Tuberculosis
What's poverty got to do with it?

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Tuberculosis by the numbers

- TB leading cause of death by an infectious disease
- 2 billion people infected
- 10 million people newly develop active TB / year
- 600.000 people develop DR-TB

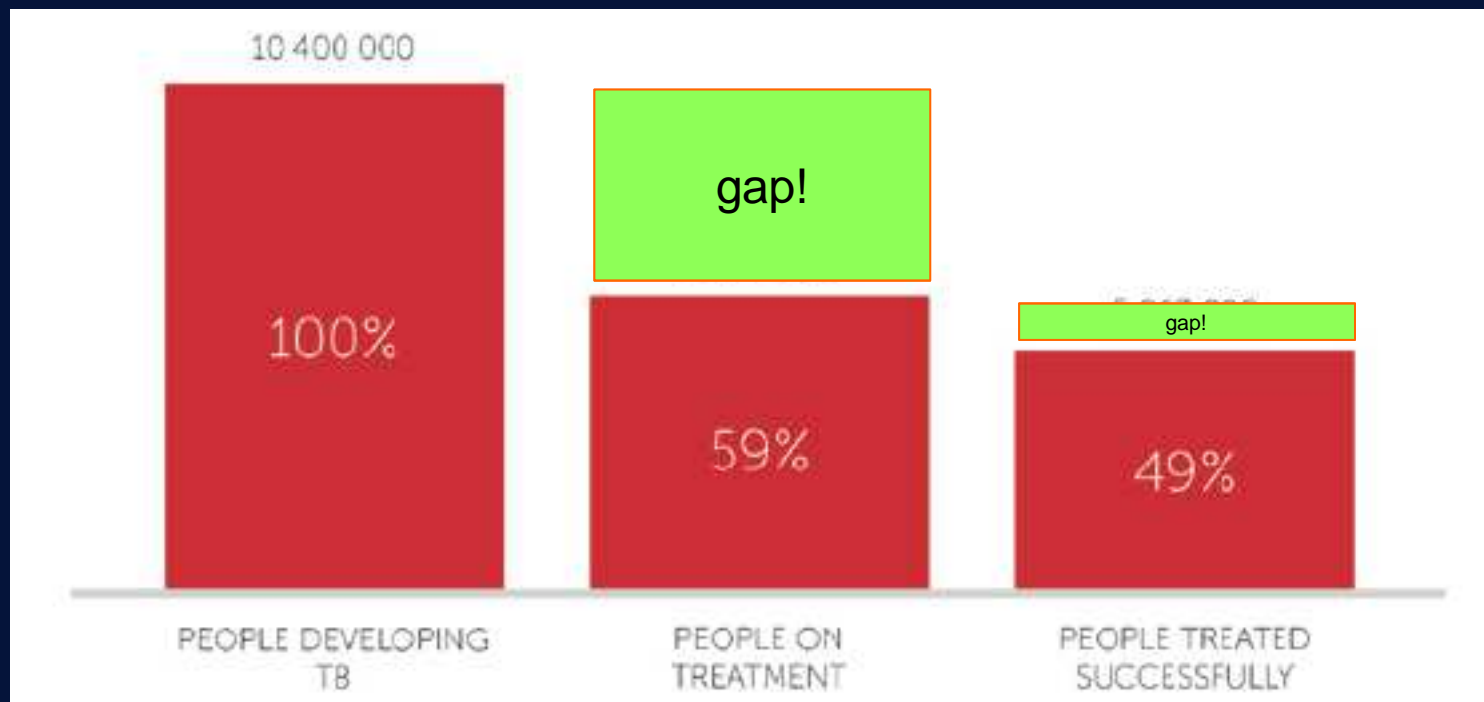# Tuberculosis by the numbers

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TB treatment success, 1ˢᵗ line

10 400 000	6 100 000	5 063 000
100%	59%	49%
PEOPLE DEVELOPING TB	PEOPLE ON TREATMENT	PEOPLE TREATED SUCCESSFULLY

Source: Stop TB Partnership, 2017

TB treatment success, 1st line

Source: Stop TB Partnership, 2017

TB: hard to find & hard to treat

gap!

gap!

- TB can mimic any disease
- slow onset disease

- diagnostic testing not easy
- diagnosis ≠ blood sample

- treatment is long & hefty
- (fear for) side effects
- drug interactions

TB high-burden countries

In 2015

10.4 million cases   **1.8 million deaths**   **480,000 *MDR-TB cases**

30 high-burden countries
Incidence rates, 2015

Estimates, new cases per 100,000 population

- 40 - 99
- 100 - 199
- 200 - 299
- 300 - 499
- 500+

Pakistan
510,000

China
918,000

Nigeria
586,000

India
2.8 million
cases

Indonesia
1 million

South Africa
454,000

● **30 high *multi-drug resistant TB countries**

Source : WHO global tuberculosis report 2016

In 2015

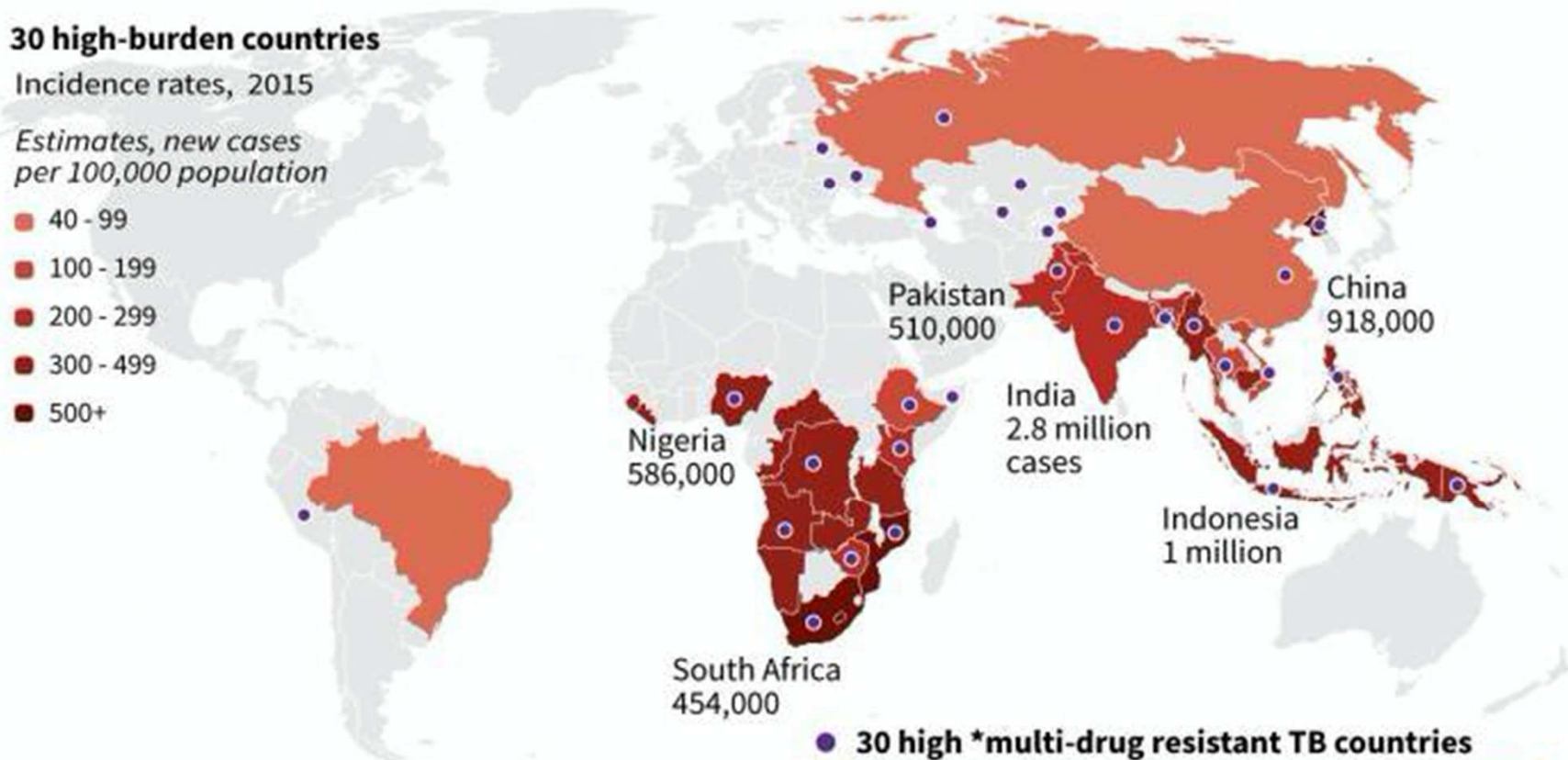10.4 million cases   1.8 million deaths   480,000 *MDR-TB cases
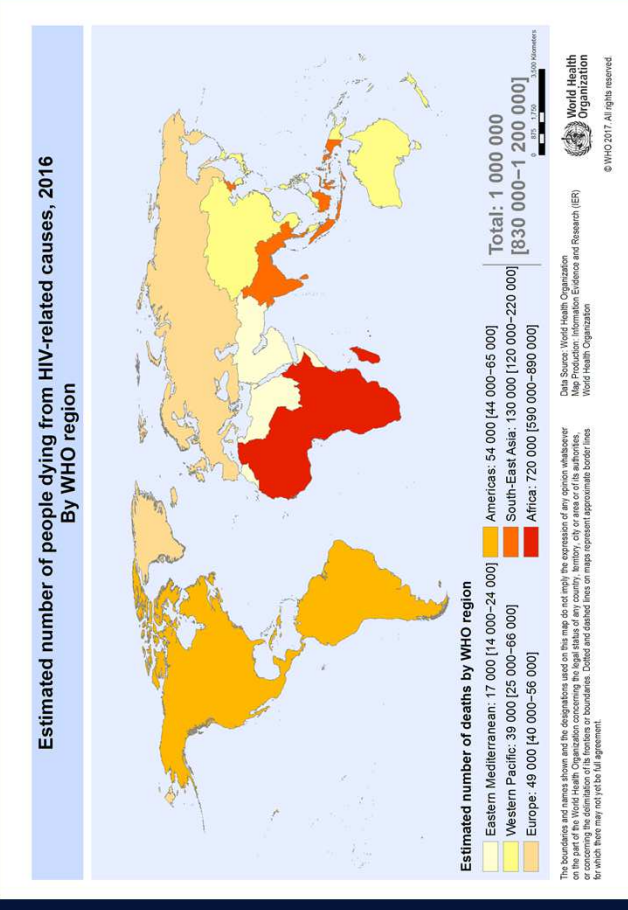
30 high-burden countries

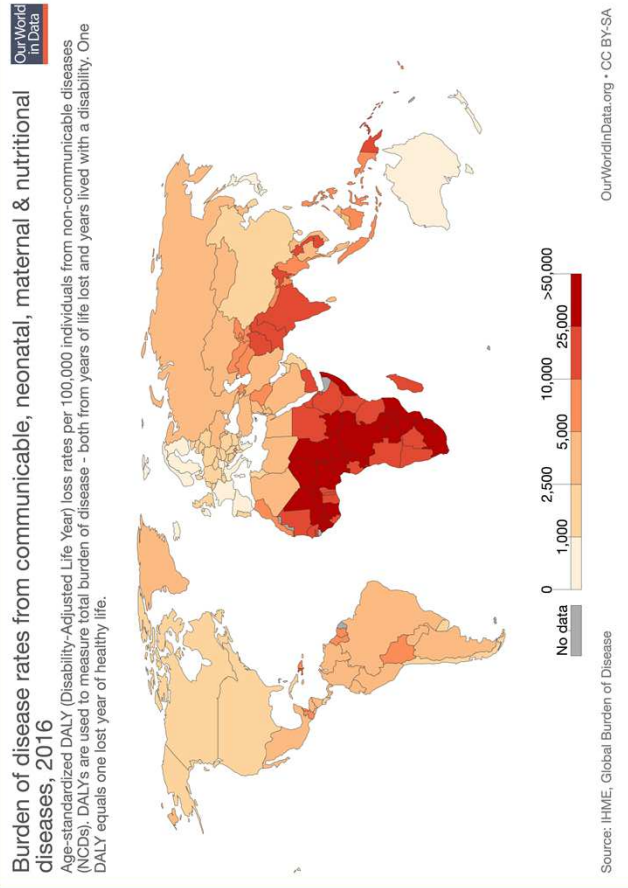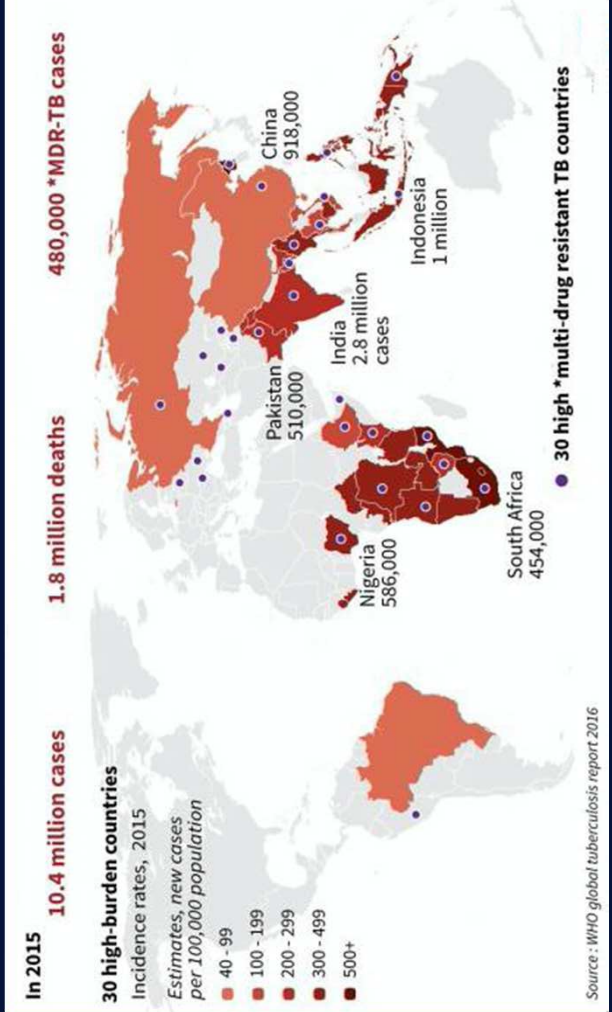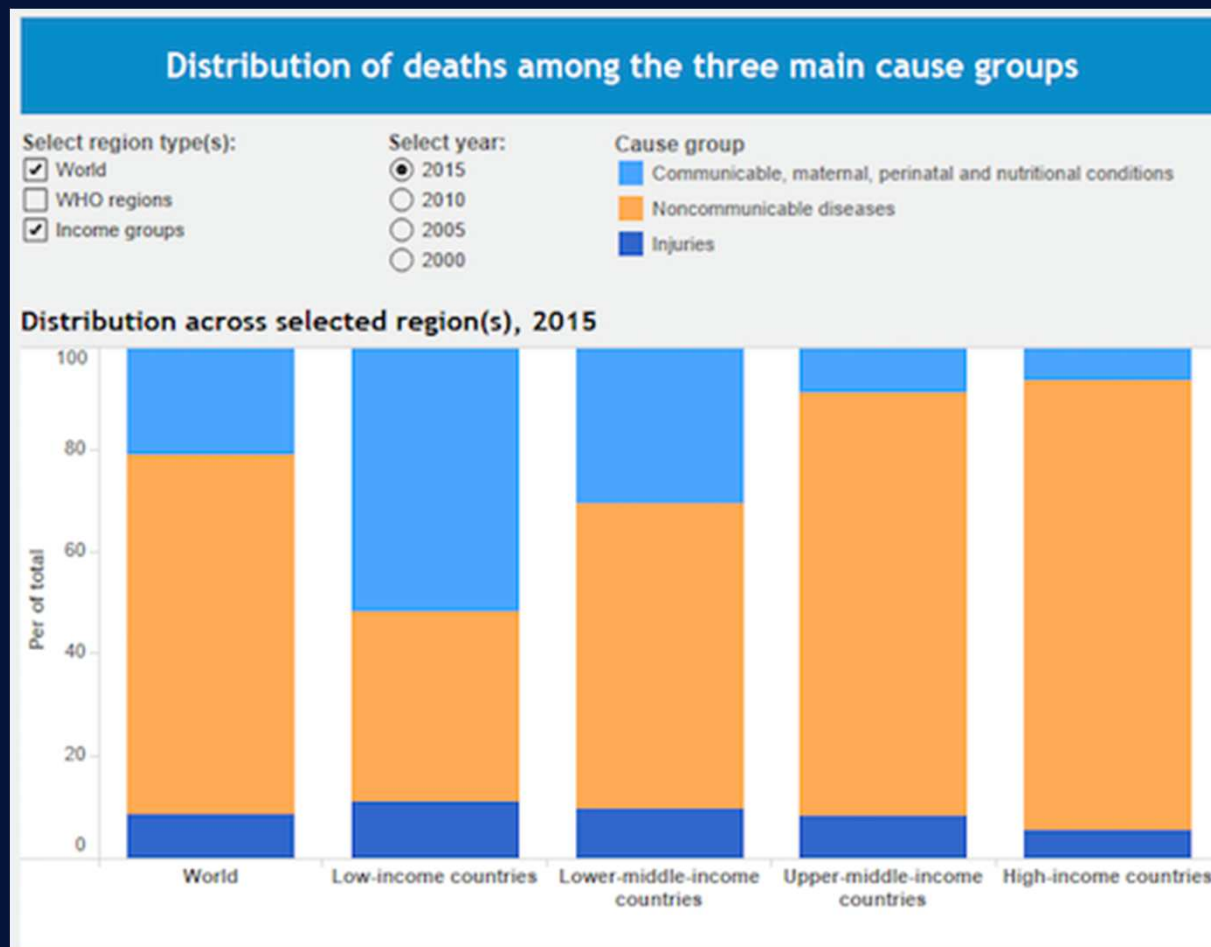Incidence rates, 2015

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● 30 high *multi-drug resistant TB countries

Source : WHO global tuberculosis report 2016

Estimated number of people dying from HIV-related causes, 2016
By WHO region

Estimated number of deaths by WHO region

Eastern Mediterranean: 17 000 [14 000–24 000]	Americas: 54 000 [44 000–65 000]	Total: 1 000 000
Western Pacific: 39 000 [25 000–66 000]	South-East Asia: 130 000 [120 000–220 000]	[830 000–1 200 000]
Europe: 49 000 [40 000–56 000]	Africa: 720 000 [590 000–890 000]	

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization
Map Production: Information Evidence and Research (IER)
World Health Organization

World Health
Organization

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Burden of disease rates from communicable, neonatal, maternal & nutritional diseases, 2016

Age-standardized DALY (Disability-Adjusted Life Year) loss rates per 100,000 individuals from non-communicable diseases (NCDs). DALYs are used to measure total burden of disease - both from years of life lost and years lived with a disability. One DALY equals one lost year of healthy life.

No data   0   1,000   2,500   5,000   10,000   25,000   >50,000

Source: IHME, Global Burden of Disease

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changing pattern of disease with income
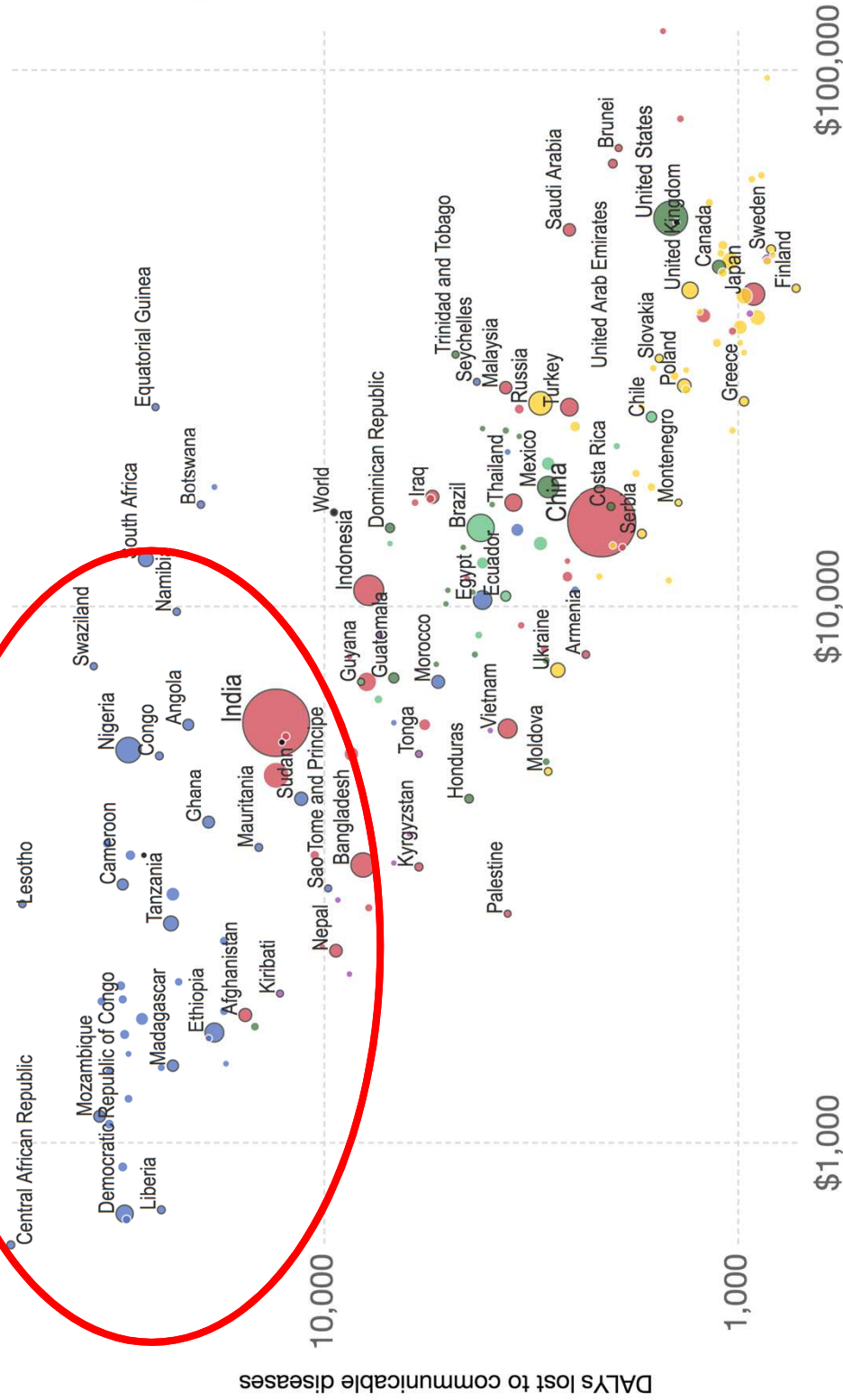

source: WHO

Disease burden due to communicable diseases vs. GDP per capita, 2016

Disease burden to communicable, maternal, neonatal and nutritional diseases, measured in DALYs (Disability-Adjusted Life Years) lost per 100,000 individuals versus gross domestic product (GDP) per capita, measured in 2011 international-$.

Africa
Asia
Europe
North America
Oceania
South America

OurWorld in Data

DALYs lost to communicable diseases

GDP per capita, PPP (constant 2011 international $)

Central African Republic
Mozambique
Democratic Republic of Congo
Liberia
Lesotho
Cameroon
Tanzania
Madagascar
Ethiopia
Afghanistan
Kiribati
Nigeria
Congo
Angola
Ghana
Mauritania
Nepal
Sao Tome and Principe
Sudan
Bangladesh
Kyrgyzstan
Tonga
Honduras
Palestine
Vietnam
Moldova
India
Indonesia
Guyana
Guatemala
Morocco
Ukraine
Armenia
Egypt
Ecuador
Brazil
Thailand
Mexico
Costa Rica
China
Serbia
Montenegro
Chile
Poland
Greece
Slovakia
Russia
Turkey
Malaysia
Seychelles
Trinidad and Tobago
Iraq
Dominican Republic
World
Swaziland
Namibia
South Africa
Botswana
Equatorial Guinea
United Arab Emirates
Saudi Arabia
Brunei
United States
United Kingdom
Canada
Sweden
Japan
Finland

10,000
1,000

$1,000
$10,000
$100,000

Source: IHME, Global Burden of Disease; World Bank – WDI

OurWorldInData.org/burden-of-disease/ • CC BY-SA

Disease burden due to communicable diseases vs. GDP per capita, 2016

Disease burden to communicable, maternal, neonatal and nutritional diseases, measured in DALYs (Disability-Adjusted Life Years) lost per 100,000 individuals versus gross domestic product (GDP) per capita, measured in 2011 international-$.

source: NASA: https://www.nasa.gov/

physician-to-population ratio

Figure 4.8.2. Physician-to-population ratio (per 10 000 population) by WHO region, 2007–2013

| Region	Ratio
Africa	2.7
South-East Asian Region	5.9
Eastern Mediterranean	12.7
Western Pacific	15.5
Americas	21.5
Europe	32.1
Global	13.9

Source : WHO, 2015

Figure 4.8.1. Physician-to-population ratio (per 10 000 population) in the African Region, 2007–2013

Country	Ratio
Africa	2.7
Liberia	0.1
Malawi	0.2
Niger	0.2
Sierra Leone	0.2
Ethiopia	0.3
UR Tanzania	0.3
Mozambique	0.4
Burkina Faso	0.5
Central African Republic	0.5
Togo	0.5
Benin	0.6
Rwanda	0.6
Senegal	0.6
Guinea-Bissau	0.7
Cameroon	0.8
Mali	0.8
Zimbabwe	0.8
Congo	1.0
Ghana	1.0
Gambia	1.1
Mauritania	1.3
Côte d'Ivoire	1.4
Madagascar	1.6
Angola	1.7
Swaziland	1.7
Zambia	1.7
Kenya	2.0
Cabo Verde	3.1
Namibia	3.7
Botswana	4.0
Nigeria	4.1
South Africa	7.8
Seychelles	10.7
Algeria	12.1

Countries of the African Region without data are not included in the chart.

Source : WHO, 2015.

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Africa
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DALYs lost to communicable diseases
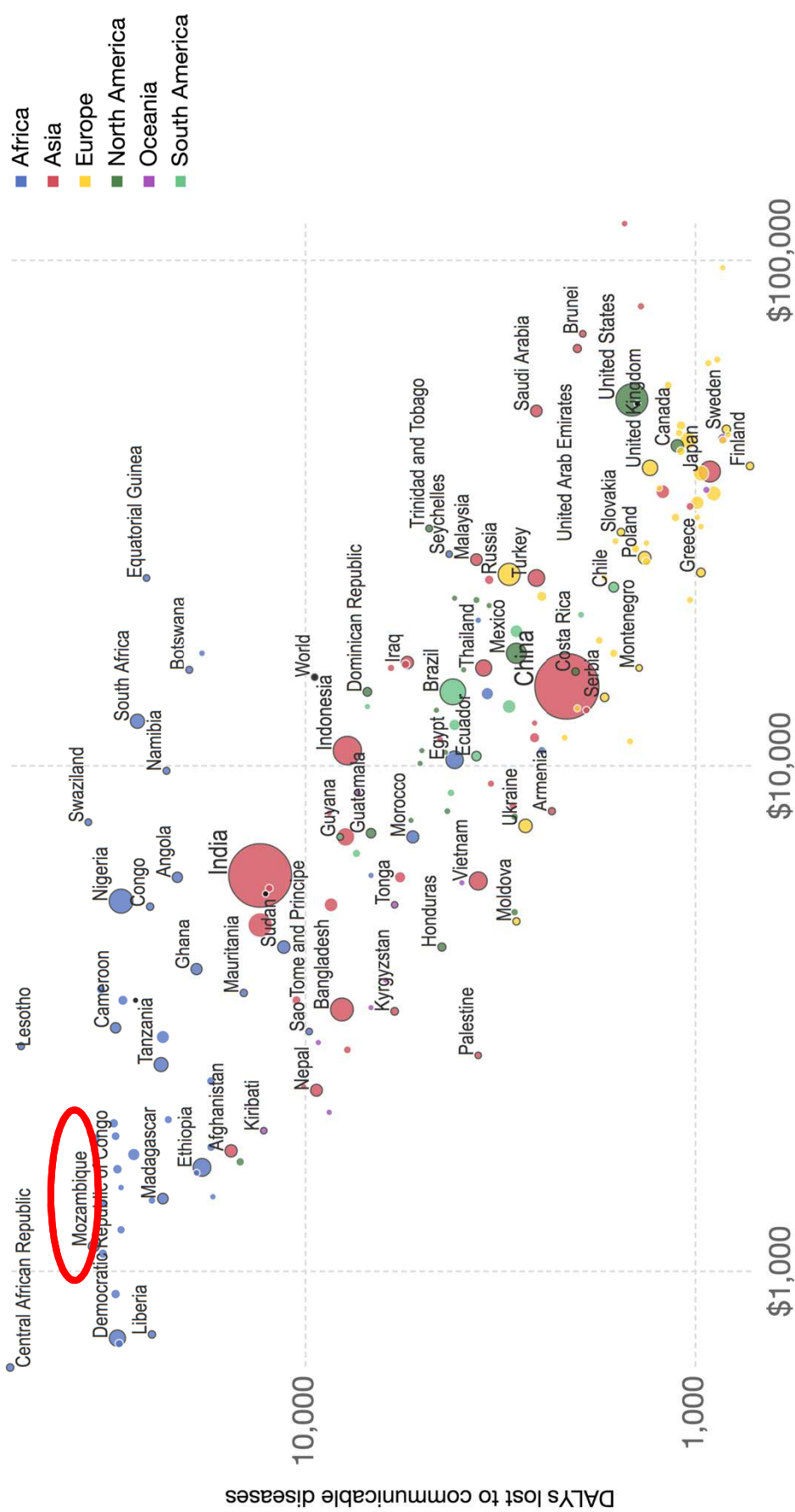
GDP per capita, PPP (constant 2011 international $)

Source: IHME, Global Burden of Disease; World Bank – WDI

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- capturi...TB treatment
- WHO g

Table 1. Patient characteristics [a]

Characteristic	All (n=514)	Presumptive TB (n=234)	No presumptive TB (n=280)
Age (years) [median (IQR)]	36 (27–48)	36 (27–44)	38 (27–50)
Female	309 (60.1)	137 (58.5)	172 (61.4)
HIV test result	333 (64.8)	175 (74.8)	158 (56.4)
positive	245 (73.6)	140 (80.0)	105 (66.5)
Chronic respiratory syndrome	–	114 (48.7)	–
ART	76 (14.8)	48 (20.5)	28 (10.0)
Death	164 (31.9)	70 (29.9)	94 (33.6)

ART: antiretroviral treatment.
[a] Data are n (%) unless otherwise stated.

- at least 50% of admitted patients presumptive TB
- danger sign evaluation: never complete
- sputum smear request: 40%
- sputum smear result present: 25%
- other TB tests: roughly 8%
- sputum smear positivity 3%

Table 2. TB diagnostic process analysis for patients with presumptive TB (n=234)

TB diagnostic workup step	n (%)
Danger signs complete evaluation	0 (0)
Respiratory rate	75 (32.1)
Body temperature	147 (62.8)
Pulse rate	99 (42.3)
Ambulatory state	0 (0)
HIV test result present	175 (74.8)
SSM requests	93 (39.7)
result present	59 (25.2)
CXR done	150 (64.1)
Other TB-specific test requests	4 (1.7)
NAC	0 (0)
BPZN	0 (0)
BPA	3 (1.3)
result present	1 (0.4)
TB culture	1 (0.4)
result present	0 (0)
TB-non-specific tests done	17 (7.3)
Lumbar puncture	9 (3.9)
complete test result present	0 (0)
Pleural tap	4 (1.7)
complete test result present	0 (0)
Ascitic tap	4 (1.7)
complete test result present	1 (0.4)
Pericardial tap	0 (0)

BPA: biopsy pathological anatomy; BPZN: biopsy Ziehl–Neelsen staining; CXR: chest radiograph; NAC: needle aspirate cytology; SSM: sputum smear microscopy.

ORIGINAL ARTICLE

TB diagnostic process management of patients in a referral hospital in Mozambique in comparison with the 2007 WHO recommendations for the diagnosis of smear-negative pulmonary TB and extrapulmonary TB
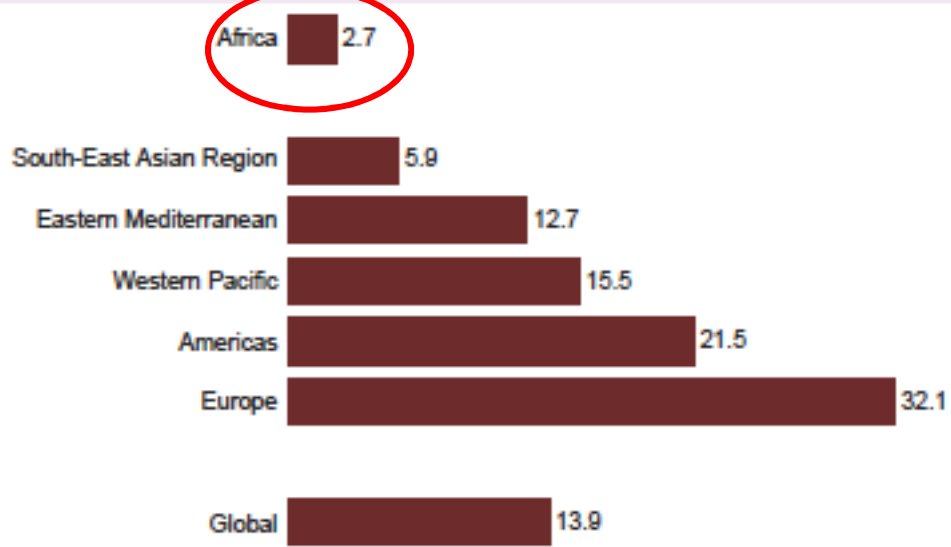
Jeannet C. Bos[a,b,*], Lisette Smalbraak[c], Augusto C. Macome[d], Ermelinda Gomes[d], Frank van Leth[b,e] and Jan M. Prins[a]

So, for locally most common, treatable infectious disease:

- largely incomplete diagnostic trajectory, even according to WHO resource-poor setting targeted guidelines

- only 28% of patients with presumptive TB (randomly) received TB treatment

physician-to-population ratio

Figure 4.8.2. Physician-to-population ratio (per 10 000 population) by WHO region, 2007–2013

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Countries of the African Region without data are not included in the chart.

Source : WHO, 2015.

Human Development Index
(income/schooling/life expectancy)

World map of the **Human Development Index** by country, grouped by quartiles (based on 2015 and 2016 data, published on 21 March 2017). ■ Highest 25% ■ Above median ■ Below median ■ Lowest 25% ■ Data unavailable

Madina market in Conakry, Guinea. Densely populated urban environments are ideal for the spread of infection.

DISEASE

Poverty and pathogens

The growth of slums in the developing world's rapidly expanding cities is creating new opportunities for infectious disease to flourish and spread.

source: Nature, March 2016

poverty = deprivations
also happening in high-income countries

BOX 2.1

Poverty is also a developed country problem

Deprivations are a universal problem afflicting people in developed and developing countries alike. An average of 11 percent of the population in Organisation for Economic Co-operation and Development (OECD) countries were below the income poverty line in 2014.[1] As of 2012 there were 633,000 homeless people in the United States and 284,000 in Germany.[2] OECD countries have the highest incarceration rates of any group of countries: an average of 274 people per 100,000, isolated from society in prison.[3] An average of 15 percent of young people ages 15–29 are neither employed nor in education or training and are struggling to find their place in society.[4] Health

deprivations caused by obesity are also high. The most recent survey data indicate that an average of 53.8 percent of the adult population in OECD countries is overweight or obese and faces high risks of cardiovascular disease, respiratory illnesses, diabetes and other diseases.[5]

The data make clear that not all people in countries classified as having very high human development are able to achieve their full life potential. Poverty can take different forms in developed countries and in developing countries, but it is no less debilitating to the choices and the future of individuals and households experiencing the deprivations.

Notes
1. OECD 2016a. 2. OECD 2015a. 3. Based on UNODC (2016). 4. OECD 2016e. 5. OECD 2015b.
Source: Human Development Report Office.

ORIGINAL ARTICLE

Recent TB transmission, clustering and predictors of large clusters in London, 2010–2012: results from first 3 years of universal MIRU-VNTR strain typing

Esther L Hamblion,[1] Arnaud Le Menach,[1,2] Laura F Anderson,[3] Maeve K Lalor,[3] Tim Brown,[4] Ibrahim Abubakar,[3,5] Charlotte Anderson,[1] Helen Maguire,[1,2] Sarah R Anderson,[1] on behalf of the Public Health England Strain Typing Project Board

The final multivariable model adjusted for age, gender and all significant variables ($p<0.05$), demonstrated clustered cases were more likely to be male (aOR=1.2 (1.0–1.3)), born in the UK and from a black-Caribbean, black-African, white or Indian background (aOR=6.7 (3.7–12.2), 4.4 (2.6–7.6), 2.3 (1.7–3.2) and 1.9 (1.1–3.3), respectively) or born abroad and from a black-Caribbean (aOR=3.3 (1.8–5.8) or black-African (aOR=1.8 (1.5–2.2)) ethnic background, to have been previously diagnosed with TB (aOR=2.1 (1.5–3.0)), to have smear positive (aOR=1.5 (1.3–1.8)) or negative (aOR=1.4 (1.2–1.7)) pulmonary TB compared with extrapulmonary disease, to have a history of drug misuse (aOR=1.6 (1.0–2.4)), and to have a history of imprisonment and problem alcohol use (aOR=3.3 (1.2–9.3)) and were less likely to be born abroad and from a Bangladeshi ethnic background (aOR=0.5 (0.3–0.7))

source: Thorax 2016

Tuberculosis in Rural America: What Tuberculosis in Marion, AL Tells Us

The Poorest County in Alabama

Perry County, of which Marion is the county seat, is the poorest county in Alabama, which is the fourth poorest state in the country by median household income; in Perry County, 26 percent of residents live below the poverty line and the annual per-capita income is $13,000. The unemployment rate is twice the state average.

Globally, more than 80% of TB occurs in high-burden countries in sub-Saharan Africa and Asia. The Marion outbreak illustrates the challenges that this pathogen still poses even in "resource-rich" settings like the US. It illustrates the impact of poverty on healthcare delivery and epidemic control.

source: hsph.harvard.edu

The Netherlands
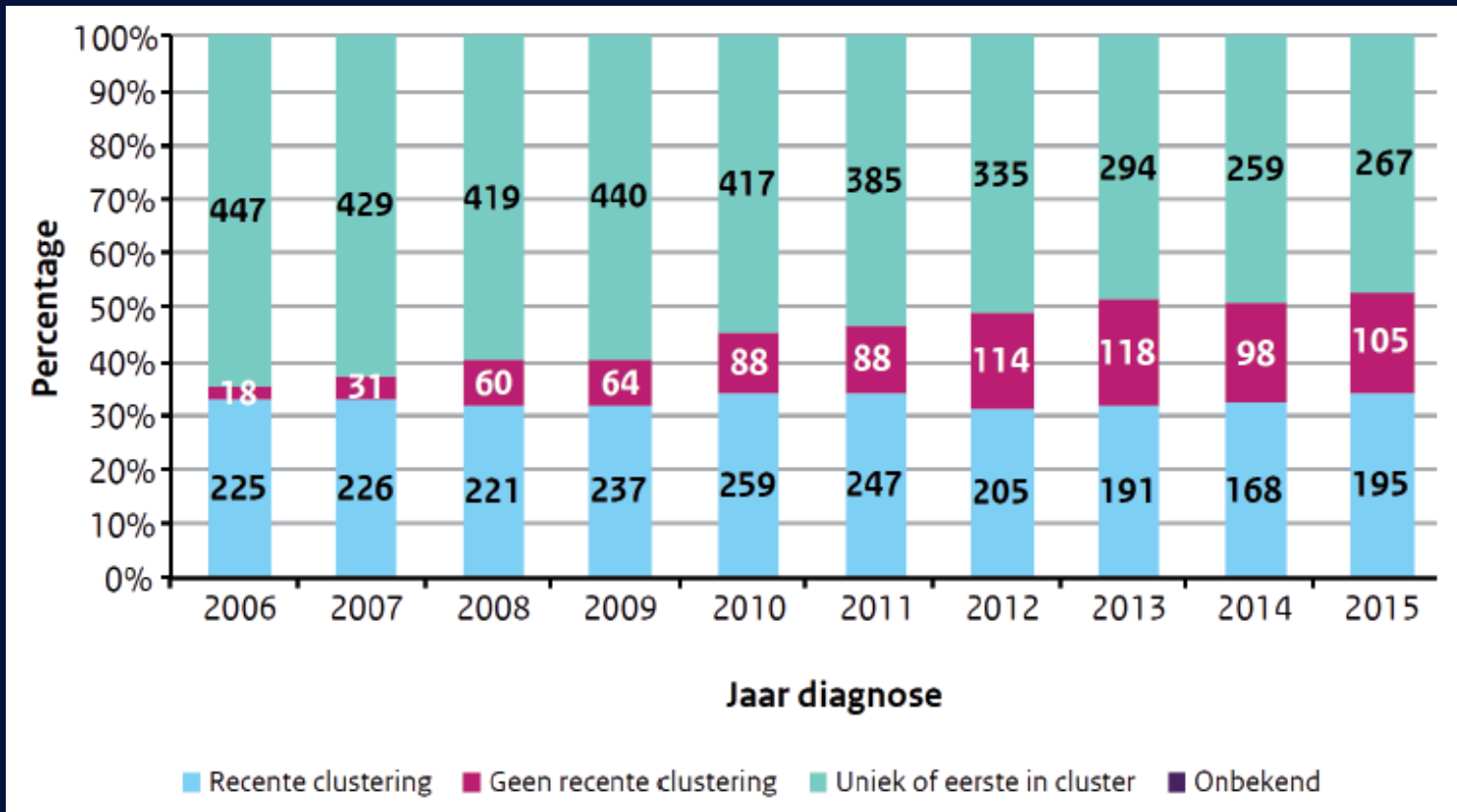
Source: KNCV, Tuberculose fonds, 2017

TB, what's poverty got to do with it?

- a lot
- poverty individual / country level
- poverty implicates a lack of opportunities, deprivations of all sorts
- makes it difficult to step forward as a patient, makes it almost impossible to act
- should have consequences for how we act

The obvious made likely?

The impact of social protection and poverty elimination on global tuberculosis incidence: a statistical modelling analysis of Sustainable Development Goal 1

Daniel J Carter, Philippe Glaziou, Knut Lönnroth, Andrew Siroka, Katherine Floyd, Diana Weil, Mario Raviglione, Rein M G J Houben*, Delia Boccia*

Interpretation Full achievement of SDG 1 could have a substantial effect on the global burden of tuberculosis. Cross-sectoral approaches that promote poverty reduction and social protection expansion will be crucial complements to health interventions, accelerating progress towards the End TB targets.

source: The Lancet, March 2018