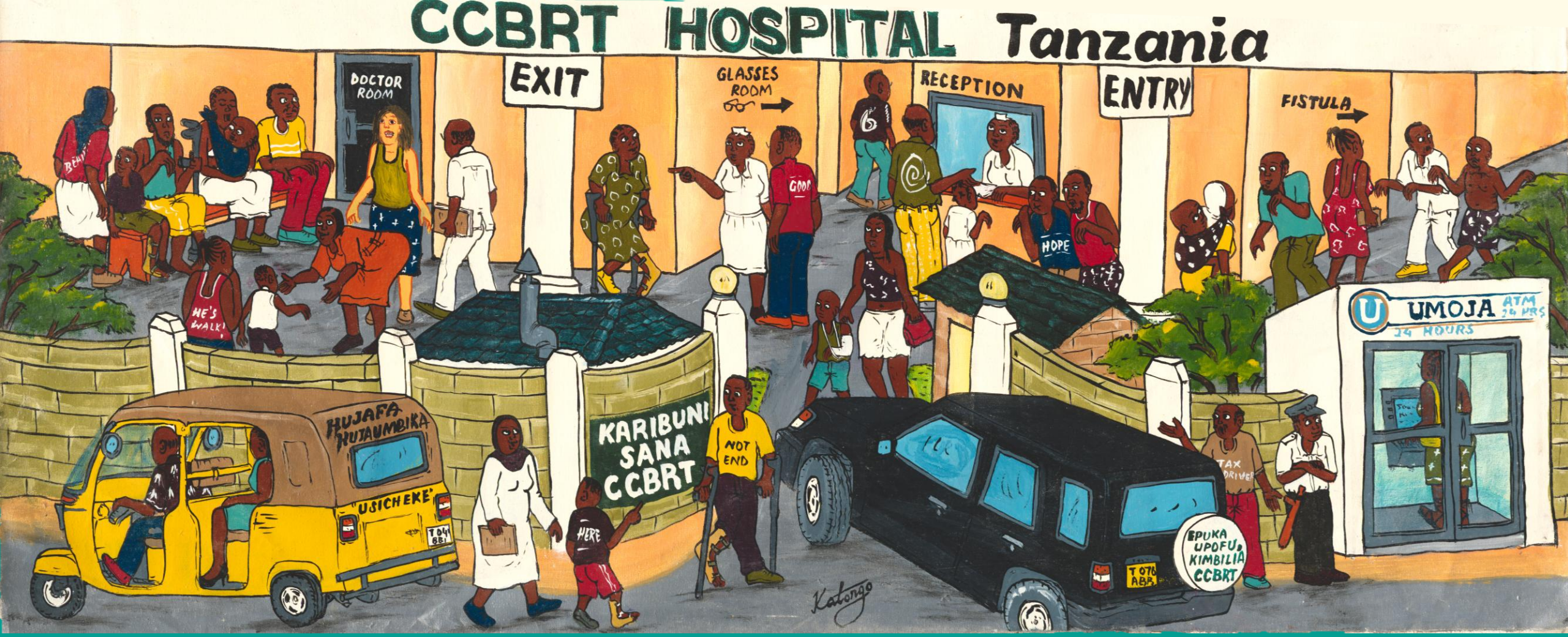


Glaucoma in Sub-Saharan Africa

P.W.M. Bonnemaijer

MD, PhD, FEBOpht

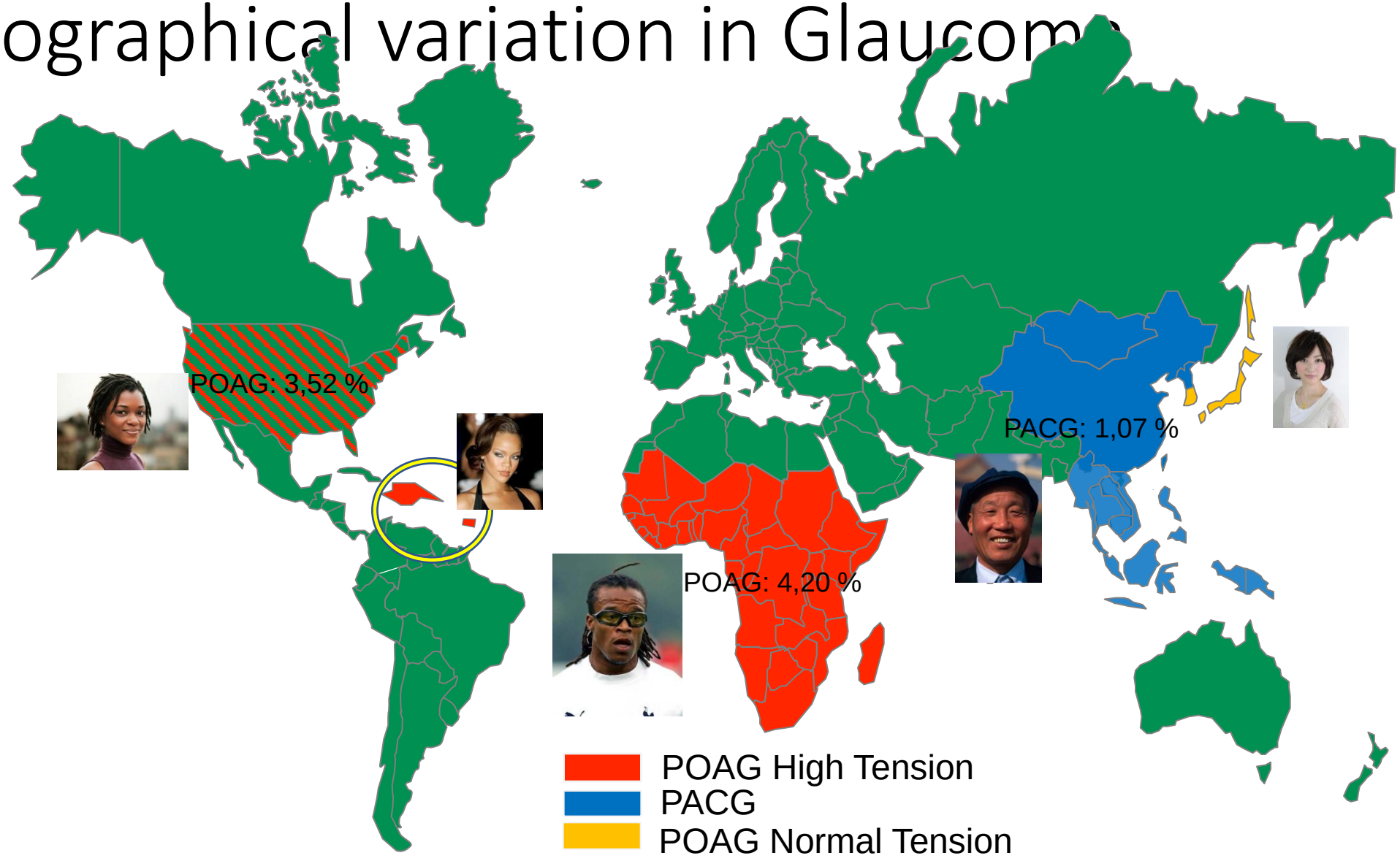
Disclosures



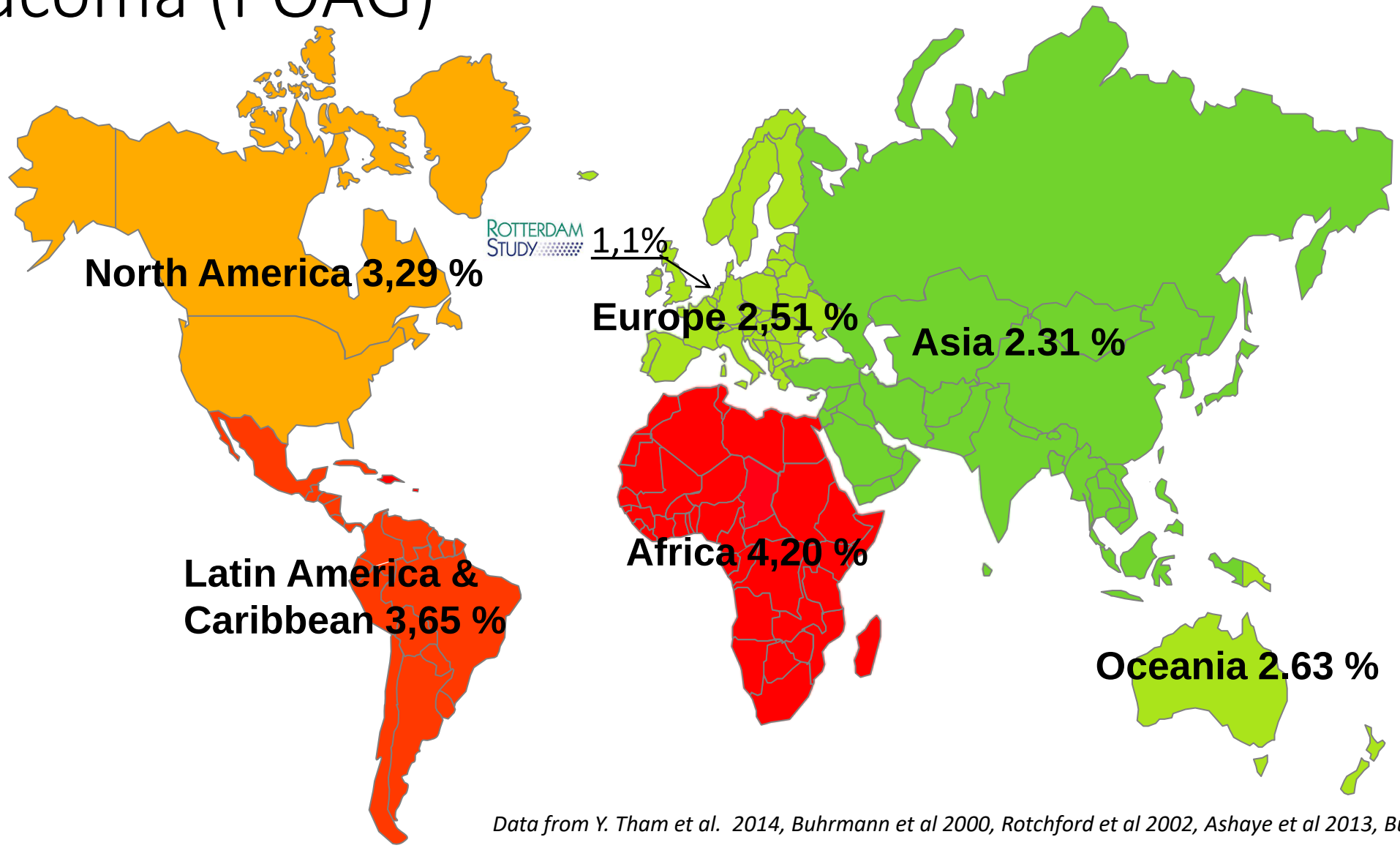
- Related to this talk: None

Research funds: Uitzicht, Bright Focus Foundation, Combined Ophthalmic Research Rotterdam (CORR) , OOG fonds, LSBS, Prof.dr. Henkes Stichting, Rotterdamse Stichting Blindenbelangen.

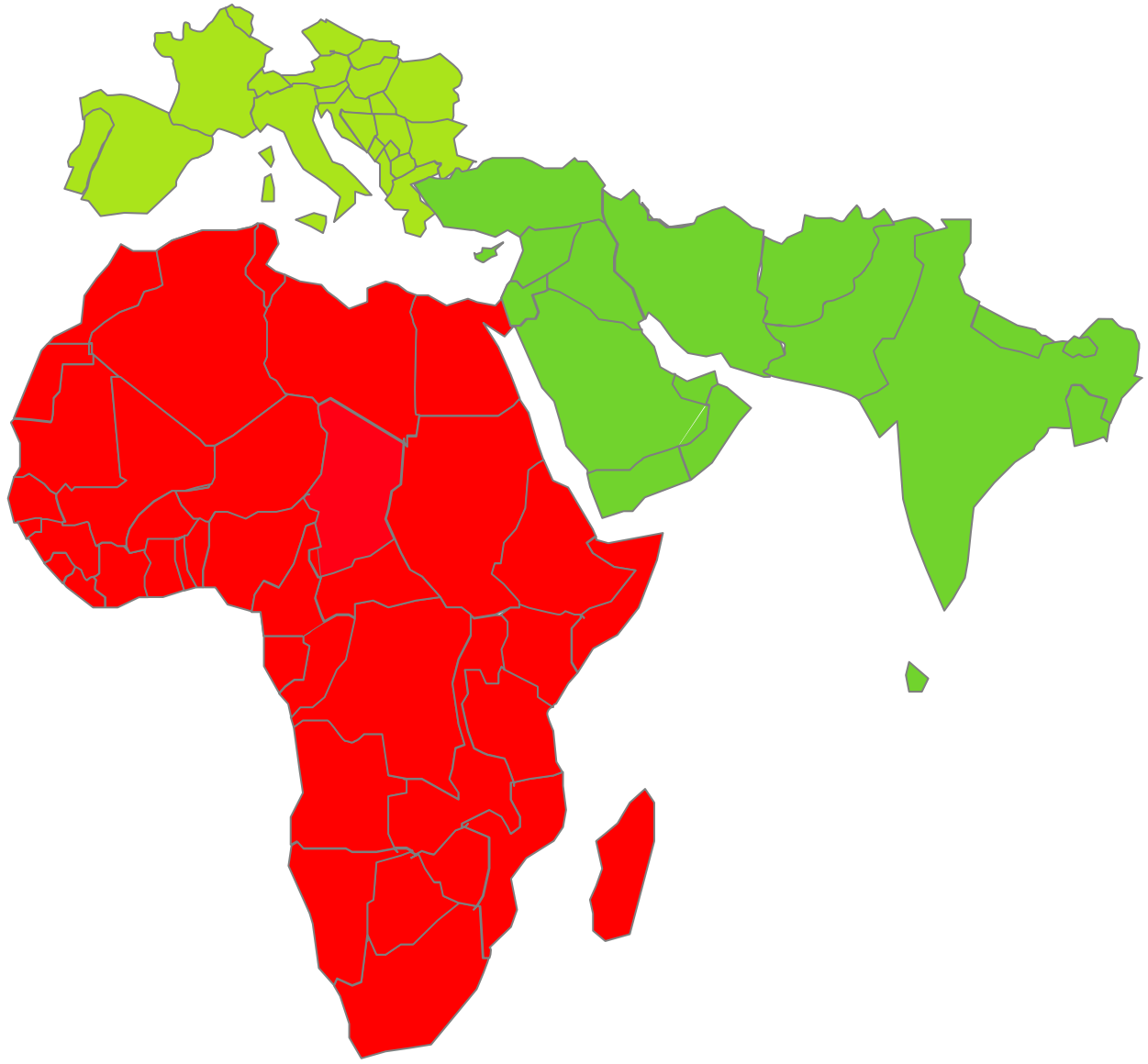
Geographical variation in Glaucoma

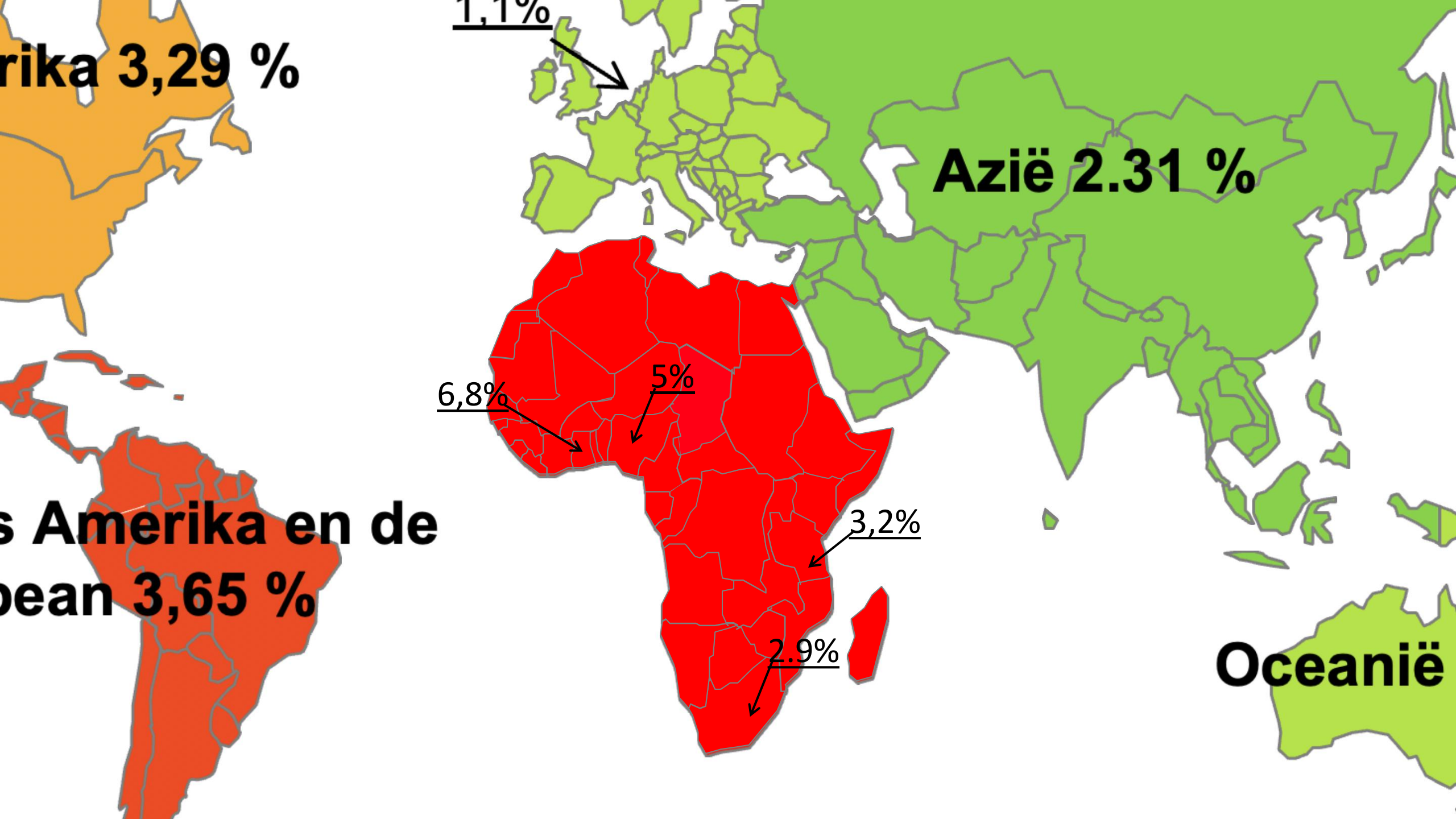


Worldwide prevalence of Primary open-angle glaucoma (POAG)



Data from Y. Tham et al. 2014, Buhrmann et al 2000, Rotchford et al 2002, Ashaye et al 2013, Budenz et al. 2013




rika 3,29 %
1,1%
Azië 2.31 %
6,8%
5%
3,2%
2,9%
s Amerika en de
bean 3,65 %
Oceanië



The case of St Lucia



Francesco del Cossa, Saint Lucy, 1473-74, National Gallery of Art

The case of St Lucia





The case of St Lucia



- HOWARD UNIVERSITY 1867 HARVARD MEDICAL SCHOOL
- from 1986 to 1987, a national survey of the prevalence of POAG in St. Lucia
- In 1997 only a few patients had undergone surgery and a few who could afford medications had continued to receive them

The case of St Lucia



- Over a 10-year period, visual field progression occurred in 52% to 73% of the eyes identified with glaucoma or glaucoma suspect status in St. Lucia

- cumulative 10 year incidence of end stage POAG (AGIS ≥ 18) in at least 1 eye is 16%

- more than 50% of eyes that progressed to end-stage visual field loss had no or minimal field loss at baseline

Wilson et al. 2002

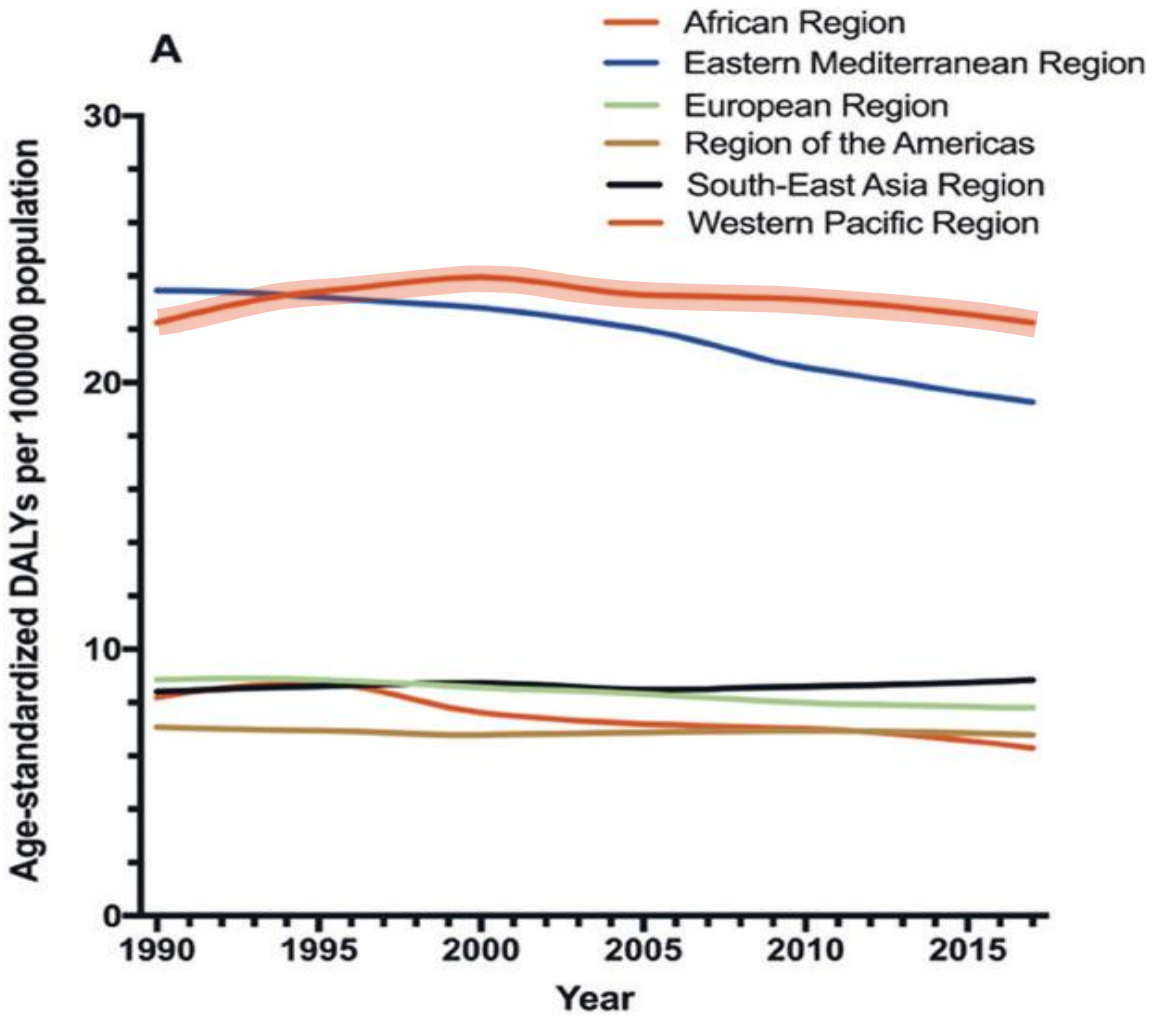
Glaucoma blindness

GBD 20
CELEBRATING 20 YEARS
OF COLLABORATION AND INNOVATION

	Cases (thousands)		Age-standardised prevalence (per 1000)	
	2020	Percentage change from 1990 to 2020	2020	Percentage change from 1990 to 2020
Glaucoma				
Global	3600 (2800 to 4410)	61·8% (57·2 to 66·8)	2·04 (1·59 to 2·49)	–31·9% (–33·0 to –30·6)
Central Europe, eastern Europe, and central Asia	178 (139 to 219)	5·5% (1·9 to 9·3)	1·25 (0·972 to 1·53)	–31·4% (–32·8 to –30·0)
High income	785 (622 to 964)	60·3% (53·0 to 69·0)	1·41 (1·12 to 1·74)	–23·2% (–24·5 to –21·9)
Latin America and Caribbean	334 (256 to 411)	105·5% (98·4 to 113·6)	2·63 (2·01 to 3·23)	–36·2% (–37·6 to –34·8)
North Africa and Middle East	463 (354 to 578)	64·8% (57·6 to 72·3)	5·69 (4·37 to 7·10)	–40·9% (–43·0 to –39)
South Asia	577 (439 to 726)	75·7% (65·1 to 86·7)	2·26 (1·71 to 2·83)	–38·7% (–41·0 to –36·1)
Southeast Asia, east Asia, and Oceania	754 (575 to 957)	52·4% (44·5 to 61·3)	1·34 (1·02 to 1·67)	–48·6% (–51·3 to –45·6)
Sub-Saharan Africa	510 (398 to 628)	70·1% (65·1 to 75·2)	6·64 (5·20 to 8·09)	–23·5% (–25·5 to –21·5)

J.D. Steinmetz et al. *Lancet Glob Health* 2021

Glaucoma burden in DALYs



Age-standardized DALYs per 100.000 population

Y. Zhang et al. *J Glob Health.* 2019

Clinical presentation of POAG in SSA

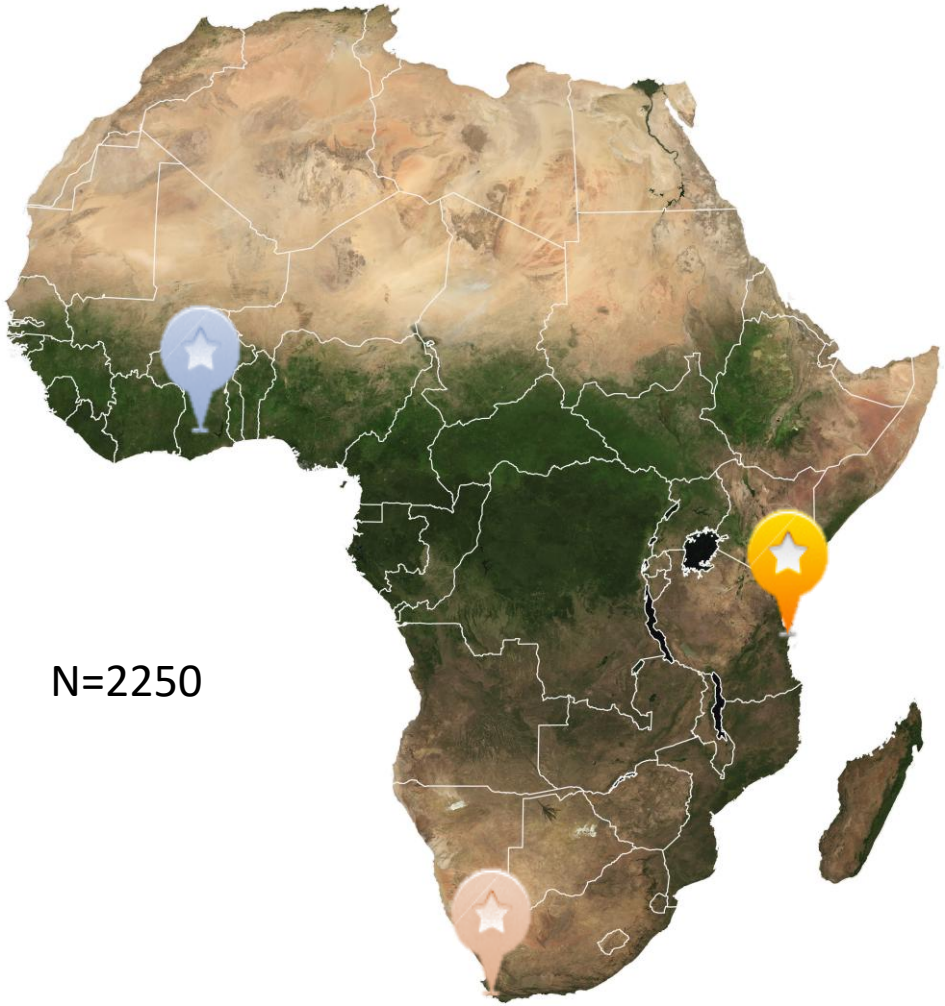
Acta Ophthalmologica

— Acta Ophthalmologica 2021

Differences in clinical presentation of primary open-angle glaucoma between African and European populations

Pieter W. M. Bonnemaijer,[1,2,3] Valeria Lo Faro,[4] Anna J. Sanyiwa,[5] Hassan G. Hassan,[6] Colin Cook,[7] GIGA study group,[†] Suzanne Van de Laar,[8] Hans G. Lemij,[3] Caroline C. W. Klaver[1,2,9,10,11] Nomdo M. Jansonius[4] and Alberta A. H. J. Thiadens[1,2]

GIGA study



N=2250

Tanzania, Dar es Salaam (2012-2015)

CCBRT



Muhimbili National Hospital



South Africa, Cape Town (2012-2015

Groote Schuur Hospital



Ghana, Kumasi (2018-2022)

Komfo Anokye Teaching Hospital



Methods



fundusphotography



pachymetry



Questionnaires



Eye pressure



VA



Blood draw

Study population

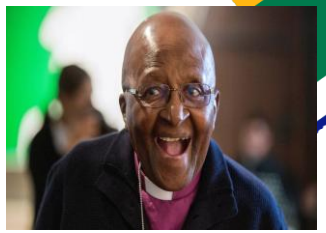




Tanzanians

N=310





South Africans

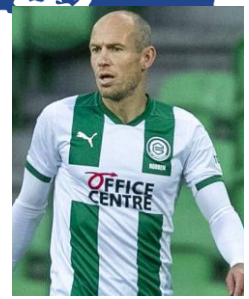
N=94



Admixed South African “Coloureds”

N=151

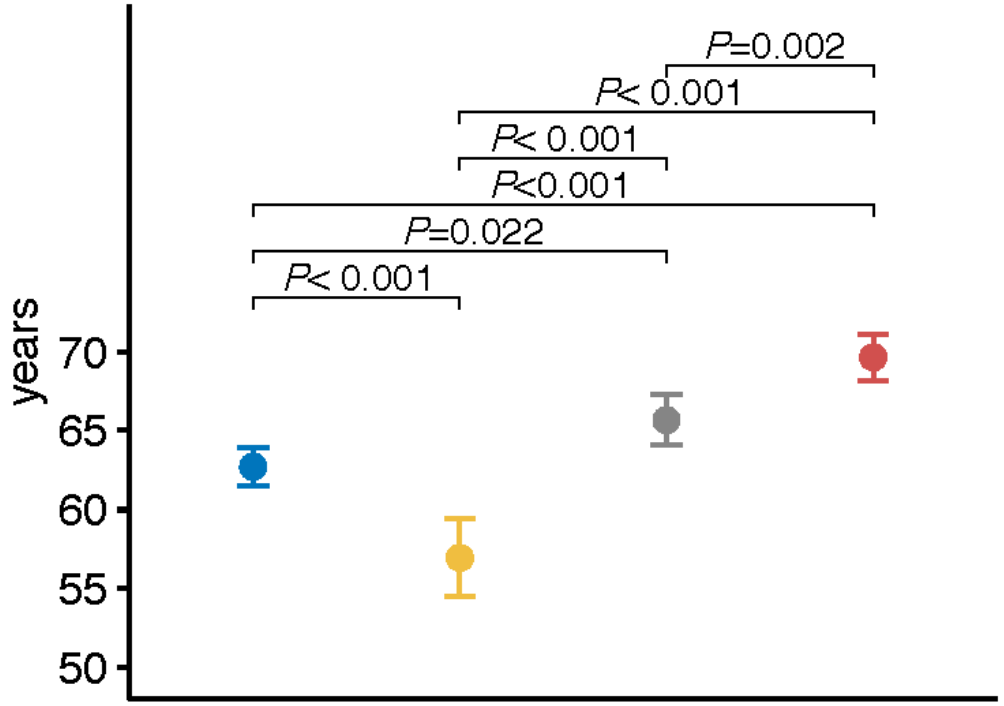




Dutch

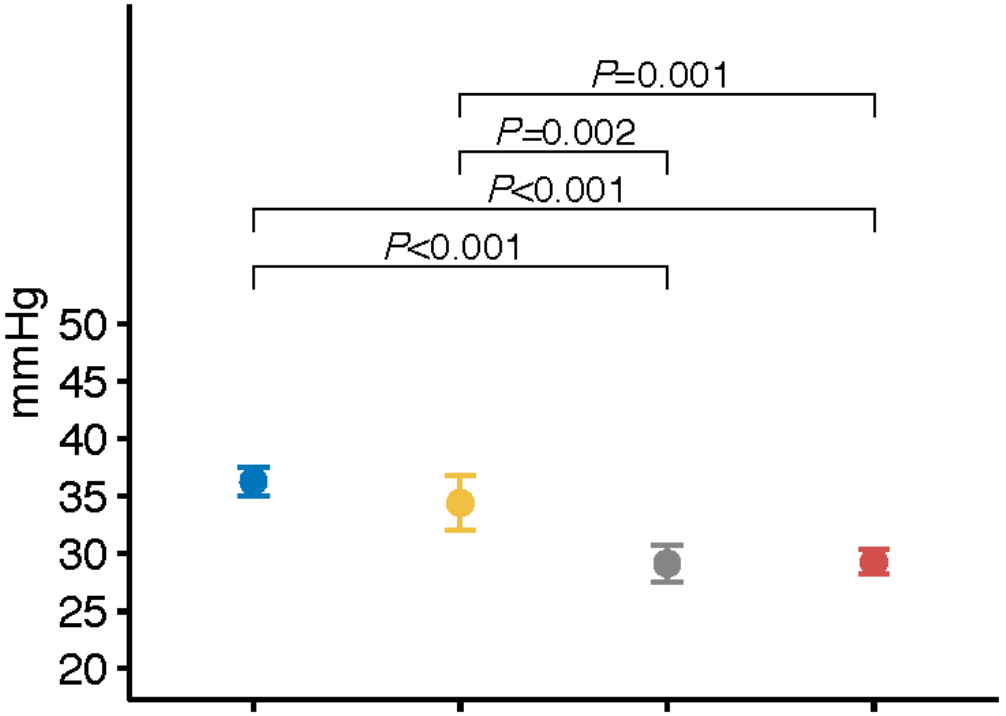
N=241

Africans presented at younger age



Tanzanians	62,7 ± 11,0 year
South African black	57,0 ± 12,0 year
South Africans coloured	65,7 ± 10,0 year
Dutch White	69,7 ± 11,7 year

Africans presented with higher IOP



Tanzanians	36,2 ± 11,1 mm Hg
South African black	34,4 ± 11,6 mm Hg
South African coloured	29,1 ± 10,0 mm Hg
Dutch White	29,3 ± 8,4 mm Hg

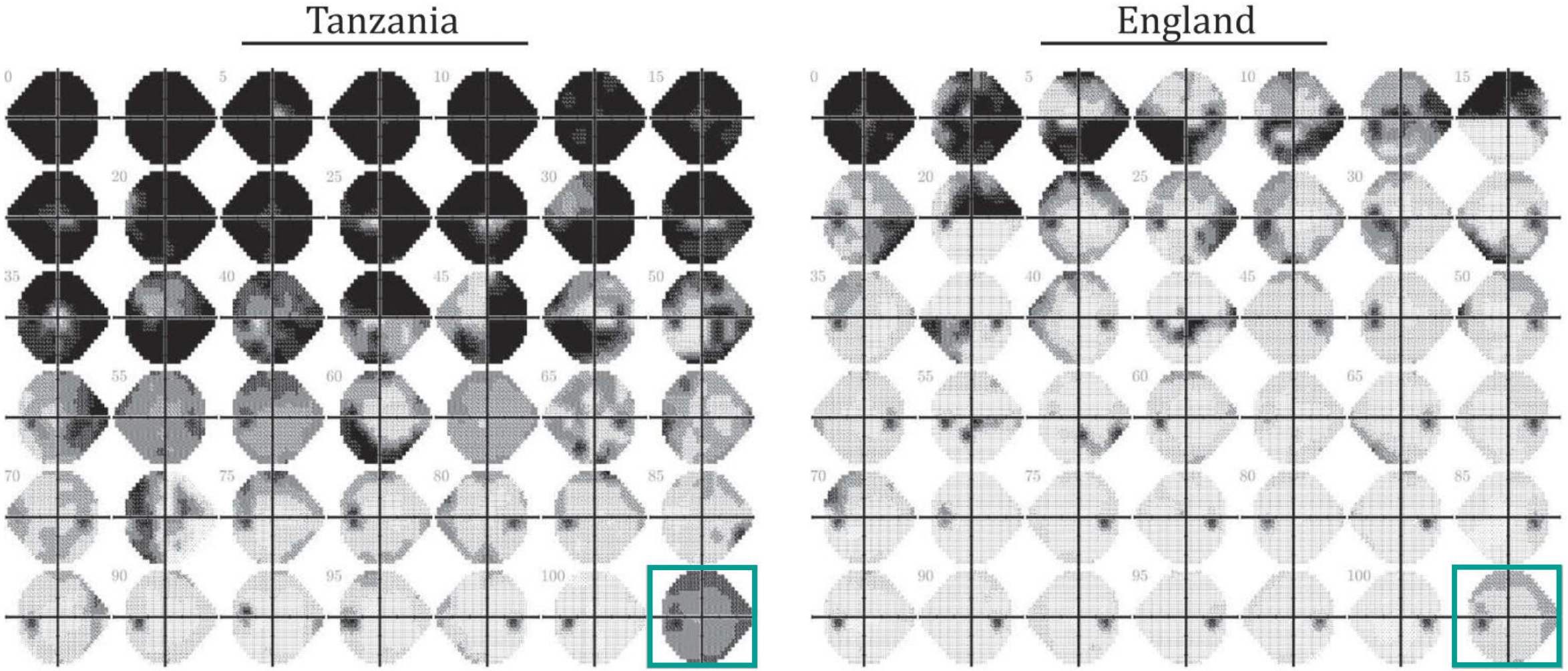
Africans present with blindness



~50% of the African patients were blind (BCVA < 0,05) in at least one eye vs. 16% of the Dutch patients

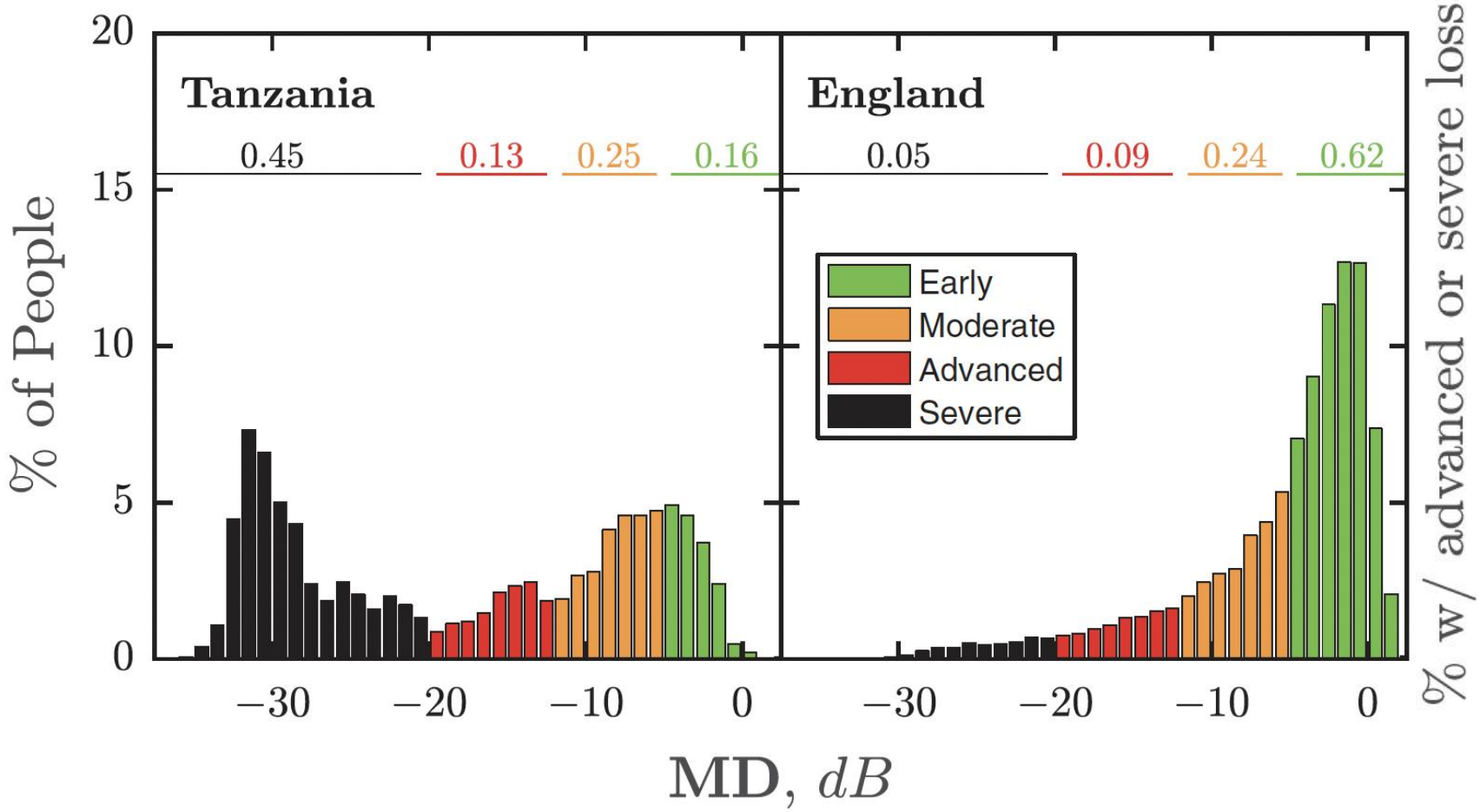
15% of the African patients were blind (BCVA < 0,05) in both eyes vs. 1.7 % of the Dutch patients

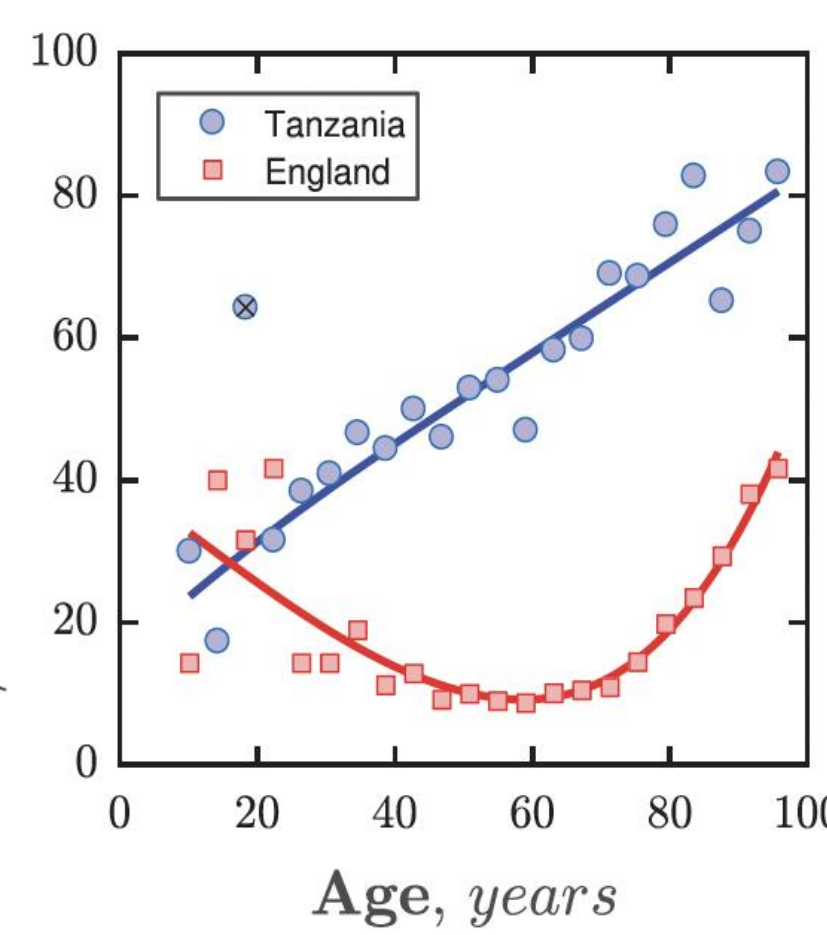
Africans presented with advanced disease



Jones P et al. *Ophthalmic Epidemiology,* 27:1, 10-18

Africans presented with advanced disease





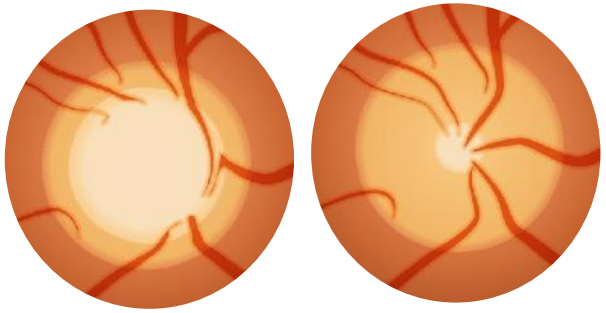
Jones P et al. *Ophthalmic Epidemiology,* 27:1, 10-18

Clinical presentation of POAG in Africans

- Younger age, ca. 6^{e} decade
- Higher IOP, ca. 5-7 mm Hg higher
- Advanced stage, very advanced glaucomatous optic neuropathy
- Blindness as a result of POAG in at least one eye in 50% of patients at first visit at the ophthalmologist

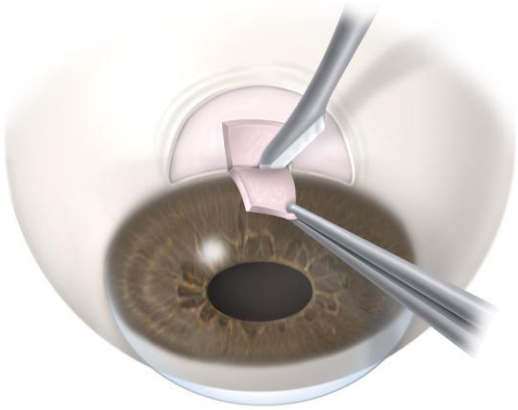








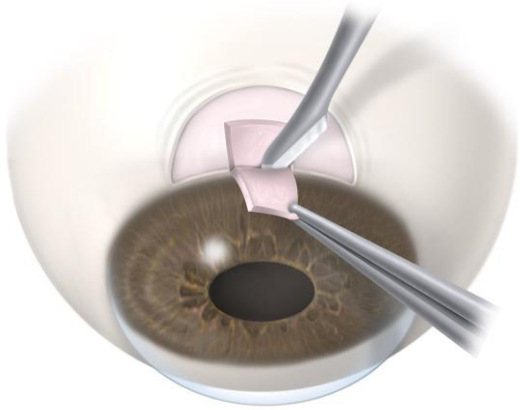
Glaucoma surgery in GIGA



Incidence of trabeculectomy in GIGA study

Tanzanians	0,76 per person year
Black South African	0,11 per person year
Coloured South African	0,06 per person year

Glaucoma surgery in GIGA



Incidence of trabeculectomy in GIGA study

Tanzanians	0,76 per person year
Black South African	0,11 per person year
Coloured South African	0,06 per person year

Median time from presentation to trabeculectomy

Tanzanians	53 days (IQR 18–211)
Black South African	300 days (IQR 105–967)
Coloured South African	314 days (IQR 150–984)

Which factors play a role in the increased risk and higher disease burden of POAG in Africa?



Socioeconomic factors



Genetic factors

Burden of POAG in Africa(ns)



Cultural factors



Ocular factors

Which factors play a role in the increased risk and higher disease burden of POAG in Africa?



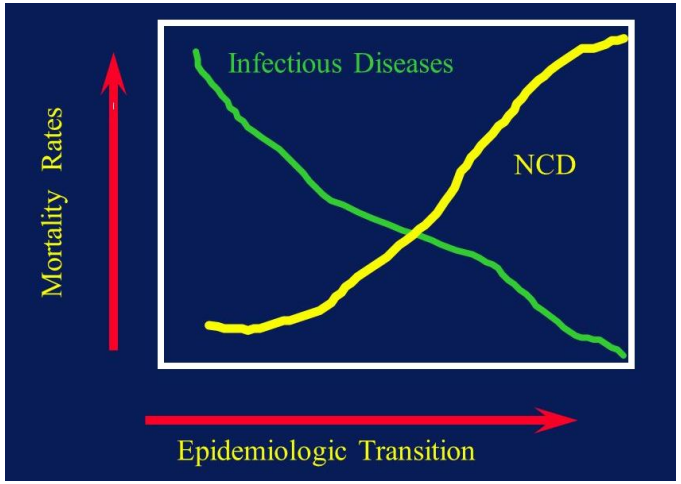
Socioeconomic factors

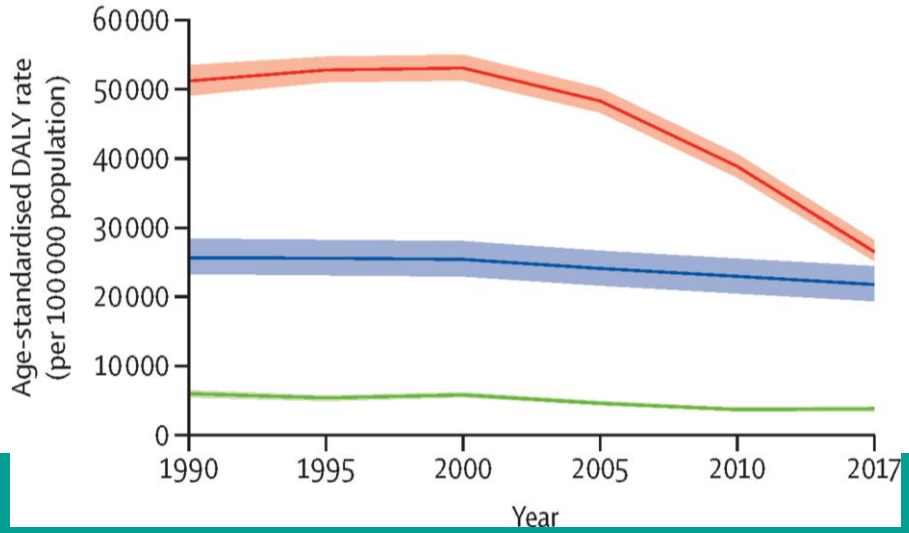
Burden of POAG in Africa(ns)

Epidemiological transition



Socioeconomic factors





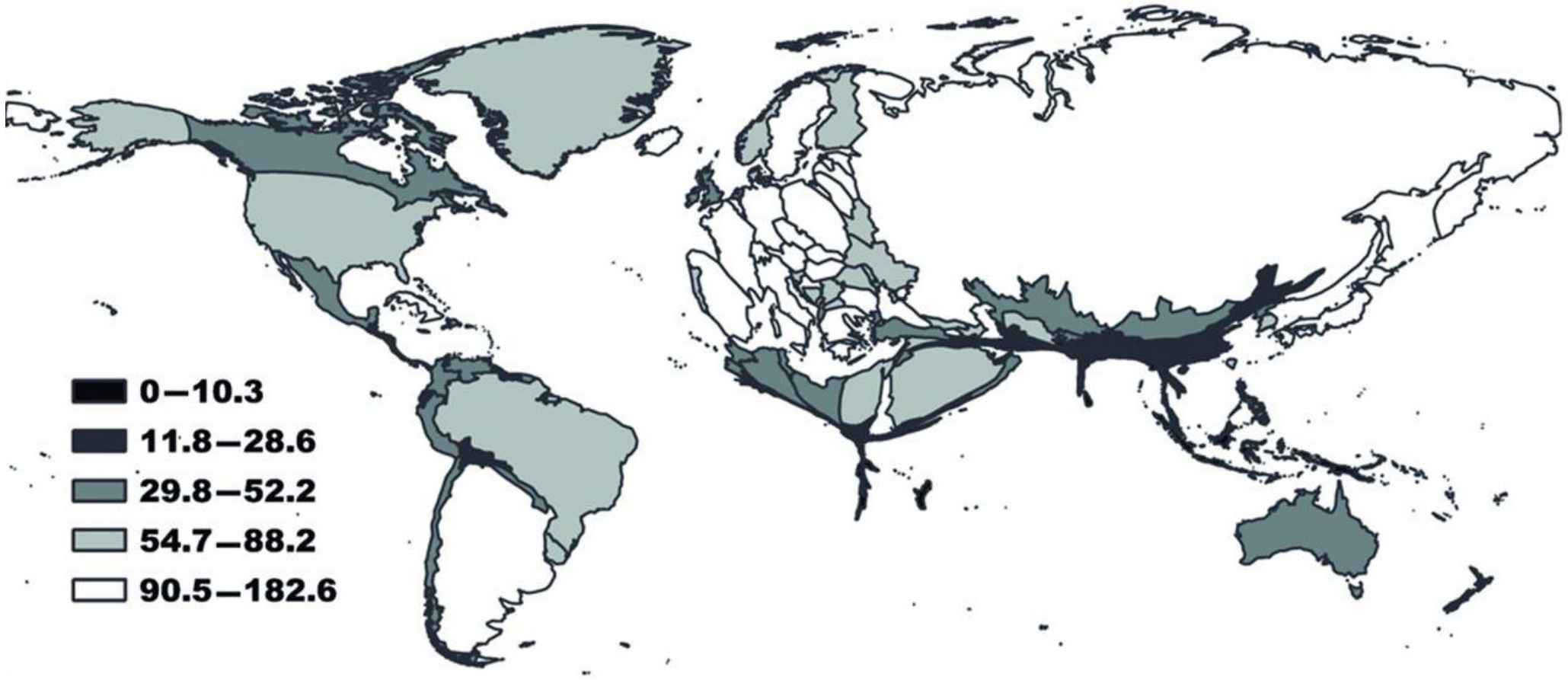
communicable, maternal, neonatal, and nutritional disorders.

non-communicable diseases.

injuries.

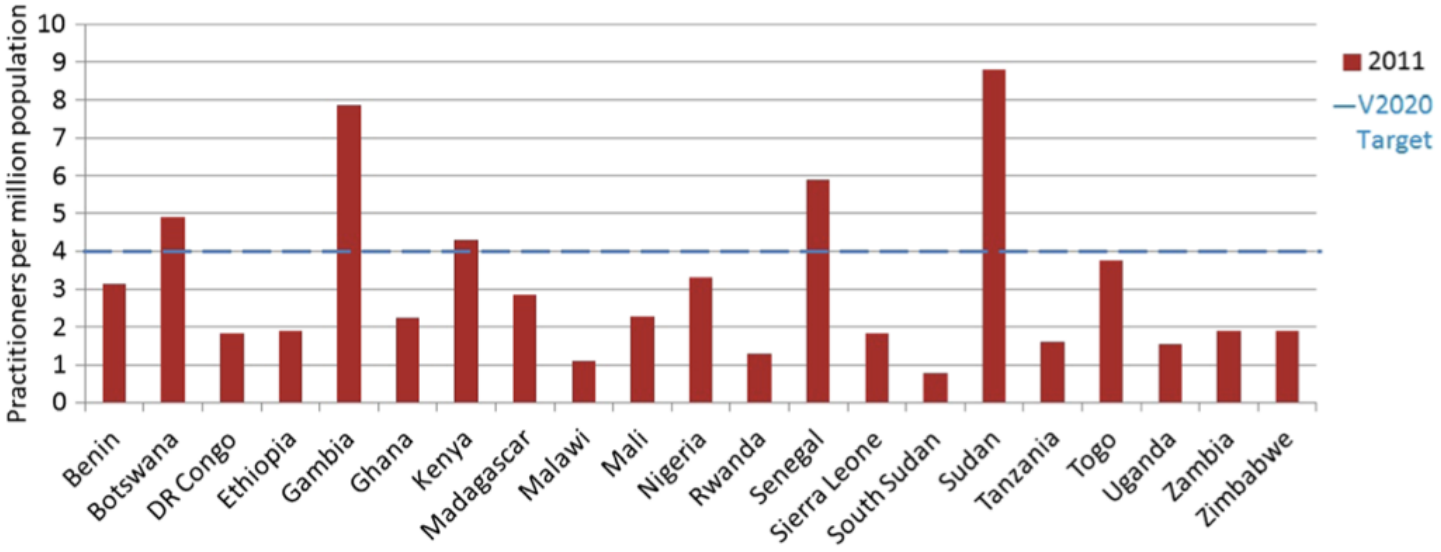
Gouda et al. *Lancet Glob Health*. 2019

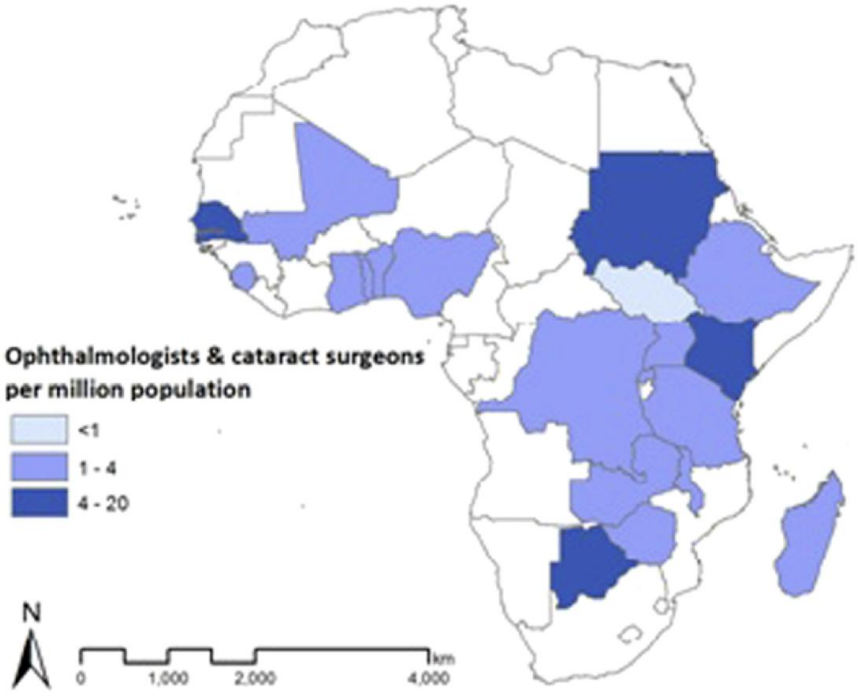
Resources - Ophthalmologists



Resnikhoff et al. *British Journal of Ophthalmology* 2020;104:588-592

Resources - Ophthalmologists





Accessibility

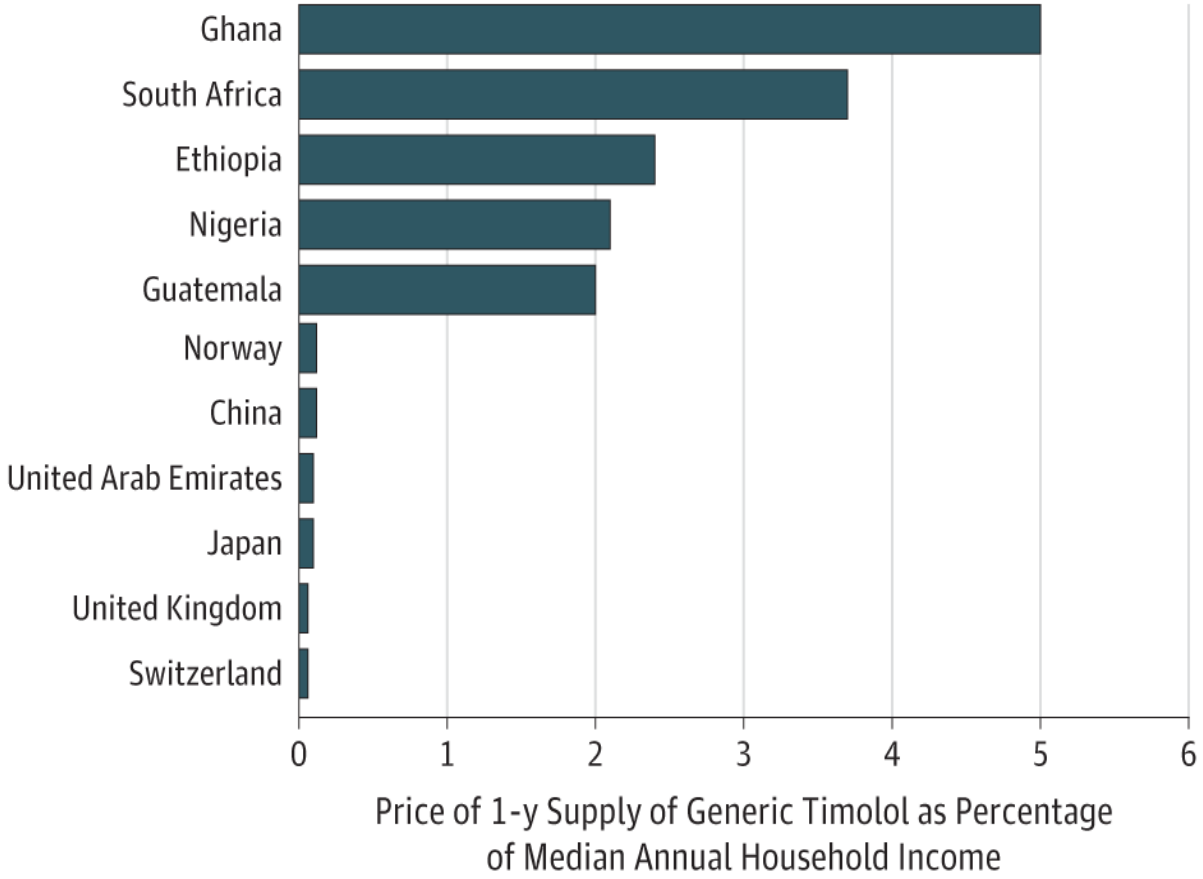
- Most eye care facilities are based in urban regions
- 59% of SSA population lives in rural communities (2020 source worldbank)
- Travel distance to ophthalmic clinics (>150 km on average in Tanzania)

	All N=1214	Western Africa* N=661	Eastern Africa† N=170	Southern Africa‡ N=383
Travel time to site (h), n (%)				
<0.5	150 (12.4)	114 (17.4)	12 (7.1)	24 (6.3)
0.5–<1	378 (31.3)	265 (40.3)	40 (23.5)	73 (19.2)
1–<3	428 (35.4)	220 (33.5)	57 (33.5)	151 (39.6)
3–<8	190 (15.7)	46 (7.0)	26 (15.3)	118 (31.0)
8–<24	42 (3.5)	11 (1.7)	21 (12.4)	10 (2.6)
≥24	20 (1.7)	1 (0.1)	14 (8.2)	5 (1.3)
Travel time to site >3 h	20.9%	8.8%	35.9%	34.9%

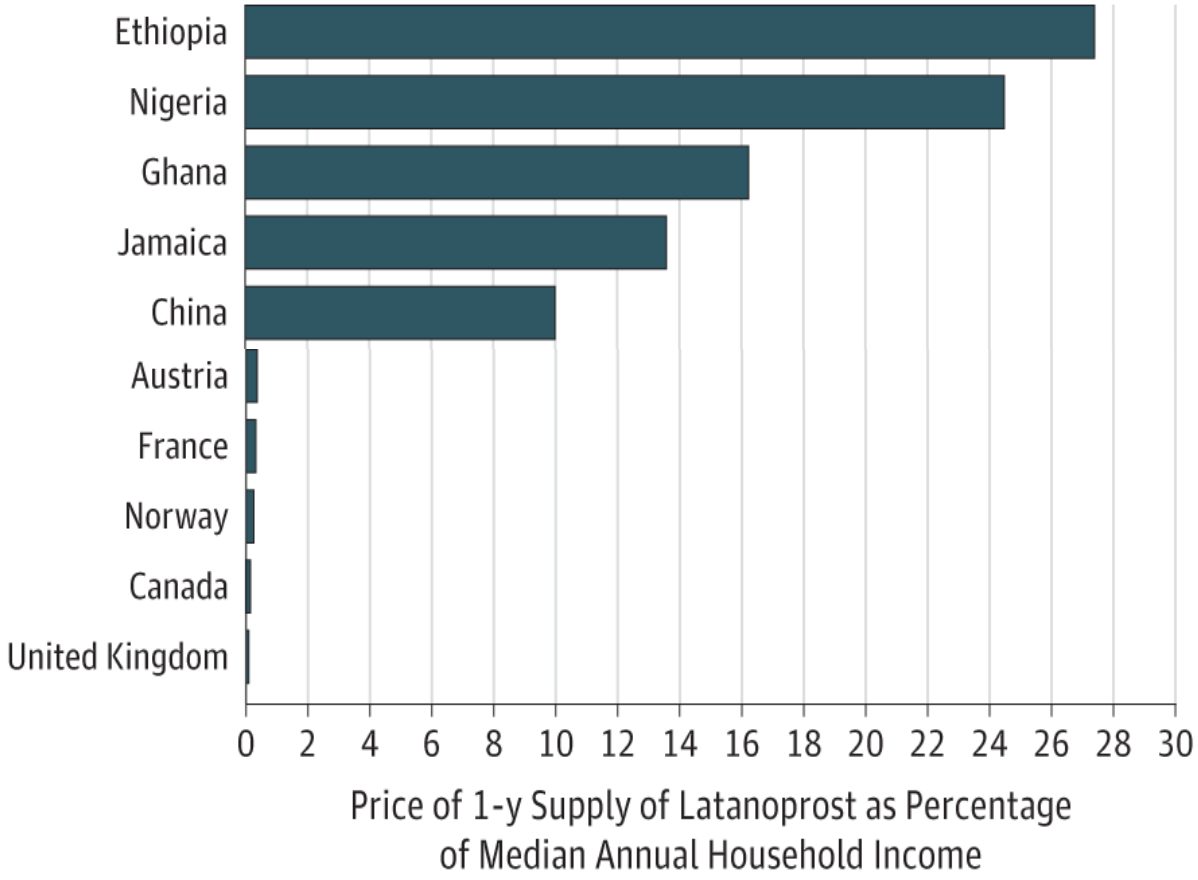
Olawoye et al. *Journal of Glaucoma* 2022, 31(9):p 717-723

Affordabilty – medical treatment

Timolol



Latanoprost



Zhao PY et al. *JAMA Ophthalmol.* 2018;136(11):1271–1279

Costs glaucoma medication

Table 1. Daily Cost in US Dollars of Most Affordable Glaucoma Medication in Each Class by Country

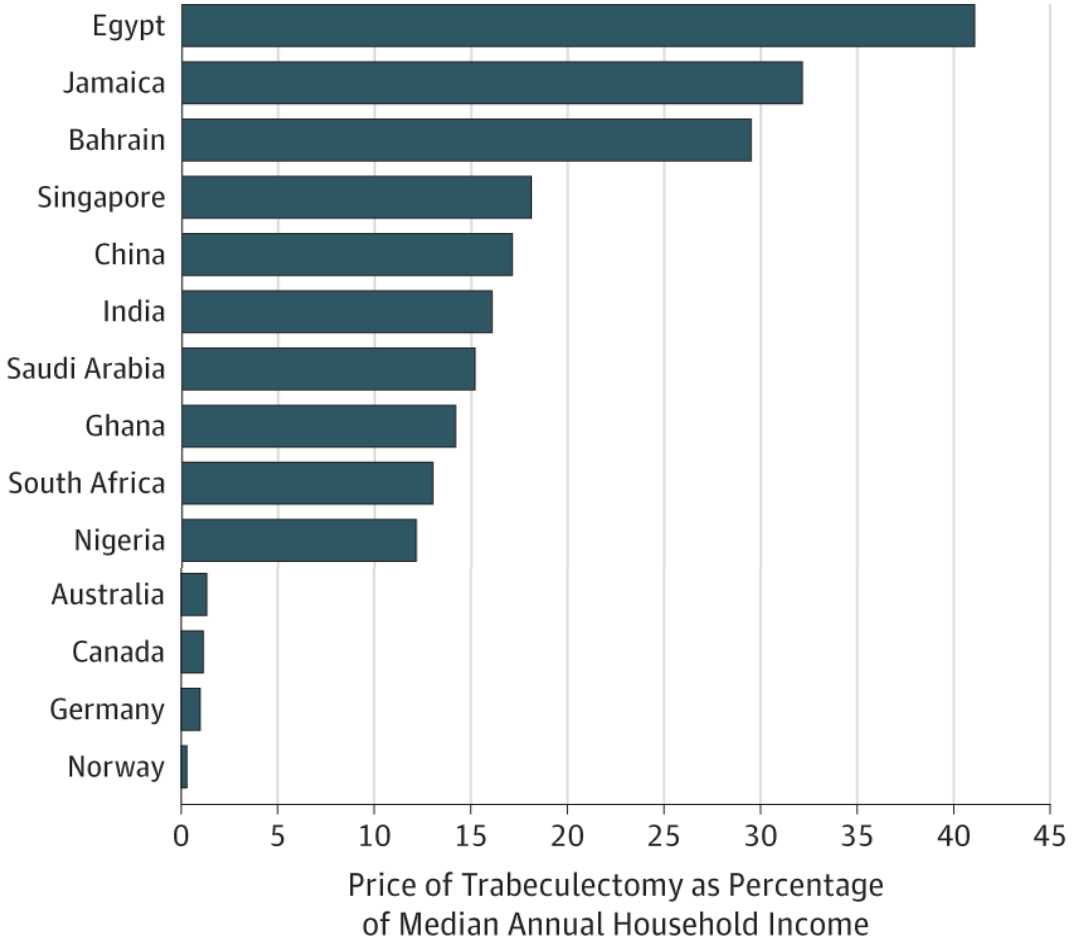
Country	PGA	BB	AA	CAI	BB + PGA[a]	BB + AA[a]	BB + CAI[a]
Europe							
Austria	0.33	0.23	0.25	0.23	0.58	0.45	0.66
France	0.27	0.26	0.21	0.26	0.34	0.74	0.33
Germany	0.81	0.53	NA	0.89	1.08	NA	1.02
Greece	0.38	0.20	0.38	0.38	0.43	0.59	0.46
Italy	0.32	0.09	0.57	0.25	0.43	0.78	0.32
Lithuania	0.52	0.17	0.49	0.41	0.70	0.97	0.57
Norway	0.32	0.18	0.37	0.42	0.31	0.53	0.48
Russia	1.76	0.09	0.98	0.58	NA	NA	1.40
Spain	0.54	0.18	0.36	0.25	0.44	0.84	0.60
Switzerland	0.57	0.19	0.73	0.59	0.85	1.01	0.84
Turkey	0.38	0.13	1.50	0.17	0.48	0.69	0.36
United Kingdom	0.08	0.05	0.09	0.10	0.11	0.47	0.12
Africa							
Egypt	x 20	x 6	x 11	x 6	x 27	x 2.5	x 12
Ethiopia	1.22	0.10	0.87	1.02	NA	NA	NA
Ghana	1.61	0.28	1.02	0.59	3.01	1.14	1.41
Nigeria	2.63	0.42	NA	2.46	NA	NA	NA
South Africa	1.32	0.52	1.43	1.01	1.49	1.68	1.62

Abbreviations: AA, α-agonist; BB, topical β-blocker; CAI, topical carbonic anhydrase inhibitor; NA, not available; PGA, prostaglandin analog.

[a] Fixed-dose combination medications.

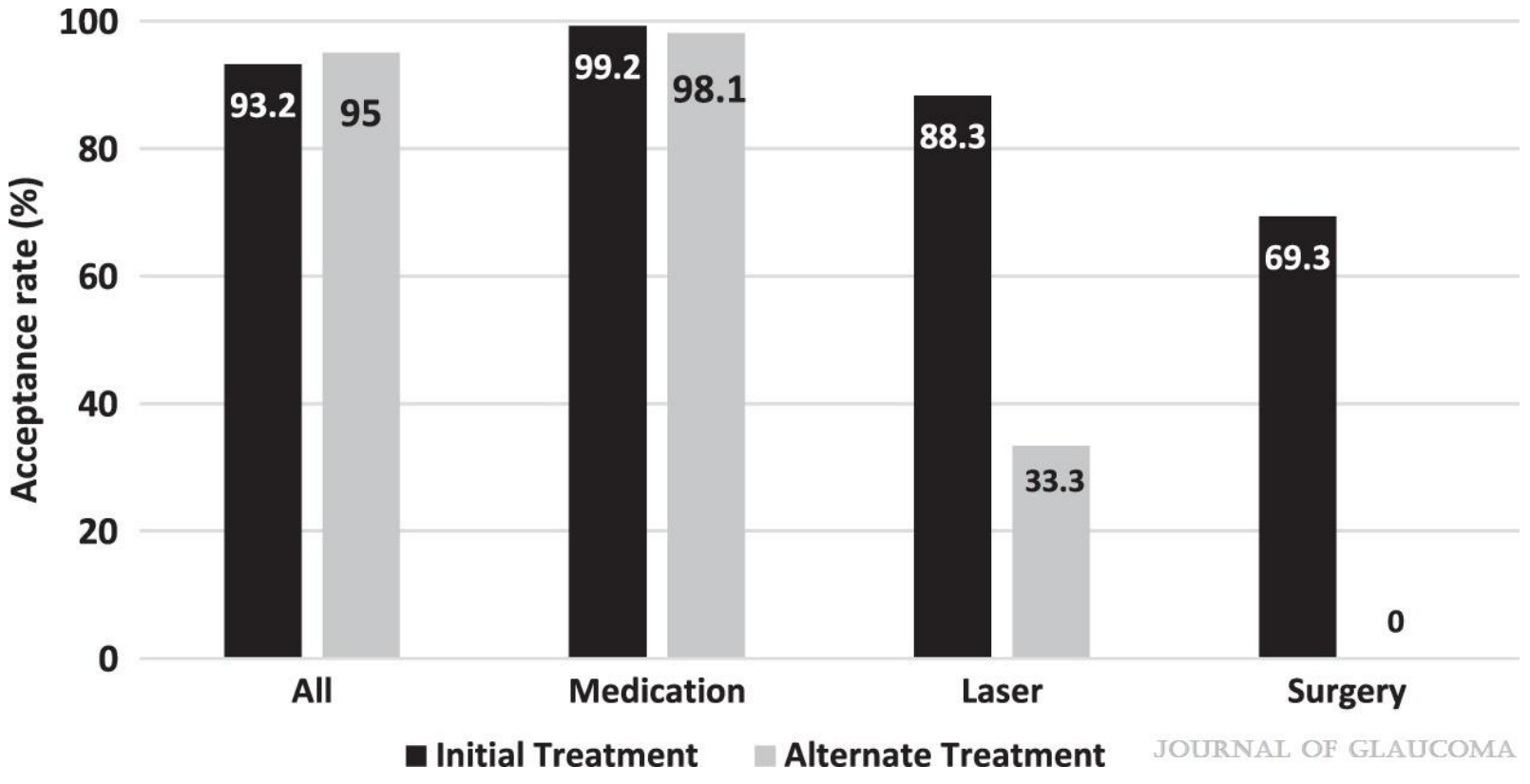
Zhao PY et al. *JAMA Ophthalmol.* 2018;136(11):1271–1279

Affordabilty – trabeculectomy



Zhao PY et al. *JAMA Ophthalmol.* 2018;136(11):1271–1279

Acceptance of treatment



Olawoye et al. Journal of Glaucoma 33(12):p 951-956

Reasons for declining treatment

TABLE 2 - Reasons for Declining Initial Recommended Therapy

	Initial therapy offered			
	All	**Meds**	**Laser**	**Surgery**
No. eyes (%)	2282 (100)	1624 (71.2)	309 (13.5)	349 (15.3)
No. eyes declining initial treatment, (%)	156 (100)	13 (0.8)	36 (11.7)	107 (30.7)
Reason(s)* for declining, n (%)				
Fear	67 (42.9)	0 (0)	6 (16.7)	61 (57.0)
Cost	65 (41.7)	8 (61.5)	22 (61.1)	35 (32.7)
Family member disagrees with treatment	16 (10.3)	0 (0)	7 (19.4)	9 (8.4)
Belief treatment will do no good	11 (7.1)	1 (7.7)	1 (2.8)	9 (8.4)
Belief treatment not needed	6 (3.8)	4 (30.8)	1 (2.8)	1 (0.9)
Other	33 (21.2)	0 (0)	6 (16.7)	27 (25.2)

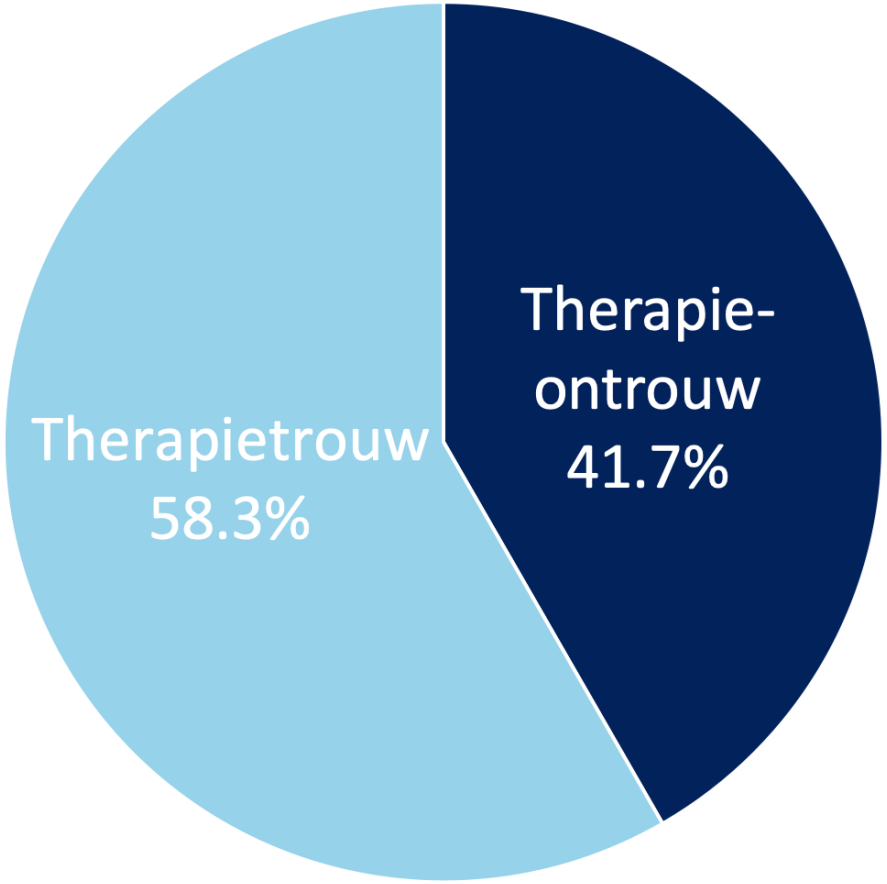
*Multiple reasons were permitted.

Olawoye et al. *Journal of Glaucoma* 33(12):p 951-956

Therapietrouw in Ghana

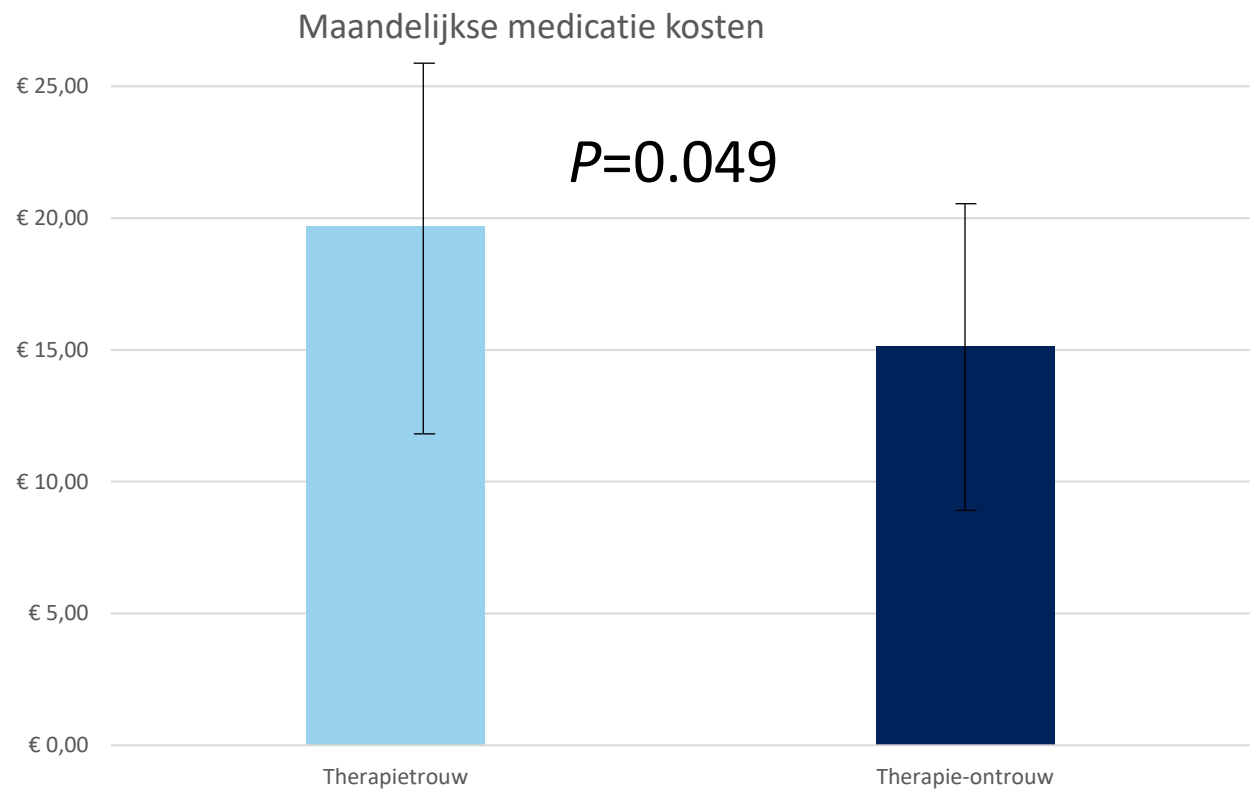
Simplified Medication Adherence Questionnaire (SMAQ)

1. Do you ever forget to take your glaucoma medication?	**Yes/No**
2. Are you careless about taking your glaucoma medication?	**Yes/No**
3. If at times you feel worse, do you stop taking your medication?	**Yes/No**
4. Did you forget to take your medication over the last weekend?	**Yes/No**
5. How many doses have you missed in the last week?	**None**
	1 – 2
	3 – 5
	6 – 10
	> 10
6. Over the past 3 months, how many days did you not take your medication?	**Days: …**



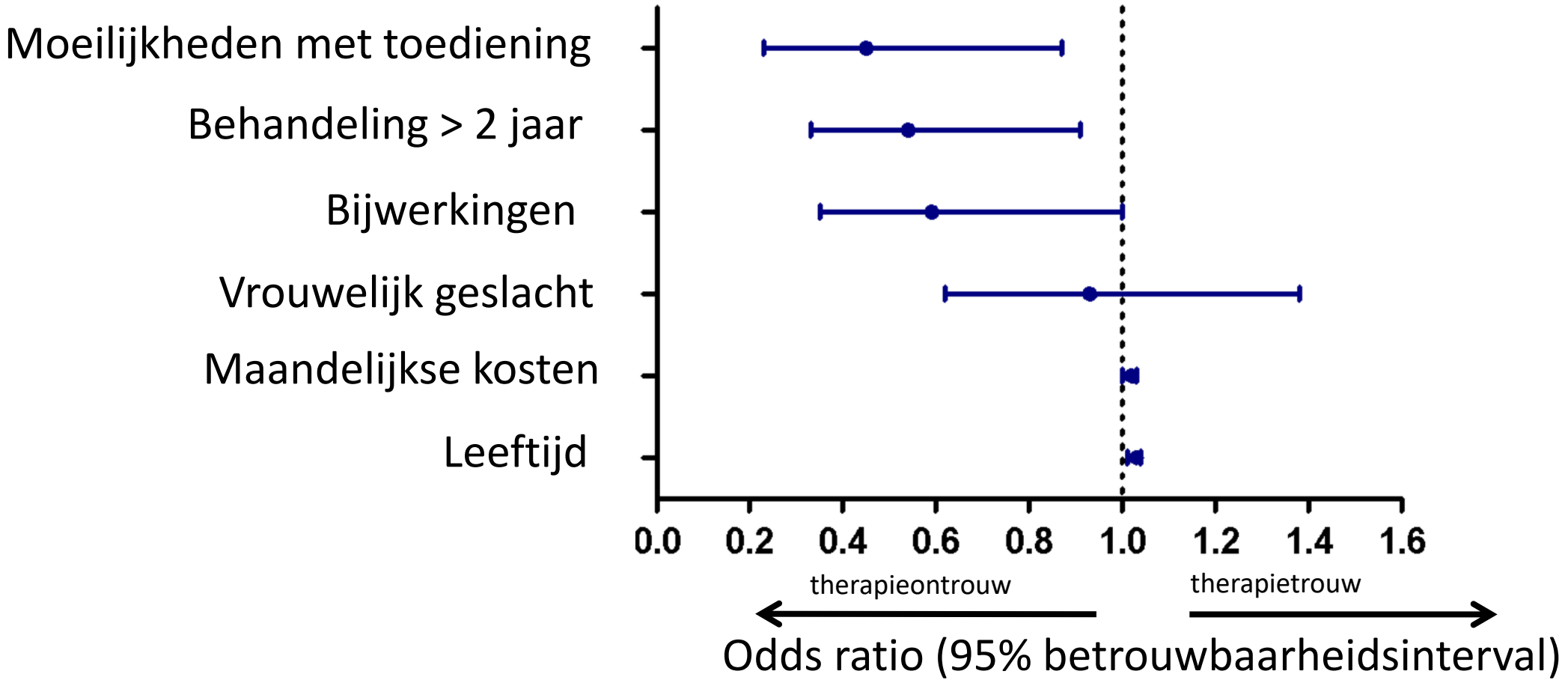
Driessen et al. submitted

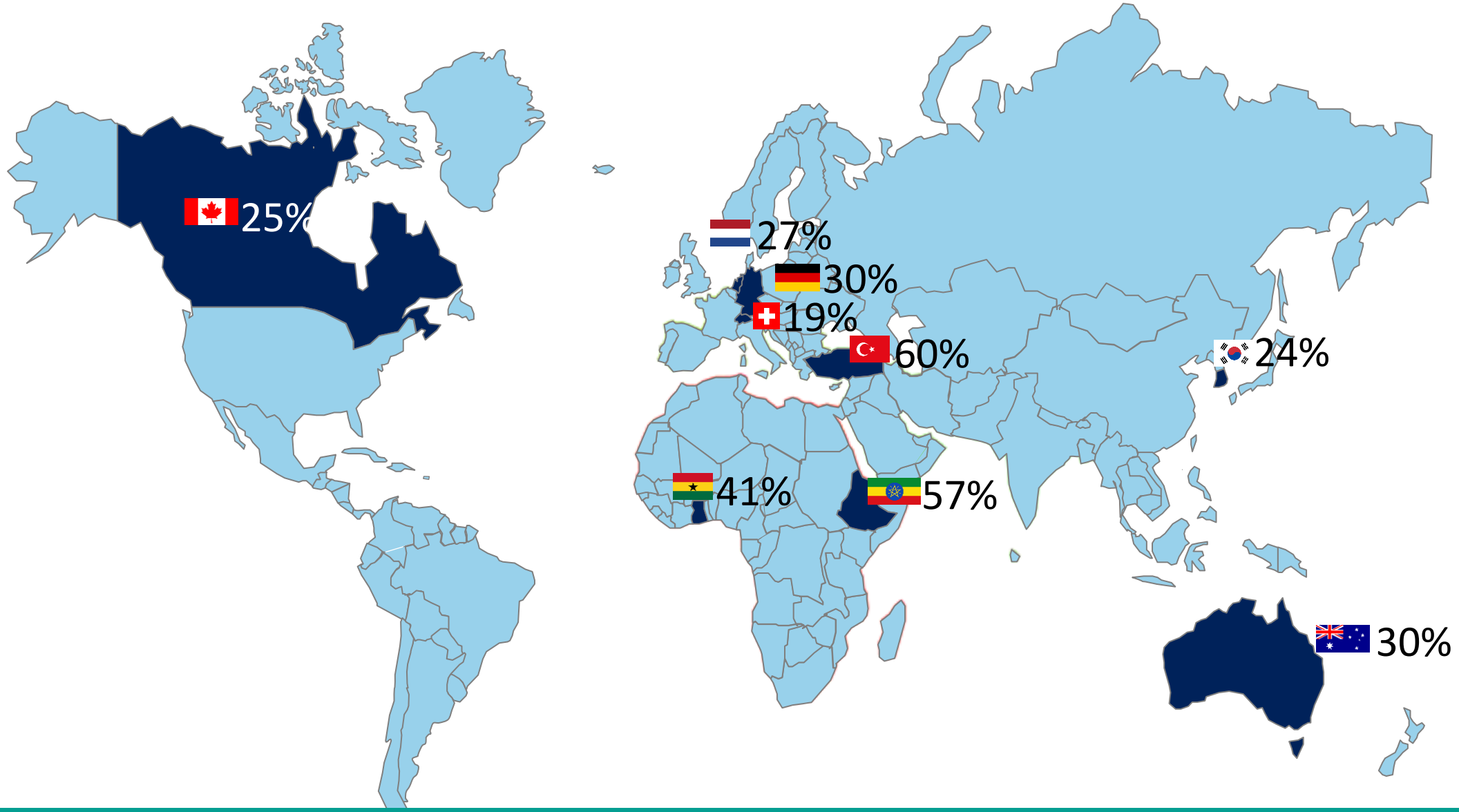
Therapietrouw in Ghana



Driessen et al. submitted

Factoren geassocieerd met therapietrouw




25%
27%
30%
19%
60%
24%
41%
57%
30%

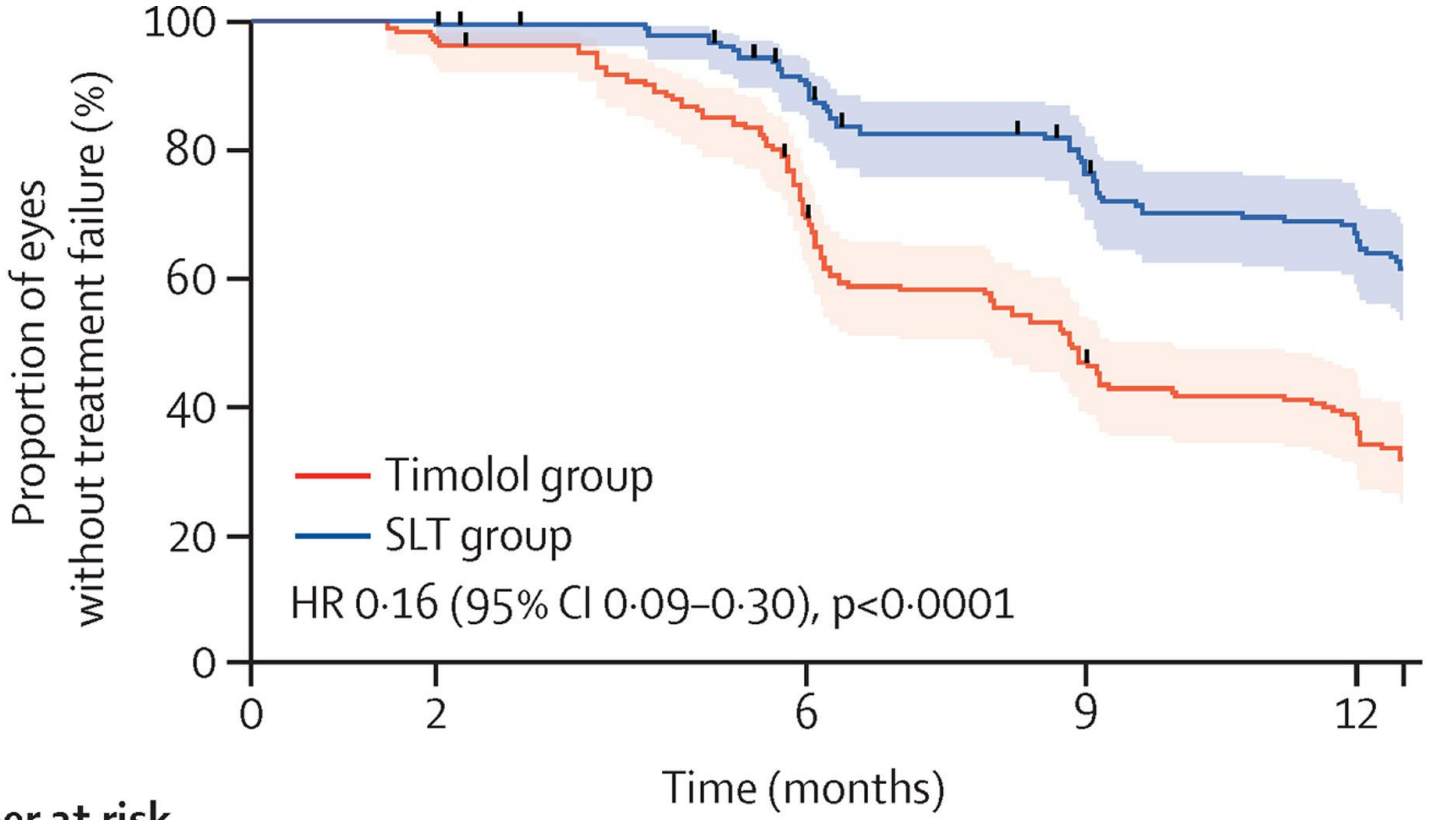
Selectieve Laser Trabeculoplasty

Articles

Selective laser trabeculoplasty versus 0·5% timolol eye drops for the treatment of glaucoma in Tanzania: a randomised controlled trial

Heiko Philippin, Einoti Matayan, Karin M Knoll, Edith Macha, Sia Mbishi, Andrew Makupa, Cristóvão Matsinhe, Vasco da Gama, Mario Monjane, Awum Joyce Ncheda, Francisco Alcides Mulobuana, Elisante Muna, Nelly Fopoussi, Gus Gazzard, Ana Patricia Marques, Peter Shah, David Macleod, William U Makupa, Matthew J Burton





Number at risk

Timolol group	182	(5)	177	(49)	125	(41)	83	(26)	55
SLT group	181	(0)	181	(16)	154	(21)	127	(27)	99

Philippin et al. *Lancet Glob Health* 2021; 9: e1589–99

Which factors play a role in the increased risk and higher disease burden of POAG in Africa?



Socioeconomic factors



Cultural factors

Burden of POAG in Africa(ns)

Traditional healer

- Trusted/ respected
- Accesible
- Causes delay
- Causes harm

"Glaucoma and cataract are like younger and older brothers. They are caused by the bite of flies known as 'fuleria'. Once bitten by the carrier fly, a person is afflicted by the ailment and can carry the germ for up to 3 years or 4 years or sometimes for up to 5 years before it affects the mucus of the eye....once it starts the poison now changes the mucus to something like groundnut oil and becomes a cataract. If it is becoming glaucoma it doesn't separate - it mixes to look like engine oil that has lasted too long in a motorcycle then it liquefies." *IDI01–1*

Which factors play a role in the increased risk and higher disease burden of POAG in Africa?



Socioeconomic factors



Genetic factors

Burden of POAG in Africa(ns)



Cultural factors



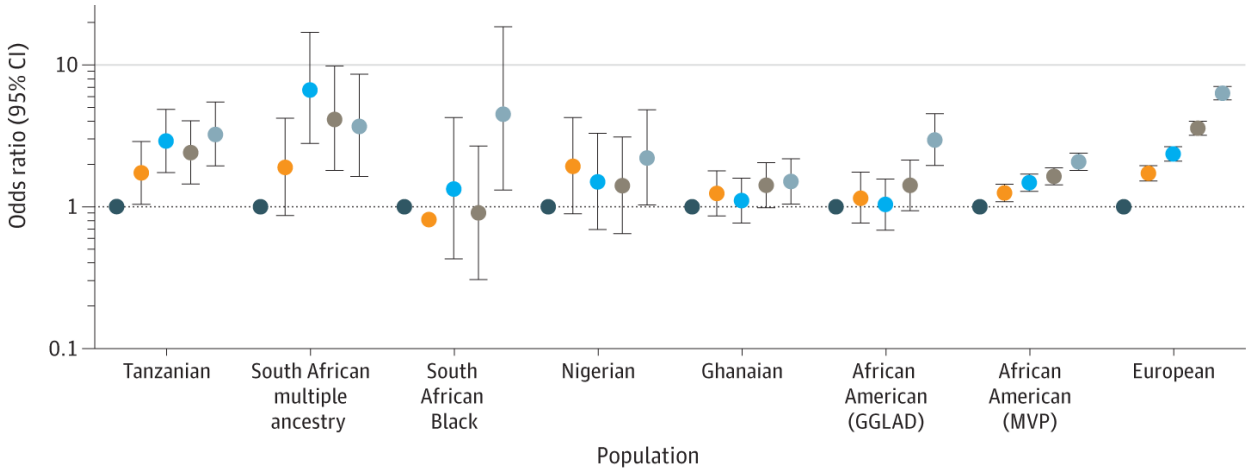
Ocular factors

Genetics – Polygenic Risk score performance

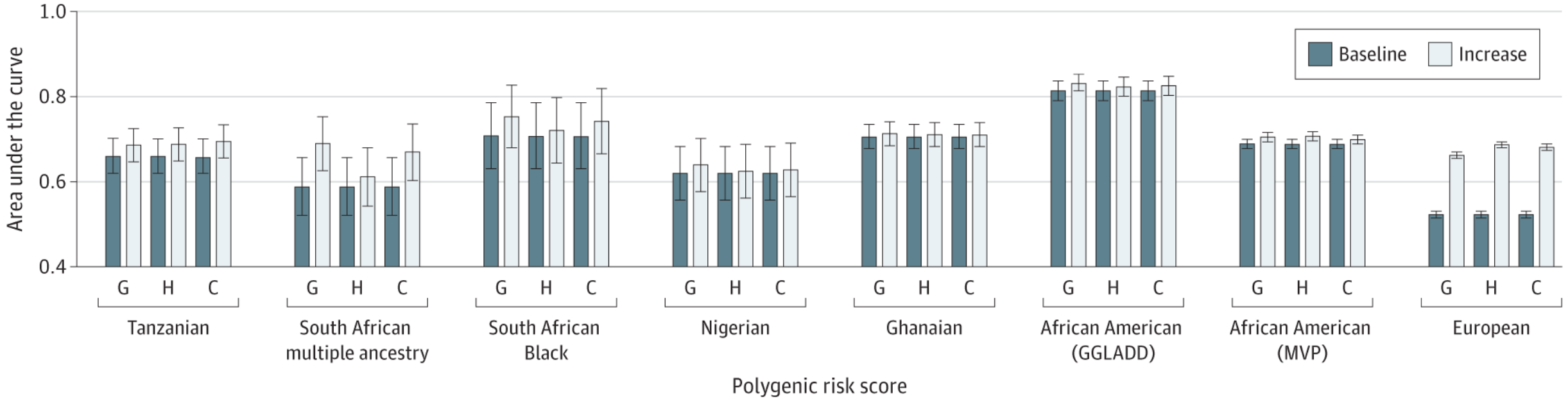
JAMA Ophthalmology | **Original Investigation**

Performance of Polygenic Risk Scores for Primary Open-Angle Glaucoma in Populations of African Descent

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Genetics – Polygenic Risk score performance



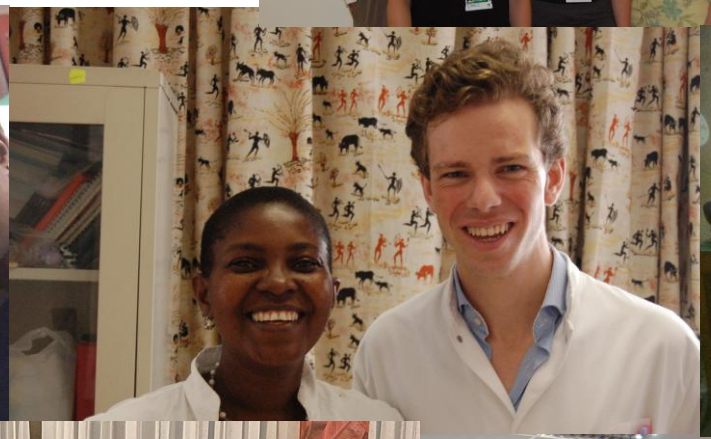
Conclusions

- Glaucoma in sub-Saharan Africans presents with a more progressive and destructive disease course
- Glaucoma is a major public health problem in SSA
- Combination of socioeconomic and behavioral factors in SSA contribute to the complexity of detection and managing POAG
- Raising awarness among sub-Saharan Africans is a challenge

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