The Progression of Hypertension and CVD Risk Factors in Africa

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THE LANCET

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BLOOD PRESSURE IN THE AFRICAN NATIVE.: ITS BEARING UPON THE ÆTIOLOGY OF HYPERPIESIA AND ARTERIO-SCLEROSIS

C.P. Donnison, M.B., B.S. LOND. (LATE MEDICAL OFFICER, EAST AFRICAN MEDICAL SERVICE.)

BLOOD PRESSURE IN THE AFRICAN NATIVE.

ITS BEARING UPON THE ÆTIOLOGY OF HYPERPIESIA AND ARTERIO-SCLEROSIS.

By C. P. DONNISON, M.B., B.S. Lond.,

LATE MEDICAL OFFICER, EAST AFRICAN MEDICAL SERVICE.

The investigations recorded here were all carried out on natives living in one of the largest of the native reserves in Kenya Colony—namely, South Kavirondo, situated on the shores of Lake Victoria Nyanza. These natives live under primitive conditions, that is, under conditions which have probably undergone no appreciable change for many centuries. They have

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A series of 1000 examinations was made in apparently healthy male natives of all ages, ranging from 15 years to about 70 or 80 years.

Age group.	Cases examined.	Aver. pulse-rate.	Blood pressure.		
			Aver. syst.	Aver. diast.	Aver. diff.
15–19	99	68·71	123·07	81·89	41·18
20–24	100	63·22	122·76		
25–29	100	63·57	126·37		
30–34	115	64·55	126·05		
35–39	100	69·46	125·55		
40–44	93	68·52	118·32		
45–49	96	69·17	113·19		
50–54	100	72·20	109·79		
55–59	100	70·73	106·59		
60 and over	97	75·23	105·76		

Collected Year 2005

N	Heart rate	SBP (mmHg)
120	69.8	126.8
129	69.3	129.5
138	72.5	132.3
108	70.0	136.4
100	70.7	141.8
143	68.2	146.5

National, regional, and global trends in systolic blood pressure since 1980: systematic analysis of health examination surveys and epidemiological studies with 786 country-years and 5·4 million participants

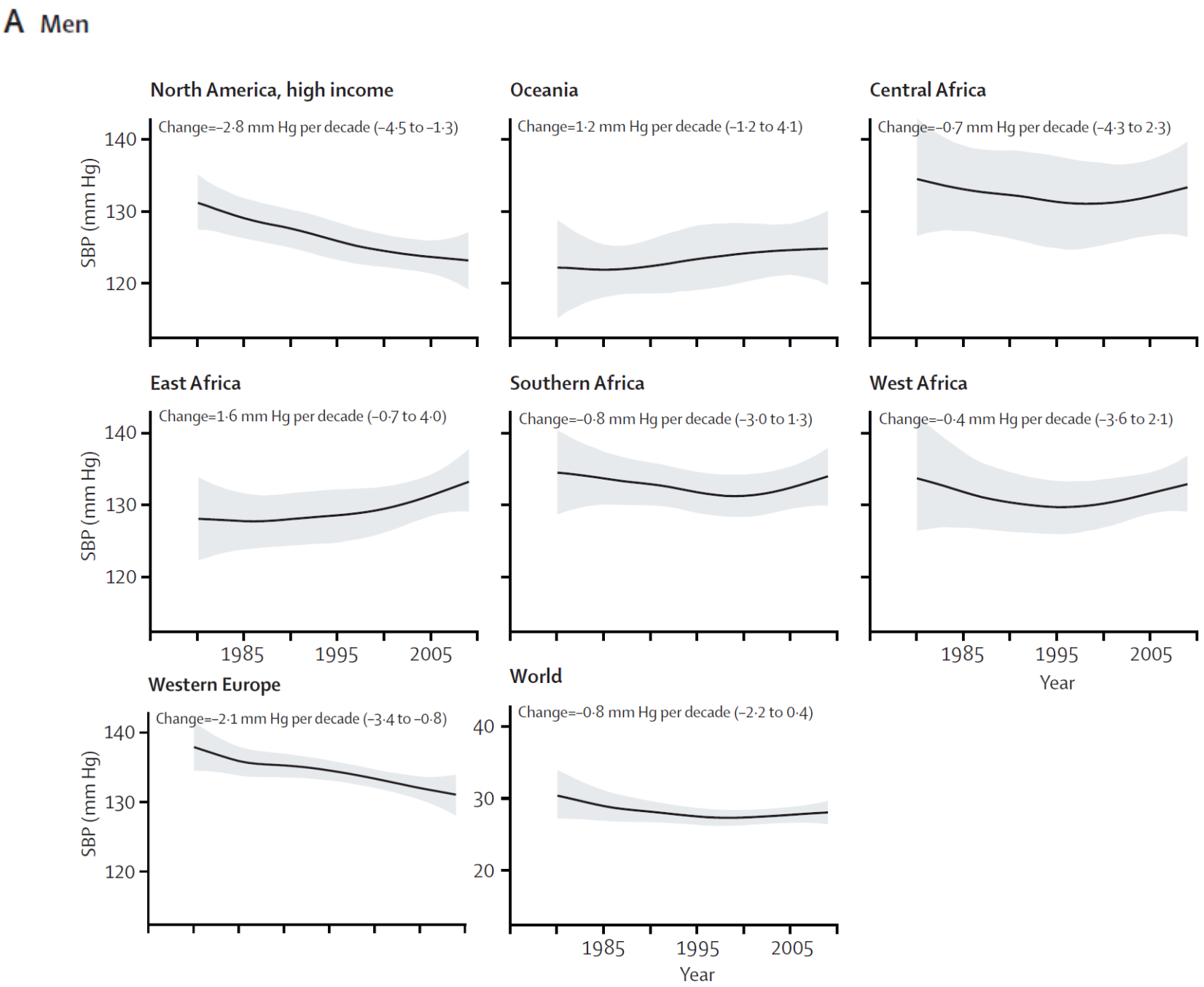
Goodarz Danaei, Mariel M Finucane*, John K Lin*, Gitanjali M Singh*, Christopher J Paciorek, Melanie J Cowan, Farshad Farzadfar, Gretchen A Stevens, Stephen S Lim, Leanne M Riley, Majid Ezzati, on behalf of the Global Burden of Metabolic Risk Factors of Chronic Diseases Collaborating Group (Blood Pressure)†*

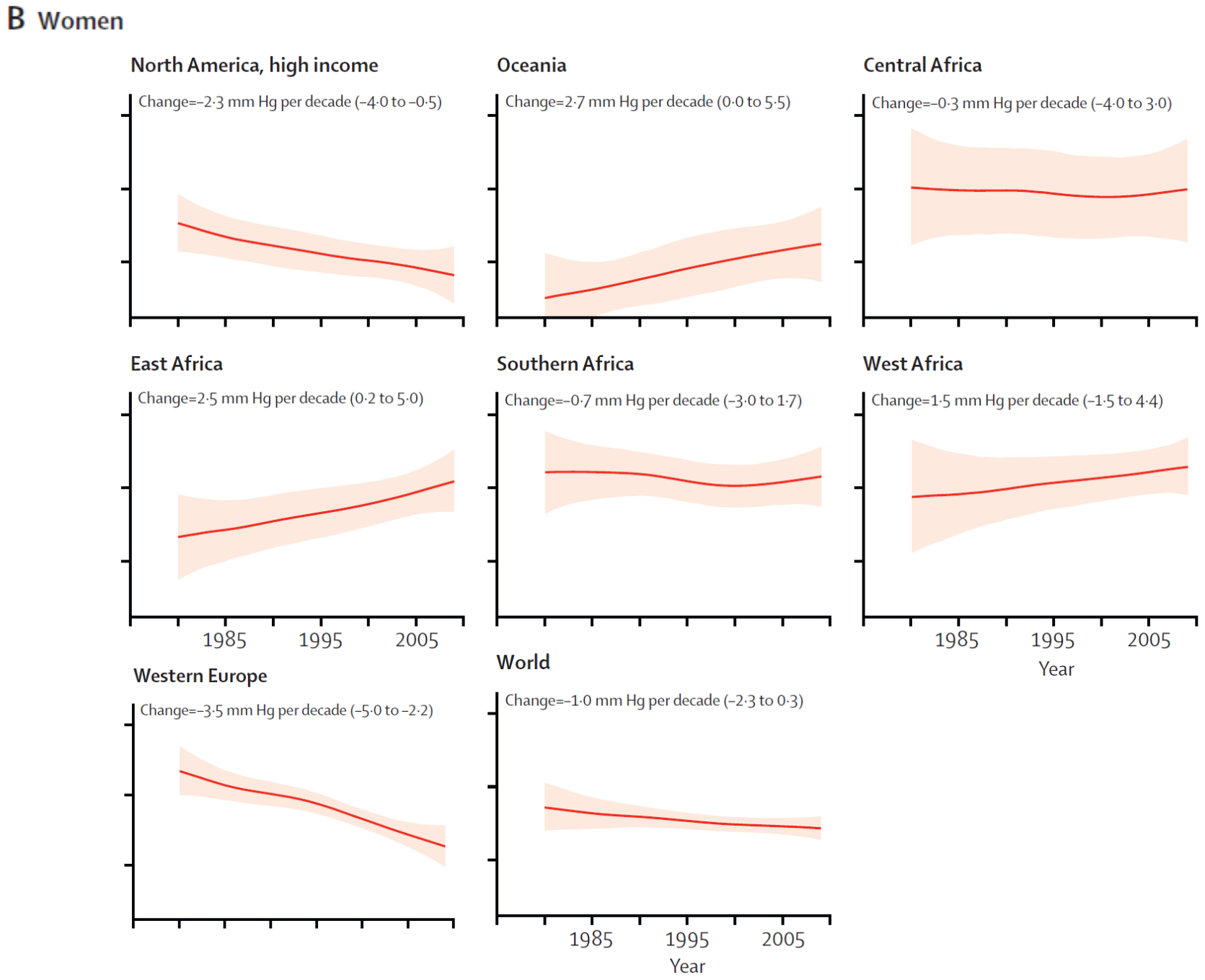
Lancet 2011; 377: 568–77
Published Online February 4, 2011
DOI:10.1016/S0140-6736(10)62036-3

Summary

Background Data for trends in blood pressure are needed to understand the effects of its dietary, lifestyle, and pharmacological determinants; set intervention priorities; and evaluate national programmes. However, few worldwide analyses of trends in blood pressure have been done. We estimated worldwide trends in population mean systolic blood pressure (SBP).

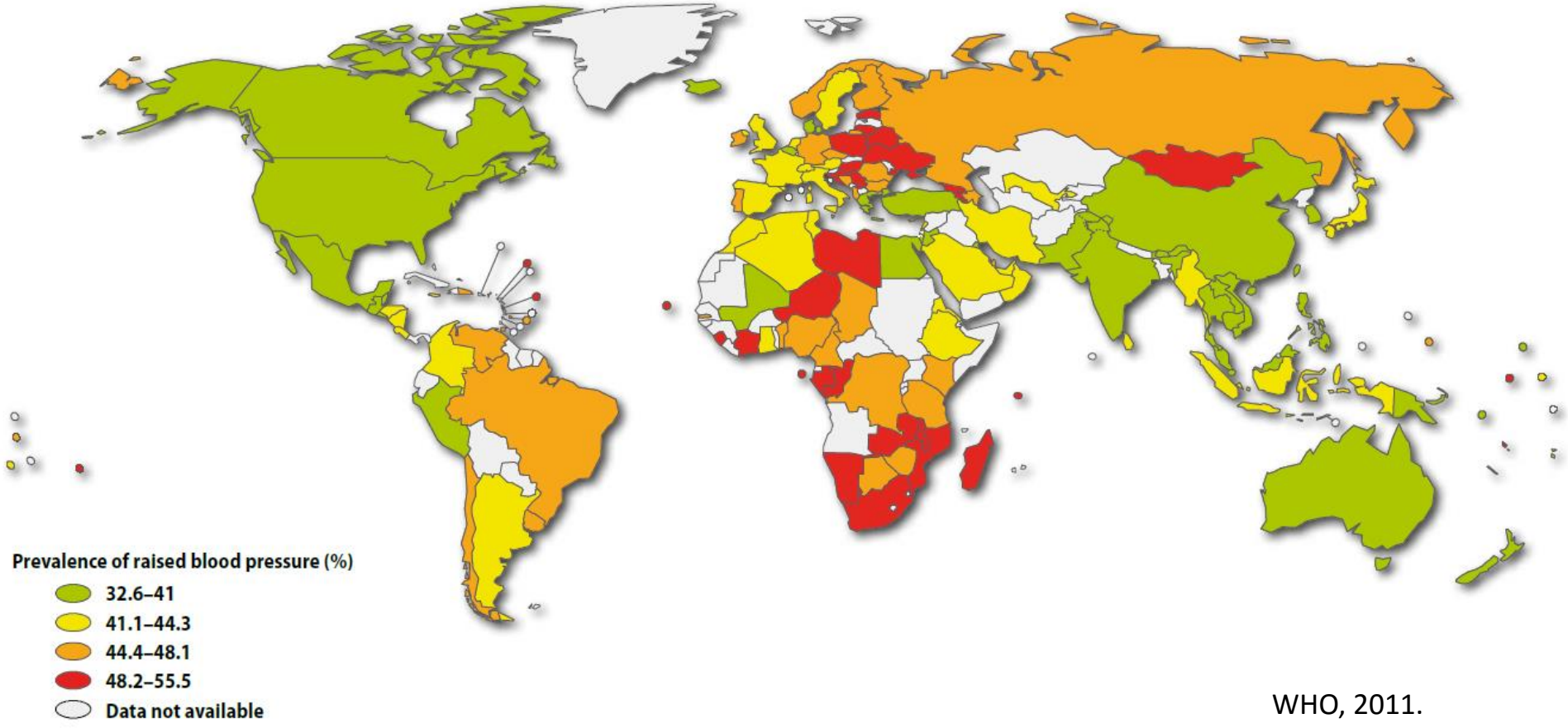
Interpretation On average, global population SBP decreased slightly since 1980, but trends varied significantly across regions and countries. SBP is currently highest in low-income and middle-income countries. Effective population-based and personal interventions should be targeted towards low-income and middle-income countries.


A Men
North America, high income
Change=−2·8 mm Hg per decade (−4·5 to −1·3)
Oceania
Change=1·2 mm Hg per decade (−1·2 to 4·1)
Central Africa
Change=−0·7 mm Hg per decade (−4·3 to 2·3)
East Africa
Change=1·6 mm Hg per decade (−0·7 to 4·0)
Southern Africa
Change=−0·8 mm Hg per decade (−3·0 to 1·3)
West Africa
Change=−0·4 mm Hg per decade (−3·6 to 2·1)
Western Europe
Change=−2·1 mm Hg per decade (−3·4 to −0·8)
World
Change=−0·8 mm Hg per decade (−2·2 to 0·4)
SBP (mm Hg)
140
130
120
40
30
20
1985
1995
2005
Year


B Women
North America, high income
Change=−2·3 mm Hg per decade (−4·0 to −0·5)
Oceania
Change=2·7 mm Hg per decade (0·0 to 5·5)
Central Africa
Change=−0·3 mm Hg per decade (−4·0 to 3·0)
East Africa
Change=2·5 mm Hg per decade (0·2 to 5·0)
Southern Africa
Change=−0·7 mm Hg per decade (−3·0 to 1·7)
West Africa
Change=1·5 mm Hg per decade (−1·5 to 4·4)
1985
1995
2005
Year
Western Europe
Change=−3·5 mm Hg per decade (−5·0 to −2·2)
World
Change=−1·0 mm Hg per decade (−2·3 to 0·3)
1985
1995
2005
Year

Background

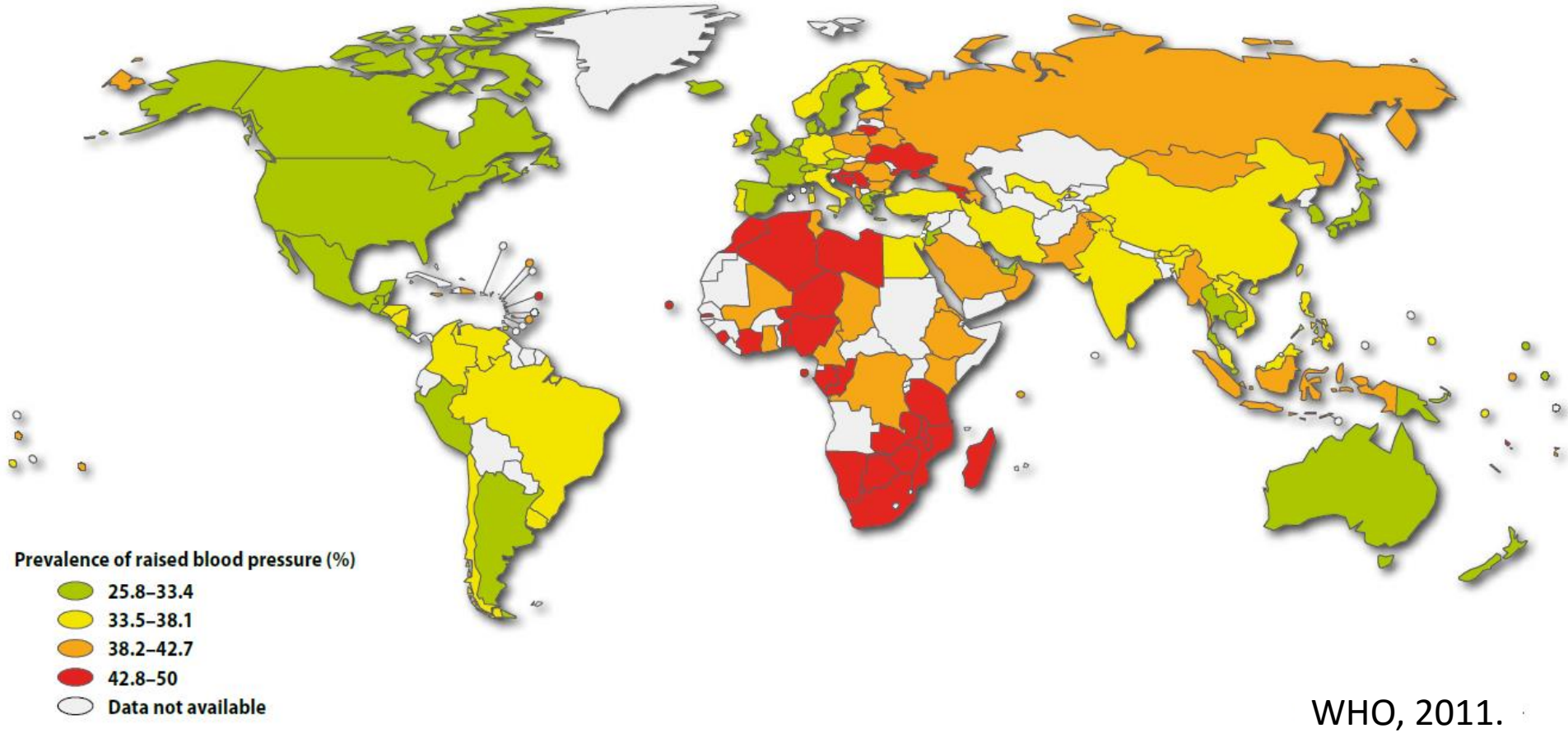
Prevalence of hypertension in MEN (aged >25 yrs)



WHO, 2011.

Background

Prevalence of hypertension in WOMEN (aged >25 yrs)



WHO, 2011.

Published by Oxford University Press on behalf of the International Epidemiological Association. *International Journal of Epidemiology* 2014;**43**:116–128
© The Author 2014. Advance Access publication 6 February 2014 doi:10.1093/ije/dyt215

CARDIOVASCULAR DISEASE

Hypertension among older adults in low- and middle-income countries: prevalence, awareness and control

Peter Lloyd-Sherlock,[1]* John Beard,[2] Nadia Minicuci,[3] Shah Ebrahim[4] and Somnath Chatterji[5]

[1]School of International Development, University of East Anglia, Norwich, UK, [2]Department of Ageing and Life Course, World Health Organization, Geneva, Switzerland [3]National Research Council, Institute of Neuroscience, Padova, Italy, [4]London School of Hygiene and Tropical Medicine, London, UK and [5]Department of Health Statistics and Informatics, World Health Organization, Geneva, Switzerland

Background This study uses data from the World Health Organization's Study on Global Ageing and Adult Health (SAGE) to examine patterns of hypertension prevalence, awareness, treatment and control for people aged 50 years and over in China, Ghana, India, Mexico, the Russian Federation and South Africa.

Published by Oxford University Press on behalf of the International Epidemiological Association. *International Journal of Epidemiology* 2014;**43**:116–128
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[1]School of International Development, University of East Anglia, Norwich, UK, [2]Department of Ageing and Life Course, World Health Organization, Geneva, Switzerland [3]National Research Council, Institute of Neuroscience, Padova, Italy, [4]London School of Hygiene and Tropical Medicine, London, UK and [5]Department of Health Statistics and Informatics, World Health Organization, Geneva, Switzerland

We found high prevalences of hypertension in all countries, with the
Africa. Around half
their condition, bu
(4.1% to 14.1%) a

of older people in high-income countries.[21–23] Indeed, South Africa's prevalence is the highest ever reported by a nationally representative survey of people aged 50 and over for any country. It is substantially higher than recently published estimates for South Africa and 11 other sub-Saharan African countries.[24]

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PLoS MEDICINE

Policy Forum

Non-Communicable Diseases in Sub-Saharan Africa: The Case for Cohort Studies

Michelle D. Holmes[1,2]*, Shona Dalal[2], Jimmy Volmink[3], Clement A. Adebamowo[4], Marina Njelekela[5], Wafaie W. Fawzi[6], Walter C. Willett[6], Hans-Olov Adami[2,7]

1 Channing Labo... of America,
2 Department of ... Stellenbosch,
Cape Town, Sout... epartment of
Physiology, Muh... alth, Boston,
Massachusetts, U...

Conclusions The prevalence of NCDs and their risk factors is high in some SSA settings. With the lack of vital statistics systems, epidemiologic studies with a variety of designs (cross-sectional, longitudinal and interventional) capable of in-depth analyses of risk factors could provide a better understanding of NCDs in SSA, and inform health-care policy to mitigate the oncoming NCD epidemic.

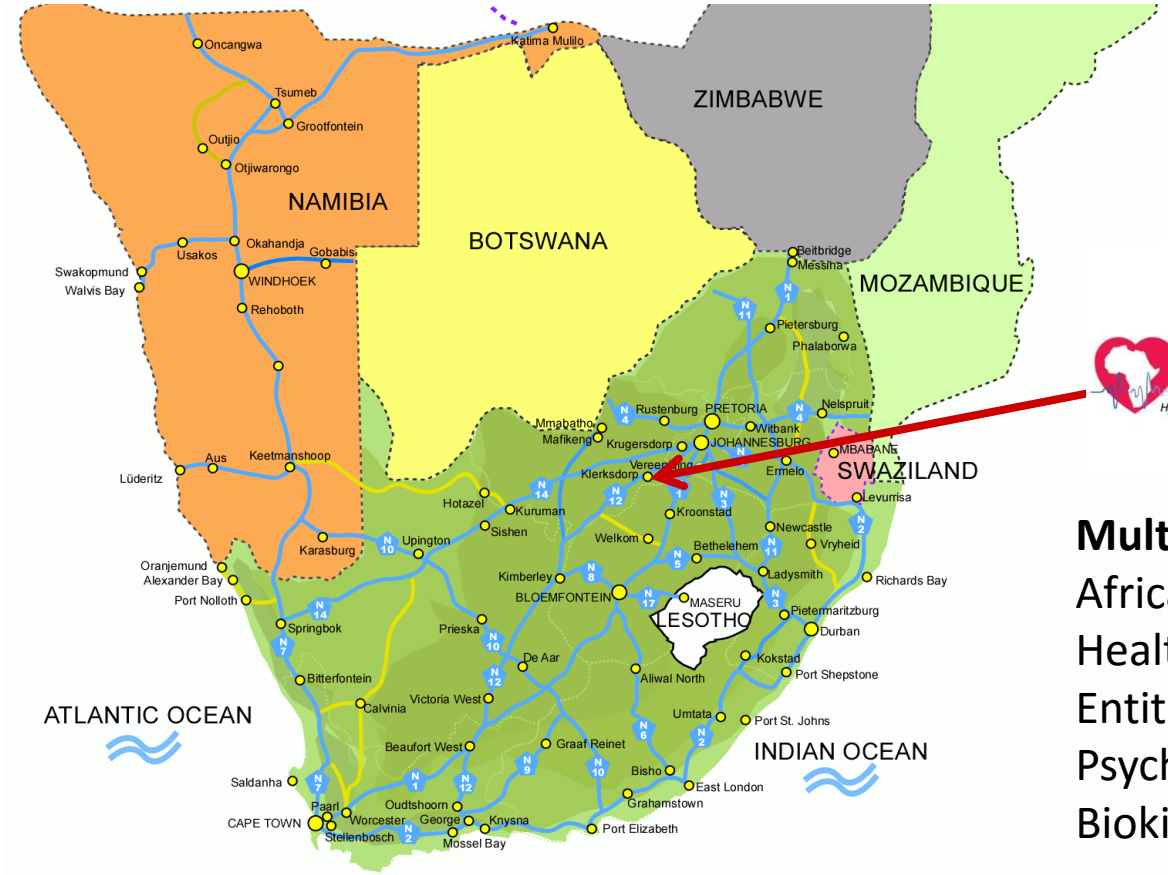
Published by O... 2011;40:885–901

...1093/ije/dyr050

NON-COMMUNICABLE DISEASES

Non-communicable diseases in sub-Saharan Africa: what we know now

Shona Dalal,[1]* Juan Jose Beunza,[1,2] Jimmy Volmink,[3] Clement Adebamowo,[4,5] Francis Bajunirwe,[6] Marina Njelekela,[7] Dariush Mozaffarian,[1,8] Wafaie Fawzi,[1,9] Walter Willett,[9] Hans-Olov Adami[10,11] and Michelle D Holmes[1,12]



HART
Hypertension in Africa Research Team

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POTCHEFSTROOM CAMPUS

Multidisciplinary team:
Africa Unit for Transdisciplinary Health Research
Entities: Physiology, Nutrition, Psychology, Pharmacy, Nursing, Biokinetics, Biochemistry

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The Prospective Urban Rural Epidemiology (PURE) study: Examining the impact of societal influences on chronic noncommunicable diseases in low-, middle-, and high-income countries

Trial Design

Koon Teo, PhD,[a] Clara K. Chow, PhD,[a] Mario Vaz, MD,[b] Sumathy Rangarajan, MSc,[a] and Salim Yusuf, DPhil[a], The PURE Investigators-Writing group *Hamilton, Ontario, Canada; and Bangalore, India*

American Heart Journal
July 2009

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Rural

Urban

The PURE study (NWP South Africa): longitudinal data, 2005, 2010, 2015

Multidisciplinary team taking a wide range of measurements in 1000 rural and 1000 urban black South Africans (aged >30 yrs)

This data provided an excellent opportunity to

(a) Explore and compare risk factors for HT development

(b) Determine which conventional CV risk factors are associated with a 5-yr change in BP

Are behavioural risk factors to be blamed for the conversion from optimal blood pressure to hypertensive status in Black South Africans? A 5-year prospective study

Aletta E Schutte,[1]* Rudolph Schutte,[1] Hugo W Huisman,[1] Johannes M van Rooyen,[1] Carla MT Fourie,[1] Nico T Malan,[1] Leoné Malan,[1] Catharina MC Mels,[1] Wayne Smith,[1] Sarah J Moss,[2] G Wayne Towers,[3] H Salomé Kruger,[3] Edelweiss Wentzel-Viljoen,[3] Hester H Vorster[3] and Annamarie Kruger[4]

International Journal of Epidemiology 2012;**41**:1114–1123

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Study population with BP data:

PURE baseline
N=1994

2005

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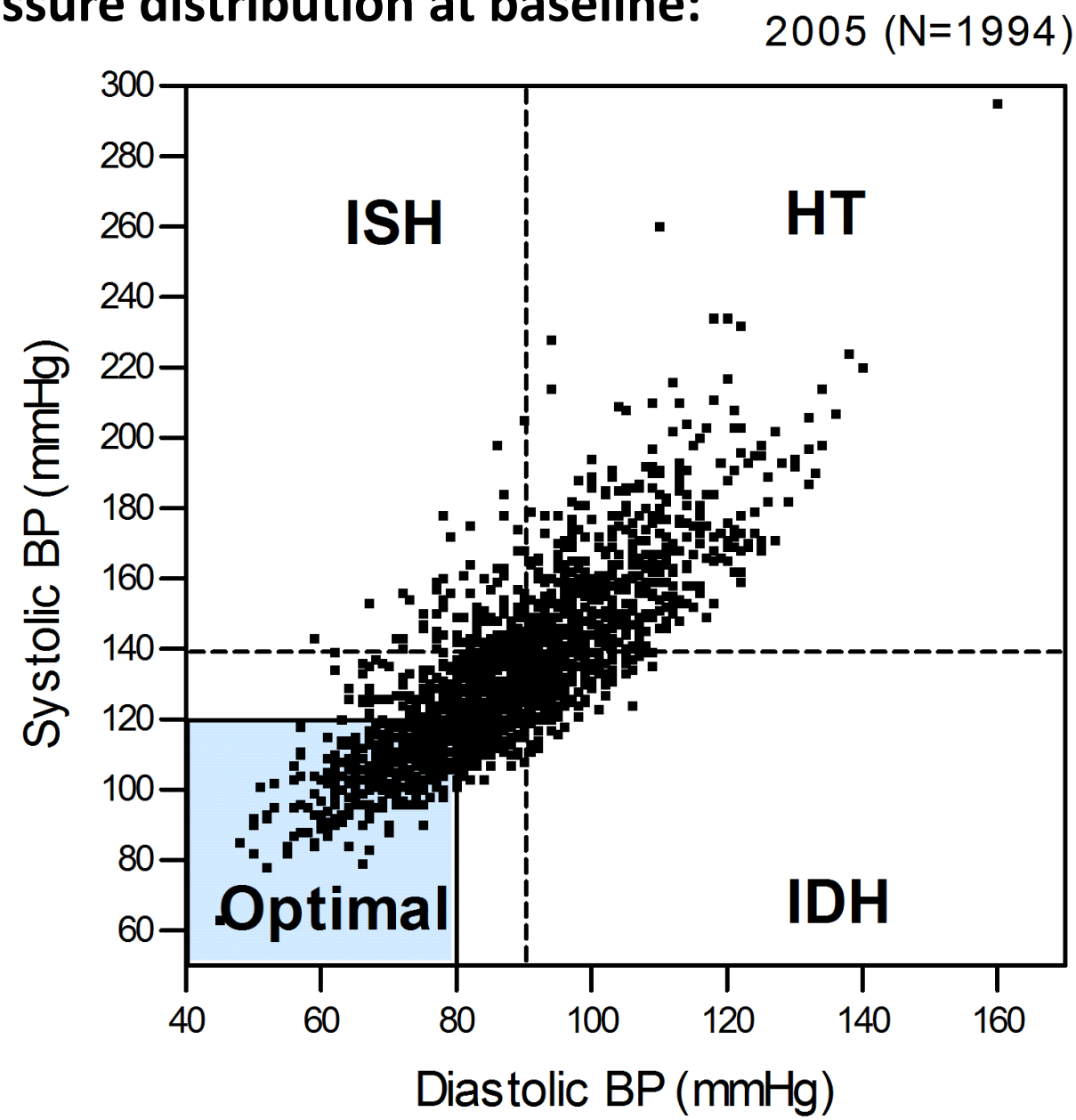
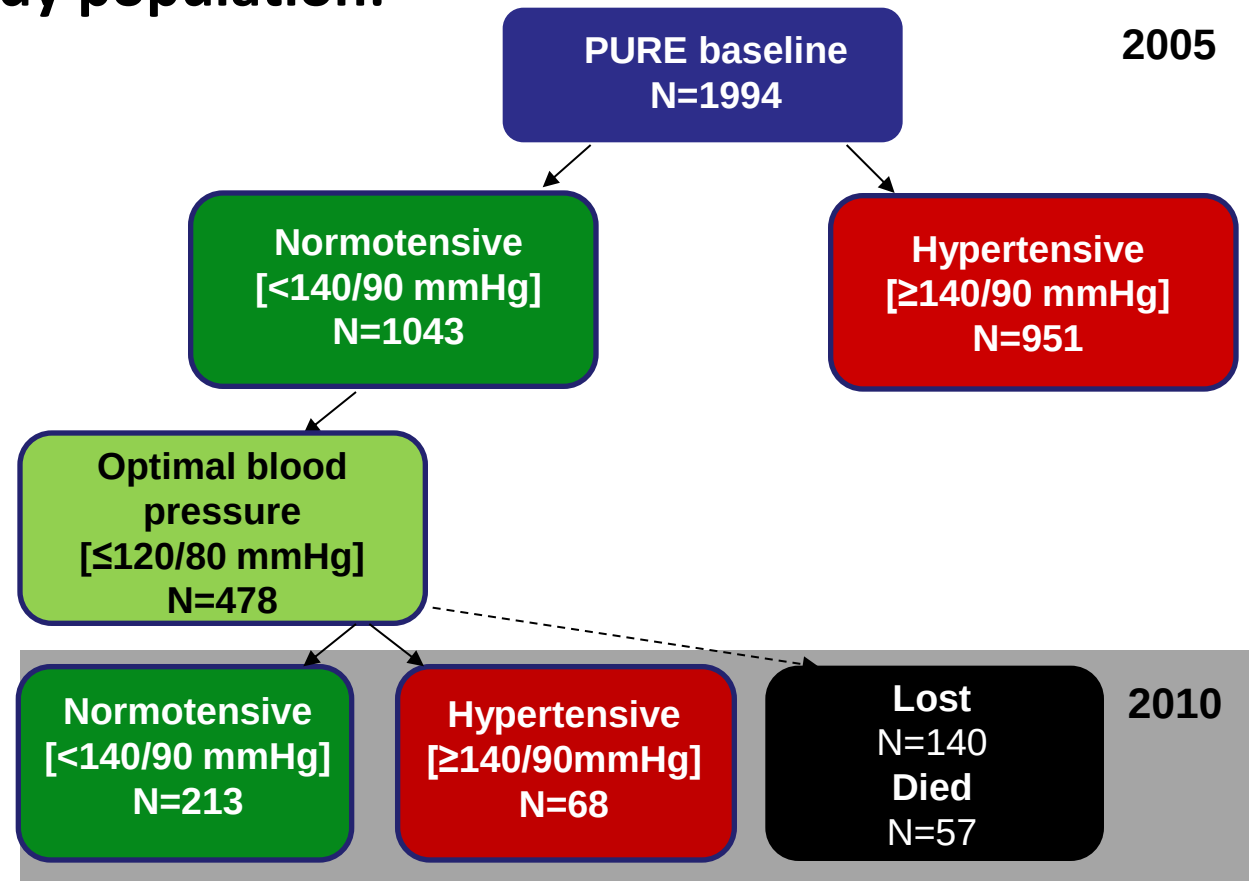
Blood pressure distribution at baseline:



International Journal of Epidemiology 2012;**41**:1114–1123

Methods:

Study population:



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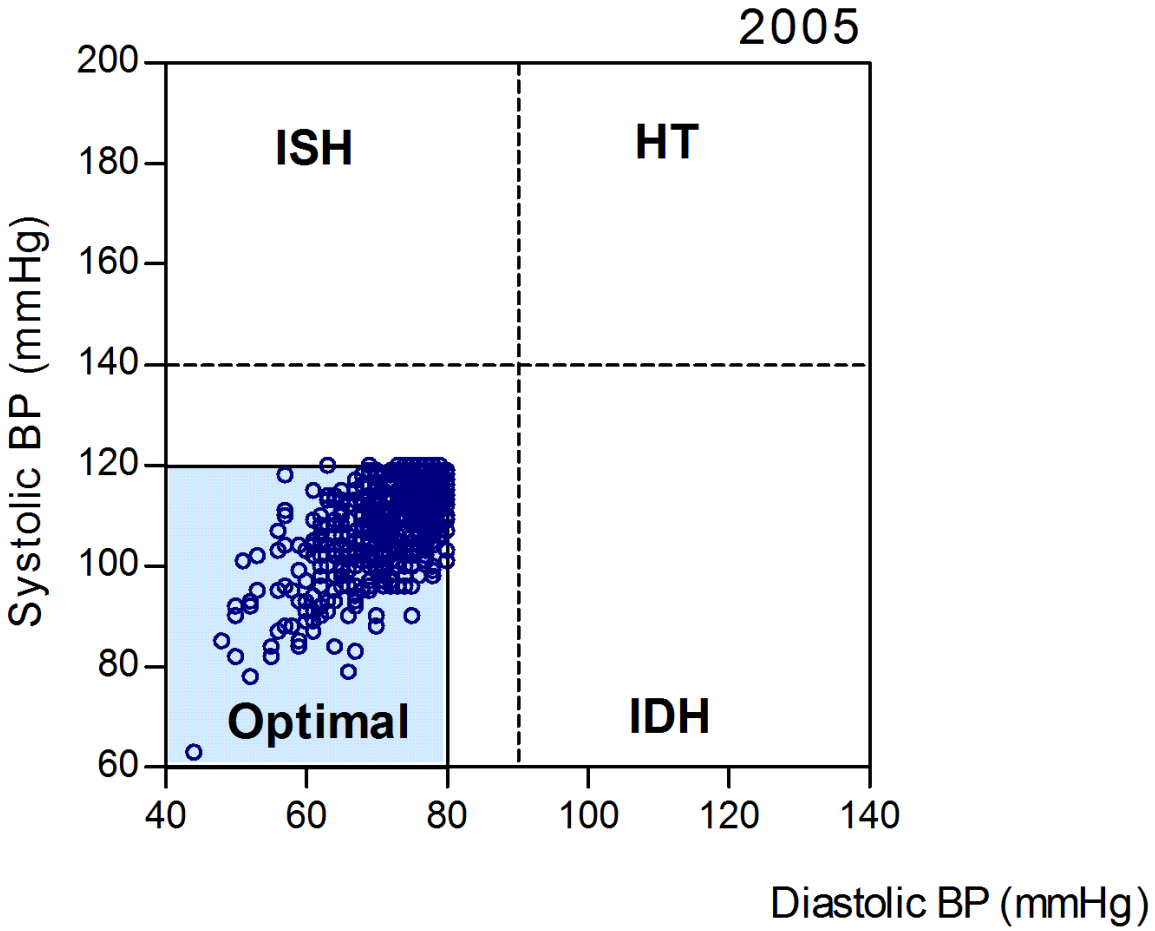
Participants with Optimal BP at baseline followed for 5 years



International Journal of Epidemiology 2012;**41**:1114–1123

Independent relationships with change in SBP:

	Δ SBP (R^2 = 0.23)
Age	
Gender (m/f)	
Rural/urban	
WC	β=0.18; p=0.006
HIV	β= -0.23; p<0.001
γGT	β= 0.13; p=0.029
Δ γGT	β= 0.17; p=0.005
HbA1c	

International Journal of Epidemiology 2012;**41**:1114–1123

Independent relationships ΔSBP or cSBP as dep var with γGT substituted with self-reported alcohol intake:

	Δ SBP (R^2 = 0.23)	cSBP (R^2 = 0.14)
Age		
SBP	β= -0.36; p<0.001	β= 0.16; p=0.011
Rural/urban		β= -0.23; p=0.008
WC	β=0.18; p=0.005	
HIV	β= -0.23; p<0.001	β= -0.22; p<0.001
Alcohol no/yes	β= 0.13; p=0.029	β= 0.19; p=0.004
HbA1c		β= 0.14; p=0.025

International Journal of Epidemiology 2012;**41**:1114–1123

SABPA study

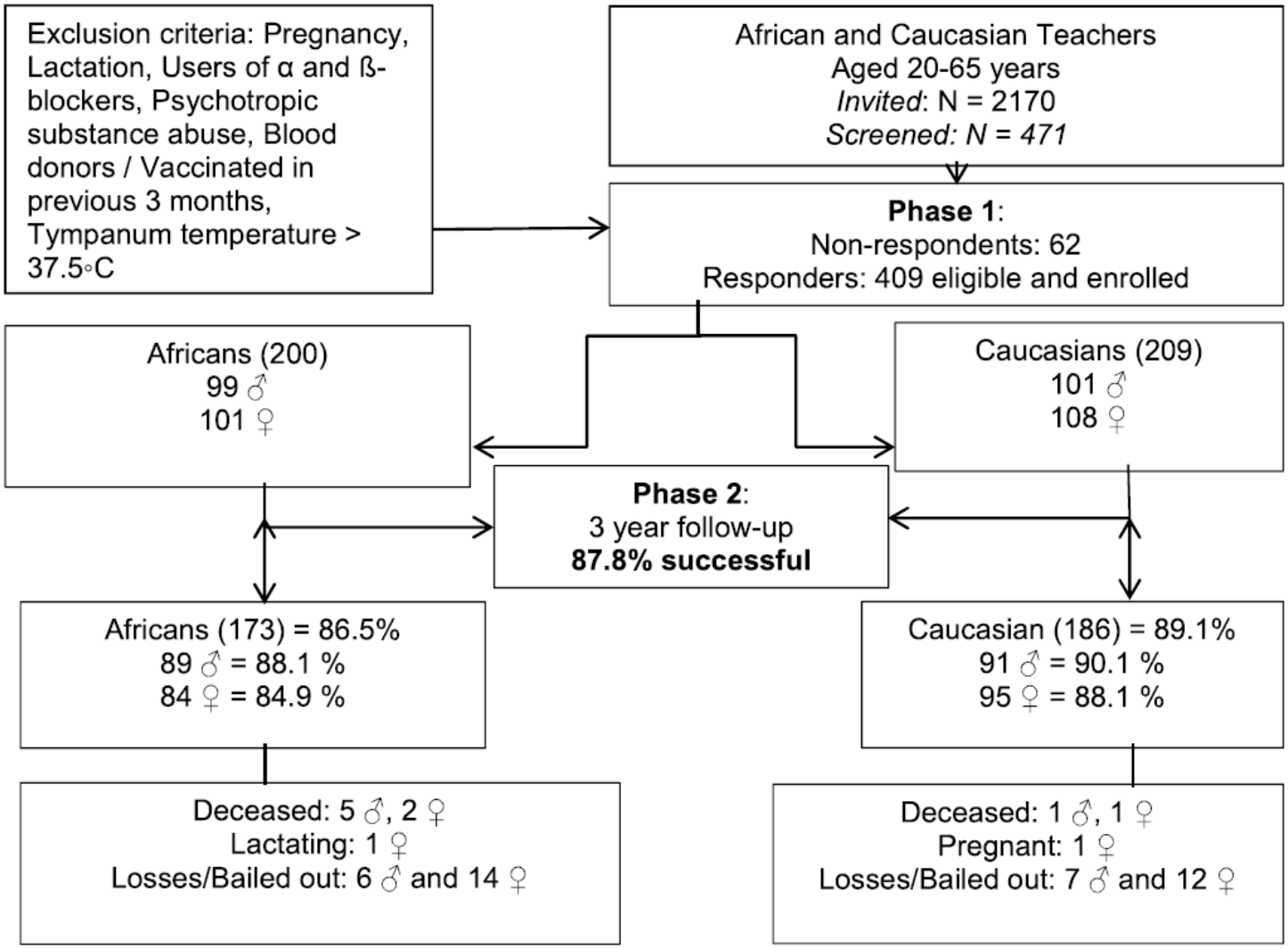


Figure 2. The Sympathetic activity and Ambulatory Blood pressure in Africans (SABPA) prospective cohort study population.

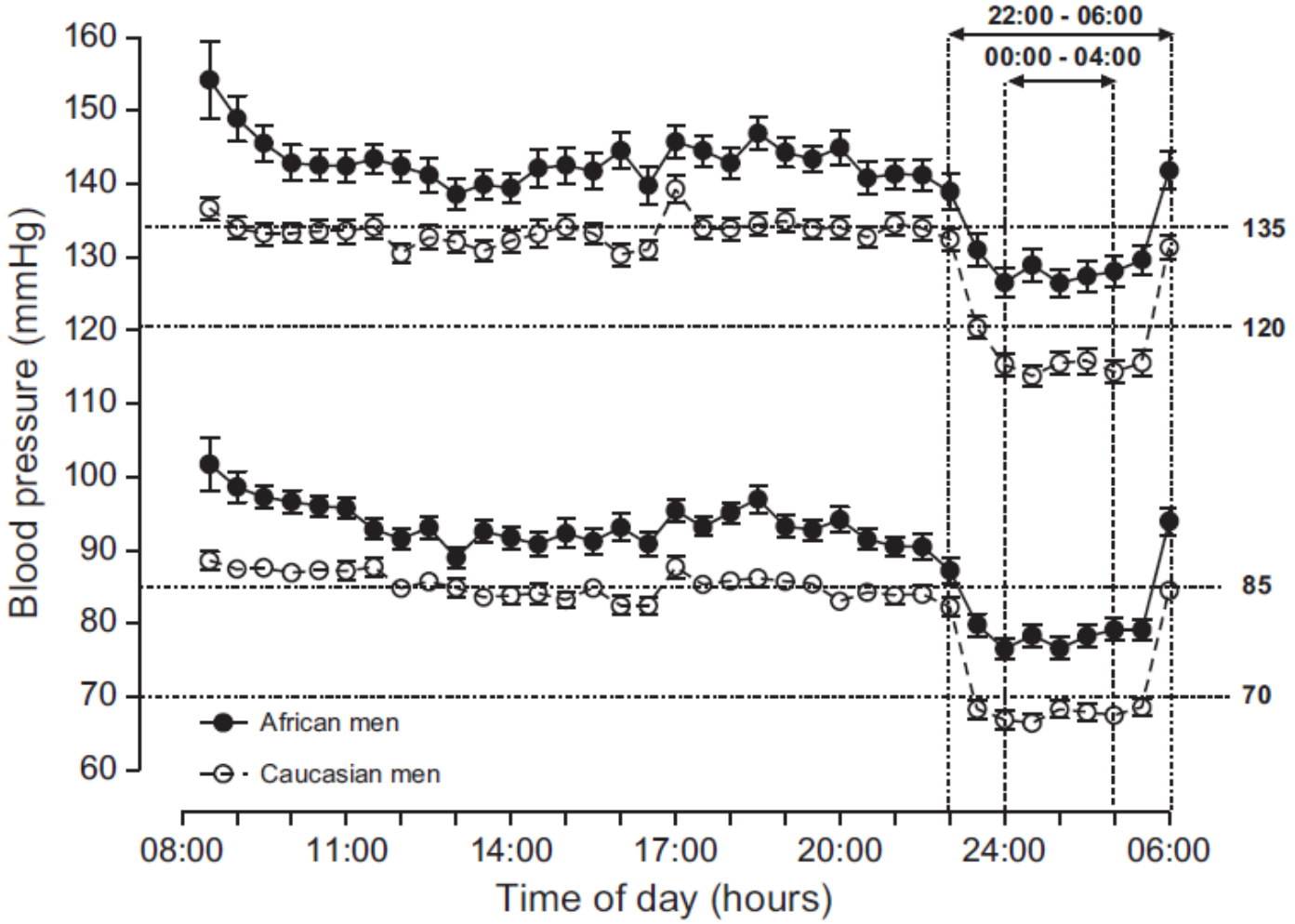


Fig. 1 – Systolic and diastolic ambulatory blood pressure of the African and Caucasian men. Bars indicate standard error.

Sympathetic activity and Ambulatory BP study (SABPA)

Atherosclerosis 238 (2015) 52–54

Contents lists available at ScienceDirect

Atherosclerosis

journal homepage: www.elsevier.com/locate/atherosclerosis

Progression of cardiovascular risk factors in black Africans: 3 year follow up of the SABPA cohort study

Mark Hamer [a, b, *], Roland von Känel [c], Manja Reimann [d], Nico T. Malan [b], Alta E. Schutte [b], Hugo W. Huisman [b], Leone Malan [b]

[a] *Department of Epidemiology and Public Health, University College London, London, UK*
[b] *Hypertension in Africa Research Team, School for Physiology, Nutrition and Consumer Sciences, North-West University, Potchefstroom, South Africa*
[c] *Department of Neurology, Inselspital, Bern University Hospital and University of Bern, Switzerland*
[d] *Autonomic and Neuroendocrinological Laboratory Dresden, Department of Neurology, University Hospital Carl Gustav Carus, Dresden University of Technology, Dresden, Germany*

Table 1
Comparison between white (reference group) and black participants of CVD risk factor progression over a three-year follow-up period.

Risk factor	Adjusted coefficient (95% CI)	*p*-value
24 h systolic blood pressure	6.02 (3.51, 8.55)	<0.001
24 h diastolic blood pressure	3.57 (1.96, 5.17)	<0.001
CIMT	−0.048 (−0.033, −0.064)	<0.001
Cross sectional wall area	−1.27 (−0.73, −1.81)	<0.001
Endothelin-1	0.21 (−0.99, 1.41)	0.73
HDL cholesterol	−0.02 (−0.08, 0.04)	0.50
Total cholesterol	0.65 (0.45, 0.86)	<0.001
Total: HDL cholesterol ratio	0.86 (0.64, 1.08)	<0.001
Triglycerides	0.26 (−0.11,0.17)	0.72
Glycated haemoglobin	0.13 (−0.05, 0.30)	0.16
Glucose	1.22 (0.91, 1.52)	<0.001
Insulin	0.35 (−0.94, 1.65)	0.59
Fibrinogen	0.55 (0.41, 0.69)	<0.001
D-dimer	132.15 (31.36, 232.94)	0.01
Interleukin-6	−1.48 (−4.37, 1.42)	0.32
Tumour necrosis factor-α	−0.57 (−1.00, −0.14)	0.01
BMI	−0.24 (−0.73, 0.25)	0.33
Waist	1.92 (0.24, 3.59)	0.03

Coefficients reflect differences between white (ref) and black Africans, adjusted for age, sex, serum cotinine, physical activity energy expenditure, history of CVD, medication, and baseline levels of the respective risk factor. Where: CIMT, carotid intima media thickness; HDL, high density lipoprotein; BMI, body mass index.

Behavioural and other associated CVD risk factors

- **Obesity & diet (sugar intake)**
- Inflammation
- Alcohol
- Endothelial function/NO bioavailability
- HIV infection

Added sugar intake in South Africa: findings from the Adult Prospective Urban and Rural Epidemiology cohort study[1–4]

Hester H Vorster, Annamarie Kruger, Edelweiss Wentzel-Viljoen, H Salome Kruger, and Barrie M Margetts

Results: Added sugar intake, particularly in rural areas, has increased rapidly in the past 5 y. In rural areas, the proportion of adults who consumed sucrose-sweetened beverages approximately doubled (for men, from 25% to 56%; for women, from 33% to 63%) in the past 5 y. After adjustment, subjects who consumed more added sugars (≥10% energy from added sugars) compared with those who consumed less added sugars had a higher waist circumference [mean difference (95% CI): 1.07 cm (0.35, 1.79 cm)] and body mass index (in kg/m^2) [0.43 (0.12, 0.74)] and lower HDL cholesterol [−0.08 mmol/L (−0.14, 0.002 mmol/L)].

Conclusions: This cohort showed dramatic increases in added sugars and sucrose-sweetened beverage consumption in both urban and rural areas. Increased consumption was associated with increased NCD risk factors. In addition, the study showed that the nutrition transition has reached a remote rural area in South Africa. Urgent action is needed to address these trends. *Am J Clin Nutr* doi: 10.3945/ajcn.113.069005.

Am J Clin Nutr doi: 10.3945/ajcn.113.069005. Printed in USA.

Nutrition, Metabolism & Cardiovascular Diseases (2014) **24**, 900–907

Available online at www.sciencedirect.com

Nutrition, Metabolism & Cardiovascular Diseases

journal homepage: www.elsevier.com/locate/nmcd

Evaluation of waist-to-height ratio to predict 5 year cardiometabolic risk in sub-Saharan African adults

L.J. Ware [a], K.L. Rennie [b], H.S. Kruger [c], I.M. Kruger [d], M. Greeff [d], C.M.T. Fourie [a], H.W. Huisman [a], J.D.W. Scheepers [a], A.S. Uys [a], R. Kruger [a], J.M. Van Rooyen [a], R. Schutte [a], A.E. Schutte [a,*]

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[b] *Centre for Lifespan and Chronic Illness Research, University of Hertfordshire, United Kingdom*
[c] *Centre of Excellence for Nutrition (CEN), Faculty of Health Sciences, North-West University, South Africa*
[d] *Africa Unit for Transdisciplinary Health Research (AUTHeR), Faculty of Health Sciences, North-West University, South Africa*

Received 16 December 2013; received in revised form 6 February 2014; accepted 11 February 2014
Available online 22 February 2014

Behavioural and other associated CVD risk factors

- Obesity & diet (sugar intake)
- **Inflammation**
- Alcohol
- Endothelial function/NO bioavailability
- HIV infection

ORIGINAL ARTICLE

Inflammation, obesity and cardiovascular function in African and Caucasian women from South Africa: the POWIRS study

AE Schutte, D van Vuuren, JM van Rooyen, HW Huisman, R Schutte, L Malan and NT Malan

School for Physiology, Nutrition and Consumer Sciences, North-West University, Potchefstroom, South Africa

❑ Inflammation (CRP, IL-6, suPAR) as prognostic markers for mortality

International Journal of Cardiology 184 (2015) 631–636

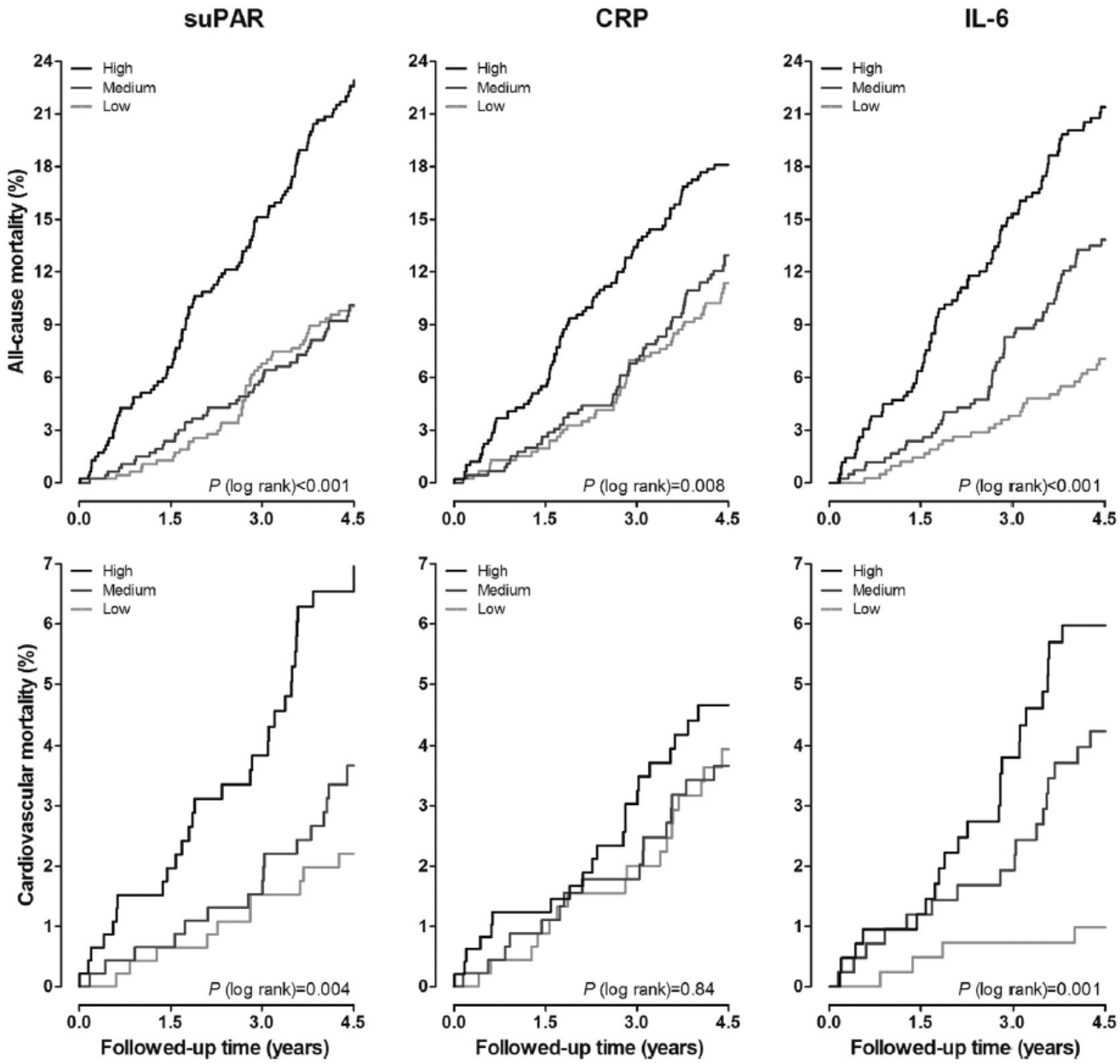
Contents lists available at ScienceDirect

International Journal of Cardiology

journal homepage: www.elsevier.com/locate/ijcard

Soluble urokinase plasminogen activator receptor as a prognostic marker of all-cause and cardiovascular mortality in a black population ☆

Shani Botha [a,*], Carla M.T. Fourie [a], Rudolph Schutte [a,b], Jesper Eugen-Olsen [c], Ronel Pretorius [d], Aletta E. Schutte [a,b]


suPAR
CRP
IL-6
High
Medium
Low
All-cause mortality (%)
Cardiovascular mortality (%)
P (log rank)<0.001
P (log rank)=0.008
P (log rank)<0.001
P (log rank)=0.004
P (log rank)=0.84
P (log rank)=0.001
Followed-up time (years)
0.0
1.5
3.0
4.5

Behavioural and other associated CVD risk factors

- Obesity & diet (sugar intake)
- Inflammation
- **Alcohol**
- Endothelial function/NO bioavailability
- HIV infection

European Journal of Preventive Cardiology

EUROPEAN SOCIETY OF CARDIOLOGY®

Original scientific paper

Alcohol intake, hypertension development and mortality in black South Africans

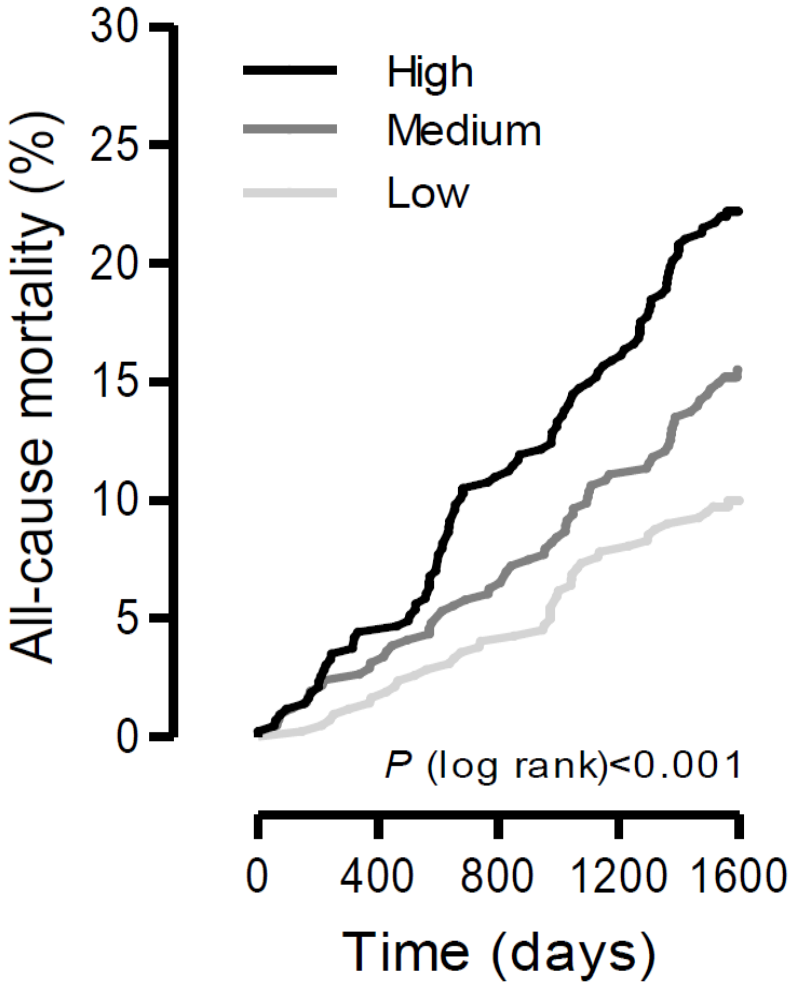
Mandlenkosi C Zatu[1,2,3], Johannes M Van Rooyen[1], Annamarie Kruger[4] and Aletta E Schutte[1]

European Journal of Preventive Cardiology
0(00) 1–8

DOI: 10.1177/2047487314563447
ejpc.sagepub.com

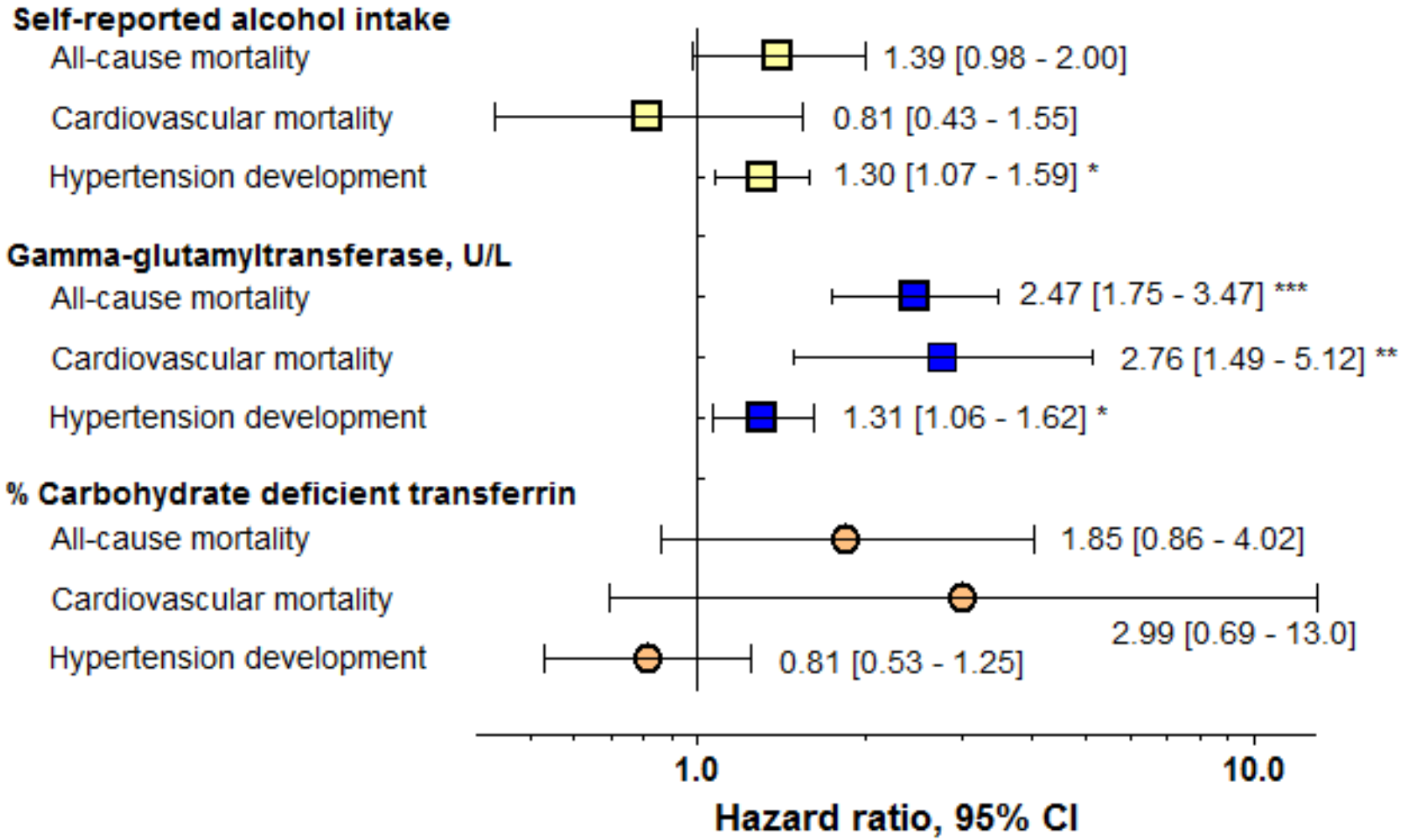
SAGE

❑ Gamma-glutamyl transferase as predictor of mortality



Zatu, Van Rooyen, Kruger, Schutte. *Eur J Cardiovasc Prev* 2015

❑ Gamma-glutamyl transferase compared to other alcohol measures as indicator/predictor of mortality?



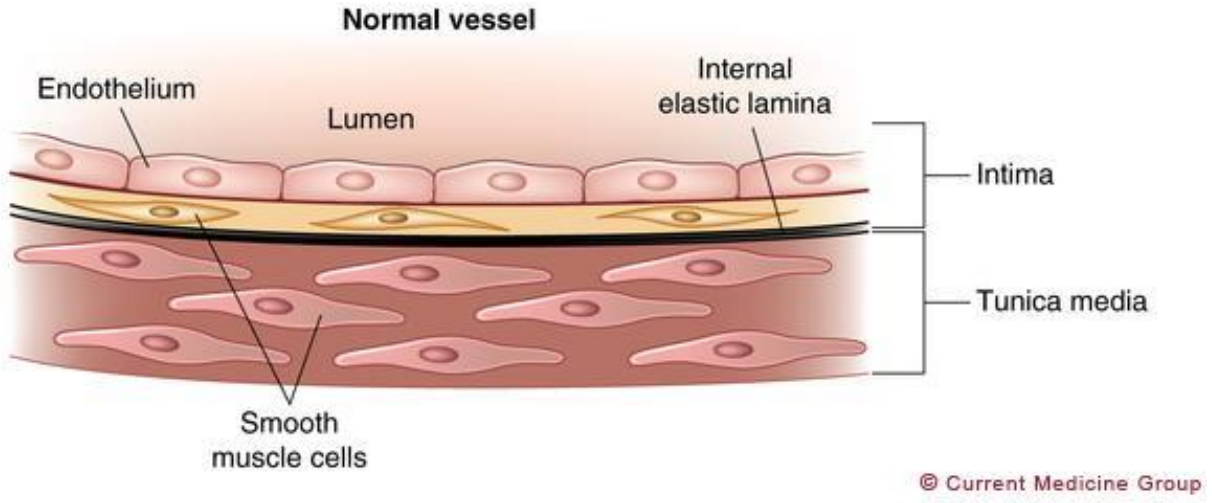
Zatu, Van Rooyen, Kruger, Schutte. *Eur J Cardiovasc Prev* 2015

Behavioural and other associated CVD risk factors

- Obesity & diet (sugar intake)
- Inflammation
- Alcohol
- **Endothelial function**
- HIV infection

Endothelial function …

Microalbuminuria (systemic endothelial dysfunction)



❑ Microalbuminuria and mortality

ORIGINAL ARTICLE

Urinary Albumin Excretion From Spot Urine Samples Predict All-Cause and Stroke Mortality in Africans

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❑ Microalbuminuria and mortality

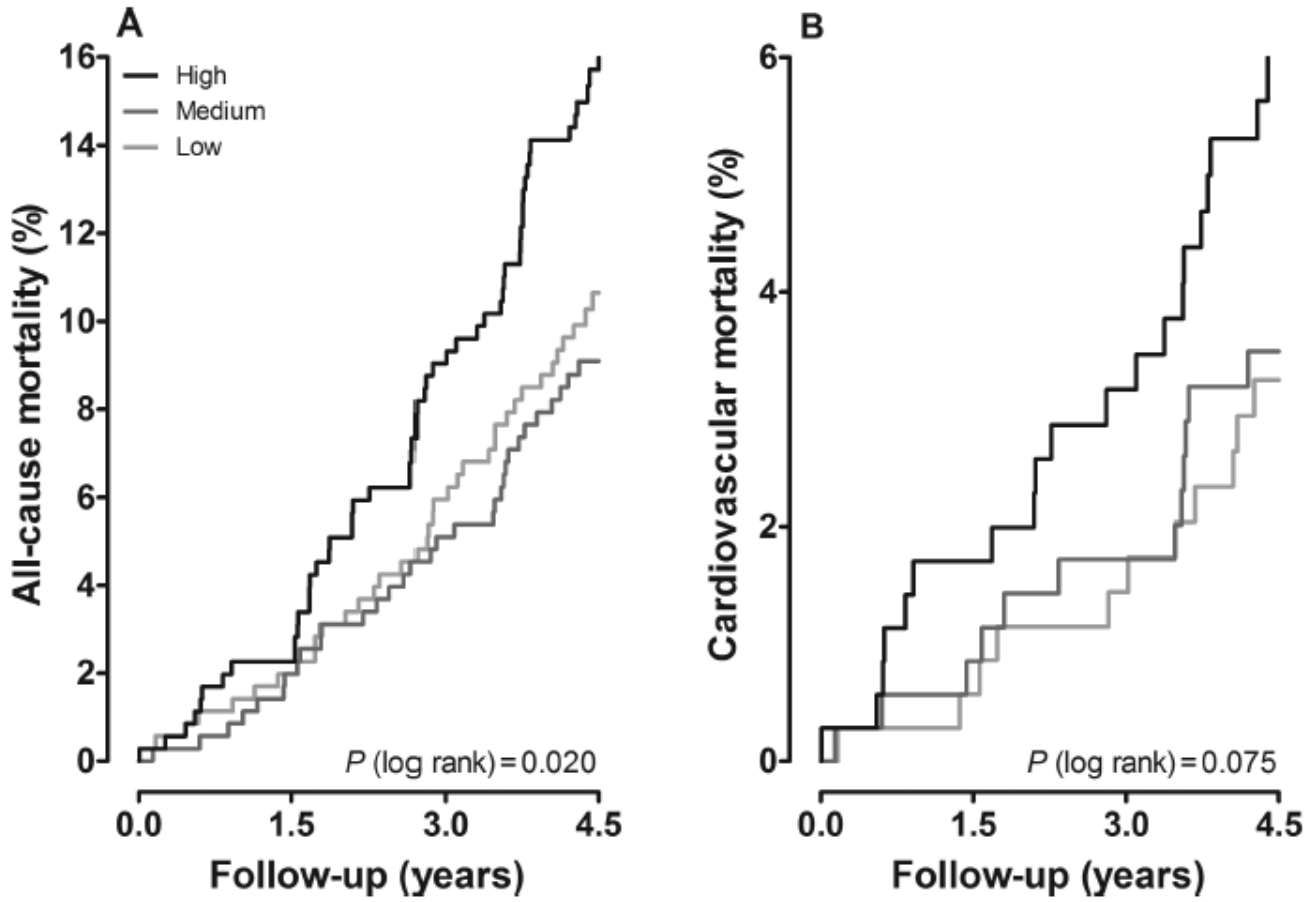
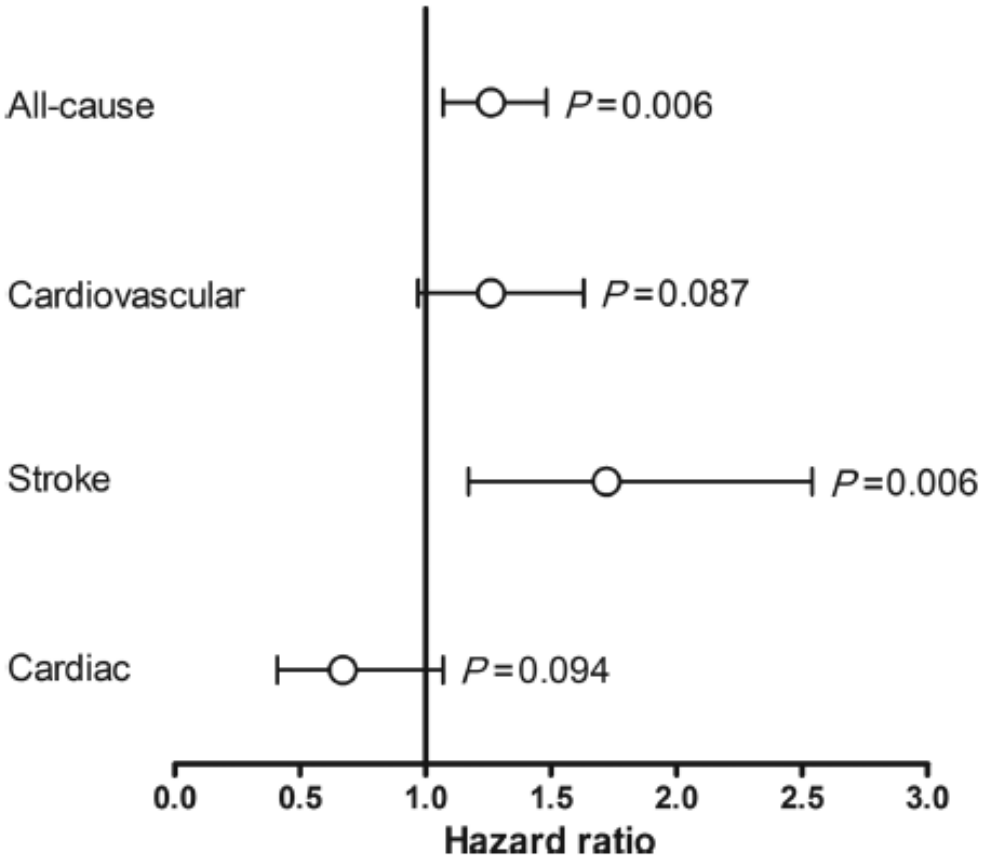


Figure 1. Kaplan-Meier survival function estimates for all-cause (**A**) and cardiovascular mortality (**B**) by tertiles of urinary albumin-to-creatinine ratio. *P* values refer to the significance of the log-rank test across three tertiles.

❑ Microalbuminuria and mortality



Behavioural and other associated CVD risk factors

- Obesity & diet (sugar intake)
- Inflammation
- Alcohol
- Endothelial function/NO bioavailability
- **HIV infection**

❑ Crossroads between NCDs and HIV-infection

134 CARDIOVASCULAR JOURNAL OF AFRICA • Vol 22, No 3, May/June 2011 CVJAFRICA

Is HIV-1 infection associated with endothelial dysfunction in a population of African ancestry in South Africa?

C FOURIE, J VAN ROOYEN, M PIETERS, K CONRADIE, T HOEKSTRA, A SCHUTTE

The objective of this study was to assess whether newly identified, never-treated, HIV-1-infected South African participants showed signs of endothelial dysfunction, accelerated atherosclerosis and increased blood coagulation.

We compared 300 newly diagnosed (never antiretroviral-treated) HIV-infected participants to 300 age-, gender-, body mass index- and locality-matched uninfected controls.

❑ Crossroads between NCDs and HIV-infection

TABLE 2. ODDS RATIOS OF HIV-INFECTED PARTICIPANTS VS UNINFECTED PARTICIPANTS

	Odds ratios HIV infected vs HIV uninfected	*95% CI*
HDL-C < 1.36 mmol/l	3.69	2.6–5.2*
TG ≥ 1.0 mmol/l	1.70	1.2–2.3*
TG:HDL ratio ≥ 0.75	3.33	2.4–4.7*
hsCRP ≥ 2.7 mg/l	1.78	1.3–2.5*
hsIL-6 ≥ 4.2 pg/ml	1.67	1.2–2.3*
sICAM-1 ≥ 516 ng/ml	2.04	1.5–2.8*
sVCAM-1 ≥ 693ng/ml	3.92	2.8–5.5*

HDL-C: high-density lipoprotein cholesterol; TG: triglycerides; TG:HDL: triglycerides–high-density lipoprotein ratio; hsCRP: high-sensitivity C-reactive protein; hsIL-6: high-sensitivity interleukin 6; sICAM-1: serum intercellular adhesion molecule-1; sVCAM-1: serum vascular cell adhesion molecule-1. For all variables, the median of total group was used as cut-off value.
*Significant.

❑ Crossroads between NCDs and HIV-infection

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Endothelial activation and cardiometabolic profiles of treated and never-treated HIV infected Africans

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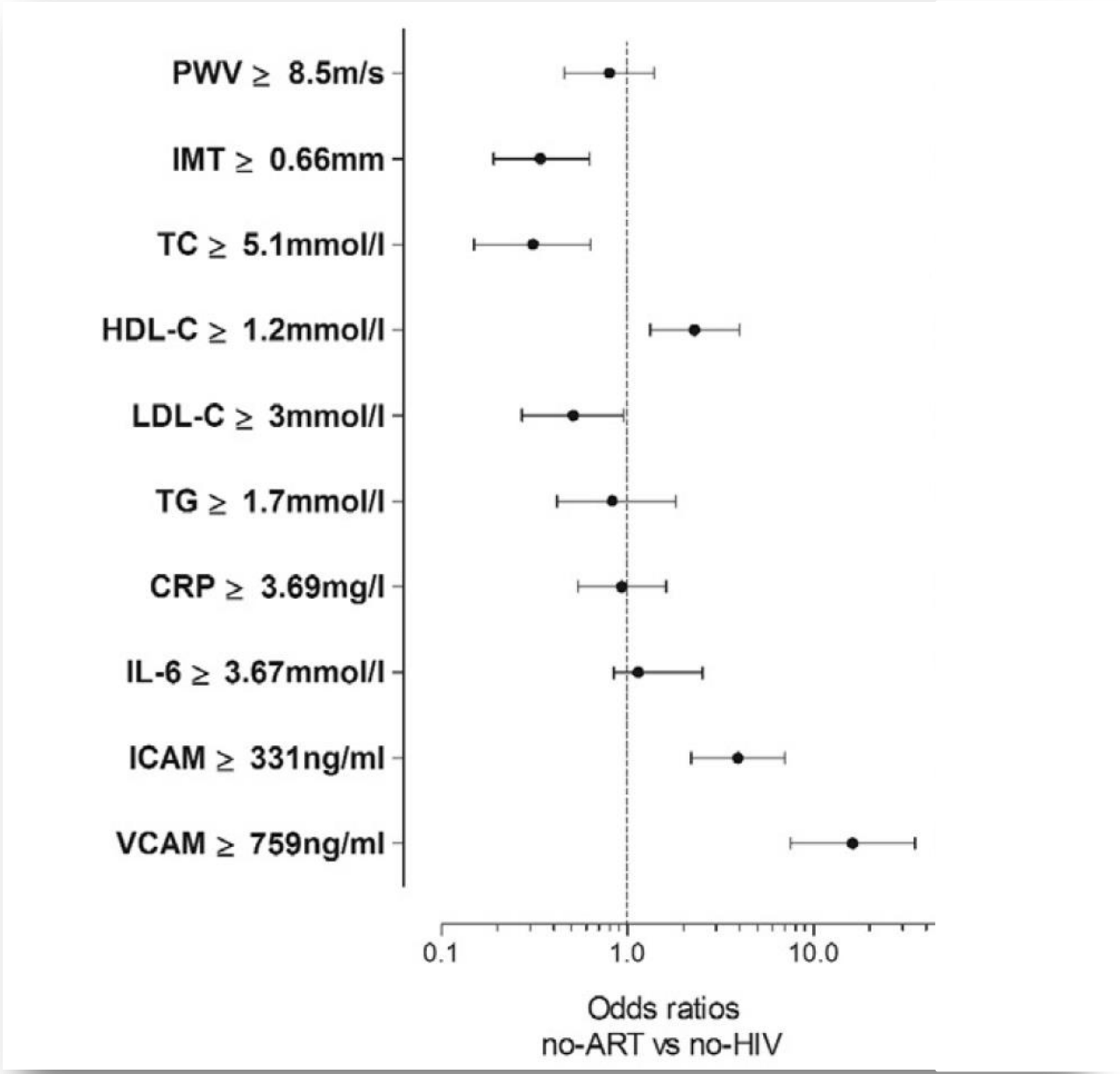

Fig. 2. Odds ratios for increased cardiovascular disease risk

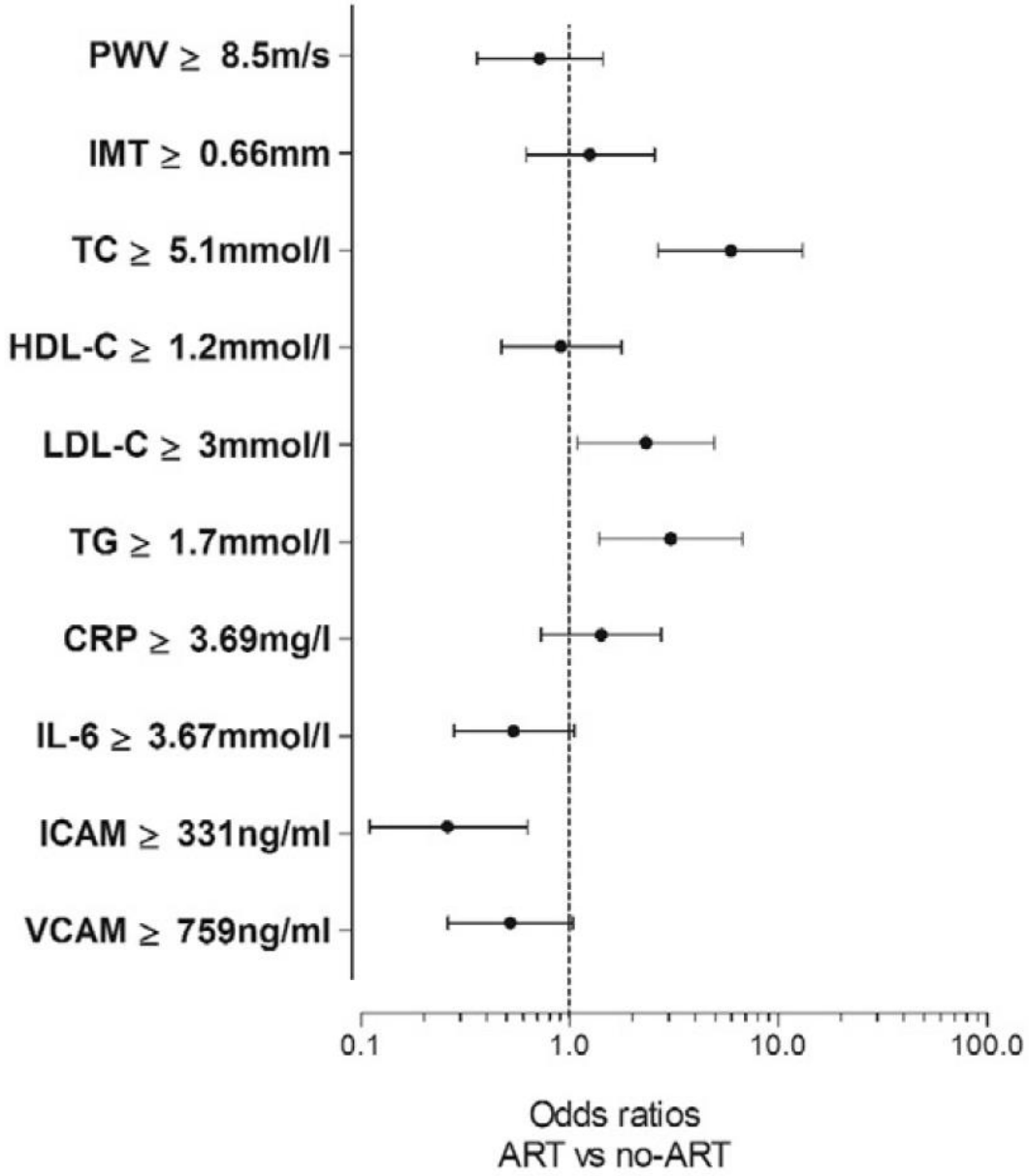

Fig. 2. Odds ratios for increased cardiovascular disease risk

Behavioural and other associated CVD risk factors

- Obesity & diet (sugar intake)
- Inflammation
- Alcohol
- Endothelial function/NO bioavailability
- HIV infection
- **Salt intake?**

❑ About salt intake…

Population health in South Africa: a view from the salt mines

www.thelancet.com/lancetgh Vol 1 August 2013

Mandatory regulations passed in March, 2013, to begin in 2016, will affect the salt content of processed food and will be a key weapon in the fight against the rising burden of hypertension.[1]

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SALT WATCH

Conclusions:

- Although **CVD is the most important contributor to mortality** world-wide, it has been ***different for Africa***.
- But all recent statistics point to CVD overtaking **infectious diseases**, such as HIV, tuberculosis and malaria as the greatest threats of health in Africa.
- Our findings confirm that **CV risk factors** associated with **urbanisation** (obesity, excessive alcohol use, sugar intake, psychological distress, inflammation) indeed **predict hypertension and CV mortality**.
- These risk factors, specifically **blood pressure**, are on an **increasing trajectory** that will be highly challenging to turn around (Westernised environment, poor health systems, low awareness, diagnosis, treatment and control).
- Question remains – how can we **get back the BPs from Donnison's era?**

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