PERFORMANCE DES NOUVELLES FORMULES D'ESTIMATION DU DFG DÉRIVÉES DE LA CRÉATININÉMIE DANS DES POPULATIONS EUROPÉENNES, AFRICAINES ET BRÉSILIENNES

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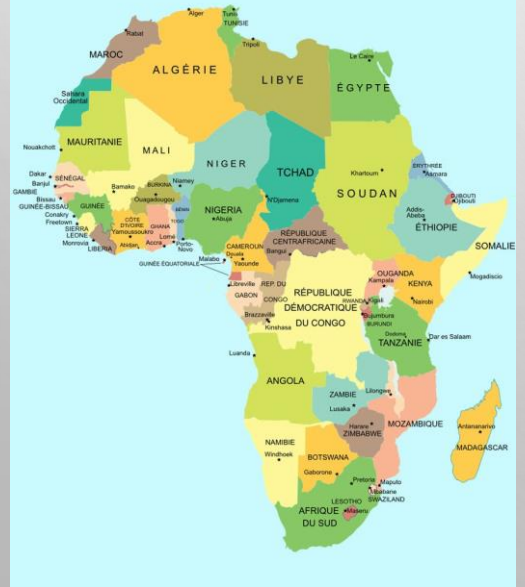
EUROPEAN KIDNEY FUNCTION CONSORTIUM

CONFLITS D'INTÉRÊT

JE SUIS CONSULTANT POUR NEPHROLYTIX

European Kidney Function Consortium



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Ernest Sumaili, Kinshasa

Eric Yayo, Abidjan
Dagui Monnet, Abidjan

INTRODUCTION

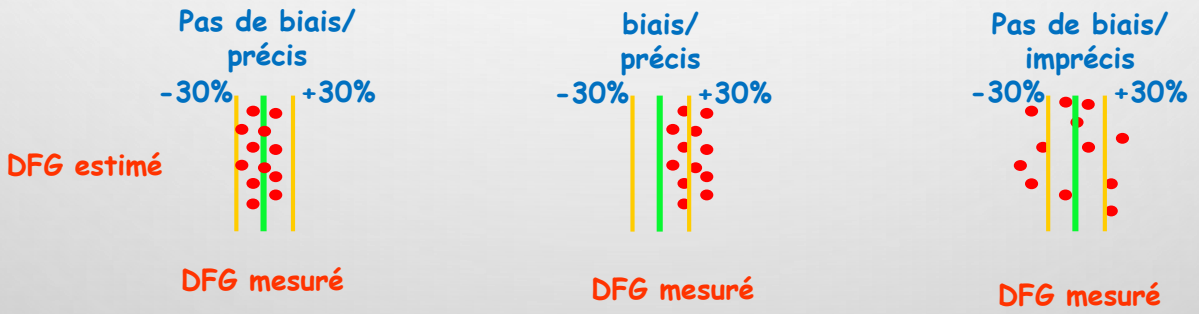
- LES EQUATIONS INCLUANT LA VARIABLE “RACE” ONT ÉTÉ TRÈS CRITIQUÉES AUX USA: ÉQUATION CKD-EPI (CKD-EPI$_{ASR}$, A=AGE, S=SEX, R=RACE)
- UNE NOUVELLE ÉQUATION SANS CETTE VARIABLE A ÉTÉ PROPOSÉE (CKD-EPI$_{AS}$)
- NON VALIDÉE EN DEHORS DES USA
- PEU DE COMPARAISON AVEC LES ÉQUATIONS EUROPÉENNES, NOTAMMENT L’ÉQUATION EUROPEAN KIDNEY FUNCTION CONSORTIUM (EKFC)

MÉTHODES

- SUJETS DE PLUS DE 18 ANS, DFG MESURÉ, CRÉATININE SÉRIQUE “IDMS TRACEABLE”
- EKFC CONSORTIUM: 11 COHORTES D’EUROPE (N=17,321)
- DONNÉES DU BRÉSIL (N=100)
- DONNÉES DE PARIS (N=4,429, PARMI LESQUELS 964 EUROPÉENS NOIRS)
- DONNÉES D’AFRIQUE (RDC ET CÔTE D’IVOIRE, N=508)

STATISTIQUES

- Corrélation: une condition "*sine qua non*" mais insuffisante!
- Biais: différence moyenne ou médiane entre 2 valeurs = erreur systématique
- Précision: SD ou IQR autour de ce biais = erreur aléatoire
- Exactitude à 30% = % du DFG estimé dans ± 30% du DFG mesuré



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Delanaye P, Nephrol Dial Transplant, 2013, 28, 1396

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Annals of Internal Medicine

ORIGINAL RESEARCH

Development and Validation of a Modified Full Age Spectrum Creatinine-Based Equation to Estimate Glomerular Filtration Rate

A Cross-sectional Analysis of Pooled Data

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Figure 1. The new EKFC equation.

Age	SCr/Q	Equation
2–40 y	<1	$107.3 \times (SCr/Q)^{-0.322}$
	≥1	$107.3 \times (SCr/Q)^{-1.132}$
>40 y	<1	$107.3 \times (SCr/Q)^{-0.322} \times 0.990^{(Age - 40)}$
	≥1	$107.3 \times (SCr/Q)^{-1.132} \times 0.990^{(Age - 40)}$

Q Values

For ages 2–25 y:

Males:

$$\ln(Q) = 3.200 + 0.259 \times Age - 0.543 \times \ln(Age) - 0.00763 \times Age^2 + 0.0000790 \times Age^3$$

Females:

$$\ln(Q) = 3.080 + 0.177 \times Age - 0.223 \times \ln(Age) - 0.00596 \times Age^2 + 0.0000686 \times Age^3$$

For ages >25 y:

Males:

$Q = 80$ µmol/L (0.90 mg/dL)

Females:

$Q = 62$ µmol/L (0.70 mg/dL)

SCr and Q in µmol/L (to convert to mg/dL, divide by 88.4)

Q values (in µmol/L or mg/dL) correspond to the median SCr values for the age- and sex-specific populations. EKFC = European Kidney Function Consortium; SCr = serum creatinine.

RÉSULTATS

Table S3: Method and patients characteristics
Mean and SD of age and measured glomerular filtration

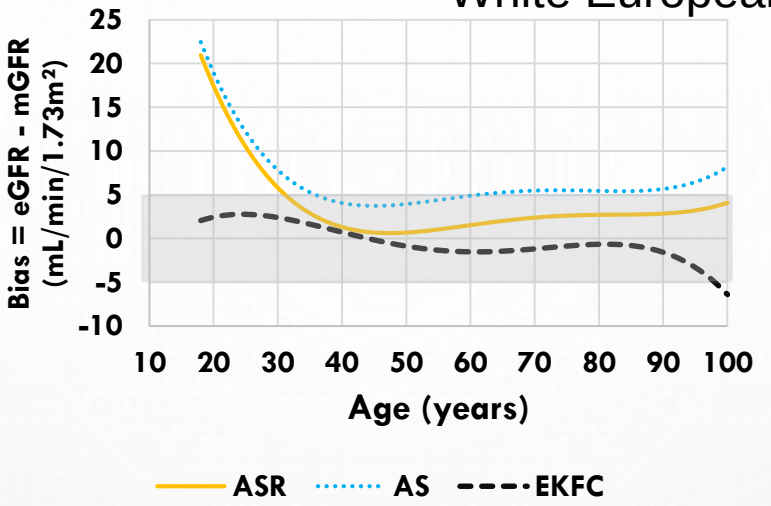
Center	Country	Cohort	n	Method	Exogenous marker	Age	mGFR (mL/min/1.73m²)	% of female
White populations								
Amsterdam	The Netherlands	CAPA-study[5] + referrals	48	Plasma clearance	Inulin	18.7±0.9	93.7±27.9	25.0
Berlin	Germany	BIS-Study[6]	657	Plasma clearance	Iohexol	78.4±6.1	60.3±21.5	41.7
France	France	Kidney Donor Study[7]	2,572	Plasma/renal clearance	Iohexol/^{51}Cr-EDTA/inulin	50.4±11.8	100.1±22.2	61.9
Kent	UK	GFR in old adults[8]	394	Plasma clearance	Iohexol	80.4±4.6	55.3±20.5	52.0
Leuven	Belgium	Referrals	21	Plasma clearance	^{51}Cr-EDTA	19.1±1.2	78.2±23.1	47.6
Lund	Sweden	CAPA-study[5]	2,847	Plasma clearance	Iohexol	60.1±16.5	62.5±34.1	48.5
Lyon	France	Referrals	2,435	Plasma/renal clearance	Iohexol/inulin	31.3±16.7	84.5±32.7	46.8
Örebro	Sweden	Referrals	2,051	Plasma clearance	Iohexol	56.5±16.3	64.3±36.0	41.7
Saint-Etienne	France	HIV-study[9]	203	Plasma clearance	Iohexol	48.7±10.3	100.3±27.3	48.7
Stockholm	Sweden	Referrals	856	Plasma clearance	Iohexol	72.9±14.1	48.7±27.6	44.2
Tromsø	Norway	RENIS-T6 study[10]	1,627	Plasma clearance	Iohexol	58.1±3.8	101.5±19.9	50.8
Kinshasa/ Abidjan	DRC/Côte d'Ivoire	African Study[11]	508	Plasma clearance	Iohexol	41.8±14.3	80.5±28.9	46.7
Rio de Janeiro	Brazil	Brazilian study[12]	39	Plasma clearance	^{51}Cr-EDTA	60.0±13.5	41.9±23.4	59.0
Paris	France	Referrals	4429	Plasma clearance	^{51}Cr-EDTA	52.4±14.8	61.3±26.6	41.1
Black population								
Kinshasa/ Abidjan	DRC/Côte d'Ivoire	African Study[11]	508	Plasma clearance	Iohexol	41.8±14.3	80.5±28.9	46.7
Rio de Janeiro	Brazil	Brazilian study[12]	61	Plasma clearance	^{51}Cr-EDTA	55.9±13.8	49.8±32.2	50.8
Paris	France	Referrals	964	Plasma clearance	^{51}Cr-EDTA	50.4±13.8	61.1±24.6	41.1

*Referrals = referred for plasma or renal clearance measurement on clinical grounds. Results mean±SD.

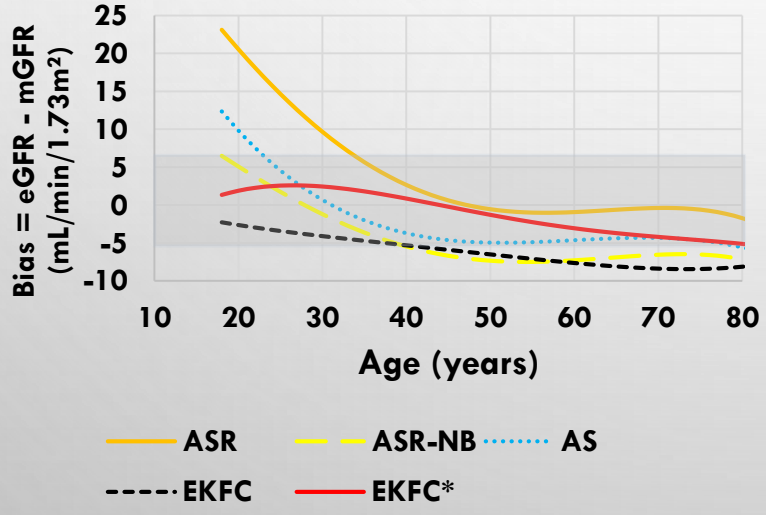
EKFC	Q Female/male
White European cohort	0.70/0.90
Black European cohort	0.74/1.02
African cohort	0.72/0.96

Q spécifiquement et indépendamment développés pour les populations noires
(pas une correction des valeurs obtenues chez les populations blanches)

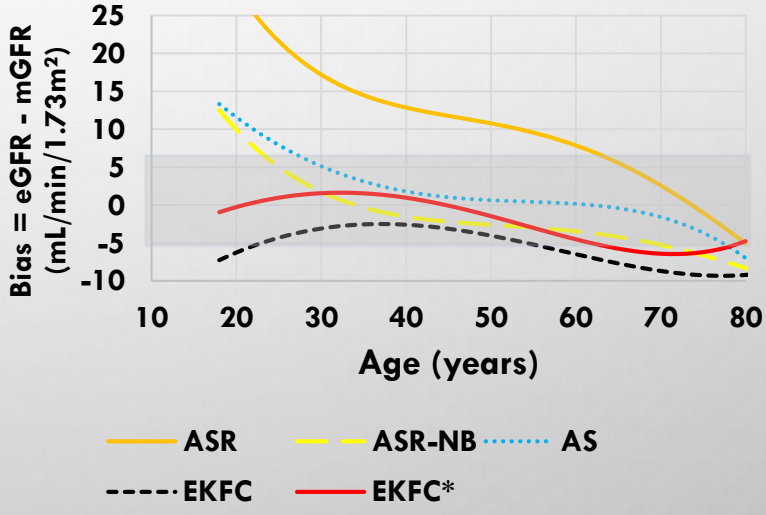
White Europeans (n=17,321)



Black Europeans (n=964)



Black Africans (n=508)



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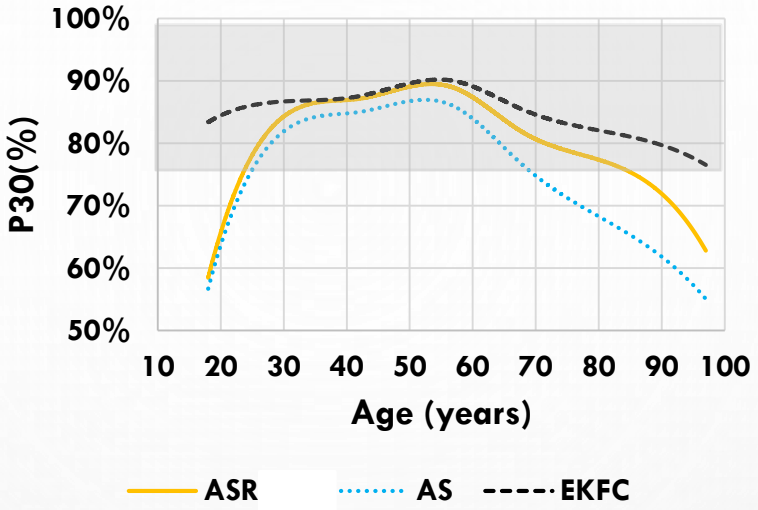

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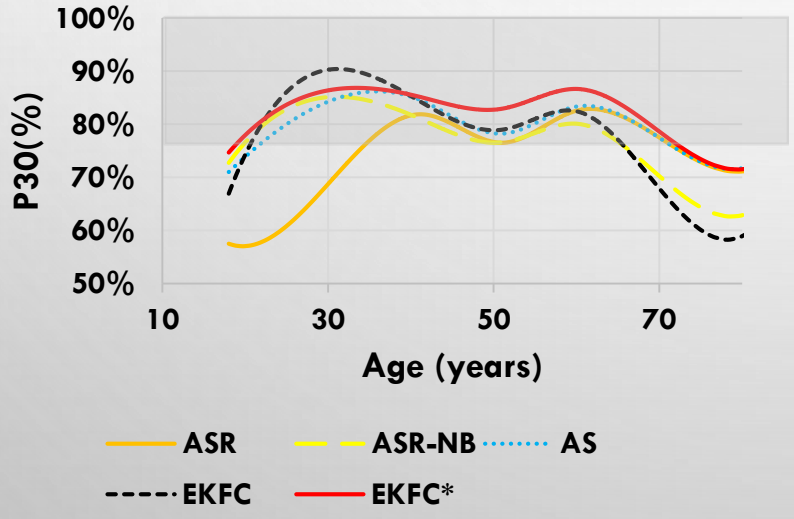
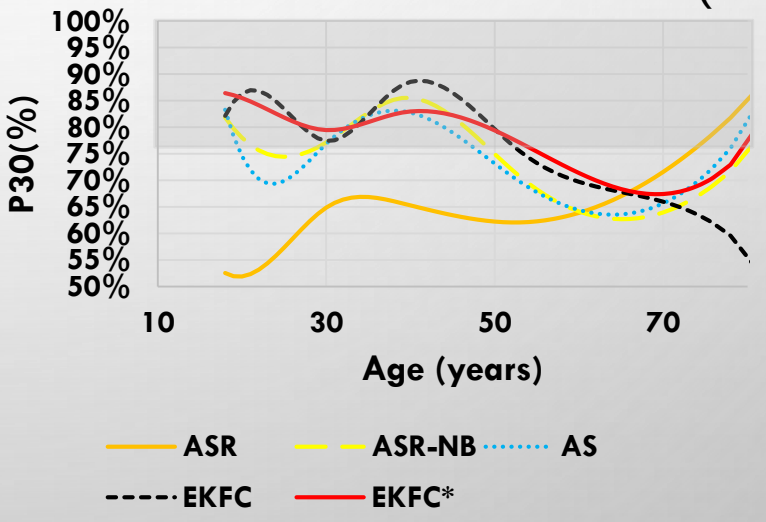


Black Africans (n=508)



CONCLUSIONS

- EN EUROPE (SUJET BLANC), LA PERFORMANCE DE LA NOUVELLE ÉQUATION CKD-EPI$_{AS}$ EST SUBOPTIMALE
- EN AFRIQUE ET CHEZ LE NOIR EUROPÉEN, LES ÉQUATIONS SONT RELATIVEMENT ÉQUIVALENTES SAUF L'ÉQUATION CKD-EPI$_{ASR}$ **AVEC** LA CORRECTION QUI EST NETTEMENT MOINS PERFORMANTE
- L'ÉQUATION EKFC EST INTÉRESSANTE POUR TOUTES LES POPULATIONS SURTOUT SI DES VALEURS DE Q DÉDIÉES SONT UTILISÉES

editorial

www.kidney-international.org

Americentrism in estimation of glomerular filtration rate equations

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KEYWORDS: glomerular filtration rate; race; serum creatinine

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Performance of creatinine-based equations to estimate glomerular filtration rate in White and Black populations in Europe, Brazil and Africa

Pierre Delanaye[1,2,*], Emmanuelle Vidal-Petiot[3,*], Jonas Björk[4,5], Natalie Ebert[6], Björn O. Eriksen[7], Laurence Dubourg[8], Anders Grubb[9], Magnus Hansson[10], Karin Littmann[11], Christophe Mariat[12], Toralf Melsom[7], Elke Schaeffner[6], Per-Ola Sundin[13], Arend Bökenkamp[14], Ulla B. Berg[15], Kajsa Åsling-Monemi[15], Anna Åkesson[4,5], Anders Larsson[16], Etienne Cavalier[17], R. Neil Dalton[18], Marie Courbebaisse[19], Lionel Couzi[20], Francois Gaillard[21], Cyril Garrouste[22], Lola Jacquemont[23], Nassim Kamar[24], Christophe Legendre[25], Lionel Rostaing[26], Thomas Stehlé[27,28], Jean-Philippe Haymann[29], Luciano da Silva Selistre[30], Jorge P. Strogoff-de-Matos[31], Justine B. Bukabau[32], Ernest K. Sumaili[32], Eric Yayo[33], Dagui Monnet[33], Ulf Nyman[34], Hans Pottel[35,†] and Martin Flamant[36,†]

JOURNAL ARTICLE ACCEPTED MANUSCRIPT

What should European nephrology do with the new CKD-EPI equation?

Ron T Gansevoort ✉, Hans-Joachim Anders, Mario Cozzolino, Danilo Fliser, Denis Fouque, Alberto Ortiz, Maria José Soler, Christoph Wanner

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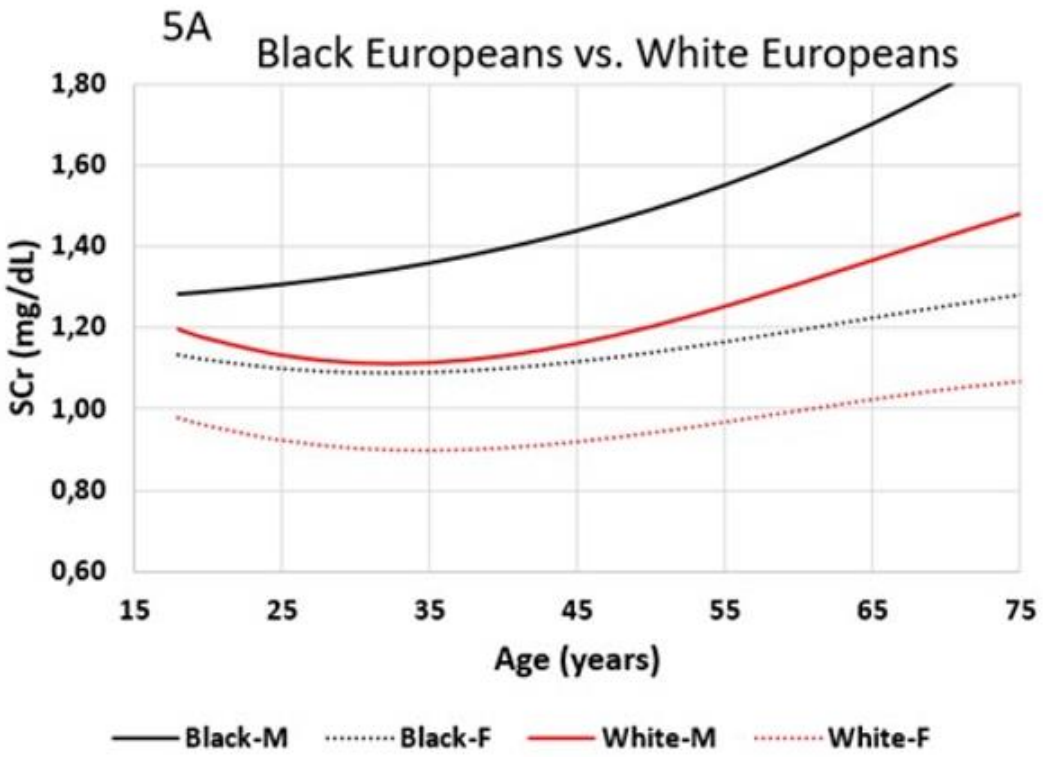
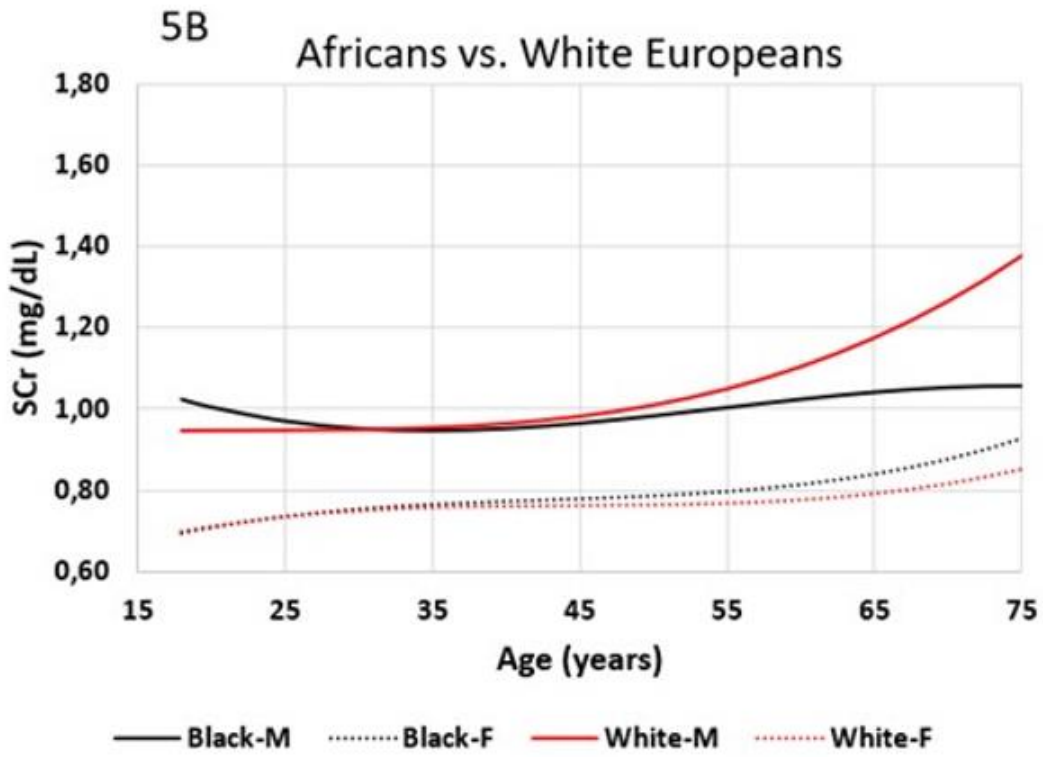
Merci !

Questions?

White Europeans (EKFC+Paris) n = 17,321	CKD-EPI$_{ASR}$	CKD-EPI$_{ASR-NB}$	CKD-EPI$_{AS}$	LMREV	EKFC
Bias	3.0 [2.7; 3.2]	3.0 [2.7; 3.2]	6.0 [5.8; 6.3]	-3.2 [-3.4; -3.0]	-0.3 [-0.5; -0.1]
IQR [Pct25; Pct75]	16.8 [-4.4; 12.3]	16.8 [-4.4; 12.3]	17.2 [-1.5; 15.7]	15.5 [-11.3; 4.2]	15.1 [-7.7; 7.4]
P20	66.9 [66.2; 67.6]	66.9 [66.2; 67.6]	63.0 [62.3; 63.7]	71.0 [70.3; 71.7]	72.4 [71.8; 73.1]
P30	82.5 [82.0; 83.1]	82.5 [82.0; 83.1]	78.5 [77.9; 79.1]	87.3 [86.8; 87.8]	86.6 [86.1; 87.1]
White Europeans (Paris) n = 3,465					
Bias	0.8 [0.3; 1.3]	0.8 [0.3; 1.3]	3.6 [3.0; 4.2]	-3.4 [-3.8; -3.0]	-0.5 [-0.9; -0.1]
IQR [Pct25; Pct75]	15.2 [-6.3; 8.9]	15.2 [-6.3; 8.9]	16.1 [-3.8; 12.3]	13.7 [-10.1; -3.4]	14.3 [-7.2; 7.2]
P20	66.4 [64.8; 68.0]	66.4 [64.8; 68.0]	65.1 [63.5; 66.7]	66.8 [65.3; 68.4]	68.7 [67.2; 70.3]
P30	83.5 [82.3; 84.8]	83.5 [82.3; 84.8]	80.9 [79.6; 82.2]	85.4 [84.2; 86.6]	85.5 [84.3; 86.7]
EKFC external validation n = 6031					
Bias	2.4 [2.1; 2.8]	2.4 [2.1; 2.8]	5.7 [5.3; 6.1]	-3.7 [-4.1; -3.3]	-0.6 [-0.9; -0.2]
IQR [Pct25; Pct75]	15.5 [-4.4; 11.1]	15.5 [-4.4; 11.1]	15.8 [-1.2; 14.6]	15.9 [-12.0; 3.9]	15.0 [-8.0; 7.0]
P20	70.2 [69.0; 71.3]	70.2 [69.0; 71.3]	65.7 [64.5; 66.9]	73.0 [71.9; 74.1]	74.4 [73.3; 75.5]
P30	85.2 [84.3; 86.1]	85.2 [84.3; 86.1]	80.9 [79.9; 81.9]	88.6 [87.8; 89.4]	87.8 [86.9; 88.6]

Black Europeans n = 964					
Bias	0.8 [0.1; 2.2]	-6.1 [-7.0; -5.4]	-3.6 [-4.7; -2.9]	-9.1 [-10.2; -8.5]	-6.3 [-7.0; -5.5]
IQR [Pct25; Pct75]	19.1 [-6.8; 12.3]	15.5 [-13.2; 2.3]	16.3 [-11.1; 5.2]	14.7 [-16.5; -1.8]	14.6 [-13.4; 1.2]
P20	59.4 [56.3; 62.5]	57.3 [54.1; 60.4]	61.7 [58.6; 64.8]	49.8 [46.6; 53.0]	59.2 [56.1; 62.3]
P30	77.4 [74.7; 80.0]	78.3 [75.7; 80.9]	81.0 [78.5; 83.5]	74.2 [71.4; 76.9]	80.5 [78.0; 83.0]
Africans n = 508					
Bias	12.2 [10.7; 15.0]	-1.3 [-2.7; 0.7]	2.5 [0.7; 4.2]	-9.0 [-10.5; -7.6]	-4.4 [-5.3; -3.3]
IQR [Pct25; Pct75]	30.0 [-3.2; 26.8]	22.6 [-11.4; 11.2]	23.3 [-9.0; 14.3]	18.3 [-17.9; 0.4]	19.9 [-14.0; 5.9]
P20	43.7 [39.4; 48.0]	59.6 [55.4; 63.9]	59.6 [55.4; 63.9]	61.6 [57.4; 65.9]	62.4 [58.2; 66.6]
P30	63.6 [59.4; 67.8]	75.8 [72.0; 79.5]	74.4 [70.6; 78.2]	77.8 [74.1; 81.4]	79.3 [75.8; 82.9]
All Brazilians n = 100					
Bias	2.4 [0.6; 5.3]	-0.0 [-3.0; 0.8]	1.0 [-0.3; 3.0]	-2.4 [-5.5; 0.7]	-0.1 [-2.9; 1.4]
IQR [Pct25; Pct75]	13.0 [-2.1; 10.9]	13.6 [-6.6; 7.0]	13.9 [-4.6; 9.3]	13.7 [-9.5; 4.3]	13.2 [-7.2; 6.0]
P20	55.0 [45.1; 64.9]	59.0 [49.2; 68.8]	60.0 [50.2; 69.8]	53.0 [43.0; 63.0]	55.0 [45.1; 64.9]
P30	74.0 [65.3; 82.7]	79.0 [70.9; 87.1]	76.0 [67.5; 84.5]	79.0 [70.9; 87.1]	78.0 [69.7; 86.3]


5A
Black Europeans vs. White Europeans
1,80
1,60
1,40
1,20
1,00
0,80
0,60
SCr (mg/dL)
15
25
35
45
55
65
75
Age (years)
Black-M
Black-F
White-M
White-F


5B
Africans vs. White Europeans
1,80
1,60
1,40
1,20
1,00
0,80
0,60
SCr (mg/dL)
15
25
35
45
55
65
75
Age (years)
Black-M
Black-F
White-M
White-F