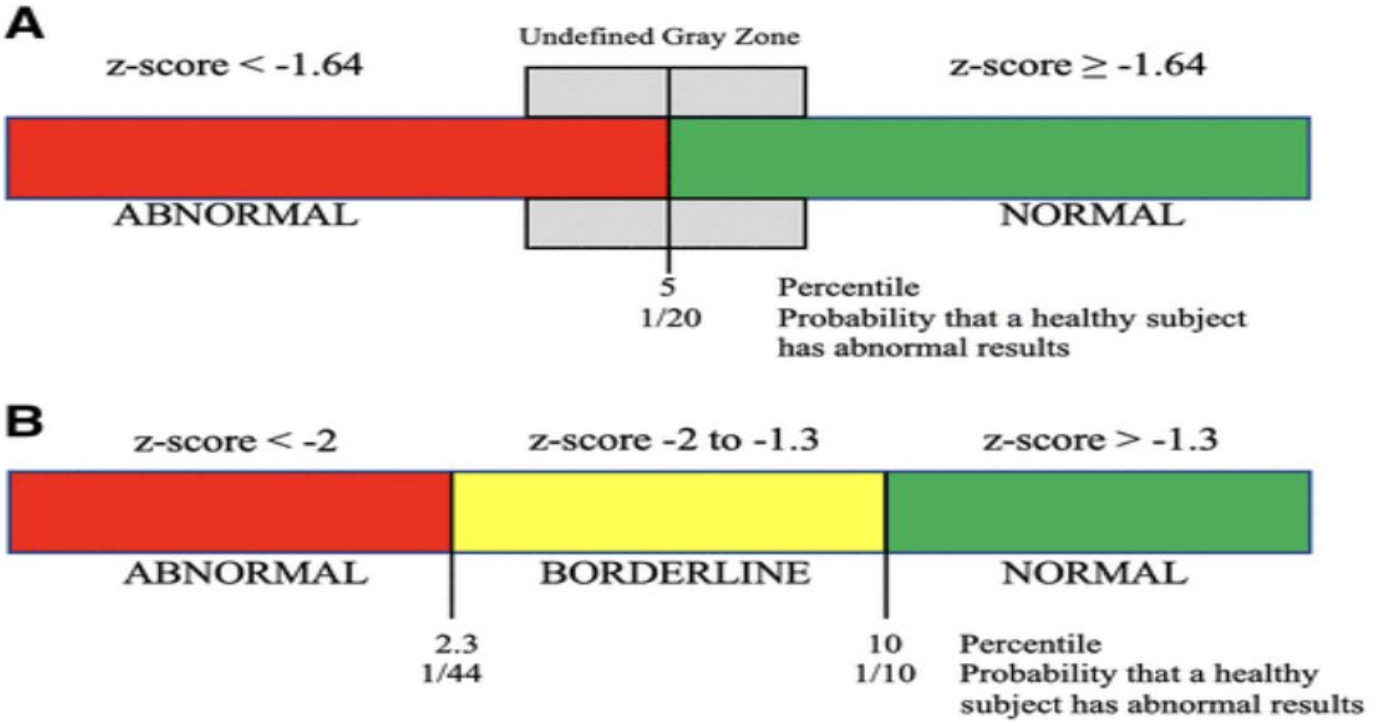
Mesure l'écart d'une valeur par rapport à la moyenne rapportée à la dispersion (écart-type)



3. Le Z-score

- Limite inférieure de la normale (LIN): < -1,645 Z-score
  - VEMS, CVF, CVL, VEMS/CV, CPT
  - DEP, DEMM
- Limite supérieure de la normale (LSN): > 1,645 Z-score
  - VR, CRF
  - VR/CPT

3. Le Z-score



Is It Time to Abandon Binary Interpretation of Pulmonary Function Data?
https://doi.org/10.1164/rccm.202305-0873LE

4. Comparaison des équations en ASS

Original Investigation | Pulmonary Medicine

June 1, 2023

Global, Race-Neutral Reference Equations and Pulmonary Function Test Interpretation

Alexander T. Moffett, MD[1,2,3]; Cole Bowerman, MS[4,5]; Sanja Stanojevic, PhD[4]; et al

» Author Affiliations | Article Information

JAMA Netw Open. 2023;6(6):e2316174. doi:10.1001/jamanetworkopen.2023.16174

- Tests interprétés pour 2722 personnes noires et 5709 blanches
- Prévalence de restriction augmentée chez les personnes noires
- Prévalence de restriction diminuée chez les personnes blanches
- Pas de changement significatif pour l'obstruction
- Sévérité augmentée pour les Noirs, diminuée pour les Blancs

4. Comparaison des équations en ASS

IJTLD Open. 2024 Oct 1;1(10):473–479. doi: 10.5588/ijtldopen.24.0339

Show available content in: English | French

Spirometric reference equations and lung function testing in adults from Southwestern Tanzania

CONCLUSION

This study provides prediction equations for spirometric lung function in a non-smoking Tanzanian population. The differences in existing equations underline the heterogeneity of locally derived reference equations in Africa and contribute insights and data to discussing global respiratory health care reference standards.

5. Recommandations

Am J Respir Crit Care Med. 2023 Apr 15;207(8):978–995. doi: 10.1164/rccm.202302-0310ST

Race and Ethnicity in Pulmonary Function Test Interpretation: An Official American Thoracic Society Statement

Nirav R Bhakta ✉, Christian Bime, David A Kaminsky, Meredith C McCormack, Neeta Thakur, Sanja Stanojevic, Aaron D Baugh, Lundy Braun, Stephanie Lovinsky-Desir, Rosemary Adamson, Jonathan Witonsky, Robert A Wise, Sean D Levy, Robert Brown, Erick Forno, Robyn T Cohen, Meshell Johnson, John Balmes, Yolanda Mageto, Cathryn T Lee, Refiloe Masekela, Daniel J Weiner, Charlie G Irvin, Erik R Swenson, Margaret Rosenfeld, Richard M Schwartzstein, Anurag Agrawal, Enid Neptune, Juan P Wisnivesky, Victor E Ortega, Peter Burney, on behalf of the

and ethnicity in PFT interpretation. The workshop ended with a discussion of potential changes to current practice through working groups on barriers to change, best practices, and long-term strategies. Despite the lack of consensus to give recommendations at the end of the workshop, many participants continued to engage together on this topic. This ongoing discussion, along with the publication of new evidence, gave this report an opportunity to make recommendations paired with cautions and countering views. The recommendation to use an average reference equation instead of race-specific equations in PFT laboratories and clinical practice represents an evolution in thought since the most recent technical standards were published. There is an urgent need to collaborate with leaders outside of the expertise

5. Recommandations

Official Journal of the Asian Pacific Society of Respirology
Respirology
APSR

Editorial | Free Access

Normal lung function, do we need to go further than ethnic differences? More questions than answers

Bruce Thompson BAppSci, CRFS, FANZSRS, PhD

First published: 06 April 2018 | https://doi.org/10.1111/resp.13301 | Citations: 1

5. Recommandations

Practice Guideline > Chest. 2023 Aug;164(2):461-475. doi: 10.1016/j.chest.2023.03.026. Epub 2023 Mar 25.

Effect of Race and Ethnicity on Pulmonary Function Testing Interpretation: An American College of Chest Physicians (CHEST), American Association for Respiratory Care (AARC), American Thoracic Society (ATS), and Canadian Thoracic Society (CTS) Evidence Review and Research Statement

Darcy D Marciniuk [1], Ellen A Becker [2], David A Kaminsky [3], Meredith C McCormack [4], Sanja Stanojevic [5], Nirav R Bhakta [6], Christian Bime [7], Vikram Comondore [8], Clayton T Cowl [9], Sharon Dell [10], Jeffrey Haynes [11], Fred Jaffe [12], Carl Mottram [13], Nneka Sederstrom [14], Mary Townsend [15], Jonathan M Iaccarino [16]

Affiliations + expand

PMID: 36972760 PMCID: PMC10475820 DOI: 10.1016/j.chest.2023.03.026

Results: Several assumptions and gaps, both in the published literature and in our evolving understanding of lung health, were identified. It seems that many past perceptions and practices regarding the effect of race and ethnicity on PFT results interpretation are based on limited scientific evidence and measures that lack reliability.

Interpretation: A need exists for more and better research that will inform our field about these many uncertainties and will serve as a foundation for future recommendations in this area. The identified shortcomings should not be discounted or dismissed because they may enable flawed conclusions, unintended consequences, or both. Addressing the identified research gaps and needs would allow a better-a more informed-understanding of the effects of race and ethnicity on PFT results interpretation.

5. Recommandations

- Utilisation du Z-score/LIN/LSN
- Production de 2 groupes d'interprétation
    - Ethnie-race dépendante
    - Ethnie-race neutre

5. Recommandations

- Groupe “bordeline” = “limite” à introduire
- Tenir compte des symptômes des malades
- Poursuivre les études
    - Normatives
    - Impact sur la morbidité et la mortalité

Conclusion

- Interprétation des EFR à intégrer dans le cortège clinique du malade
- Evaluation des pratiques
- Poursuite de la recherche sur “race/ethnie” et fonction pulmonaire

Merci