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Department of Global Health and Population

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Improving dietary quality and prevention of NCDs among women and adolescents

A need to start early

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Director, Research and Publications

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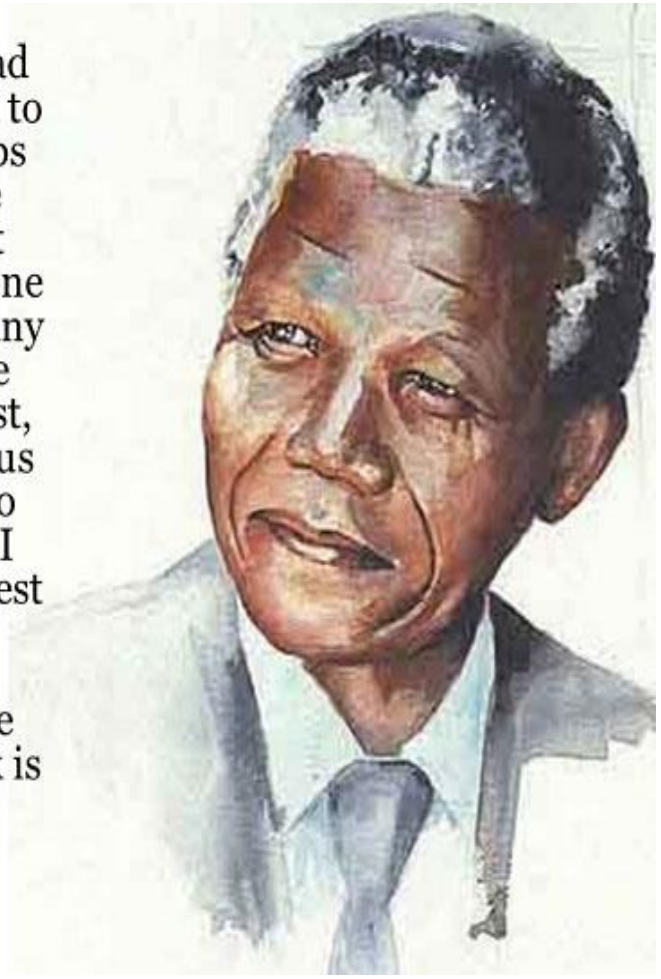
Preamble

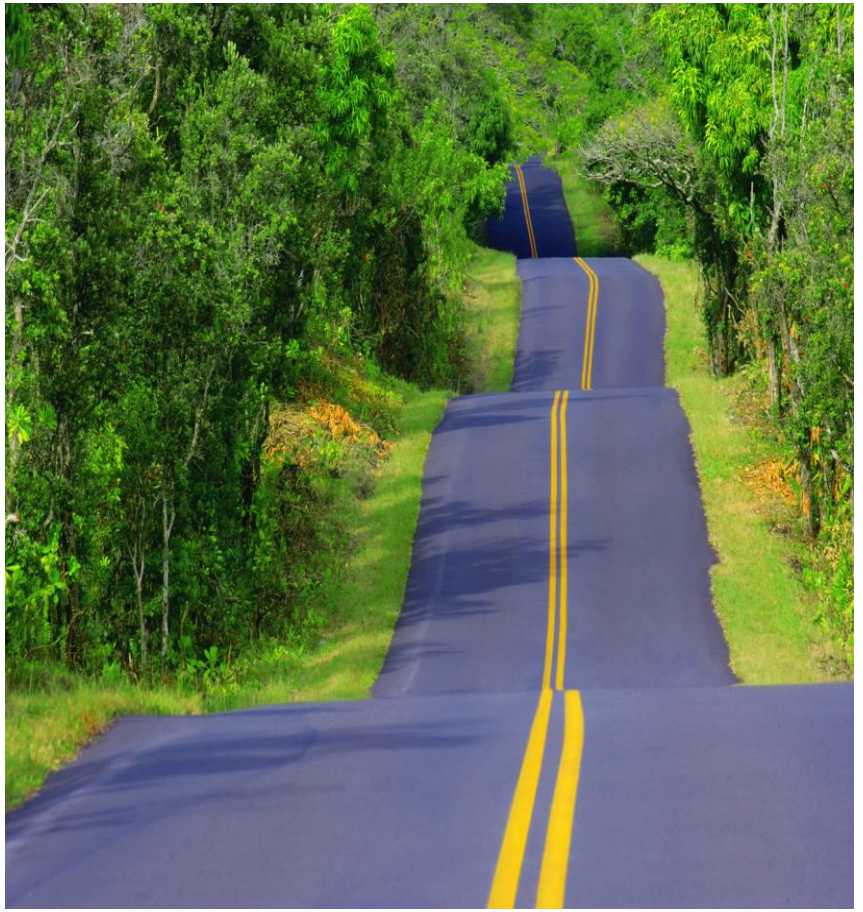
I have walked that long road to freedom. I have tried not to falter; I have made missteps along the way. But I have discovered the secret that after climbing a great hill, one only finds that there are many more hills to climb. I have taken a moment here to rest, to steal a view of the glorious vista that surrounds me, to look back on the distance I have come. But I can only rest for a moment, for with freedom comes responsibilities, and I dare not linger, for my long walk is not ended.

Nelson Mandela



The roadmap

1. Background
   - Should we start from the end or beginning?
   - Developmental Origin of Health and Disease
   - Risk factors of NCDs (Globally known)
   - Risk factors – Focus on diet and quality
2. Tanzanian context
3. Focus on workable solutions



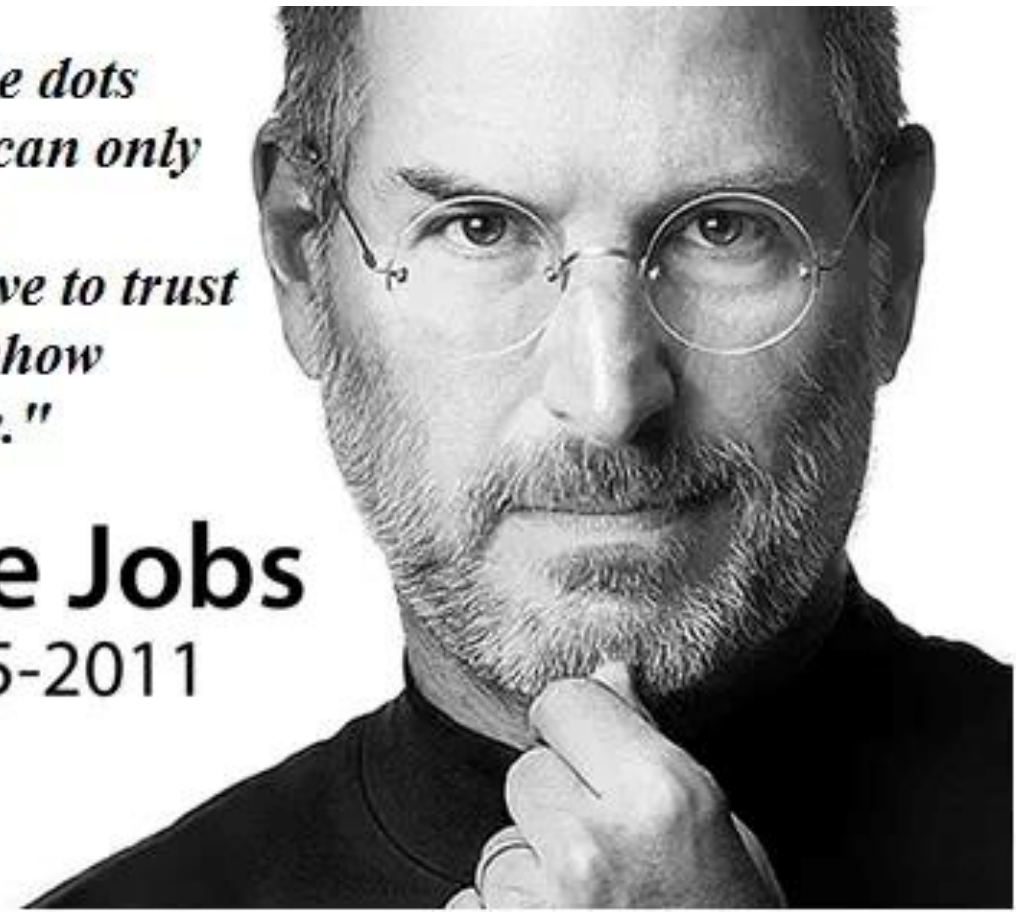
Should we focus the now or beginnings

- NCDs are largely behavioral triggered diseases –
- Causes are largely unknown
  - Common risk factors are
  - Varies significantly within and between countries
- Focus has been largely emphasized prevention
  - Lifestyles have proven difficult to intervene (at a population stage)
  - The impact relies on social vaccine (population-wide approach)
- How successful have we been? Globally? Nationally?
- Are we on track in the current thinking?

"You can't connect the dots looking forward; you can only connect them looking backwards. So you have to trust that the dots will somehow connect in your future."

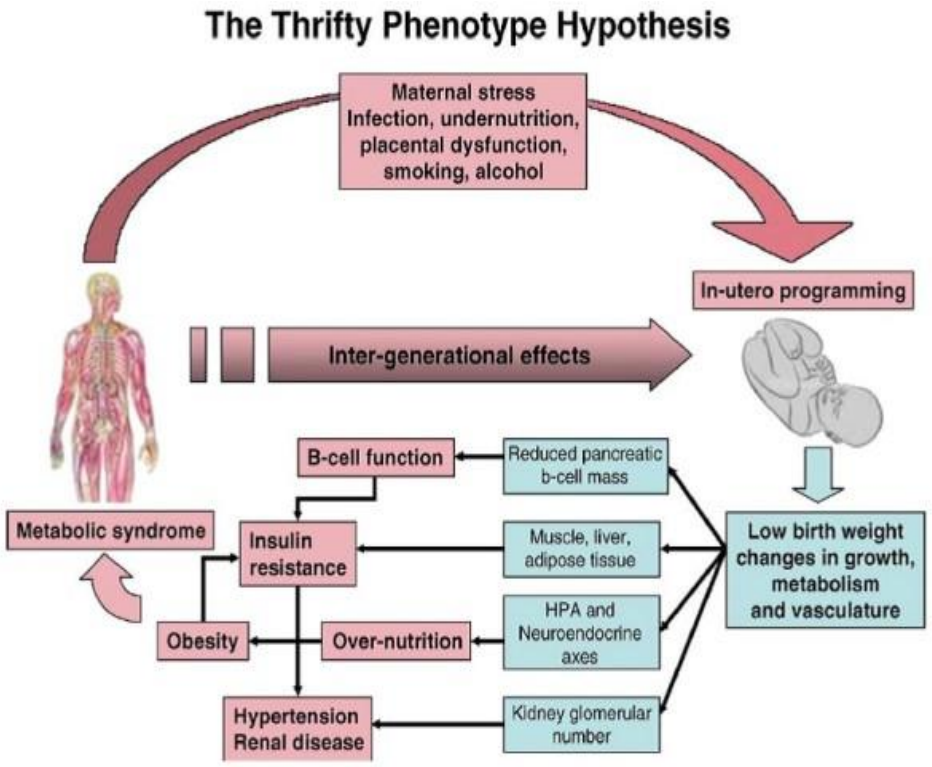
Steve Jobs

1955-2011



Far reaching effects Needs to go back in origins of life

Origin of life: theories for NCDs



- DOHAD may explain current increase in chronic disease

Barker's hypothesis:

- Low birth weight or who were Thin or short at birth or who Failed to grow in infancy (1000 days)
- As adults, children in the above categories develop increased rates of
  - coronary heart disease
  - stroke
  - Type 2 diabetes
  - hypertension.
- The risk increases with accelerated weight gain in childhood or if obesity develops later in life

Fetal origins of NCDs

Symposium

Journal of INTERNAL MEDICINE

doi: 10.1111/j.1365-2796.2007.01809.x

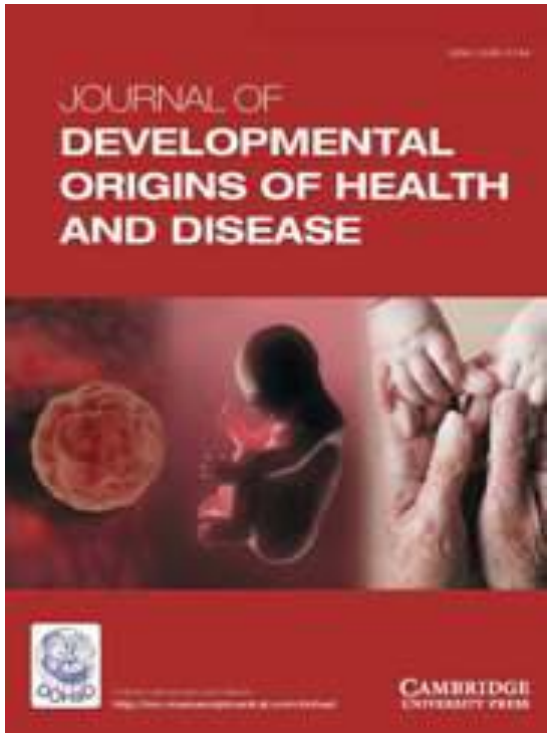
The origins of the developmental origins theory

D. J. P. Barker

From DoHAD Division, University of Southampton, UK; and Heart Research Center, Oregon Health and Science University, Portland, OR, USA

Abstract. Barker DJP. (University of Southampton, UK; and Oregon Health and Science University, OR, USA). The origins of the developmental origins theory (Symposium). *J Intern Med* 2007; **261**: 412–417.

Current orthodoxy states that coronary heart disease results from the unhealthy lifestyles of westernized adults together with a contribution from genetic inheritance. This does not provide a secure basis for prevention of the disease. Geographical studies gave the among newborn babies. In the past most deaths among newborns were attributed to low birthweight. This led to the hypothesis that undernutrition *in utero* permanently changes the body's structure, function and metabolism in ways that lead to coronary heart disease in later life. The association between low birthweight and coronary heart disease has been confirmed in longitudinal studies of men and women around the world. The developmental model of the origins of the disease offers a new way forward.



Growth and chronic disease: findings in the Helsinki Birth Cohort

2009, Vol. 36, No. 5 , Pages 445-458 (doi:10.1080/03014460902980295)

David J. P. Barker, Clive Osmond, Eero Kajantie, and Johan G. Eriksson

HTML

Early life and diseases

- Diseases such as coronary heart diseases (CHD) are closely related to fetal adaptations to undernutrition that are only beneficial to short term survival, while are also detrimental to health in post-reproductive lives
- In fetal life, the tissues and organs of the body go through critical periods of development.
    - They may coincide with period of rapid cell division
- In early lives, human beings adapt to the environment easily
- Growth is determined by genetic make ups, but easily affected by environment, especially nutrients and oxygen from the mother.

Cumulative insult and risks

Mezhal et al.
Diabetology & Metabolic Syndrome (2021) 13:140
https://doi.org/10.1186/s13098-021-00758-w

Diabetology & Metabolic Syndrome

RESEARCH Open Access

The interrelationship and accumulation of cardiometabolic risk factors amongst young adults in the United Arab Emirates: The UAE Healthy Future Study

Fatima Mezhal[1*], Abderrahim Oulhaj[2], Abdishakur Abdulle[3], Abdulla AlJunaibi[3], Abdulla Alnaeemi[4], Amar Ahmad[1], Andrea Leinberger-Jabari[1], Ayesha S. Al Dhaheri[5], E. Murat Tuzcu[6], Eiman AlZaabi[7], Fatma Al-Maskari[8,9], Fatme Alanouti[10], Fayza Alameri[11], Habiba Alsafar[12,13,14], Hamad Alblooshi[15], Juma Alkaabi[16], Laila Abdel Wareth[17], Mai Aljaber[18], Marina Kazim[15], Micheal Weitzman[19], Mohammad Al-Houqani[20], Mohammad Hag Ali[21], Naima Oumeziane[15], Omar El-Shahawy[22], Rami H. Al-Rifai[8], Scott Scherman[22], Syed M. Shah[8], Tom Loney[23], Wael Almahmeed[6], Youssef Idaghdour[1], Luai A. Ahmed[8,9†] and Raghib Ali[1,24†]

- People who develop cardiovascular disease (CVD) typically have more than one risk factor
- The clustering of risk factors begins in youth, early adulthood, and middle age
- They increase the risk for atherosclerosis development in young and middle-aged adults and risk of CVD in middle age.
- Cardiometabolic risk factors are associated with each other, therefore creating a heavy burden of risk factors

Breastfeeding and income—new evidence

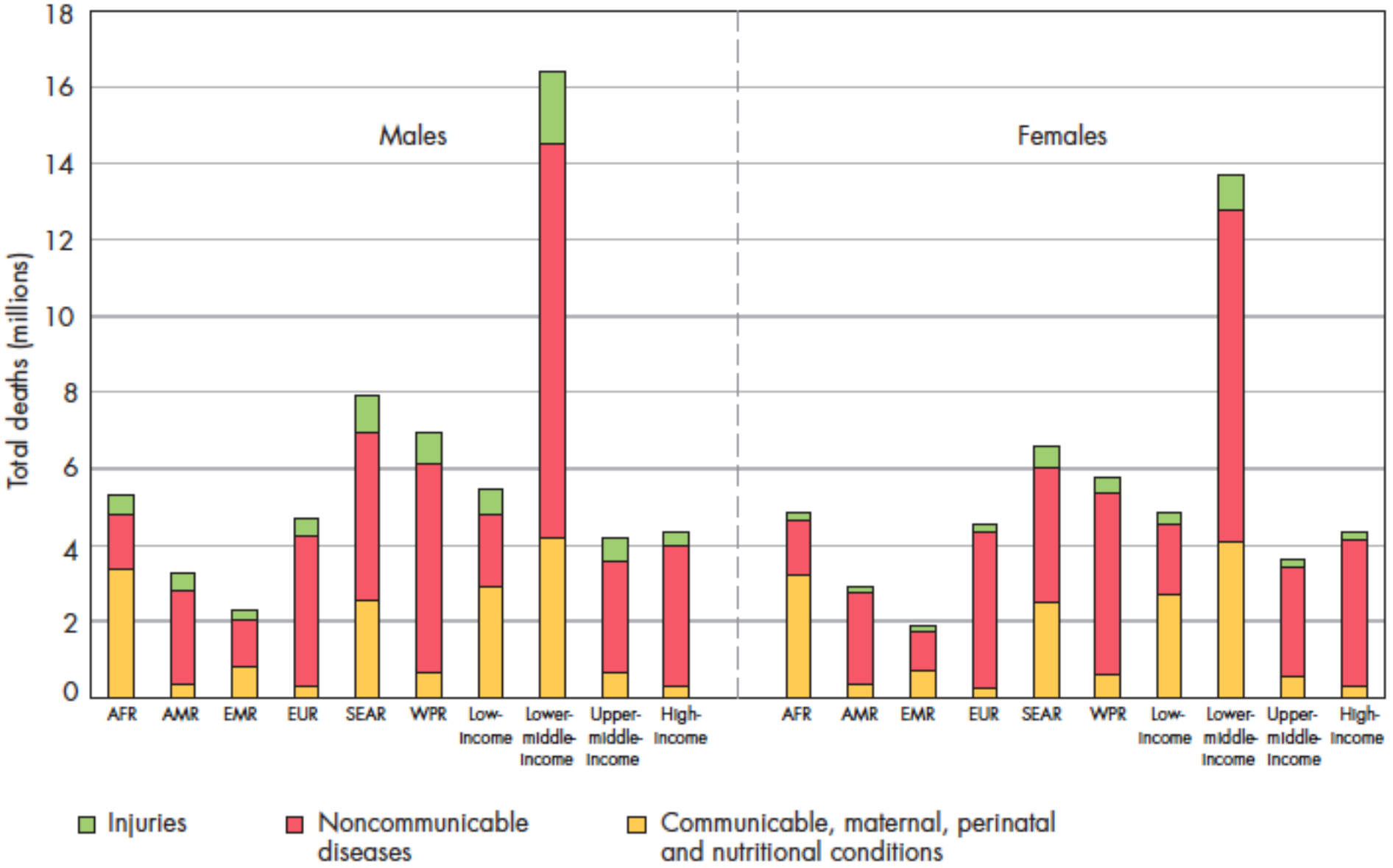
Association between breastfeeding and intelligence, educational attainment, and income at 30 years of age: a prospective birth cohort study from Brazil

Cesar G Victora, Bernardo Lessa Horta, Christian Loret de Mola, Luciana Quevedo, Ricardo Tavares Pinheiro, Denise P Gigante, Helen Gonçalves, Fernando C Barros

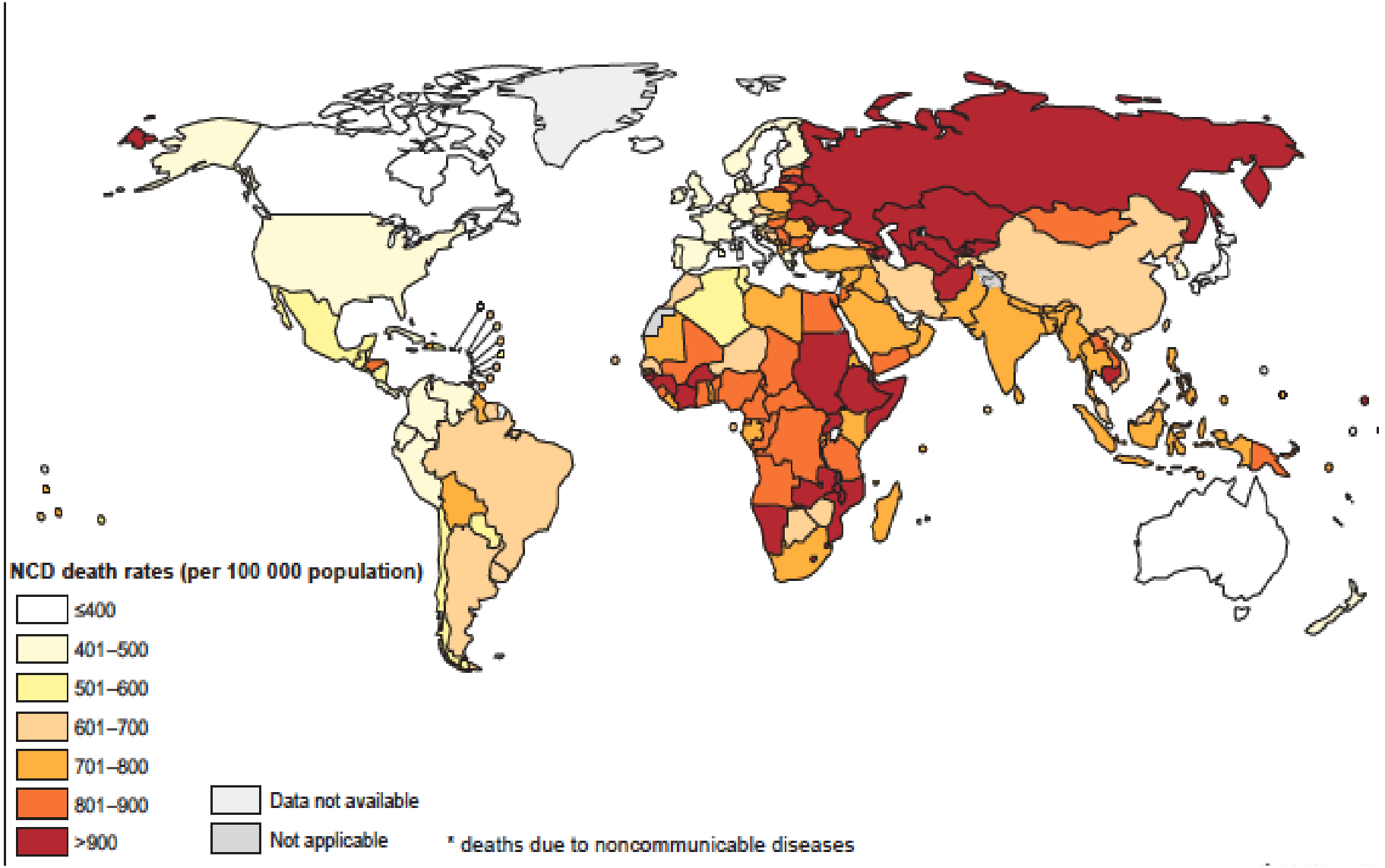
Summary

Background Breastfeeding has clear short-term benefits, but its long-term consequences on human capital are yet to be established. We aimed to assess whether breastfeeding duration was associated with intelligence quotient (IQ), years of schooling, and income at the age of 30 years, in a setting where no strong social patterning of breastfeeding exists.

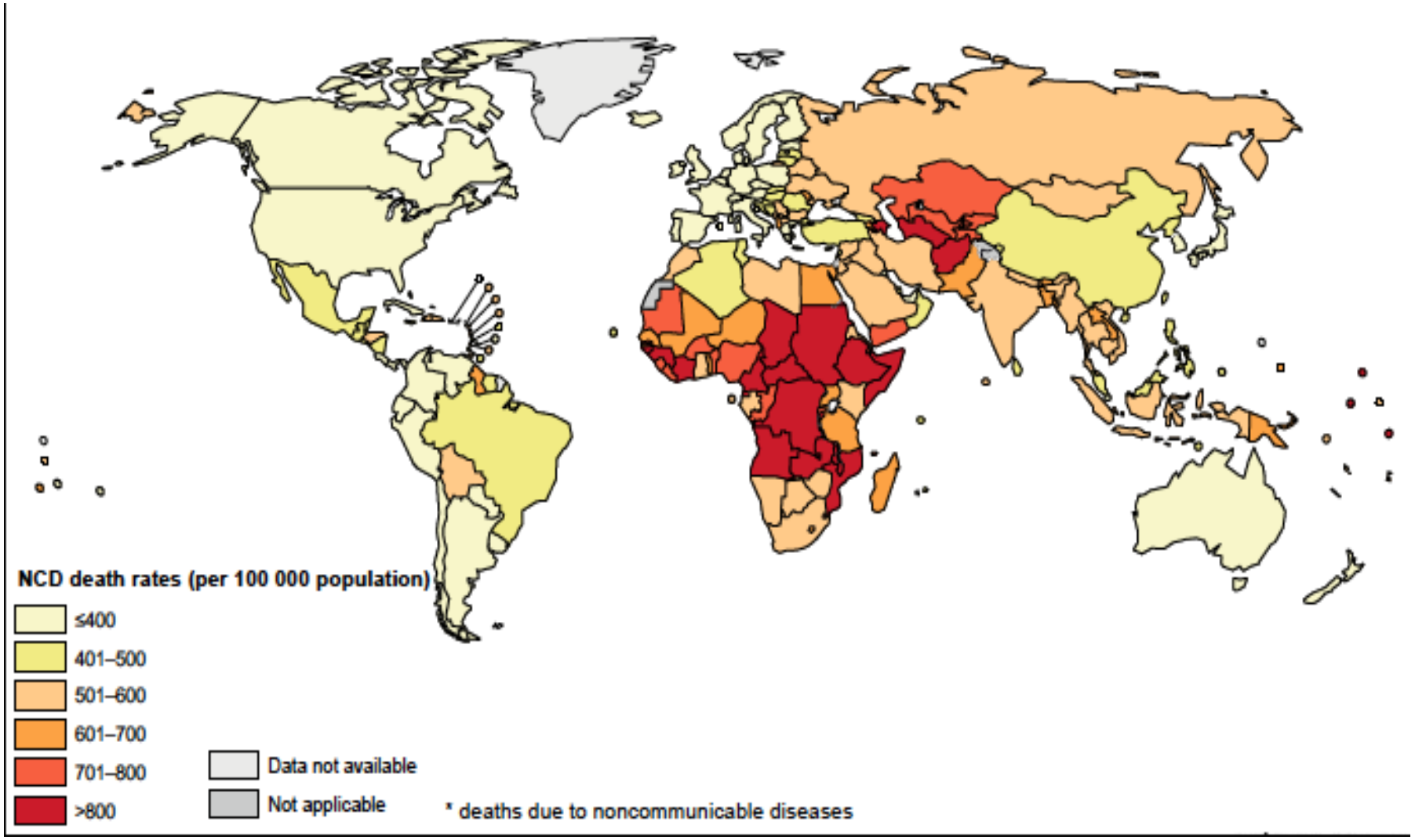
Deaths caused by NCDs compared to other causes (WHO 2011)



NCDs male


NCD death rates (per 100 000 population)
≤400
401–500
501–600
601–700
701–800
801–900
>900
Data not available
Not applicable
* deaths due to noncommunicable diseases

NCDs female


NCD death rates (per 100 000 population)
≤400
401–500
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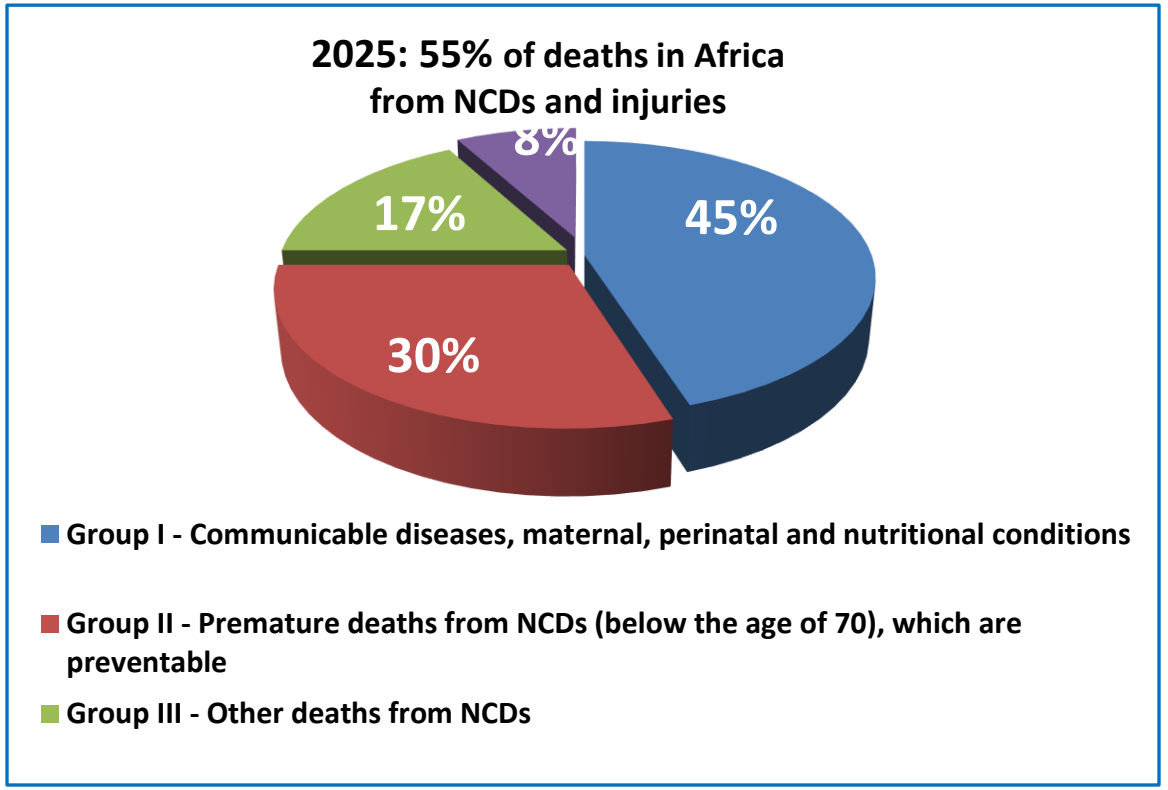
701–800
>800
Data not available
Not applicable
* deaths due to noncommunicable diseases

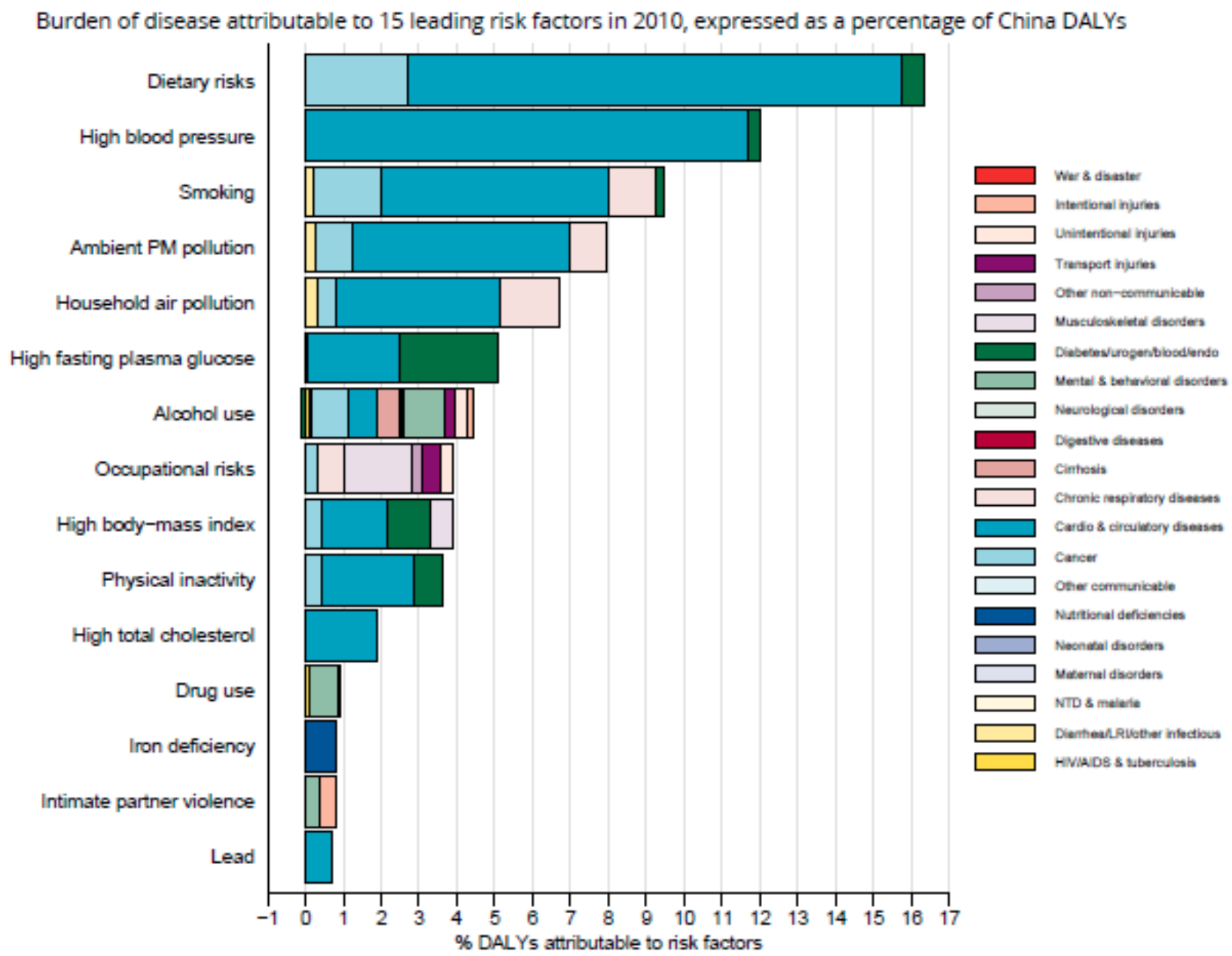
The burden of NCDs will increase in the AFRO region and by 2025 will become a major contributor to mortality (40% in 2010 to 55% in 2025)



Projected Deaths from NCDs in the African Region in 2025

Genesis of NCDs

UNDERLYING SOCIOECONOMIC, CULTURAL, POLITICAL AND ENVIRONMENTAL DETERMINANATS	COMMON MODIFIABLE RISK FACTORS	INTERMEDIATE RISK FACTORS	MAIN CHRONIC DISEASES
	Unhealthy diet	Raised blood pressure	Heart disease
	Physical inactivity	Raised blood glucose	Stroke
Globalization	Tobacco use	Abnormal blood lipids	Cancer
Urbanization	**NON- MODIFIABLE RISK FACTORS**	Overweight/obesity	Chronic respiratory diseases
Population ageing	Age		Diabetes
Early Life Characteristics	Heredity		


Burden of disease attributable to 15 leading risk factors in 2010, expressed as a percentage of China DALYs
Dietary risks
High blood pressure
Smoking
Ambient PM pollution
Household air pollution
High fasting plasma glucose
Alcohol use
Occupational risks
High body−mass index
Physical inactivity
High total cholesterol
Drug use
Iron deficiency
Intimate partner violence
Lead
−1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
% DALYs attributable to risk factors
War & disaster
Intentional injuries
Unintentional injuries
Transport injuries
Other non−communicable
Musculoskeletal disorders
Diabetes/urogen/blood/endo
Mental & behavioral disorders
Neurological disorders
Digestive diseases
Cirrhosis
Chronic respiratory diseases
Cardio & circulatory diseases
Cancer
Other communicable
Nutritional deficiencies
Neonatal disorders
Maternal disorders
NTD & malaria
Diarrhea/LRI/other infectious
HIV/AIDS & tuberculosis

Deadly NCD conditions

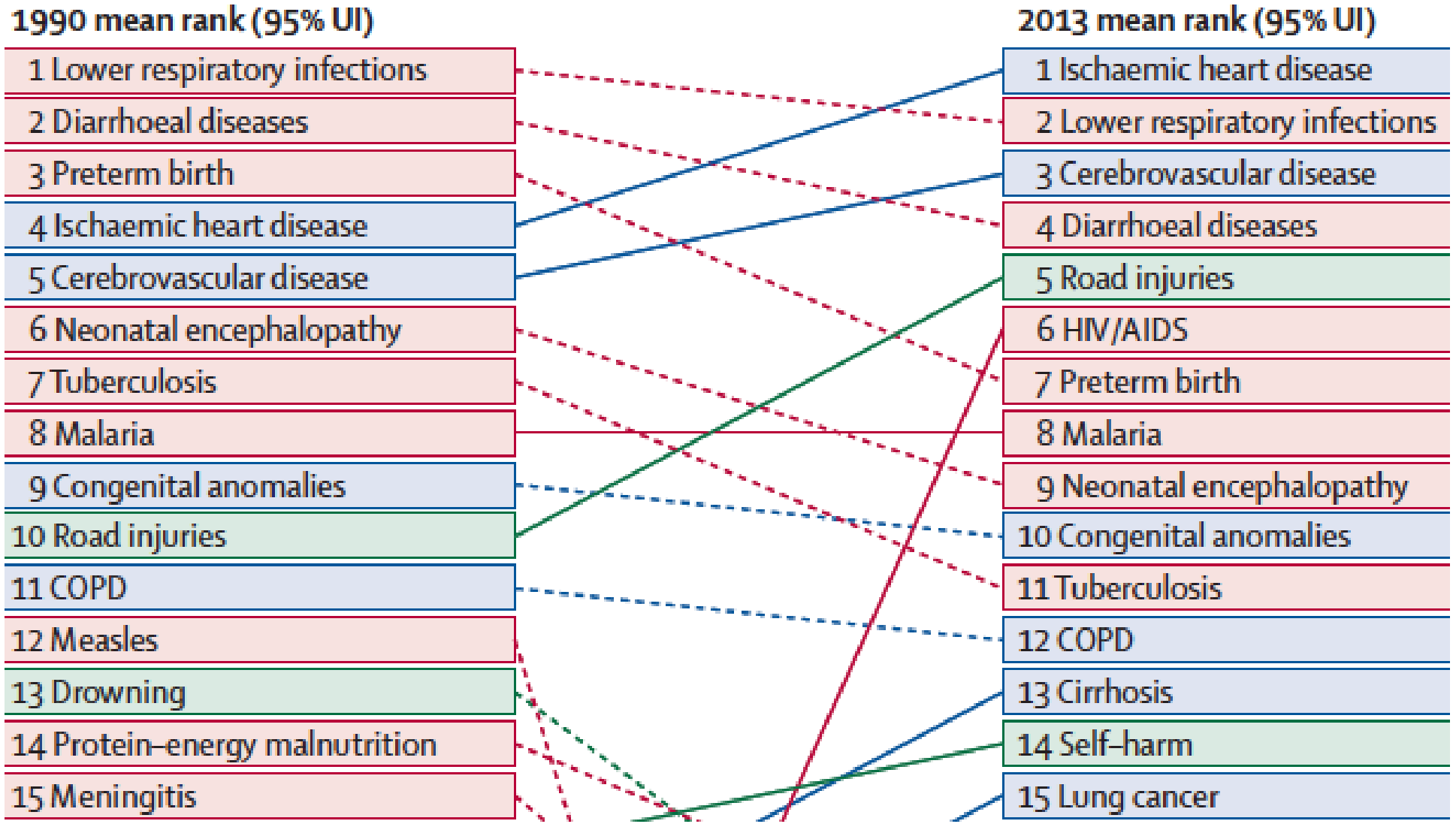
- Four most common NCDs contributed to majority of deaths:
  - Cardiovascular diseases
  - Diabetes
  - Cancers
  - Chronic lung diseases
- Each of them is common in lower income settings than it is currently among wealthier countries

WHO 2012

  - More of these conditions occurs in low and middle income countries, e.g.
    - > 80% of cardiovascular deaths and diabetes deaths
    - > 90% of deaths from chronic obstructive pulmonary disease
    - > two thirds of all cancer deaths

WHO 2011

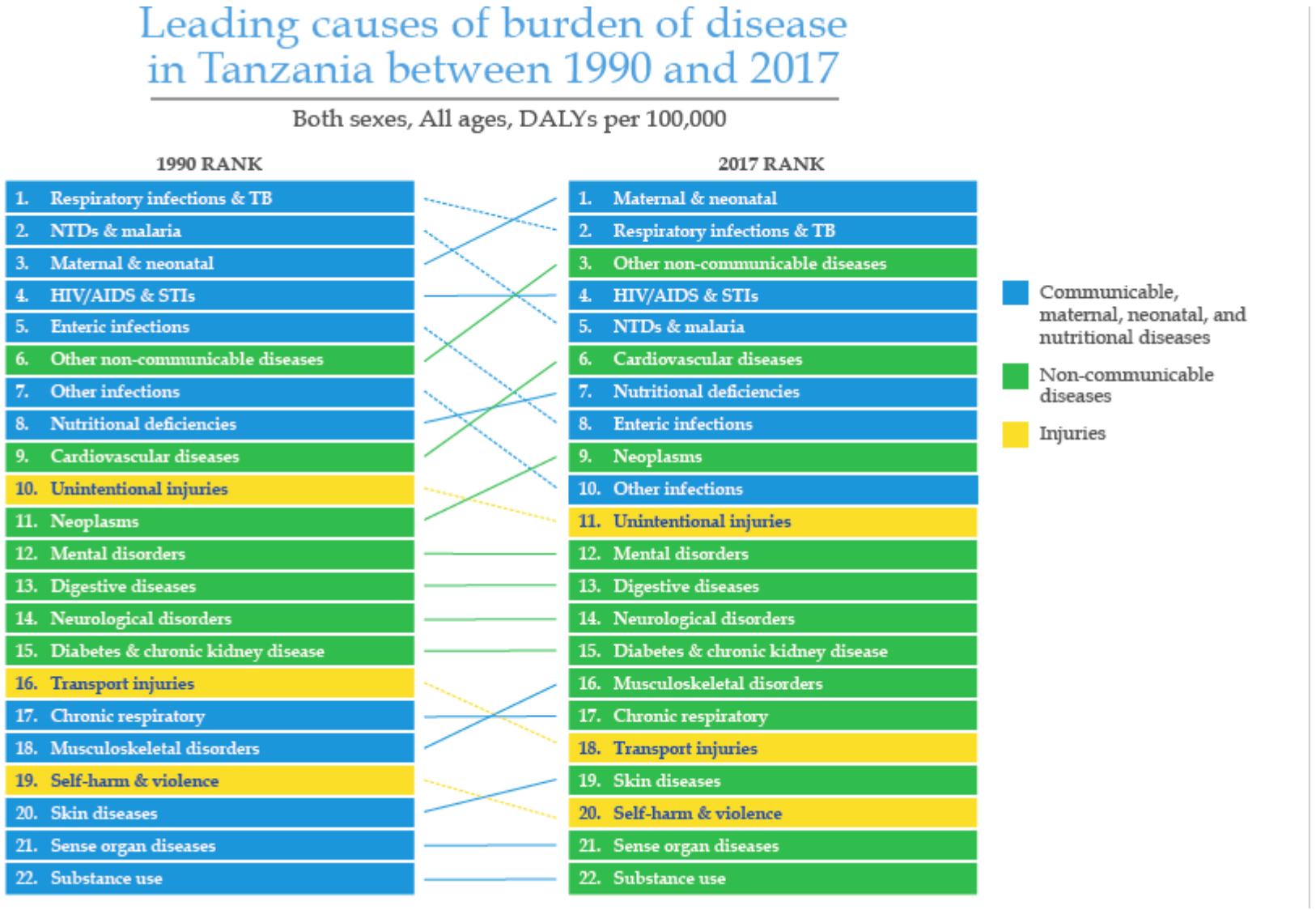
Epidemiological shift



Tanzania at a Glance

SN	Cause of Death-All ages	N	%	Top 10	Top 20	Top 30	Least 13
1	Malaria	28,219	12.75				
2	Respiratory diseases	22,316	10.08				
3	HIV/AIDS	17,790	8.04				
4	Anaemia	17,218	7.78				
5	Cardio-circulatory diseases	13,981	6.31	67			
6	Injury	11,772	5.32				
7	Cancer	11,662	5.27				
8	Septicaemia	8,691	3.93				
9	Neonatal disorders	8,036	3.63				
10	Stroke	7,588	3.43				
11	Tuberculosis	6,778	3.06				
12	Meningitis	5,932	2.68		87		
13	Preterm Complications	5,373	2.43				
14	Respiratory distress	5,261	2.38				
15	Gastro-intestinal diseases	4,273	1.93				
16	Diabetes	4,116	1.86				
17	Birth Complications	3,992	1.8				
18	Shock	3,672	1.66				
19	Metabolic disorder	3,268	1.48				
20	Maternal Complications-Child	3,056	1.38				
21	Liver diseases	2,904	1.31				
22	HIV with Tuberculosis	2,892	1.31				
23	Malnutrition	2,801	1.27			97	
24	Unspecified	2,624	1.19				
25	Brain Diseases	2,492	1.13				
26	Kidney failure	2271	1.03				
27	Diarrhoeal diseases	2235	1.01				
28	Maternal Complications-Adult	2103	0.95				
29	Haemorrhage	1240	0.56				
30	Kidney diseases	1115	0.5				
31	Intoxication	1094	0.49				
32	Congenital anomalies	986	0.45				
33	Multiple organ failure	809	0.37				
34	Poisoning	593	0.27				
35	Surgical Conditions	549	0.25				2.6
36	Genito-urinary diseases	399	0.18				
37	Tetanus	399	0.18				
38	Mental illness	247	0.11				
39	Rabies	236	0.11				
40	Drowning	213	0.1				
41	Bites	147	0.07				
42	Anaesthesia Complications	40	0.02				
43	Liver failure	23	0.01				

Burden of NCDs and Health system response



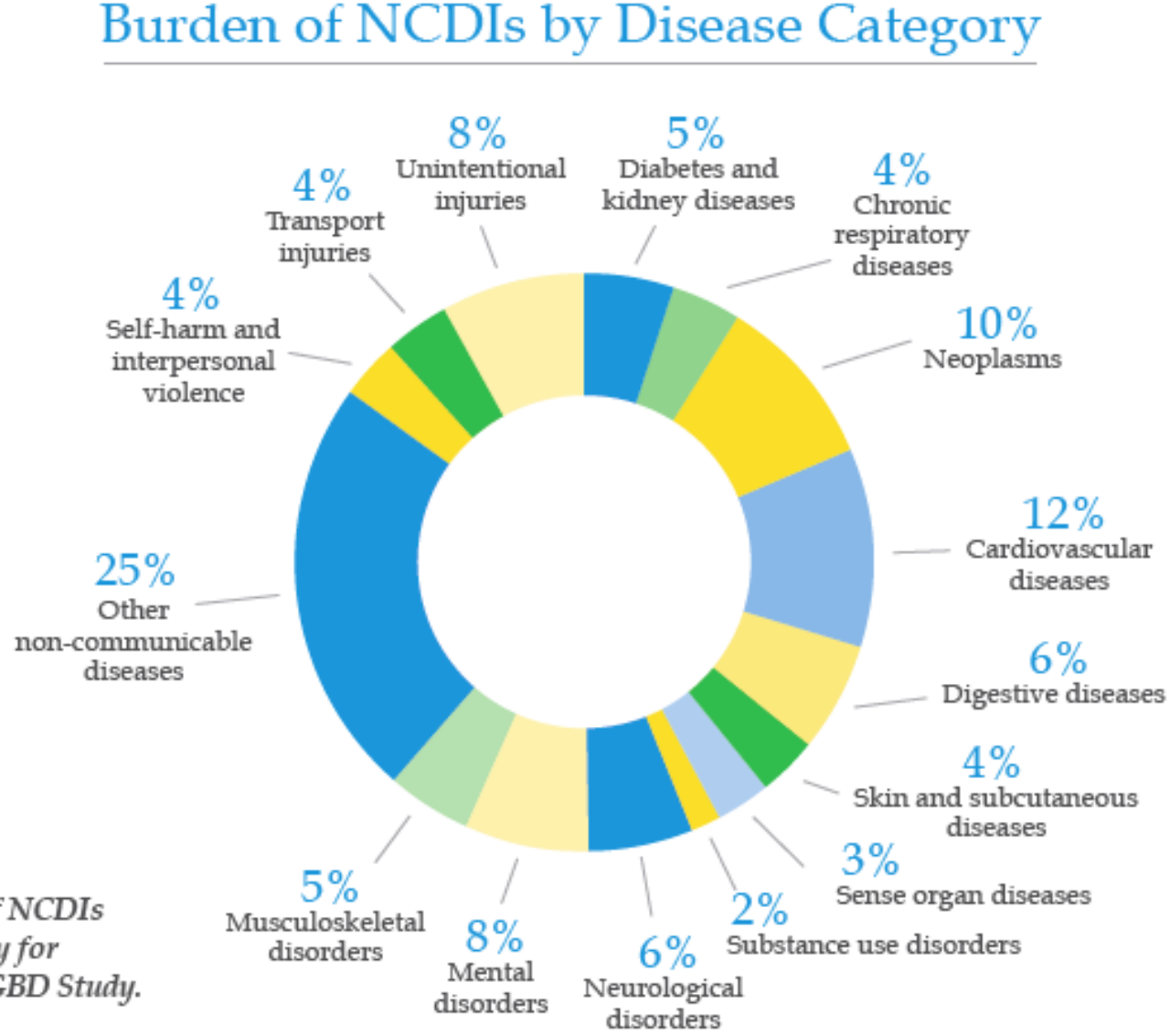
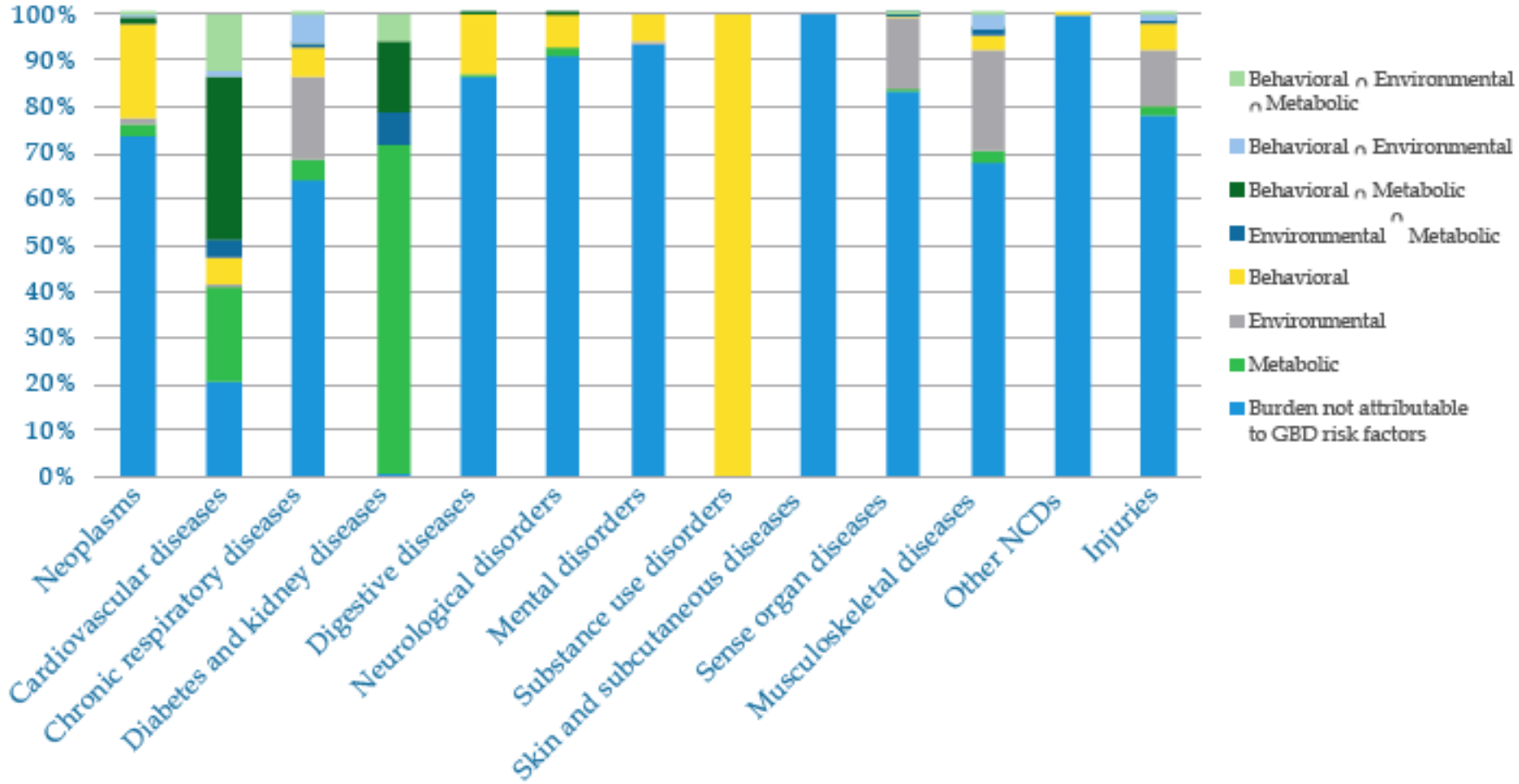


Figure 3: Burden of NCDIs by disease category for Tanzania in 2017, GBD Study.

NCDI Risk Factor Attribution by Disease Categoryin 2017

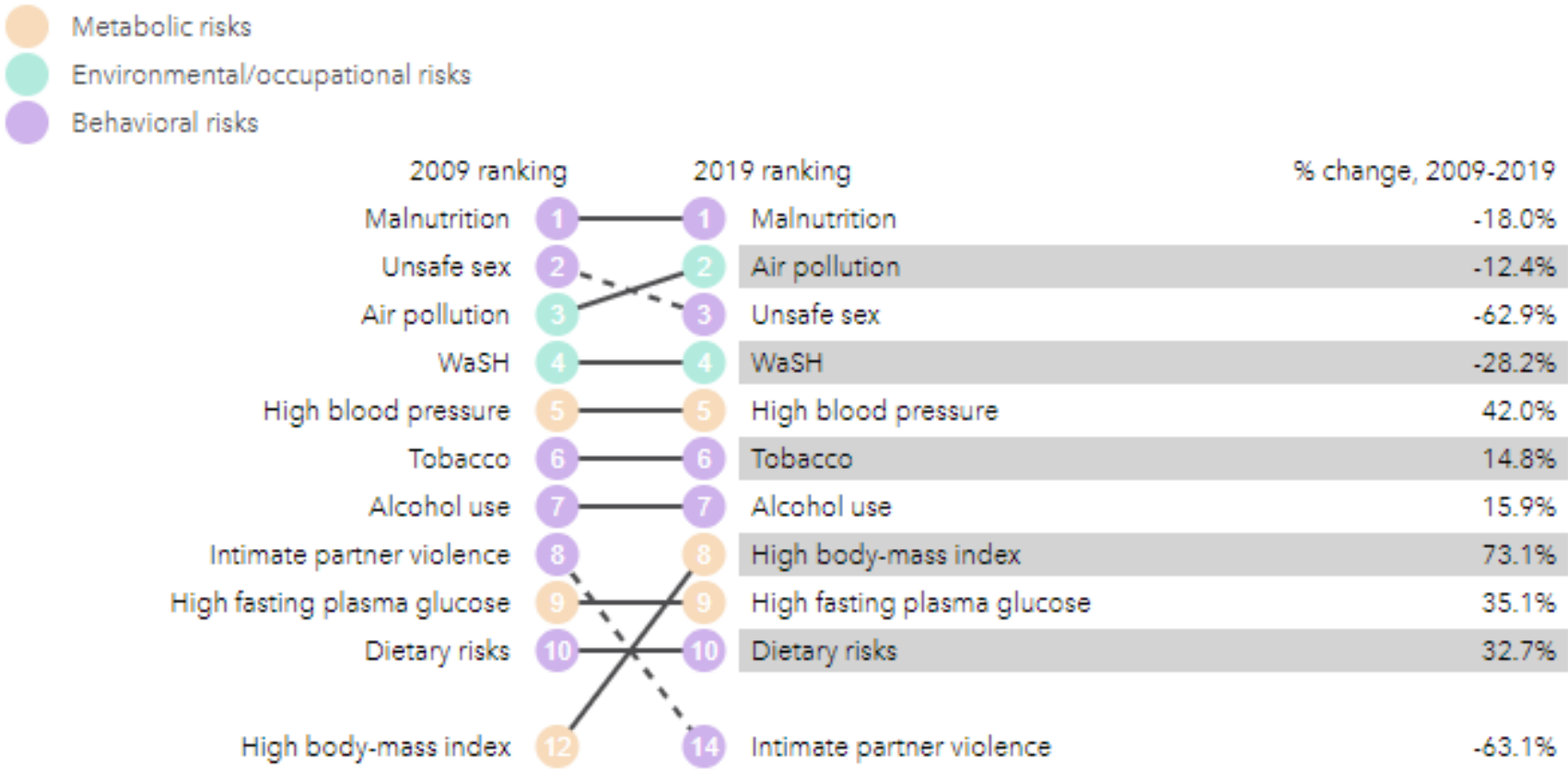


Population Screening 2014-2019

				Hypertension			Diabetes		
Screened Population (n)	Persons	Obese	Overweight	Known	**New**	Total	Known	**New**	Total
Medical Camps, Regions (4)	4056	21.3%	27.3%	17.9%	**29.2%**	47.1%	4.7%	**2.2%**	6.9%
Employees, DSM (5)	424	43.5%	35.1%	3.4%	**26.2%**	29.7%	2.4%	**2.2%**	4.6%
Facility Attendees, DSM (4)	1100	16.9%	25.7%	3.4%	**33.6%**	37.0%	1.0%	**6.5%**	7.5%
Communities, DSM (13)	4040	20.5%	29.8%	11.7%	**21.5%**	33.1%	6.6%	**4.3%**	10.9%
Communities, Regions (11)	5879	20.4%	28.0%	21.6%	**23.0%**	44.5%	9.7%	**2.5%**	12.2%
Universities (5)	1260	16.4%	28.1%	4.8%	**17.0%**	21.8%	1.8%	**1.0%**	2.9%
Medical Students, DSM	104	7.7%	17.3%	0.0%	**5.1%**	5.1%	0.0%	**1.1%**	1.1%
Secondary Schools, DSM (2)	984	2.7%	14.7%	0.0%	**5.3%**	5.3%			
Teacher Colleges (5)	2560	2.8%	11.6%	0.6%	**14.7%**	15.4%	0.1%	**1.5%**	1.6%
Total	**20407**	**17.5%**	**25.5%**	**12.7%**	**22.0%**	**34.7%**	**5.5%**	**2.8%**	**8.3%**

Source: Prof. Kaushik

What risk factors drive the most death and disability combined?



Top 10 risks contributing to total number of DALYs in 2019 and percent change 2009–2019, all ages combined

Feeding practices vs. Nutrition status

- Focus

1. Stunting (children underfive)
2. Anemia (Children underfive)
3. Anemia (Women of reproductive age)
4. Anemia (Pregnant women)

Improved Indicators With Remaining Challenges

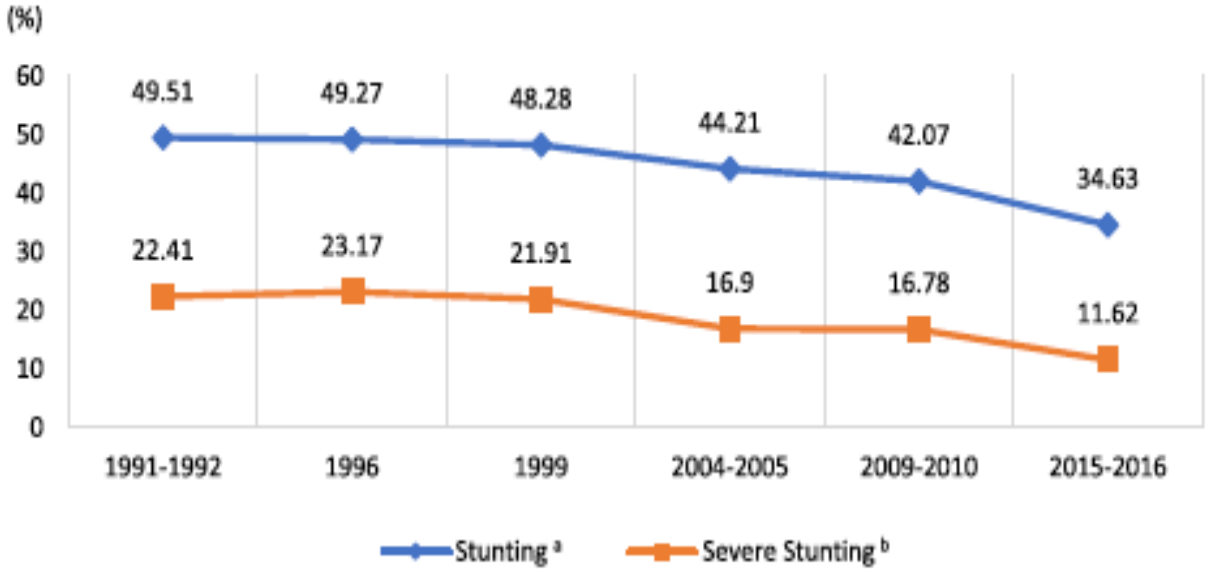
Sunguya et al. Nutrition Journal (2019) 18:85
https://doi.org/10.1186/s12937-019-0505-8

Nutrition Journal

RESEARCH Open Access

Trends in prevalence and determinants of stunting in Tanzania: an analysis of Tanzania demographic health surveys (1991–2016)

Bruno F. Sunguya[1†], Si Zhu[2,3†], Rose Mpembeni[1*] and Jiayan Huang[2,3*]



...The pace for ameliorating stunting, however, is slow—with remaining burden among one in every three under-fives..

...the remaining determinants of stunting which include

- low birth weights,
- poor nutritional status of mothers,
- short duration of breastfeeding and
- low wealth status of the families.

Urban and rural disparity

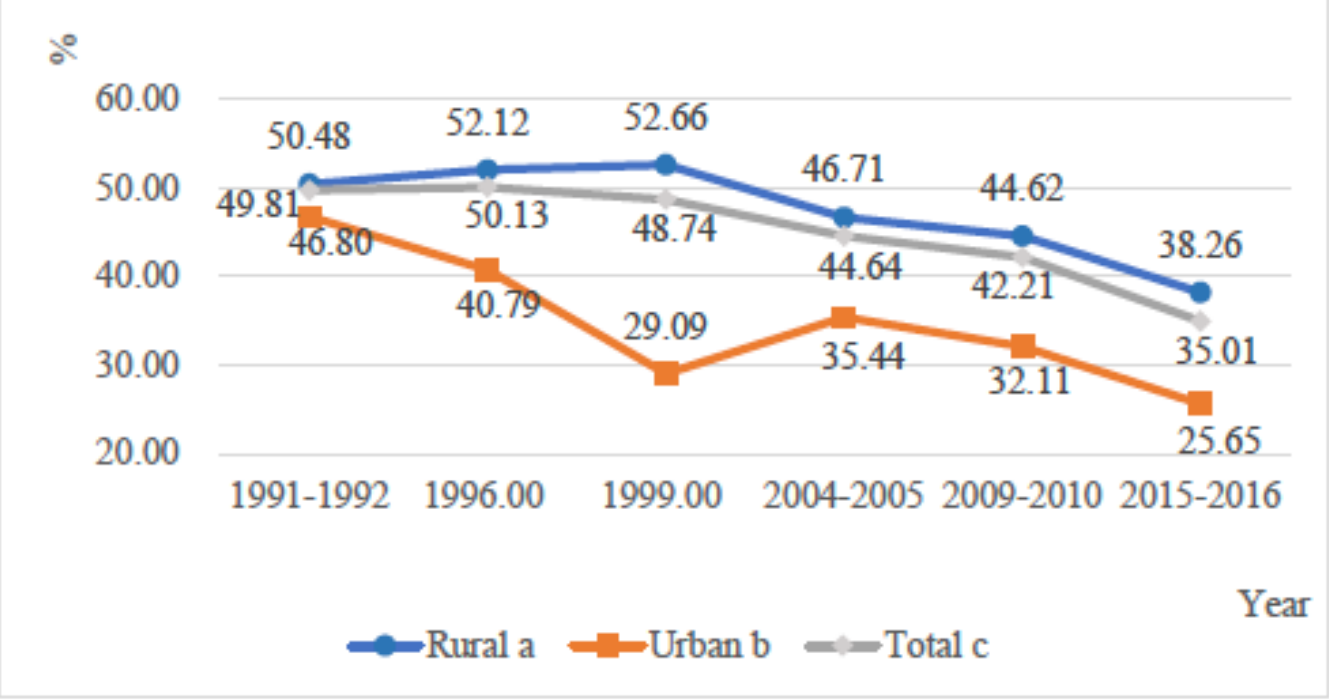
International Journal of *Environmental Research and Public Health*

MDPI

Article

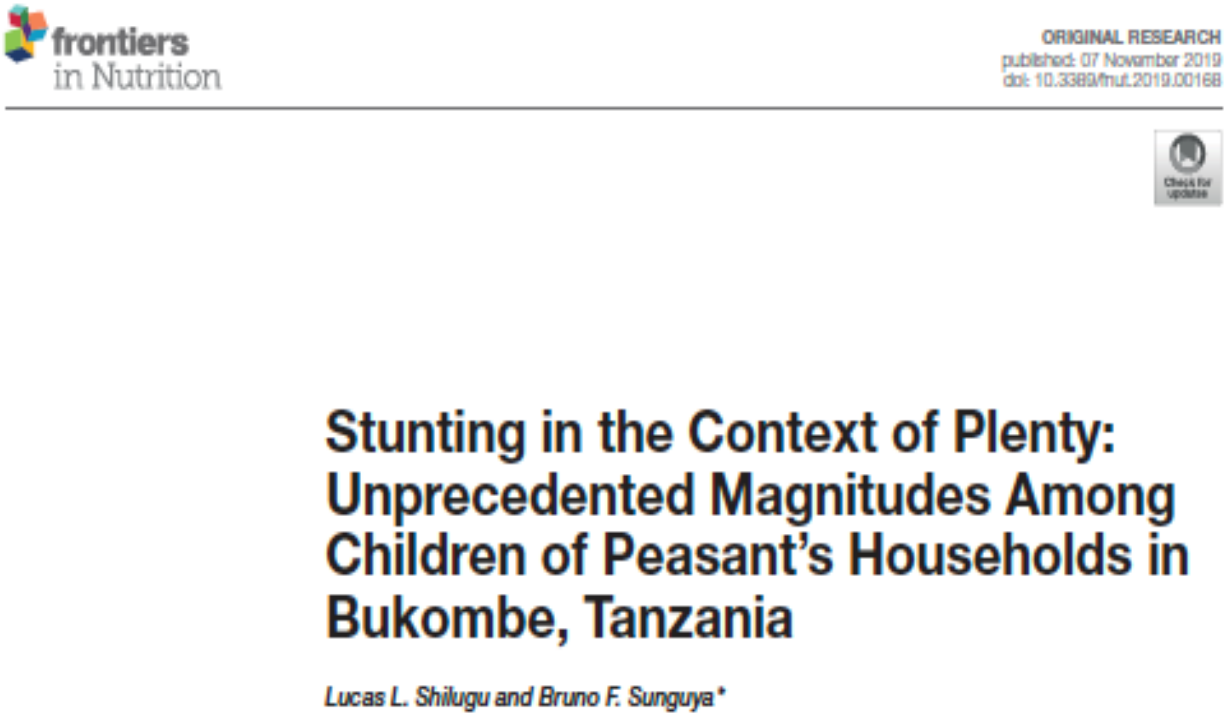
Urban–Rural Disparities in the Magnitude and Determinants of Stunting among Children under Five in Tanzania: Based on Tanzania Demographic and Health Surveys 1991–2016

Wenjun Zhu [1,2,3,†], Si Zhu [1,2,3,†], Bruno F. Sunguya [4] and Jiayan Huang [1,2,3,*]



- the nutritional disparity between urban and rural has widened, and stunting is still an overwhelming phenomenon in the rural area.
- the nutritional disparity was mainly attributed to the socioeconomic imbalance between rural and urban households.
- initiatives should be directed at vulnerable children, such as
  - children from agricultural families,
  - in the economy, education, food supply, and women's status gradually narrow

food secure regions with poor feeding



- Magnitude of undernutrition was high in Bukombe district.
- Chronic form of undernutrition was prevalent in among 52.8% of all under-5 children
- Stunting was more prevalent among children in peasant population due to poor feeding practices.
- Majority of children were fed at a low feeding frequency and dietary diversity.
- Stunting was also significantly associated with
  - age, household food insecurity, and low birth weight.

Feeding practices Vs Anemia among U5

International Journal of *Environmental Research and Public Health*

MDPI

Article

Regional Disparities in the Decline of Anemia and Remaining Challenges among Children in Tanzania: Analyses of the Tanzania Demographic and Health Survey 2004–2015

Bruno F. Sunguya [1,†], Si Zhu [2,3,4,†], Linda Simon Paulo [1], Bupe Ntoga [5], Fatma Abdallah [5], Vincent Assey [5], Rose Mpembeni [1] and Jiayan Huang [2,3,4,*]

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* Correspondence: jyhuang@shmu.edu.cn
† These two authors equally contribute to this article.

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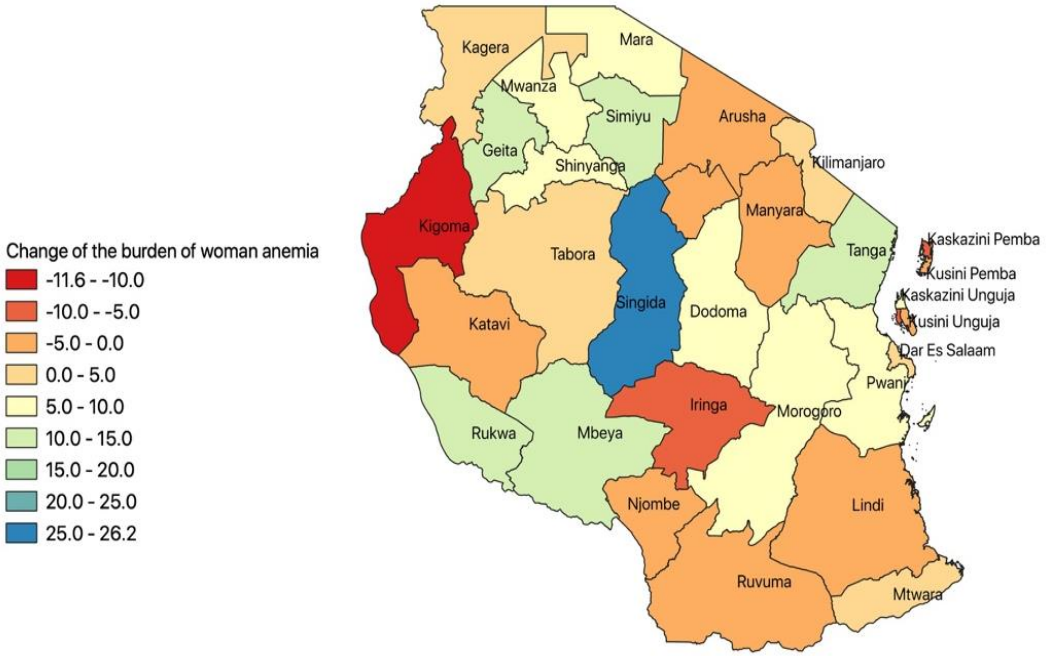
- Tanzania has observed a 42% decline in child anemia over the past decade
  - The burden is still high (59%)
- Remained determinants included:
  - Low education level
  - Food insecurity
  - Breastfeeding

Anemia Status	2004/2005		2015/2016		*p*-Value
	N	%	n	%	
Normal	2141	29.1	3232	41.3	
Anemia status	5220	70.9	4596	58.7	<0.001
Mild anemia	1762	23.9	2091	26.7	0.834
Moderate anemia	3153	42.8	2369	30.3	<0.001
Severe anemia	305	4.1	136	1.7	<0.001
Total	7361		7828		

Anemia (WRA) Vs Feeding practices

Anemia status	2004-2005		2015-2016		P-Value
	N	%	N	%	
Normal	5,236	51.6	7,207	55.2	0.007
Anemic	4,903	48.4	5,857	44.8	
Mild	3,309	67.5	4,287	73.2	0.851
Moderate	1,474	30.1	1,446	24.7	<0.001
Severe	120	2.4	124	2.1	0.145



- Tanzania has observed a 15% decline of anemia among WRA over 10 yrs.
- Factors associated with anemia:
  - younger age 15-24 years and older WRA
  - Low education level
  - Poverty
  - Underweight
  - Dietary diversity and feeding frequency

In peer review

Pregnant women Anemia Vs. Feeding practices

Sunguya et al. Nutr J (2021) 20:65
https://doi.org/10.1186/s12937-021-00726-0

Nutrition Journal

RESEARCH Open Access

High burden of anemia among pregnant women in Tanzania: a call to address its determinants

Bruno F. Sunguya[1†], Yue Ge[2,3†], Linda Mlunde[1,4], Rose Mpembeni[1], Germana Leyna[5] and Jiayan Huang[2,3*]

Abstract

Background: Anemia in pregnancy is behind a significant burden of maternal mortality and poor birth outcomes globally. Efforts to address it need evidence on trends and its pertinent factors as they vary from one area to another.

Methods: We pooled data of 23,203 women of reproductive age whose hemoglobin levels were measured from two Tanzania Demographic and Health Surveys (TDHS). Of them, 2,194 women were pregnant. Analyses employed descriptive analyses to determine the burden of anemia, its characteristics, and severity; GIS mapping to determine the regional changes of anemia between 2005 and 2015; and logistic regression to determine the remaining determinants of anemia among pregnant women using Stata 15.

Results: The burden of anemia among pregnant women in Tanzania has remained unprecedently high, and varies between regions. There was no significant decline of anemia in general between the two periods after adjusting for individual, households, reproductive, and child characteristics [AOR = 0.964, 95% CI = 0.774–1.202, $p = 0.747$). Anemia is currently prevalent in 57% of pregnant women in Tanzania. The prevalence is more likely to be higher among women aged 15–19 years than those aged between 20–34 years. It is more likely to be prevalent among those within large families, with no formal education, food insecurity, lack of health insurance, had no antimalaria during pregnancy, and had low frequency of ANC attendance. On the other hand, delivery in a health facility may be potentially protective against anemia.

Conclusions: Anemia in pregnancy remained persistently high and prevalent among 57% of pregnant women in Tanzania. Efforts to address anemia are crucial and need to be focused in regions with increasing burden of anemia among pregnant women. It is imperative to address important risk factors such as food insecurity, strengthening universal health coverage, empowering women of reproductive age with education and especially nutritional knowledge and advocating for early antenatal booking, attendance, and facility delivery.

Keywords: Anemia, Pregnancy, Demographic and health survey, Tanzania, Women of reproductive age

- Not declined for a decade (57%)
- Associated with
  - food insecurity
  - ANC attendance
  - attendance, and facility delivery.

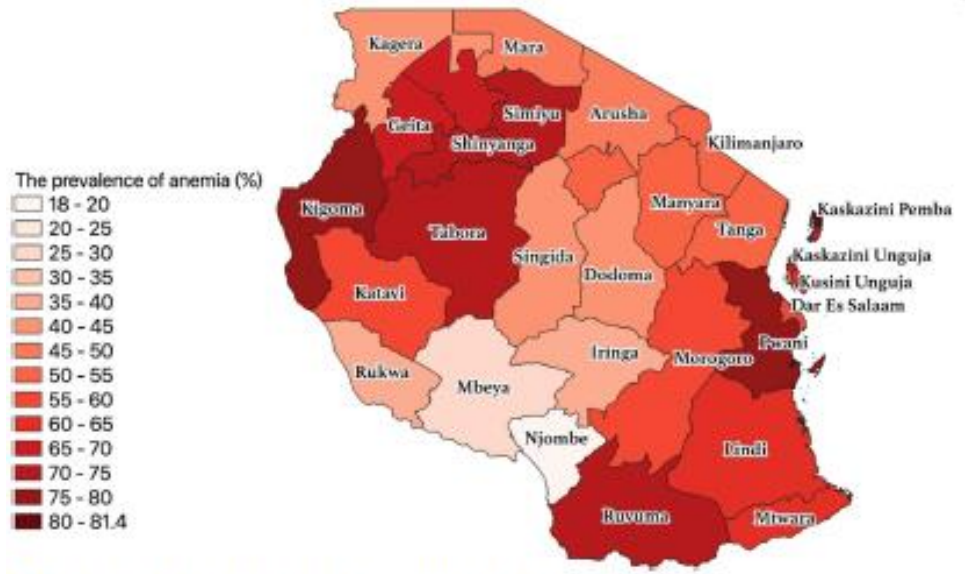


Fig. 2 The GIS mapping of the regional burdens of anemia among pregnant in 2015–2016 survey

We know what works at the community level—No silver bullet

Nutrition-Specific and Nutrition-Sensitive Interventions

Specific Nutrition Interventions

- Support for exclusive breastfeeding up to 6 months of age and continued breastfeeding, together with appropriate and nutritious food, up to 2 years of age
- Fortification of foods
- Micronutrient supplementation
- Treatment of severe malnutrition.

Nutrition-Sensitive Approaches

Agriculture: Making nutritious food more accessible to everyone, and supporting small farms as a source of income for women and families

Clean Water and Sanitation: Improving access to reduce infection and disease

Education and Employment: Making sure children have the energy that they need to learn and earn sufficient income as adults

Healthcare: Improving access to services to ensure that women and children stay healthy

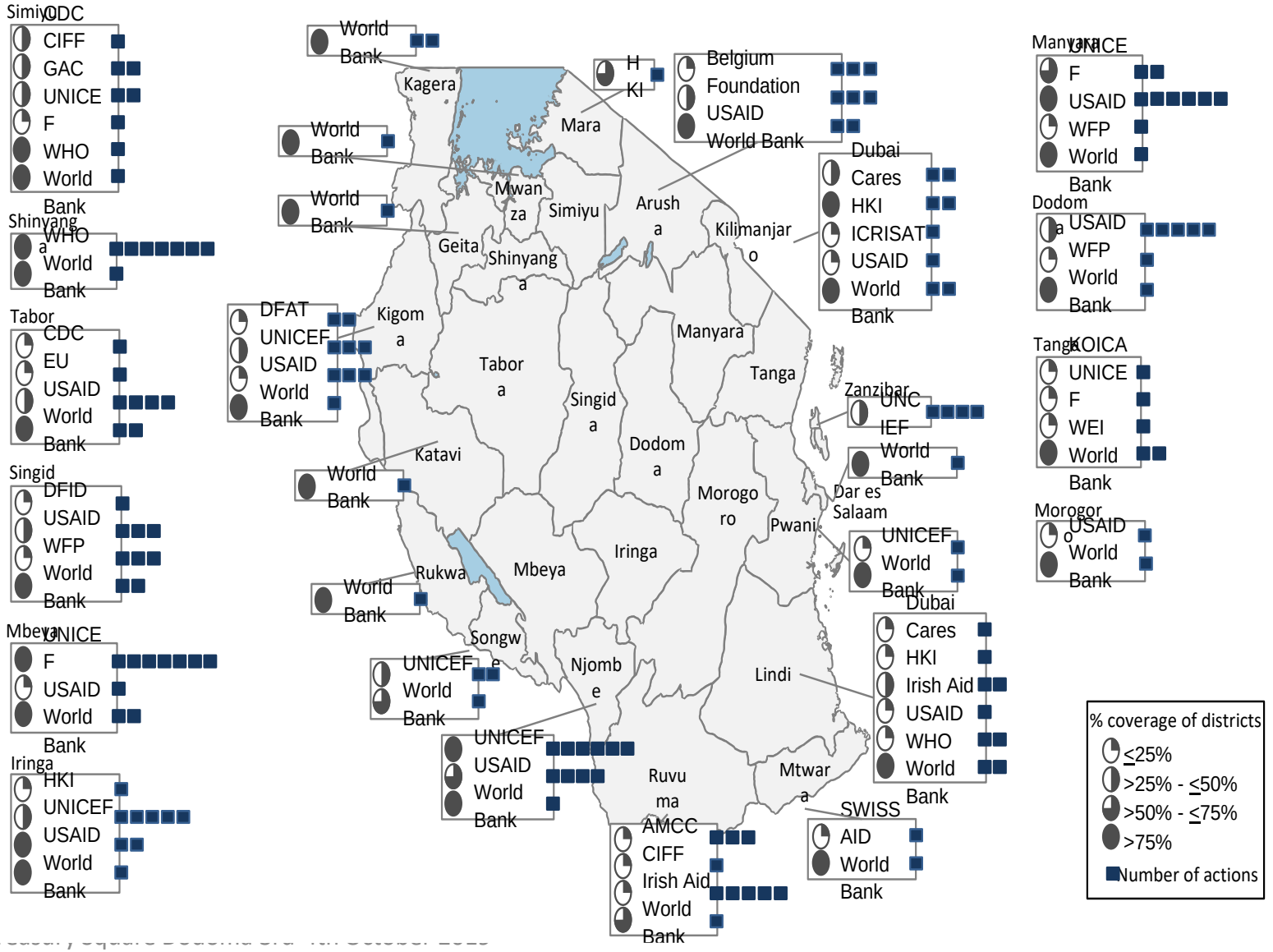
Support for Resilience: Establishing a stronger, healthier population and sustained prosperity to better endure emergencies and conflicts

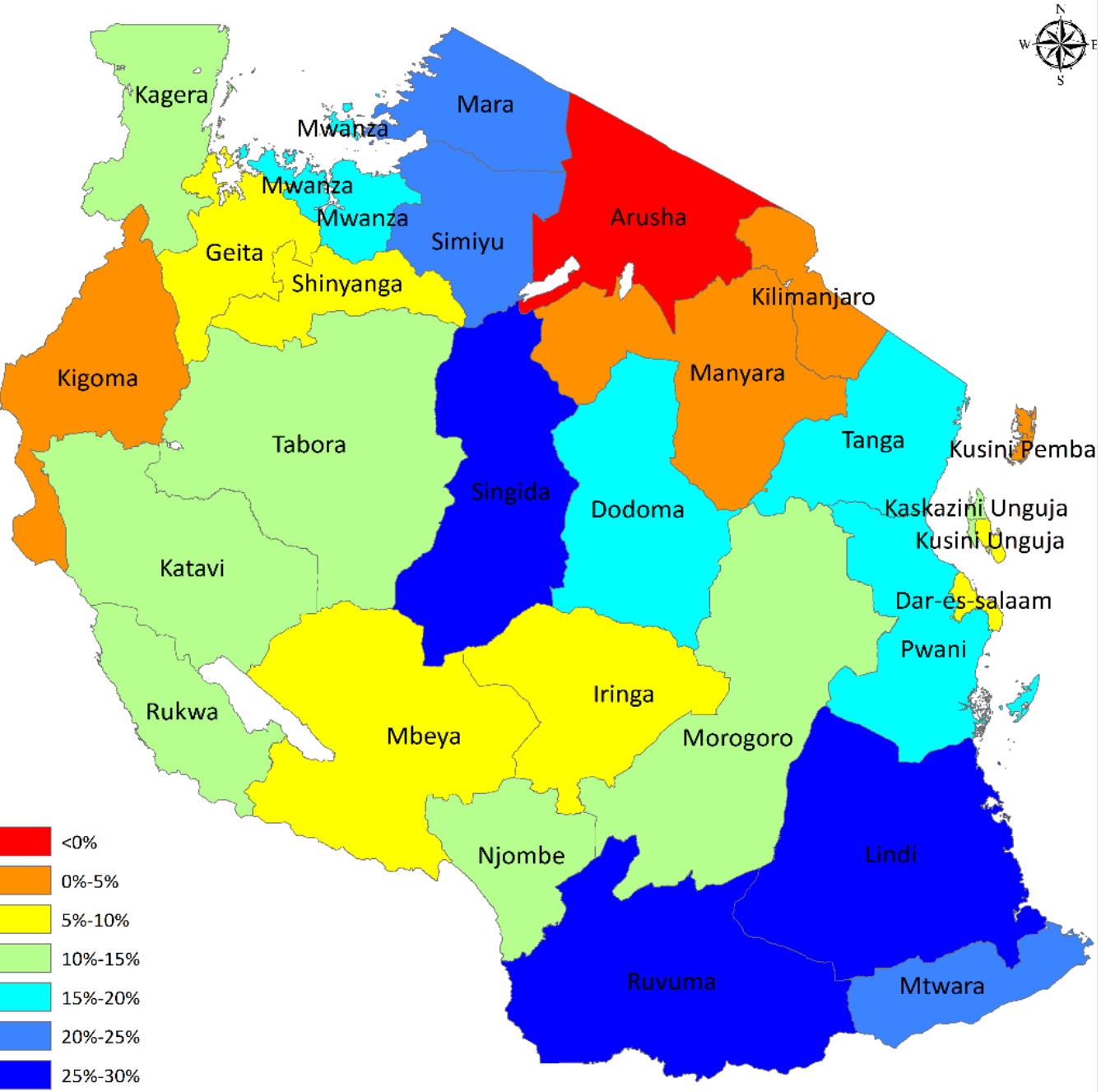
Women's Empowerment: At the core of all efforts, women are empowered to be leaders in Nutrition-Sensitive Approaches.

Factors for Success/ collaboration

Could partnership work?

The decline of children anemia seems to collate with number and coverage of interventions and nutrition actions.

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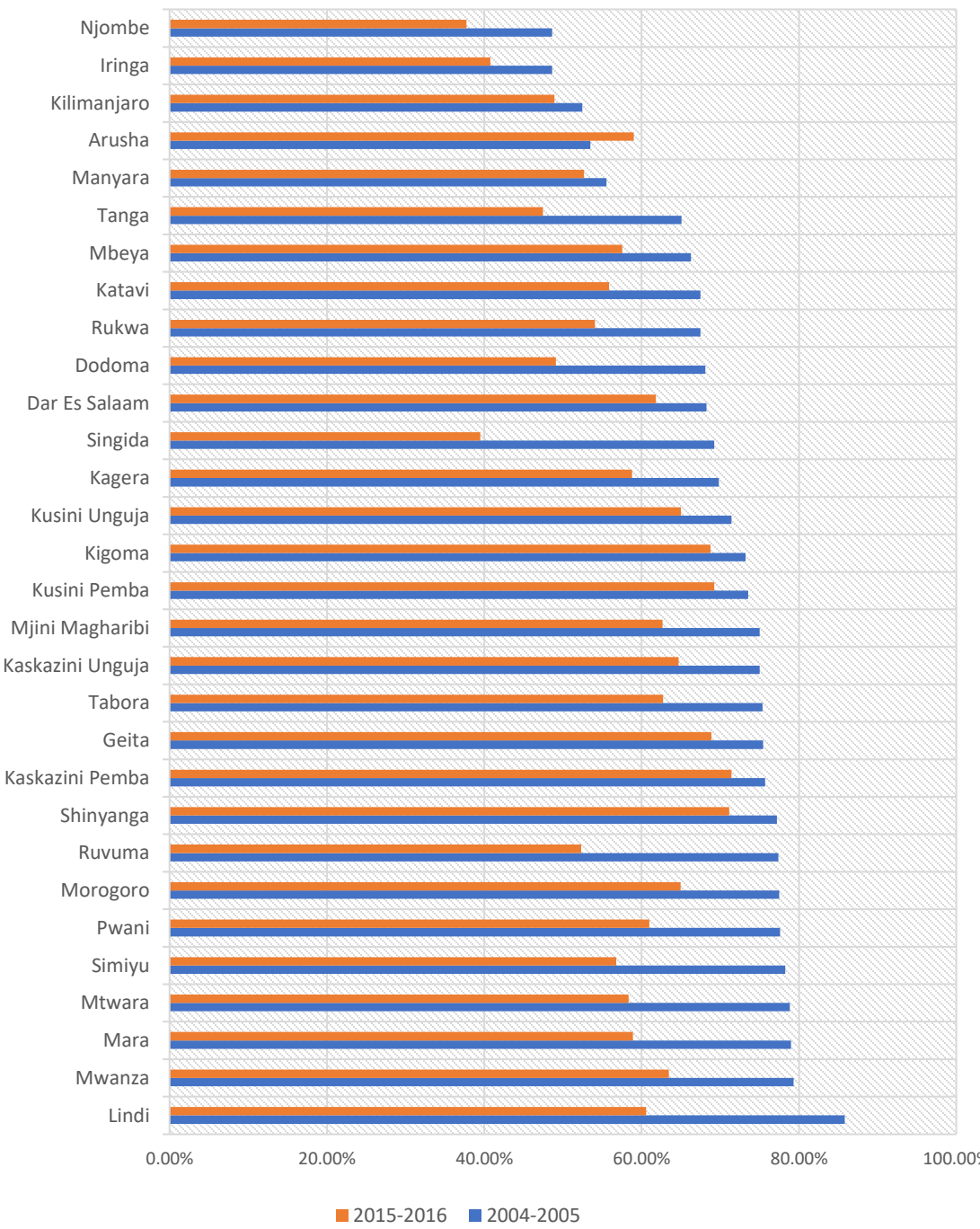
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60.00%
80.00%
100.00%
2015-2016
2004-2005

Final thoughts

- In addressing NCDs for the Tanzanian context
  1. Evidence based on the Tanzanian context are highly needed
  2. Focus on intergeneration interventions
  3. Broader than very specific interventions
  4. Analysis of food systems and contextual barriers in feeding practices
  5. Start at the vulnerable stage (to break the cycle)
  6. Integrate efforts within health system, school system, community system
  7. Implementation science is key
- Multisectoral approach is key
- Partnerships to avoid duplicated efforts