

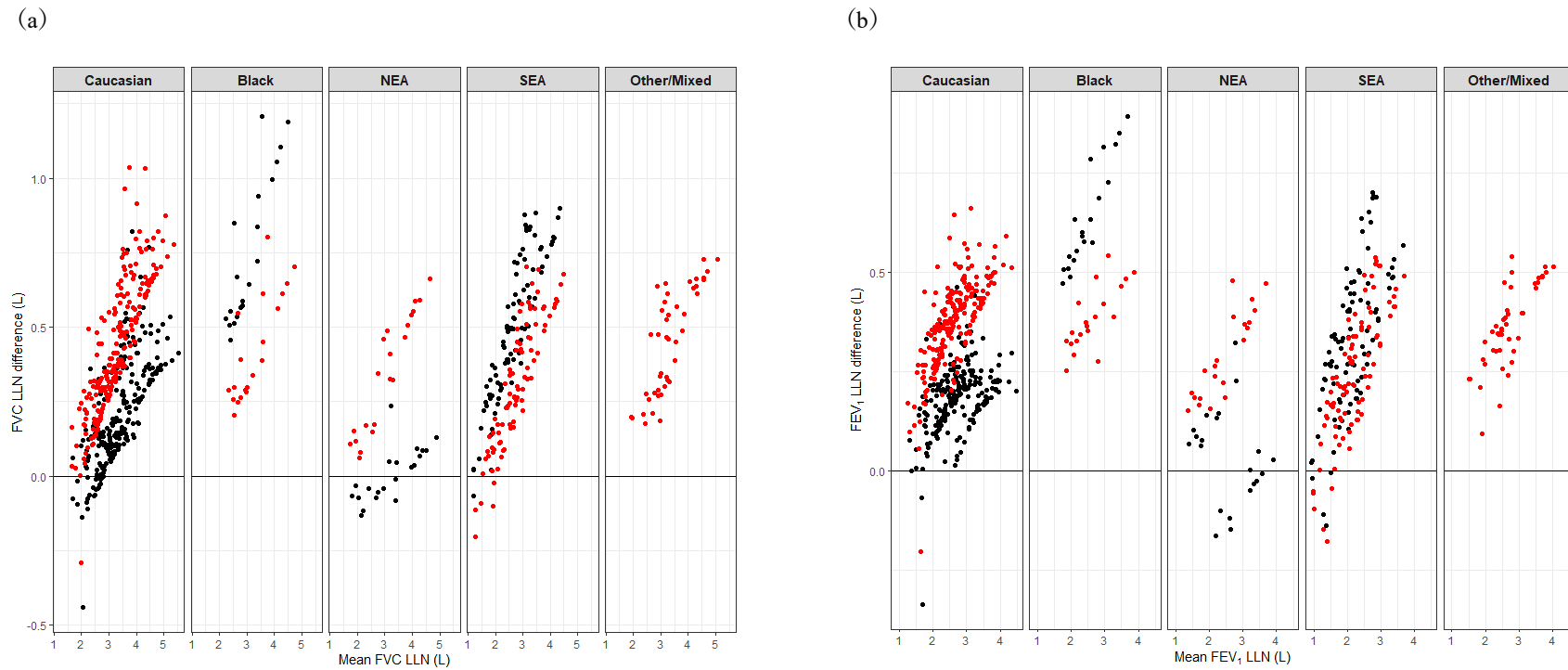
**Changes in interpretation of spirometry by implementing the GLI 2012 reference equations: impact on patients tested in a hospital-based PFT lab in a large metropolitan city**

**Supplemental Materials**

Haruna Kitazawa<sup>1</sup>, Annie Jiang<sup>1</sup>, Cynthia Nohra<sup>1</sup>, Honami Ota<sup>1</sup>, Joyce K. Y. Wu<sup>1,2</sup>, Clodagh M. Ryan<sup>1,2</sup>, Chung-Wai Chow<sup>1,2</sup>

<sup>1</sup>Division of Respiriology, Department of Medicine, University Health Network, Toronto, Canada

<sup>2</sup>Toronto General-Pulmonary Function Laboratory, University Health Network, Toronto, Canada



Supplementary Figure S1. The plots of predicted lower limit of normal (LLN) differences with the Canadian reference equations comparing GLI-Race and GLI-Other reference equations. a) FVC, b) FEV<sub>1</sub>. Black dots show the mean and the difference of predicted LLN between Canadian reference equations and GLI-Race, and red dots show those of predicted LLN between Canadian reference equations and GLI-Other.

Abbreviations: LLN; Lower limit of normal, GLI; Global Lung Function Initiative, FVC; Forced vital capacity, FEV<sub>1</sub>; Forced expiratory volume in 1 s, NEA; North East Asian, SEA; South East Asian.

Supplementary Table S1. The ethnic group and representative country/region in GLI-2012

Self-Reported Race/Ethnic Categories	GLI groups
1. Asian-East (e.g., Chinese, Japanese, Korean)	NE Asian †
2. Asian-South (e.g., Indian, Pakistani, Sri Lankan)	Mixed/Other
3. Asian-South East (e.g., Malaysian, Filipino, Vietnamese)	SE Asian
4. Black-African (e.g., Ghanaian, Kenyan, Somali)	Black
5. Black-Caribbean (e.g., Barbadian, Jamaican)	Black
6. Black-North American (e.g., Canadian, American)	Black
7. First Nations; Please specify: ___	Mixed/Other
8. Indian-Caribbean (e.g., Guyanese with origins in India)	Mixed/Other
9. Indigenous/Aboriginal - not included elsewhere	Mixed/Other
10. Inuit	Mixed/Other
11. Latin American (e.g., Argentinean, Chilean, Salvadoran)	Caucasian
12. Metis	Mixed/Other
13. Middle Eastern (e.g., Egyptian, Iranian, Lebanese)	Caucasian
14. White-European (e.g., English, Italian, Portuguese, Russian)	Caucasian
15. White-North American (e.g., Canadian, American)	Caucasian
16. Mixed heritage (e.g., Black-African & White-North American)	Mixed/Other
17. Other(s); Please specify: ___	Variable
18. Do not know	N/A
19. Prefer not to answer	N/A

Abbreviations: GLI; Global Lung Function Initiative, NE; North East, SE; South East.

† Because the detailed information on the geographic origin of the participants who chose this option was not available, we consider these as NE Asian and SE Asian separately. The results of NE Asian version (model 1) are shown in the main manuscript and Supplementary Table S3, and those of SE Asian version (model 2) are presented in Supplementary Tables S4 to 10.

Supplementary Table S2. The ethnic group and representative country/region in GLI-2012

Group	Country/region
Caucasian	Europe, Israel, Australia, USA, Canada, Mexican Americans, Brazil, Chile, Mexico, Uruguay, Venezuela, Algeria, Tunisia
Black	African American
South East Asian	Thailand, Taiwan and China (including Hong Kong) south of the Huaihe River and Qinling Mountains
North East Asian	Korea and China north of the Huaihe River and Qinling Mountain
Other/mixed	

This table was extracted from Reference No.1 (R1).

Supplementary Table S3. Numbers of concordant and discordant pairs for abnormal FEV<sub>1</sub>/FVC (FEV<sub>1</sub>/FVC < LLN) when using Canadian reference equation compared to GLI-Race or GLI-Other equation by model 1<sup>†</sup>

Ethnicity		GLI-Race		Total	GLI-Other		Total	
		FEV <sub>1</sub> /FVC ≥ FEV <sub>1</sub> /FVC <			FEV <sub>1</sub> /FVC ≥ FEV <sub>1</sub> /FVC <			
		LLN	LLN	LLN	LLN			
<b>All</b>	Canadian				Canadian			
	FEV <sub>1</sub> /FVC ≥ LLN	368 (90.6%)	3 (0.7%)	371	FEV <sub>1</sub> /FVC ≥ LLN	367 (90.4%)	4 (1.0%)	371
	FEV <sub>1</sub> /FVC < LLN	7 (1.7%)	28 (6.9%)	35	FEV <sub>1</sub> /FVC < LLN	2 (0.5%)	33 (8.1%)	35
	Total	375	31	406	Total	369	37	406
<b>Caucasian</b>	Canadian				Canadian			
	FEV <sub>1</sub> /FVC ≥ LLN	213 (93.0%)	0 (0%)	213	FEV <sub>1</sub> /FVC ≥ LLN	210 (91.7%)	3 (1.3%)	213
	FEV <sub>1</sub> /FVC < LLN	6 (2.6%)	10 (4.4%)	16	FEV <sub>1</sub> /FVC < LLN	1 (0.4%)	15 (6.6%)	16
	Total	219	10	229	Total	211	18	229
<b>Black</b>	Canadian				Canadian			
	FEV <sub>1</sub> /FVC ≥ LLN	19 (95.0%)	0 (0%)	19	FEV <sub>1</sub> /FVC ≥ LLN	19 (95.0%)	0 (0%)	19
	FEV <sub>1</sub> /FVC < LLN	0 (0%)	1 (5.0%)	1	FEV <sub>1</sub> /FVC < LLN	0 (0%)	1 (5.0%)	1
	Total	19	1	20	Total	19	1	20
<b>NE Asian</b>	Canadian				Canadian			
	FEV <sub>1</sub> /FVC ≥ LLN	20 (95.2%)	1 (4.8%)	21	FEV <sub>1</sub> /FVC ≥ LLN	21 (100%)	0 (0%)	21
	FEV <sub>1</sub> /FVC < LLN	0 (0%)	0 (0%)	0	FEV <sub>1</sub> /FVC < LLN	0 (0%)	0 (0%)	0
	Total	20	1	21	Total	21	0	21
<b>SE Asian</b>	Canadian				Canadian			
	FEV <sub>1</sub> /FVC ≥ LLN	77 (83.7%)	2 (2.2%)	79	FEV <sub>1</sub> /FVC ≥ LLN	78 (84.8%)	1 (1.1%)	79
	FEV <sub>1</sub> /FVC < LLN	0 (0%)	13 (14.1%)	13	FEV <sub>1</sub> /FVC < LLN	0 (0%)	13 (14.1%)	13
	Total	77	15	92	Total	78	14	92
<b>Other/Mix</b>	Canadian				Canadian			
	FEV <sub>1</sub> /FVC ≥ LLN	39 (88.6%)	0 (0%)	39	FEV <sub>1</sub> /FVC ≥ LLN	39 (88.6%)	0 (0%)	39
	FEV <sub>1</sub> /FVC < LLN	1 (2.3%)	4 (9.1%)	5	FEV <sub>1</sub> /FVC < LLN	1 (2.3%)	4 (9.1%)	5
	Total	40	4	44	Total	40	4	44

Abbreviations: FEV<sub>1</sub>; Forced expiratory volume in 1 s, FVC; Forced vital capacity, LLN; Lower limit of normal, NE; North East, SE; South East, GLI; Global Lung Function Initiative.

† We analyzed the data by classifying Asian participants as NE Asian (model 1) if they could not be classified clearly as either NE Asian or SE Asian.

Supplementary Table S4. Kappa values (Cohen's k) to assess the degrees of concordance between the Canadian reference equations and GLI-2012 (GLI-Race or GLI-Other)

1) Model 1<sup>†</sup>

	FVC		FEV <sub>1</sub>		FEV <sub>1</sub> /FVC	
	GLI-Race	GLI-Other	GLI-Race	GLI-Other	GLI-Race	GLI-Other
<b>All</b>	0.59 *	0.59 *	0.67 *	0.59 *	0.84 *	0.91 *
<b>Caucasian</b>	0.77 *	0.56 *	0.80 *	0.54 *	0.76 *	0.87 *
<b>Black</b>	0.17	0.53 *	0.14	0.53 *	1 *	1 *
<b>NE Asian</b>	0.67 *	0.64 *	0.80 *	0.43 *	NaN	NaN
<b>SE Asian</b>	0.30 *	0.55 *	0.54 *	0.67 *	0.92 *	0.96 *
<b>Other/Mixed</b>	0.55 *	0.55 *	0.61 *	0.61 *	0.88 *	0.88 *

2) Model 2<sup>‡</sup>

	FVC		FEV <sub>1</sub>		FEV <sub>1</sub> /FVC	
	GLI-Race	GLI-Other	GLI-Race	GLI-Other	GLI-Race	GLI-Other
<b>All</b>	0.57 *	0.59 *	0.64 *	0.59 *	0.82 *	0.91 *
<b>Caucasian</b>	0.77 *	0.56 *	0.80 *	0.54 *	0.76 *	0.87 *
<b>Black</b>	0.17	0.53 *	0.14	0.53 *	1 *	1 *
<b>NE Asian</b>	-	-	-	-	-	-
<b>SE Asian</b>	0.35 *	0.57 *	0.52 *	0.62 *	0.85 *	0.96 *
<b>Other/Mixed</b>	0.55 *	0.55 *	0.61 *	0.61 *	0.88 *	0.88 *

Abbreviations: NE; North East, SE; South East, FVC; Forced vital capacity, FEV<sub>1</sub>; Forced expiratory volume in 1 s, GLI; Global Lung Function Initiative.

Data are presented as Kappa value. The Kappa value or p-value for FEV<sub>1</sub>/FVC for NE Asian group could not be calculated, because of the very high concordance rate and its distribution.

\*P<0.05.

<sup>†</sup> We analyzed the data by classifying Asian participants as NE Asian (model 1) if they could not be classified clearly as either NE Asian or SE Asian.

<sup>‡</sup> We analyzed the data by classifying Asian participants as SE Asian (model 2) if they could not be classified clearly as either NE Asian or SE Asian.

Supplementary Table S5. Participant demographics by model 2†

	All	Caucasian	Black	NE Asia	SE Asia	Other/Mixed	p
Number of participants	406	229	20	0	113	44	
Male	174 (42.9)	85 (37.1)	7 (35.0)		57 (50.4)	25 (56.8)	0.021
Age, y	48.68 [35.55, 59.87]	47.35 [35.96, 57.11]	48.06 [35.29, 57.96]		54.75 [44.60, 65.77]	37.89 [29.19, 56.84]	<0.001
Height, cm	168.23 ± 9.74	170.51 ± 9.72	170.68 ± 6.22		163.11 ± 8.91	168.36 ± 8.37	<0.001
Weight, kg	79.11 ± 23.27	84.66 ± 24.81	89.03 ± 22.76		66.49 ± 15.57	77.83 ± 18.40	<0.001
BMI, kg/m <sup>2</sup>	27.77 ± 7.15	29.02 ± 7.85	30.78 ± 8.71		24.84 ± 4.61	27.34 ± 5.48	<0.001
Smoking status							0.11
Current smoker	16 (4.0)	6 (2.7)	0 (0.0)		9 (8.0)	1 (2.3)	
Ex-smoker	107 (26.7)	69 (30.5)	4 (20.0)		27 (24.1)	7 (16.3)	
Never smoker	278 (69.3)	151 (66.8)	16 (80.0)		76 (67.9)	35 (81.4)	
Lung function							
FVC, L	3.63 ± 1.06	3.92 ± 1.02	3.31 ± 1.04		3.18 ± 0.98	3.46 ± 1.01	<0.001
FEV <sub>1</sub> , L	2.88 ± 0.87	3.11 ± 0.83	2.68 ± 0.83		2.47 ± 0.82	2.81 ± 0.82	<0.001
FEV <sub>1</sub> /FVC, %	79.23 ± 7.62	79.48 ± 6.37	81.27 ± 6.82		77.48 ± 9.82	81.49 ± 6.69	0.009
FVC % predicted as per							
Canadian equation	87.69 ± 16.48	92.26 ± 15.76	76.92 ± 15.06		83.93 ± 15.28	78.45 ± 15.61	<0.001
GLI-Race	94.75 ± 16.77	94.15 ± 15.66	92.34 ± 18.26		98.79 ± 17.87	88.56 ± 16.78	0.004
GLI-Other	97.61 ± 17.79	102.30 ± 17.03	85.47 ± 16.78		93.77 ± 16.73	88.56 ± 16.78	<0.001
FEV <sub>1</sub> % predicted as per							
Canadian equation	85.44 ± 16.17	89.93 ± 15.48	76.39 ± 14.27		80.77 ± 15.89	78.13 ± 13.60	<0.001
GLI-Race	92.23 ± 16.87	92.99 ± 16.17	92.04 ± 16.88		92.65 ± 18.66	87.26 ± 15.23	0.225
GLI-Other	94.86 ± 18.05	99.82 ± 17.36	84.84 ± 15.53		89.54 ± 17.76	87.26 ± 15.23	<0.001

Abbreviations: NE; North East, SE; South East, BMI; Body mass index, FVC; Forced vital capacity, FEV<sub>1</sub>; Forced expiratory volume in 1 s, GLI; Global Lung Function Initiative.

Data are presented as n (%), mean ± SD, or median [IQR].

Information on weight, BMI, and smoking status was missing in 2, 2, and 5, respectively.

† We analyzed the data by classifying Asian participants as SE Asian (model 2) if they could not be classified clearly as either NE Asian or SE Asian.

Supplementary Table S6. Numbers of concordant and discordant pairs for abnormal FVC (FVC < LLN) when using Canadian reference equation compared to GLI-Race or GLI-Other equation by model 2<sup>†</sup>

Ethnicity		GLI-Race		Total	GLI-Other		Total	
		FVC ≥ LLN	FVC < LLN		FVC ≥ LLN	FVC < LLN		
<b>All</b>	Canadian				Canadian			
	FVC ≥ LLN	294 (72.4%)	0 (0%)	294	FVC ≥ LLN	294 (72.4%)	0 (0%)	294
	FVC < LLN	58 (14.3%)	54 (13.3%)	112	FVC < LLN	56 (13.8%)	56 (13.8%)	112
	Total	352	54	406	Total	350	56	406
<b>Caucasian</b>	Canadian				Canadian			
	FVC ≥ LLN	186 (81.2%)	0 (0%)	186	FVC ≥ LLN	186 (81.2%)	0 (0%)	186
	FVC < LLN	14 (6.1%)	29 (12.7%)	43	FVC < LLN	24 (10.5%)	19 (8.3%)	43
	Total	200	29	229	Total	210	19	229
<b>Black</b>	Canadian				Canadian			
	FVC ≥ LLN	7 (35.0%)	0 (0%)	7	FVC ≥ LLN	7 (35.0%)	0 (0%)	7
	FVC < LLN	10 (50.0%)	3 (15.0%)	13	FVC < LLN	5 (25.0%)	8 (40.0%)	13
	Total	17	3	20	Total	12	8	20
<b>NE Asian</b>	Canadian				Canadian			
	FVC ≥ LLN	0 (0%)	0 (0%)	0	FVC ≥ LLN	0 (0%)	0 (0%)	0
	FVC < LLN	0 (0%)	0 (0%)	0	FVC < LLN	0 (0%)	0 (0%)	0
	Total	0	0	0	Total	0	0	0
<b>SE Asian</b>	Canadian				Canadian			
	FVC ≥ LLN	80 (70.8%)	0 (0%)	80	FVC ≥ LLN	80 (70.8%)	0 (0%)	80
	FVC < LLN	24 (21.2%)	9 (8.0%)	33	FVC < LLN	17 (15.0%)	16 (14.2%)	33
	Total	104	9	113	Total	97	16	113
<b>Other/Mixed</b>	Canadian				Canadian			
	FVC ≥ LLN	21 (47.7%)	0 (0%)	21	FVC ≥ LLN	21 (47.7%)	0 (0%)	21
	FVC < LLN	10 (22.7%)	13 (29.5%)	23	FVC < LLN	10 (22.7%)	13 (29.5%)	23
	Total	31	13	44	Total	31	13	44

Abbreviations: FVC; Forced vital capacity, LLN; Lower limit of normal, NE; North East, SE; South East, GLI; Global Lung Function Initiative.

† We analyzed the data by classifying Asian participants as SE Asian (model 2) if they could not be classified clearly as either NE Asian or SE Asian.



Supplementary Table S7. Numbers of concordant and discordant pairs for abnormal FEV<sub>1</sub> (FEV<sub>1</sub> < LLN) when using Canadian reference equation compared to GLI-Race or GLI-Other equation by model 2<sup>†</sup>

Ethnicity		GLI-Race		Total	GLI-Other		Total	
		FEV <sub>1</sub> ≥ LLN	FEV <sub>1</sub> < LLN		FEV <sub>1</sub> ≥ LLN	FEV <sub>1</sub> < LLN		
<b>All</b>	Canadian				Canadian			
	FEV <sub>1</sub> ≥ LLN	286 (70.4%)	0 (0%)	286	FEV <sub>1</sub> ≥ LLN	286 (70.4%)	0 (0%)	286
	FEV <sub>1</sub> < LLN	53 (13.1%)	67 (16.5%)	120	FEV <sub>1</sub> < LLN	59 (14.5%)	61 (15.0%)	120
	Total	339	67	406	Total	345	61	406
<b>Caucasian</b>	Canadian				Canadian			
	FEV <sub>1</sub> ≥ LLN	178 (77.7%)	0 (0%)	178	FEV <sub>1</sub> ≥ LLN	178 (77.7%)	0 (0%)	178
	FEV <sub>1</sub> < LLN	14 (6.1%)	37 (16.2%)	51	FEV <sub>1</sub> < LLN	29 (12.7%)	22 (9.6%)	51
	Total	192	37	229	Total	207	22	229
<b>Black</b>	Canadian				Canadian			
	FEV <sub>1</sub> ≥ LLN	8 (40.0%)	0 (0%)	8	FEV <sub>1</sub> ≥ LLN	8 (40.0%)	0 (0%)	8
	FEV <sub>1</sub> < LLN	10 (50.0%)	2 (10.0%)	12	FEV <sub>1</sub> < LLN	5 (25.0%)	7 (35.0%)	12
	Total	18	2	20	Total	13	7	20
<b>NE Asian</b>	Canadian				Canadian			
	FEV <sub>1</sub> ≥ LLN	0 (0%)	0 (0%)	0	FEV <sub>1</sub> ≥ LLN	0 (0%)	0 (0%)	0
	FEV <sub>1</sub> < LLN	0 (0%)	0 (0%)	0	FEV <sub>1</sub> < LLN	0 (0%)	0 (0%)	0
	Total	0	0	0	Total	0	0	0
<b>SE Asian</b>	Canadian				Canadian			
	FEV <sub>1</sub> ≥ LLN	75 (66.4%)	0 (0%)	75	FEV <sub>1</sub> ≥ LLN	75 (66.4%)	0 (0%)	75
	FEV <sub>1</sub> < LLN	21 (18.6%)	17 (15.0%)	38	FEV <sub>1</sub> < LLN	17 (15.0%)	21 (18.6%)	38
	Total	96	17	113	Total	92	21	113
<b>Other/Mixed</b>	Canadian				Canadian			
	FEV <sub>1</sub> ≥ LLN	25 (56.8%)	0 (0%)	25	FEV <sub>1</sub> ≥ LLN	25 (56.8%)	0 (0%)	25
	FEV <sub>1</sub> < LLN	8 (18.2%)	11 (25.0%)	19	FEV <sub>1</sub> < LLN	8 (18.2%)	11 (25.0%)	19
	Total	33	11	44	Total	33	11	44

Abbreviations: FEV<sub>1</sub>; Forced expiratory volume in the first second, LLN; Lower limit of normal, NE; North East, SE; South East, GLI; Global Lung Function Initiative.

† We analyzed the data by classifying Asian participants as SE Asian (model 2) if they could not be classified clearly as either NE Asian or SE Asian.

Supplementary Table S8. Numbers of concordant and discordant pairs for abnormal FEV<sub>1</sub>/FVC (FEV<sub>1</sub>/FVC < LLN) when using Canadian reference equation compared to GLI-Race or GLI-Other equation by model 2†

Ethnicity		GLI-Race		Total	GLI-Other		Total	
		FEV <sub>1</sub> /FVC ≥ LLN	FEV <sub>1</sub> /FVC < LLN		FEV <sub>1</sub> /FVC ≥ LLN	FEV <sub>1</sub> /FVC < LLN		
<b>All</b>	Canadian				Canadian			
	FEV <sub>1</sub> /FVC ≥ LLN	367 (90.4%)	4 (1.0%)	371	FEV <sub>1</sub> /FVC ≥ LLN	367 (90.4%)	4 (1.0%)	371
	FEV <sub>1</sub> /FVC < LLN	7 (1.7%)	28 (6.9%)	35	FEV <sub>1</sub> /FVC < LLN	2 (0.5%)	33 (8.1%)	35
	Total	374	32	406	Total	369	37	406
<b>Caucasian</b>	Canadian				Canadian			
	FEV <sub>1</sub> /FVC ≥ LLN	213 (93.0%)	0 (0%)	213	FEV <sub>1</sub> /FVC ≥ LLN	210 (91.7%)	3 (1.3%)	213
	FEV <sub>1</sub> /FVC < LLN	6 (2.6%)	10 (4.4%)	16	FEV <sub>1</sub> /FVC < LLN	1 (0.4%)	15 (6.6%)	16
	Total	219	10	229	Total	211	18	229
<b>Black</b>	Canadian				Canadian			
	FEV <sub>1</sub> /FVC ≥ LLN	19 (95.0%)	0 (0%)	19	FEV <sub>1</sub> /FVC ≥ LLN	19 (95.0%)	0 (0%)	19
	FEV <sub>1</sub> /FVC < LLN	0 (0%)	1 (5.0%)	1	FEV <sub>1</sub> /FVC < LLN	0 (0%)	1 (5.0%)	1
	Total	19	1	20	Total	19	1	20
<b>NE Asian</b>	Canadian				Canadian			
	FEV <sub>1</sub> /FVC ≥ LLN	0 (0%)	0 (0%)	0	FEV <sub>1</sub> /FVC ≥ LLN	0 (0%)	0 (0%)	0
	FEV <sub>1</sub> /FVC < LLN	0 (0%)	0 (0%)	0	FEV <sub>1</sub> /FVC < LLN	0 (0%)	0 (0%)	0
	Total	0	0	0	Total	0	0	0
<b>SE Asian</b>	Canadian				Canadian			
	FEV <sub>1</sub> /FVC ≥ LLN	96 (85.0%)	4 (3.5%)	100	FEV <sub>1</sub> /FVC ≥ LLN	99 (87.6%)	1 (0.9%)	100
	FEV <sub>1</sub> /FVC < LLN	0 (0%)	13 (11.5%)	13	FEV <sub>1</sub> /FVC < LLN	0 (0%)	13 (11.5%)	13
	Total	96	17	113	Total	99	14	113
<b>Mix/Other</b>	Canadian				Canadian			
	FEV <sub>1</sub> /FVC ≥ LLN	39 (88.6%)	0 (0%)	39	FEV <sub>1</sub> /FVC ≥ LLN	39 (88.6%)	0 (0%)	39
	FEV <sub>1</sub> /FVC < LLN	1 (2.3%)	4 (9.1%)	5	FEV <sub>1</sub> /FVC < LLN	1 (2.3%)	4 (9.1%)	5
	Total	40	4	44	Total	40	4	44

Abbreviations: FEV<sub>1</sub>; Forced expiratory volume in the first second, FVC; Forced vital capacity, LLN; Lower limit of normal, NE; North East, SE; South East, GLI; Global Lung Function Initiative.

† We analyzed the data by classifying Asian participants as SE Asian (model 2) if they could not be classified clearly as either NE Asian or SE Asian.

Supplementary Table S9. Lower limit of normal (LLN) differences for FVC, FEV<sub>1</sub>, and FEV<sub>1</sub>/FVC by race/ethnicities by model 2†

	All	Caucasian	Black	NE Asian	SE Asian	Mixed/Other	p
n	406	229	20	0	113	44	
<b>LLN FVC differences (L)</b>							
Canadian equation – GLI-Race	0.32 [0.14, 0.50]	0.16 [0.08, 0.34]	0.66 [0.55, 0.95] *	NA	0.50 [0.32, 0.72] *	0.47 [0.29, 0.62] *	<0.001
Canadian equation – GLI-Other	0.37 [0.25, 0.57]	0.38 [0.27, 0.60]	0.36 [0.29, 0.57]	NA	0.31 [0.15, 0.51] *	0.47 [0.29, 0.62]	<0.001
<b>LLN FEV<sub>1</sub> differences (L)</b>							
Canadian equation – GLI-Race	0.23 [0.17, 0.35]	0.20 [0.14, 0.23]	0.59 [0.54, 0.74] *	NA	0.33 [0.24, 0.46] *	0.35 [0.30, 0.46] *	<0.001
Canadian equation – GLI-Other	0.36 [0.27, 0.43]	0.38 [0.31, 0.44]	0.37 [0.33, 0.43]	NA	0.24 [0.16, 0.36] *	0.35 [0.30, 0.46]	<0.001
<b>LLN FEV<sub>1</sub>/FVC difference (%)</b>							
Canadian equation – GLI-Race	1.16 [-0.53, 1.90]	1.81 [1.31, 2.21]	1.07 [0.67, 1.40] *	NA	-1.52 [-2.02, -0.86] *	0.10 [-0.24, 0.34] *	<0.001
Canadian equation – GLI-Other	0.13 [-0.35, 0.57]	0.03 [-0.50, 0.42]	0.12 [-0.16, 0.39]	NA	0.51 [-0.09, 1.11] *	0.10 [-0.24, 0.34]	<0.001

Abbreviations: NE; North East, SE; South East, LLN; Lower limit of normal, FVC; Forced vital capacity, GLI; Global Lung Function Initiative, FEV<sub>1</sub>; Forced expiratory volume in 1s.

Data are presented as median [IQR]. P value is the result of overall by Kruskal-Wallis test.

\* Bonferroni correction for multiple comparisons with P < 0.05 compared to Caucasian group.

† We analyzed the data by classifying Asian participants as SE Asian (model 2) if they could not be classified clearly as either NE Asian or SE Asian.

Supplementary Table S10. Univariable and multivariable analysis to identify the factors causing discordance in FVC and FEV<sub>1</sub> interpretation defined as abnormal (< LLN) in Canadian reference equation and normal ( $\geq$  LLN) in GLI-Race by model 2<sup>†</sup>

Variables	Univariable analysis		Multivariable analysis	
	OR (95% C.I.)	p	OR (95% C.I.)	p
<b>A) FVC</b>				
Sex	Female	Ref	Ref	
	Male	3.24 (1.82 - 5.95)	<0.001	2.83 (1.23 - 6.67) 0.016
Age	0.996 (0.98 - 1.02)	0.70	0.99 (0.97 - 1.01)	0.41
Height	1.03 (0.997 - 1.06)	0.086	1.02 (0.97 - 1.07)	0.56
Weight	1.002 (0.99 - 1.01)	0.76	1.00 (0.98 - 1.02)	0.96
Race/ethnicity		<0.001		<0.001
	Caucasian	Ref	Ref	
	Black	15.36 (5.49 - 43.94)	<0.001	18.65 (6.35 - 56.85) <0.001
	SEA	4.14 (2.07 - 8.56)	<0.001	4.59 (2.00 - 11.04) <0.001
	Mixed/Other	4.52 (1.82 - 10.94)	0.001	4.02 (1.52 - 10.50) 0.004
<b>B) FEV<sub>1</sub></b>				
Sex	Female	Ref	Ref	
	Male	0.78 (0.43 - 1.41)	0.42	0.41 (0.17 - 0.97) 0.045
Age	0.99 (0.97 - 1.01)	0.36	0.99 (0.97 - 1.02)	0.62
Height	0.999 (0.97 - 1.03)	0.94	1.04 (0.99 - 1.10)	0.14
Weight	0.999 (0.99 - 1.01)	0.92	1.004 (0.99 - 1.02)	0.62
Race/ethnicity		<0.001		<0.001
	Caucasian	Ref	Ref	
	Black	15.36 (5.49 - 43.94)	<0.001	15.71 (5.54 - 45.70) <0.001
	SEA	3.51 (1.72 - 7.34)	0.001	6.06 (2.56 - 15.05) <0.001
	Mixed/Other	3.41 (1.28 - 8.58)	0.010	4.73 (1.67 - 12.97) 0.003

Abbreviations: OR; Odds ratio, C.I.; Confidence interval, FVC; Forced vital capacity, NEA; North East Asian, SEA; South East Asian, FEV<sub>1</sub>; Forced expiratory volume in 1s.

<sup>†</sup> We analyzed the data by classifying Asian participants as SE Asian (model 2) if they could not be classified clearly as either NE Asian or SE Asian.

Supplementary Table S11. Univariable and multivariable analysis to identify the factors causing discordance in FVC and FEV<sub>1</sub> interpretation defined as abnormal (< LLN) in Canadian reference equation and normal ( $\geq$  LLN) in GLI-Other by model 2<sup>†</sup>

Variables	Univariable analysis		Multivariable analysis		
	OR (95% C.I.)	p	OR (95% C.I.)	p	
<b>A) FVC</b>					
Sex	Female	Ref	Ref		
	Male	4.03 (2.21 - 7.67)	<0.001	3.05 (1.36 - 7.04)	0.008
Age	0.99 (0.97 - 1.01)	0.42	0.99 (0.97 - 1.01)	0.36	
Height	1.05 (1.02 - 1.08)	0.001	1.01 (0.97 - 1.06)	0.57	
Weight	1.01 (1.002 - 1.02)	0.020	1.01 (0.996 - 1.03)	0.14	
Race/ethnicity		0.071		0.087	
	Caucasian	Ref	Ref		
	Black	2.85 (0.87 - 8.11)	0.062	3.15 (0.92 - 9.47)	0.050
	SEA	1.51 (0.77 - 2.93)	0.22	1.94 (0.86 - 4.41)	0.11
	Mixed/Other	2.51 (1.07 - 5.60)	0.028	2.37 (0.93 - 5.82)	0.063
<b>B) FEV<sub>1</sub></b>					
Sex	Female	Ref	Ref		
	Male	0.90 (0.51 - 1.57)	0.72	0.76 (0.35 - 1.64)	0.49
Age	0.98 (0.96 - 0.99)	0.011	0.97 (0.95 - 0.99)	0.015	
Height	1.01 (0.98 - 1.04)	0.47	1.00 (0.96 - 1.05)	0.99	
Weight	1.01 (0.999 - 1.02)	0.063	1.01 (1.001 - 1.03)	0.027	
Race/ethnicity		0.42		0.22	
	Caucasian	Ref	Ref		
	Black	2.30 (0.71 - 6.45)	0.13	2.22 (0.67 - 6.34)	0.16
	SEA	1.22 (0.63 - 2.31)	0.54	1.96 (0.91 - 4.22)	0.086
	Mixed/Other	1.53 (0.61 - 3.49)	0.33	1.67 (0.63 - 4.11)	0.28

Abbreviations: OR; Odds ratio, C.I.; Confidence interval, FVC; Forced vital capacity, NEA; North East Asian, SEA; South East Asian, FEV<sub>1</sub>; Forced expiratory volume in 1s.

<sup>†</sup> We analyzed the data by classifying Asian participants as SE Asian (model 2) if they could not be classified clearly as either NE Asian or SE Asian.

Supplementary Table S12. Comparison of predicted values of LLN in Caucasian group (n = 229)

	Gutierrez, et al <sup>†</sup>	Tan, et al <sup>‡</sup>	NHANES III <sup>§</sup>	GLI-Race <sup>§</sup>	GLI-Other
LLN FVC (L)	3.40 [2.80, 4.07]	3.29 [2.71, 3.92] *	3.33 [2.86, 3.93] *	3.22 [2.69, 3.80] *	3.01 [2.51, 3.54] *
LLN FEV <sub>1</sub> (L)	2.76 [2.33, 3.23]	2.58 [2.13, 3.05] *	2.64 [2.22, 3.07] *	2.57 [2.16, 3.00] *	2.38 [2.01, 2.79] *
LLN FEV <sub>1</sub> /FVC (%)	71.38 [69.35, 73.15]	69.06 [65.64, 72.09] *	70.14 [67.85, 72.68] *	69.50 [67.30, 71.60] *	71.20 [69.10, 73.40]

Abbreviations: LLN; Lower limit of normal, FVC; Forced vital capacity, FEV<sub>1</sub>; Forced expiratory volume in 1s, NHANES III; National Health and Nutrition Examination Survey III, GLI; Global Lung Function Initiative.

Data are presented as median [IQR].

\*P < 0.001 compared to the values calculated by the Canadian reference equations (Gutierrez, et al.) using the Wilcoxon signed-rank test.

<sup>†</sup> The Canadian reference equations [Reference No.2 (R2)] .

<sup>‡</sup> The reference equations generated from Canadian Caucasian adults data [Reference No.3 (R3)].

<sup>§</sup> The reference equations for Caucasian were applied.

**Reference**

R1. ERS e-Learning Resources. Global Lung Function Initiative. What reference equations do I apply for non-Caucasians? <https://www.ers-education.org/guidelines/global-lung-function-initiative/faq/what-reference-equations-do-i-apply-for-non-caucasians/>. Date last updated: January 21, 2020. Date last accessed: March 11, 2022.

R2. Gutierrez C, Ghezzi RH, Abboud RT, et al. Reference values of pulmonary function tests for Canadian Caucasians. *Can Respir J*. 2004;11(6):414-24.

R3. Tan WC, Bourbeau J, Hernandez P, et al. Canadian prediction equations of spirometric lung function for Caucasian adults 20 to 90 years of age: results from the Canadian Obstructive Lung Disease (COLD) study and the Lung Health Canadian Environment (LHCE) study. *Can Respir J*. 2011;18(6):321-6.