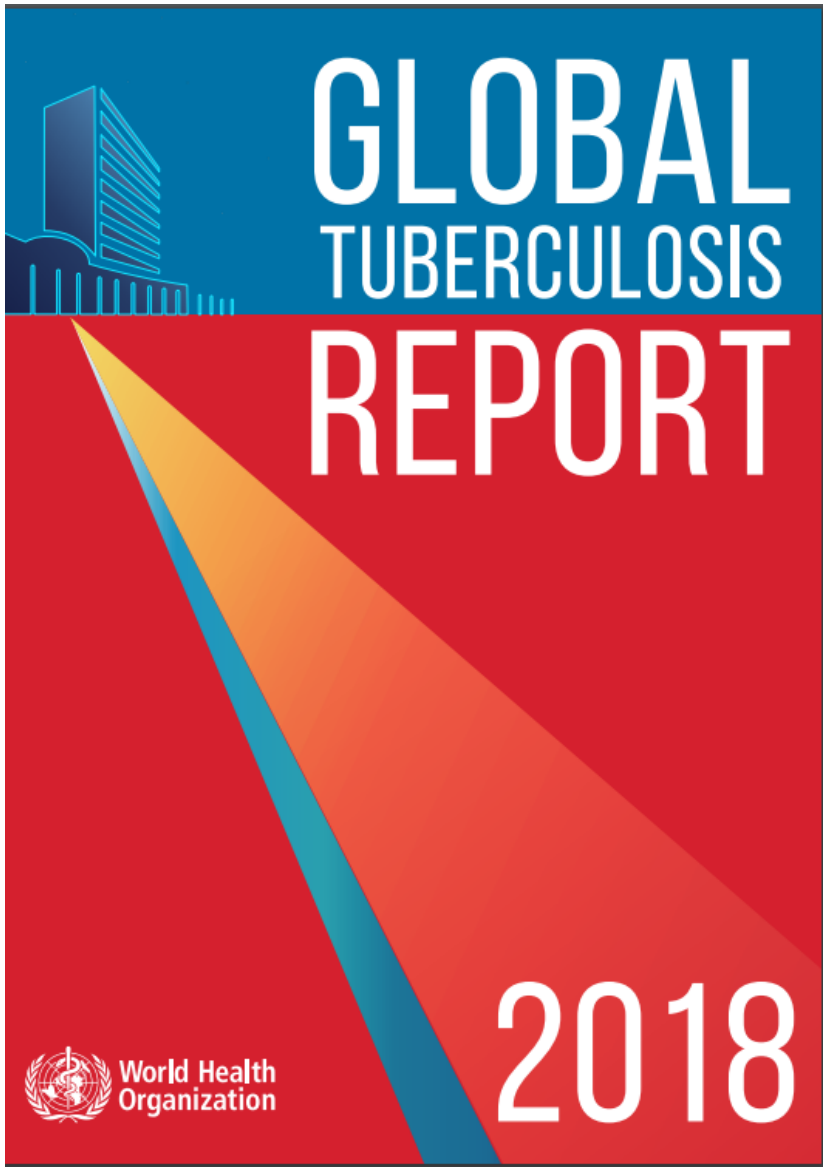

TB epidemiology

http://www.who.int/tb/country/en/

Philippe Glaziou
Tuberculosis Epidemiologist, WHO

Speaker: Howard Takiff

Global Epidemiology of Tuberculosis

Philippe Glaziou, MD[1] Katherine Floyd, PhD[1] Mario C. Raviglione, MD[2]

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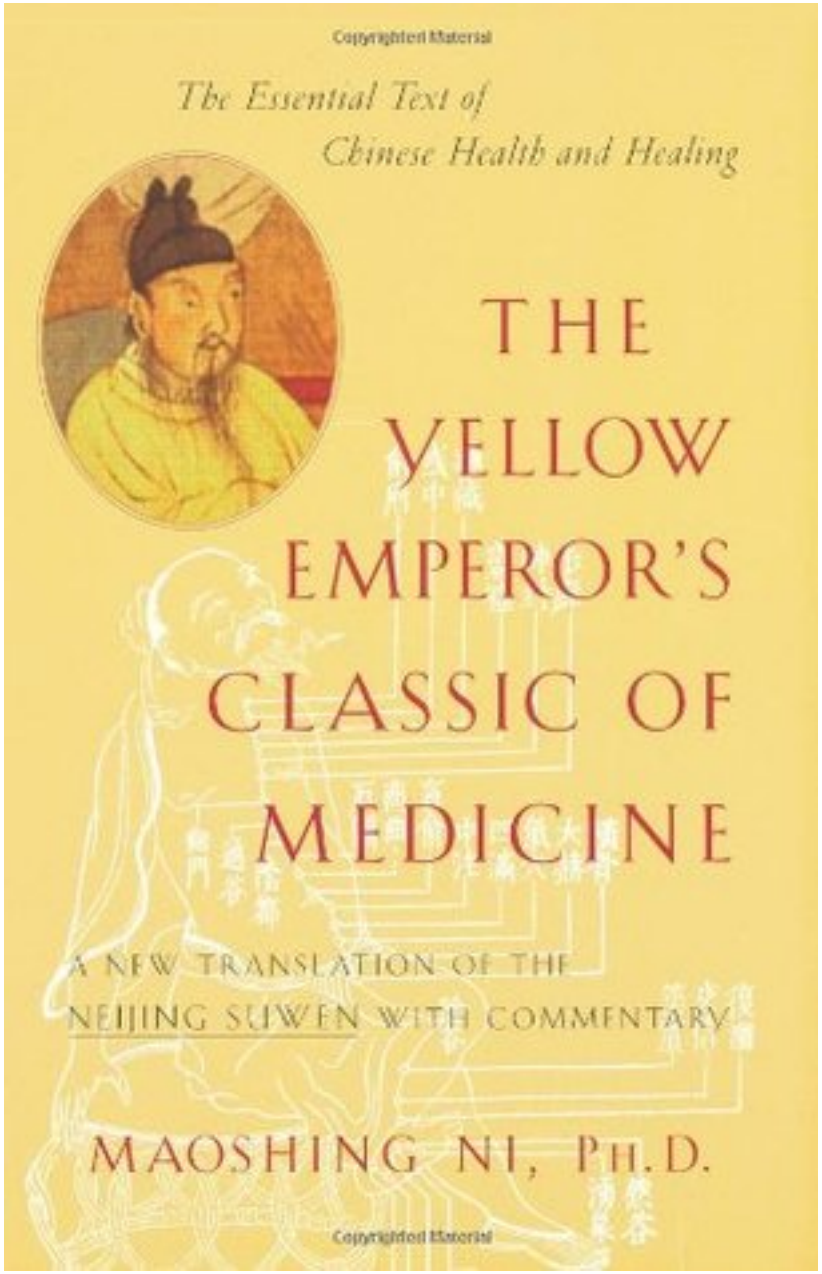
Address for correspondence Philippe Glaziou, MD, Global TB Programme, World Health Organization, 20 Avenue Appia, 1211 Geneva 27. Switzerland (e-mail: glazioup@who.int).

Semin Respir Crit Care Med 2018;39:271–285.



Huang Di Nei Jing

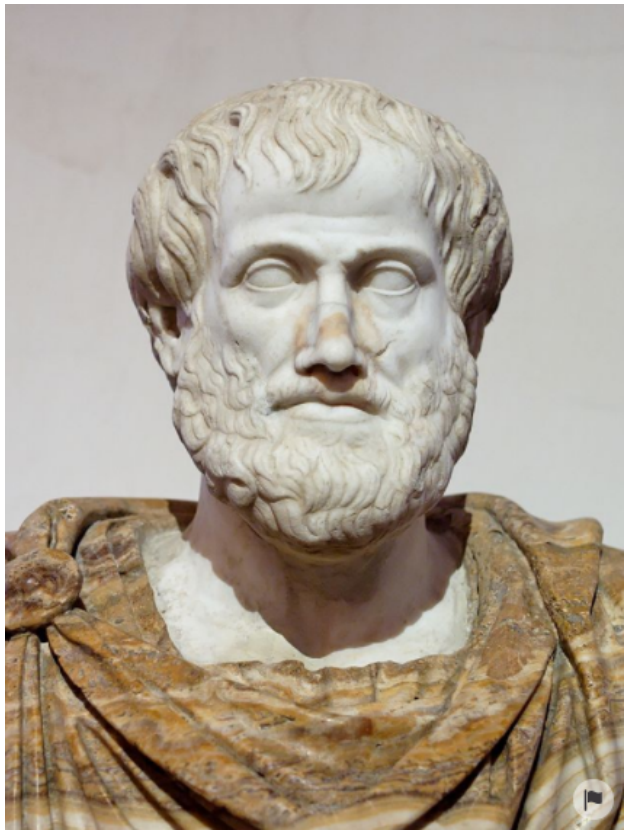
The Yellow Emperor's inner cannon,

the first written medical text in China

around 2700 BC

described as Xulao Bing

– weak consumptive disease

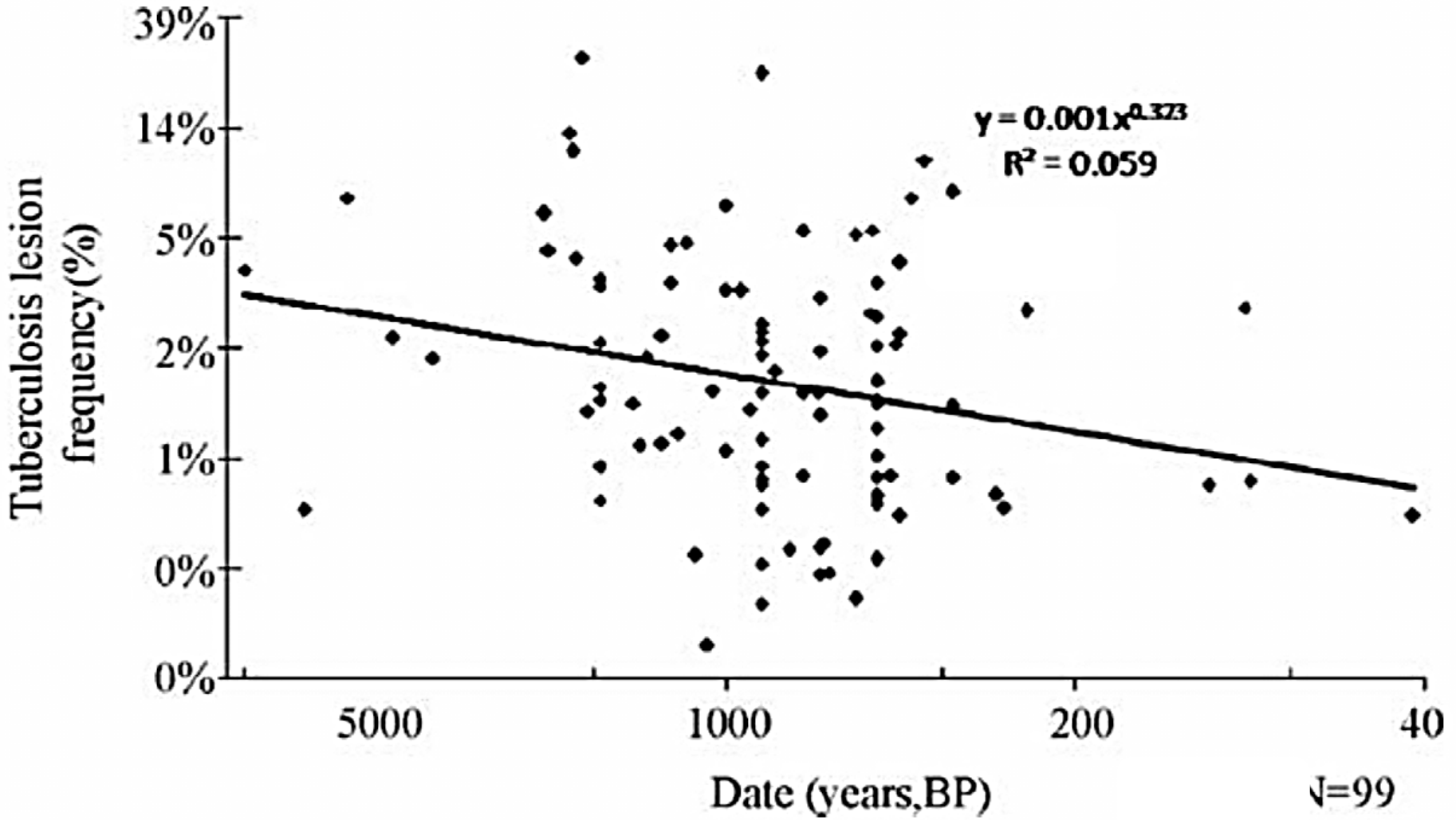


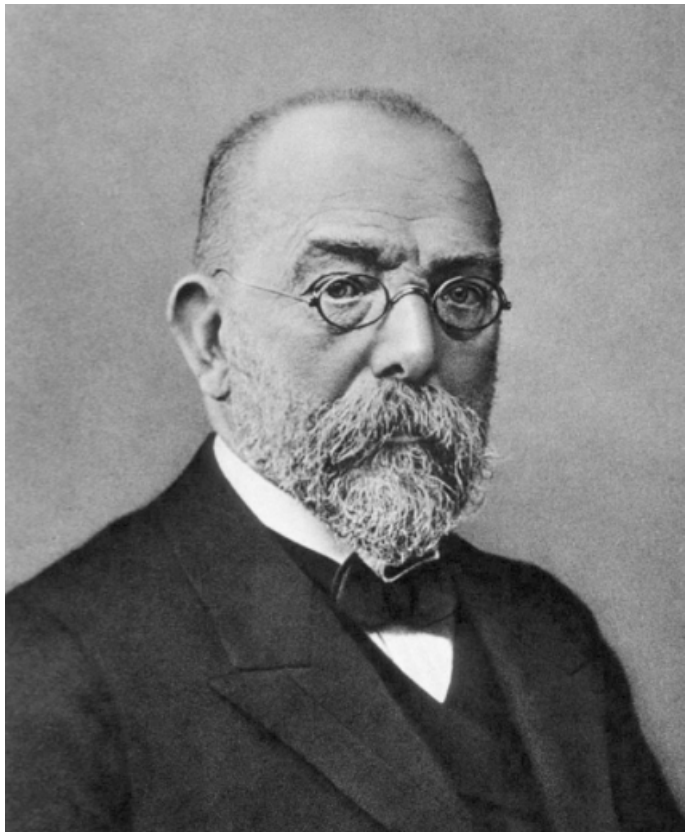
Aristotle (384-322 BC) – “He who comes into contact with the [*phtisis*] sufferer inhales his corrupted breath and so himself becomes ill”

Delphi Classics, 2013

TB has been with us for a very long time

K.L. Holloway et al. / HOMO - Journal of Comparative Human Biology 62 (2011) 402–458

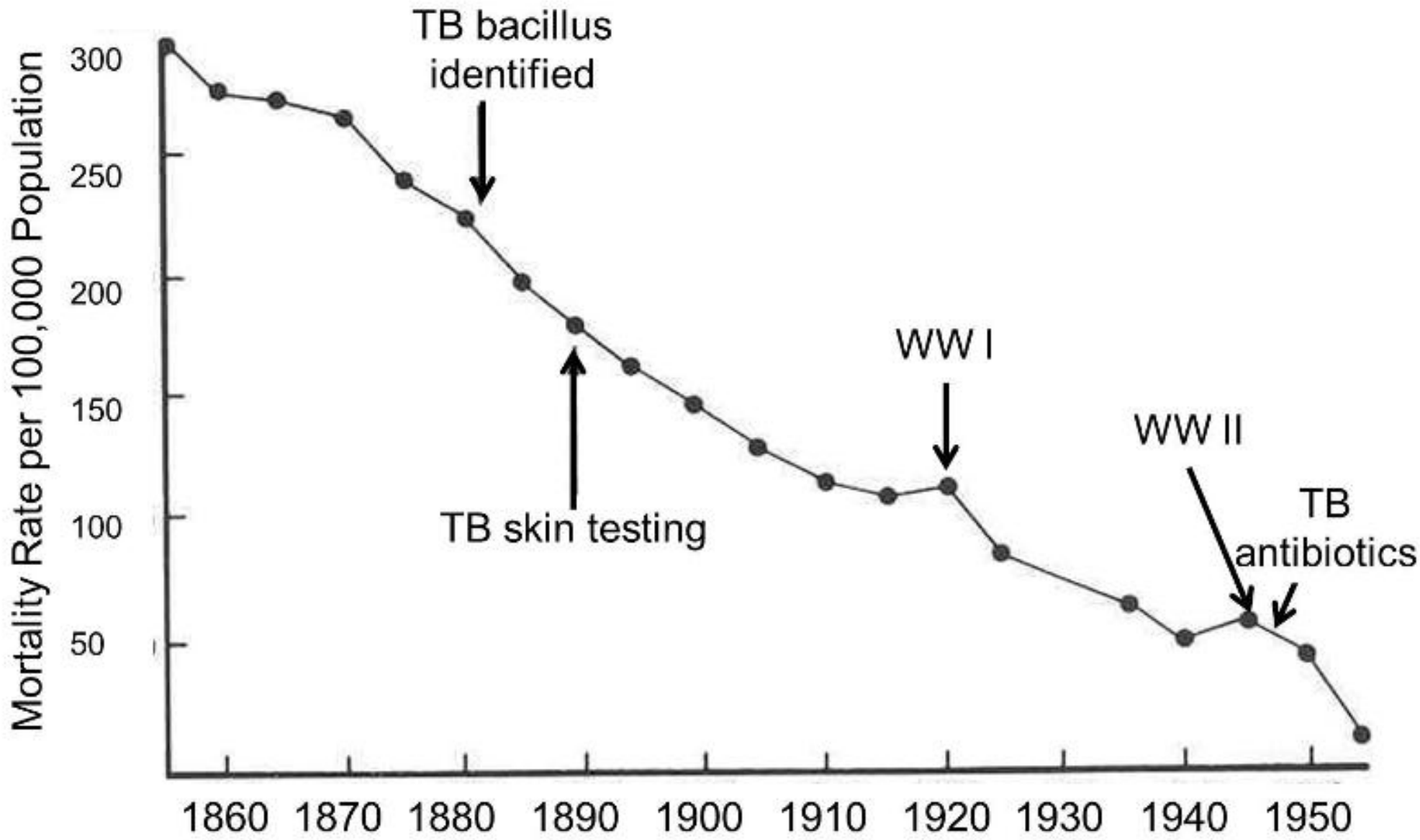




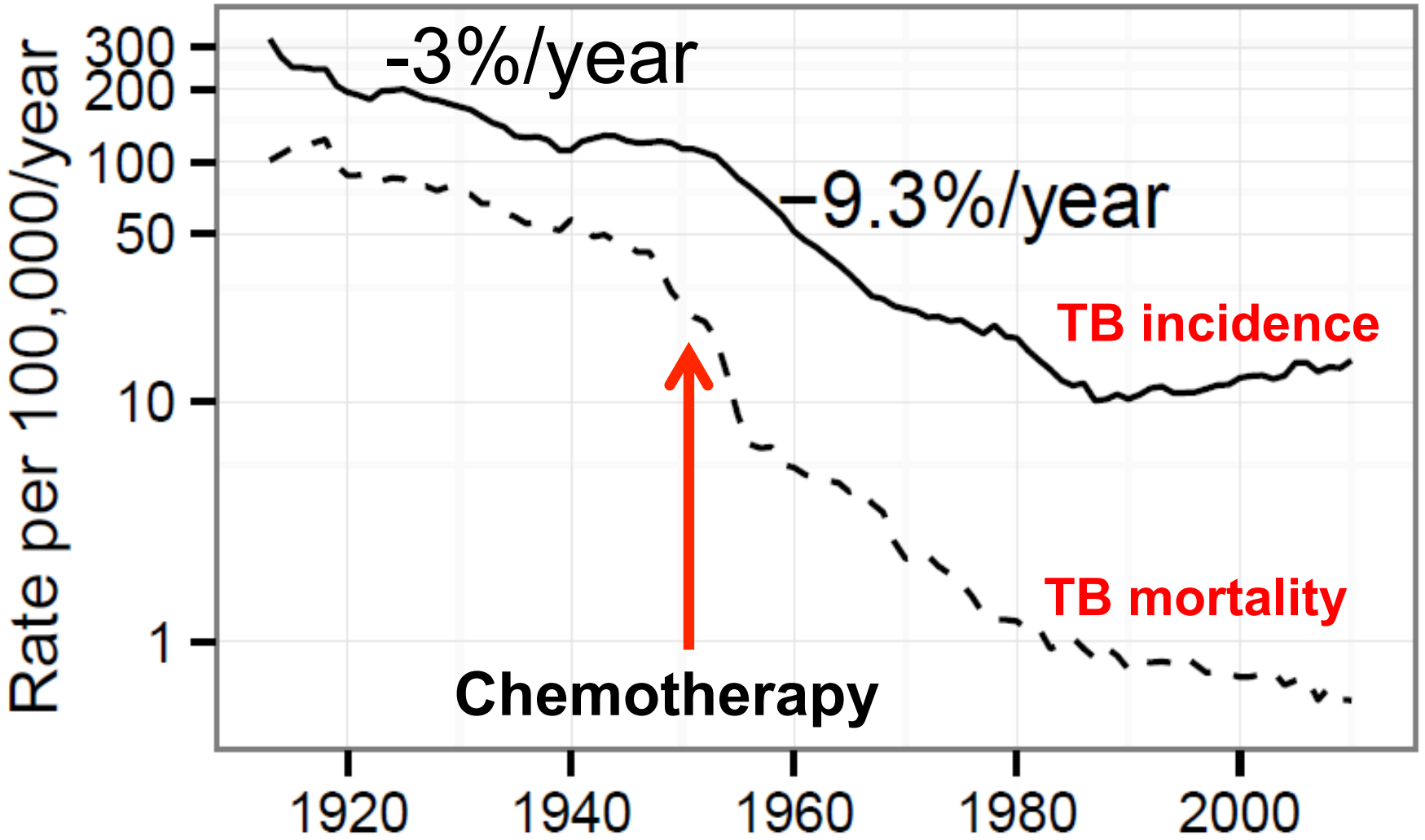
Robert Koch (1843-1910) – “one seventh of all human beings die of tuberculosis”

Nobel Lecture, 1905

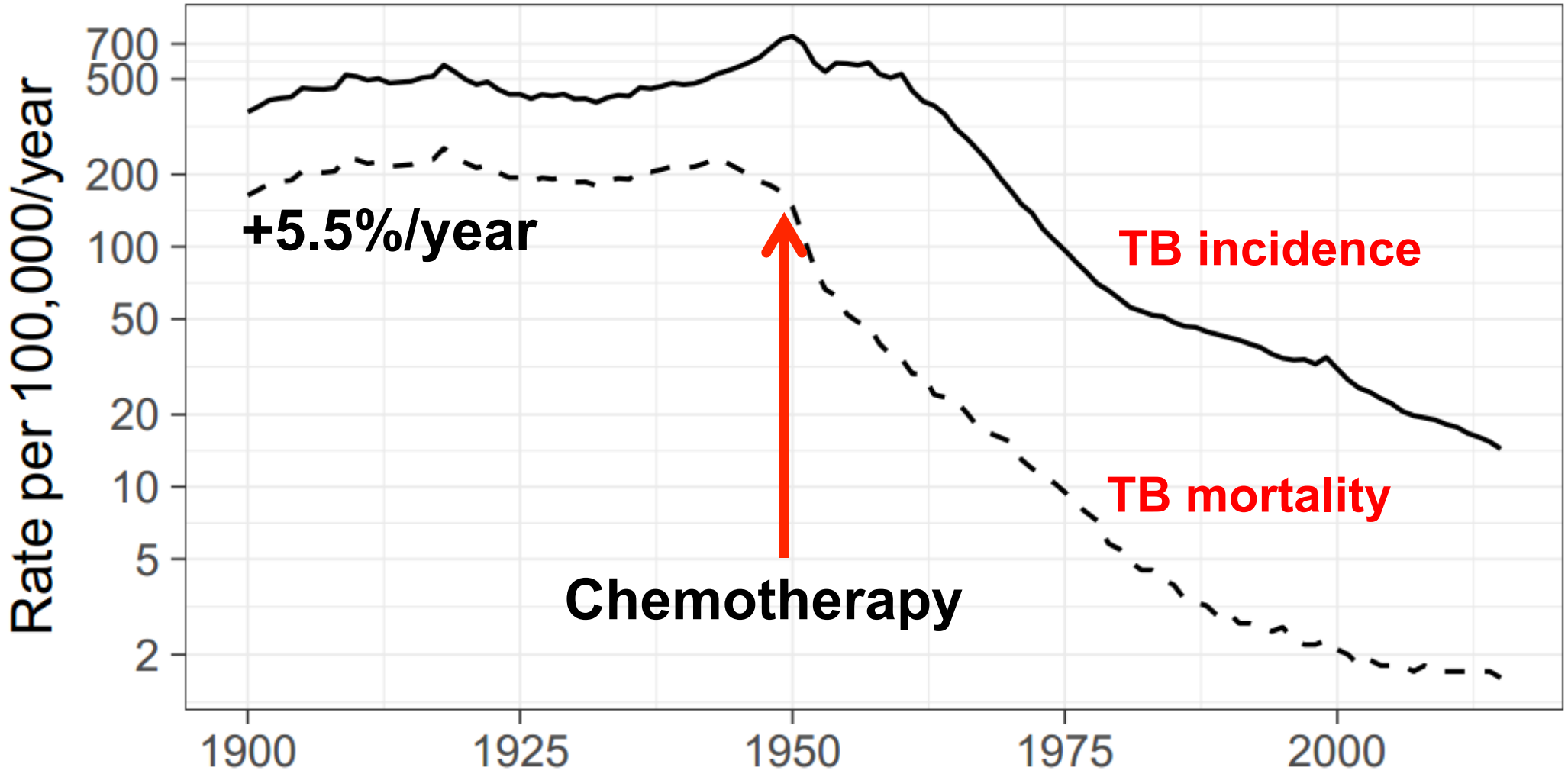
Most of the Decline in Tuberculosis Mortality in the England and Wales Occurred Before Antibiotics were Discovered



Post-industrialization decline in TB
(England and Wales)

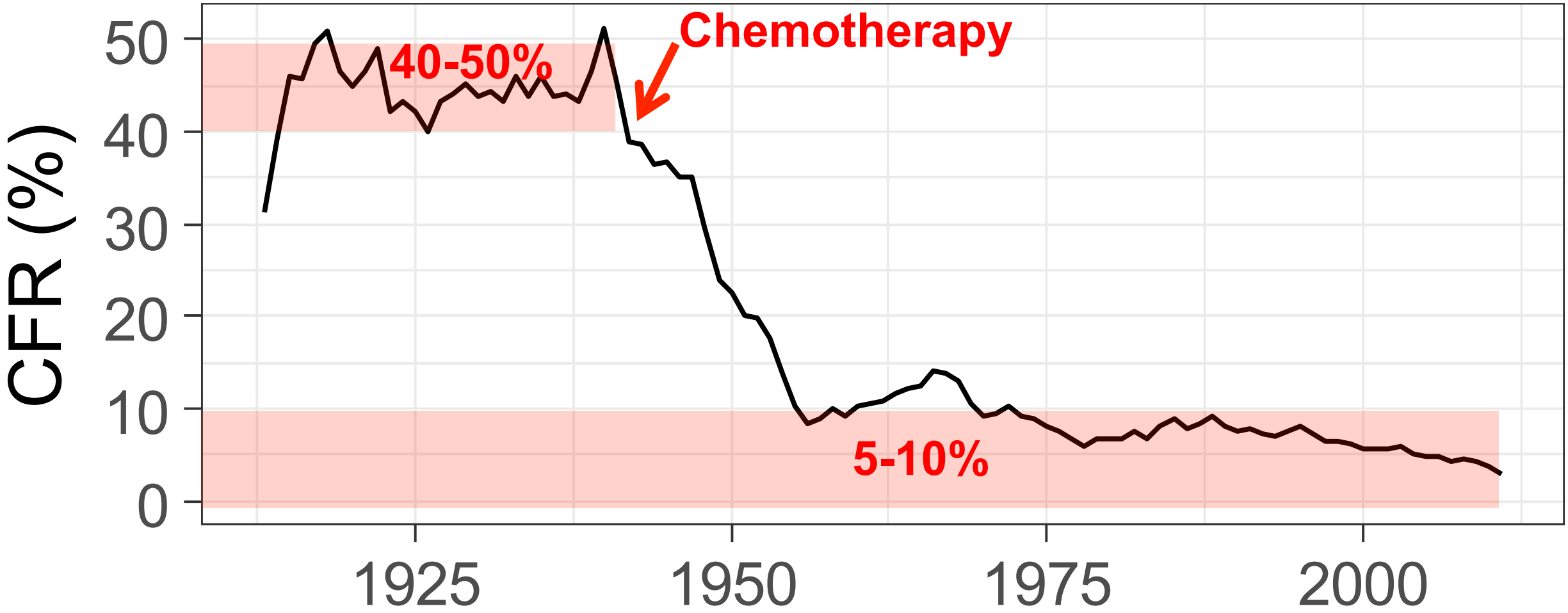


Worsening of the TB epidemic during the industrial revolution in Japan

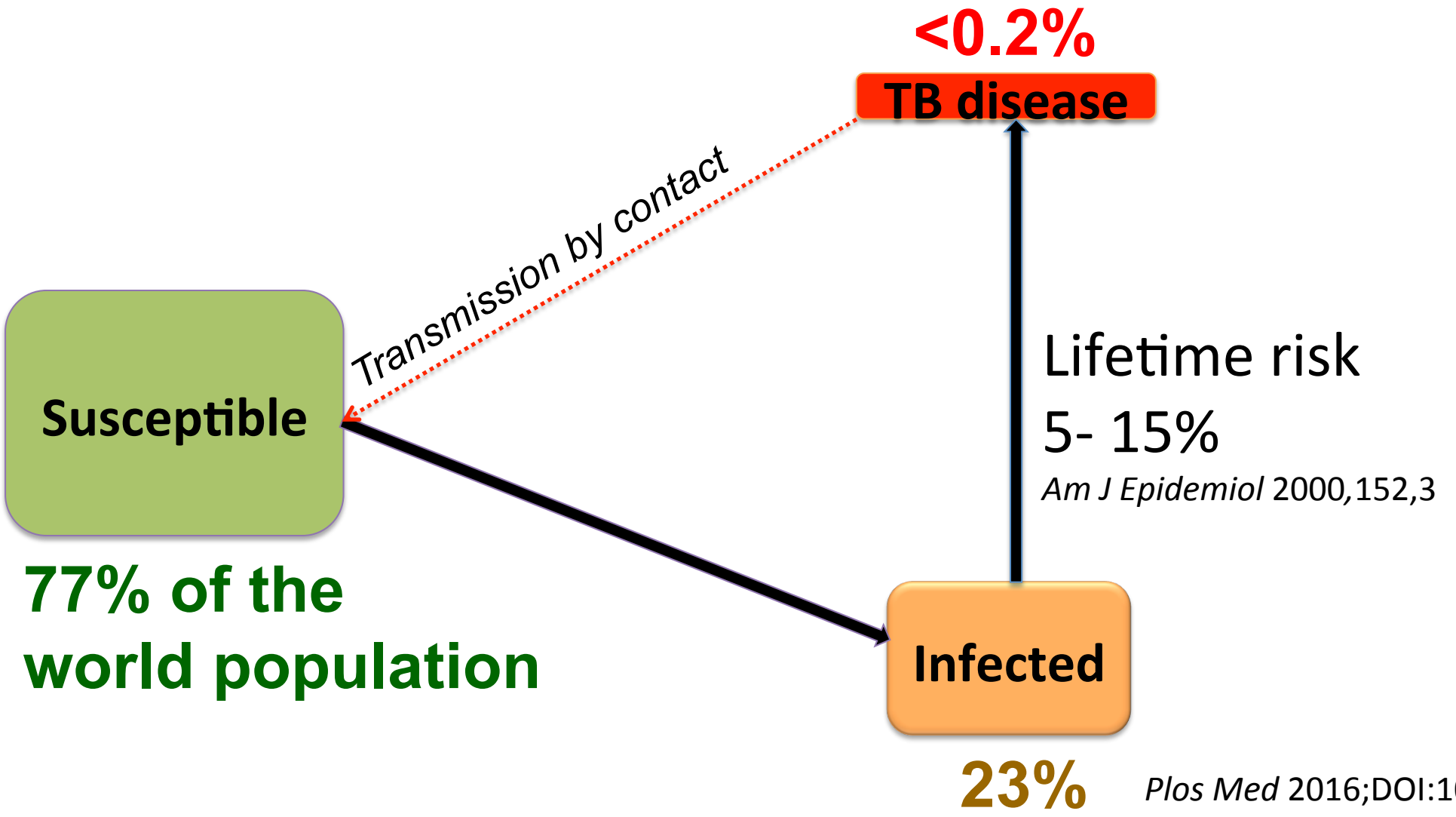


Case Fatality Ratio (CFR ≈ mortality / incidence)

England & Wales



Global TB infection and disease, 2015



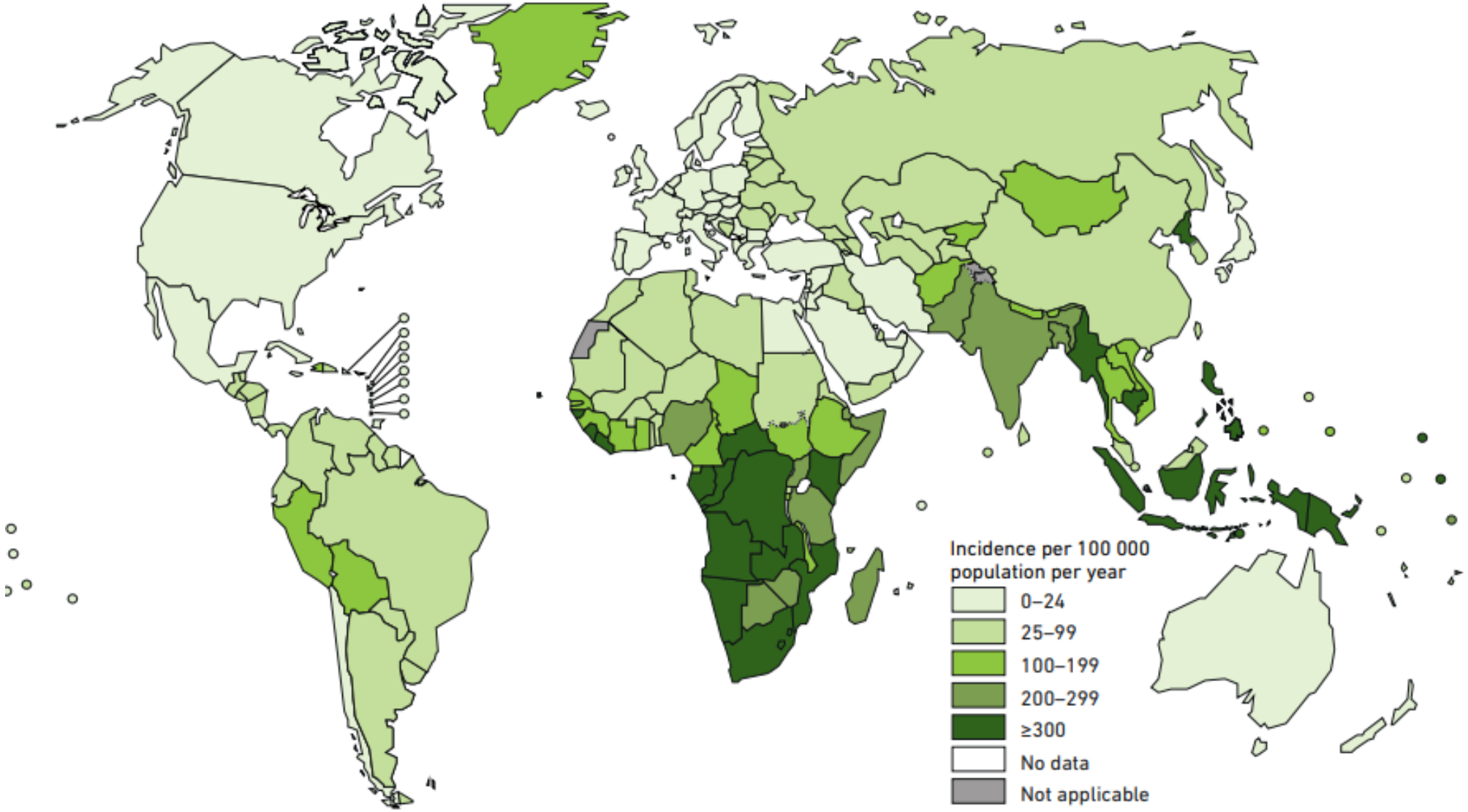
The risk of TB disease is not the same for everyone

Risk factor	Relative risk^	Exposed (million in 2017)	Attributable TB cases (2017)
Under-nutrition	3	734	**1,900,000**
HIV infection	20	36	**880,000**
Cigarette smoking	2	1,047	**830,000**
Diabetes	3	460	**790,000**
Alcohol abuse	3	407	**490,000**

^Lancet 2010;375(9728):1814-29; HIV: WHO Global TB Report 2018

TB incidence rate worldwide (2017)

10 million new TB cases, 1.4% *M. bovis*

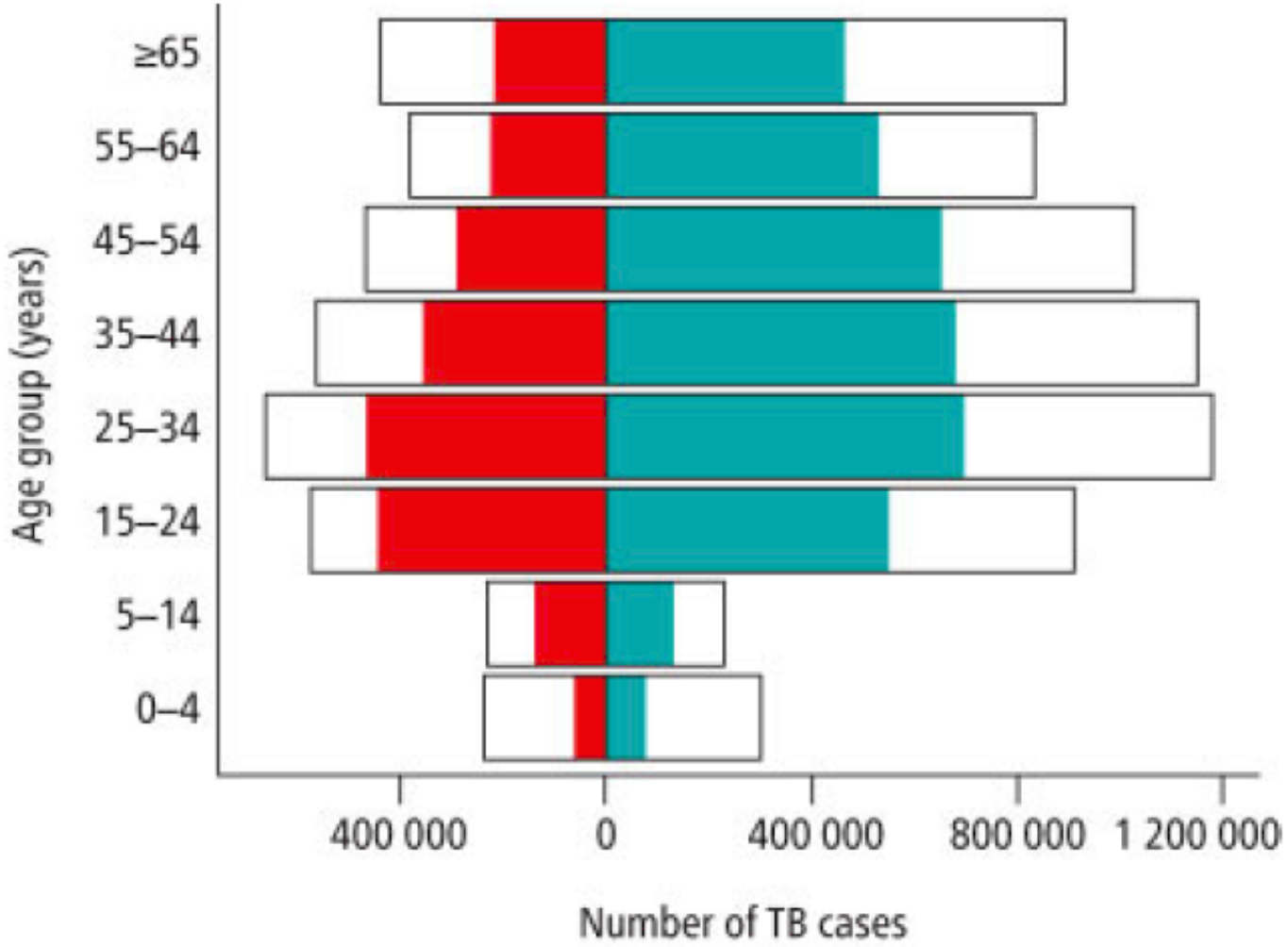


Distribution of TB Cases by Region

	Population (billions)	HIV-negative TB mortality	HIV-positive TB incidence	Total TB incidence	HIV-positive TB incidence
WHO Region[a]					
AMR	0.996	17,000 (16,100–17,900)	6,240 (5,570–6,940)	274,000 (255,000–294,000)	30,100 (27,700–32,700)
EMR	0.669	81,700 (69,100–95,400)	3,020 (1,810–4,530)	766,000 (573,000–985,000)	9,850 (5,930–14,800)
AFR	1.02	417,000 (351,000–488,000)	320,000 (272,000–372,000)	2,590,000 (2,310,000–2,900,000)	764,000 (660,000–876,000)
EUR	0.916	26,100 (25,500–26,800)	5,060 (3,910–6,360)	290,000 (251,000–333,000)	33,600 (26,200–41,800)
WPR	1.89	103,000 (84,600–123,000)	4,960 (3,040–7,340)	1,800,000 (1,500,000–2,130,000)	29,100 (23,100–35,800)
SEA	1.95	652,000 (542,000–772,000)	34,700 (24,800–46,200)	4,670,000 (3,190,000–6,440,000)	163,000 (120,000–211,000)
Global	7.44	1,300,000 (1,160,000–1,440,000)	374,000 (325,000–427,000)	10,400,000 (8,770,000–12,200,000)	1,030,000 (915,000–1,150,000)

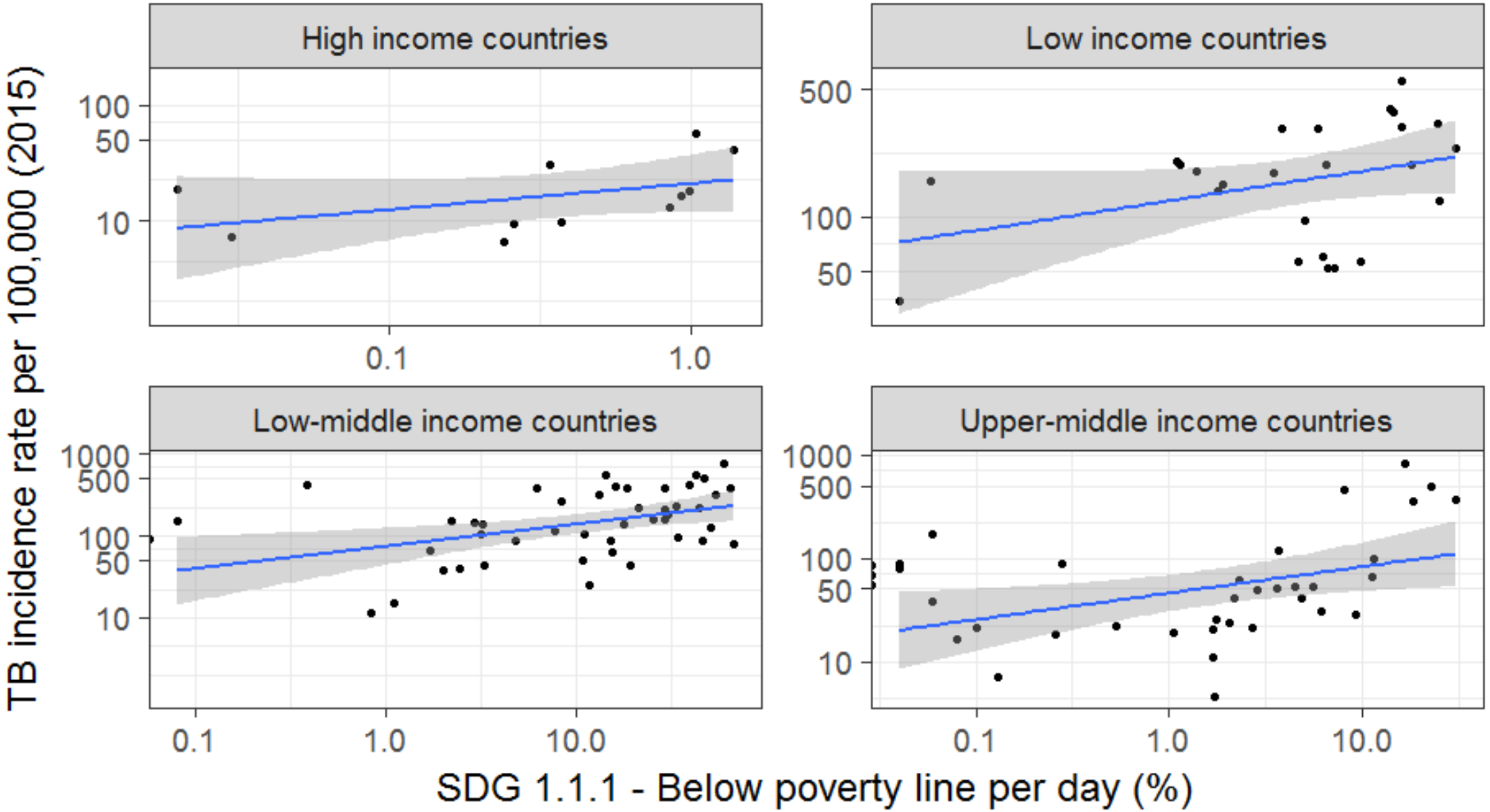
[a]The six WHO Regions are as follows: AFR, Africa; AMR, the Americas; EMR, Eastern Mediterranean; EUR, Europe; WPR, Western Pacific. Countries in each region are listed in Global TB Report 2017.[1]

Age Distribution of TB Patients - 2016

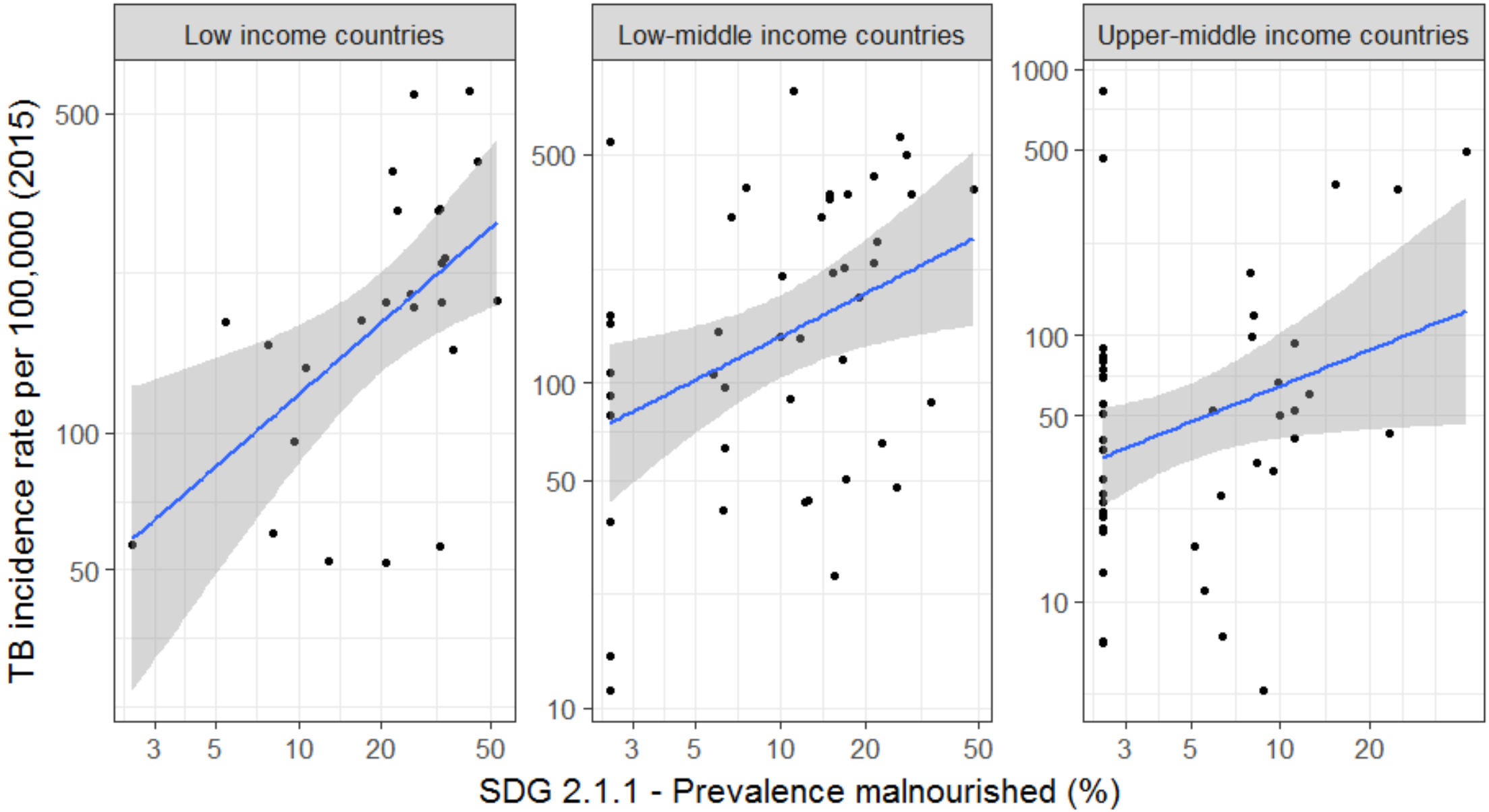


Global Distribution of estimated incident cases (black lines)
Shaded portions are the number of cases officially reported to the WHO in 2016
Blue (men) and Red (women)

TB is associated with poverty



The risk of TB is greater in malnourished people



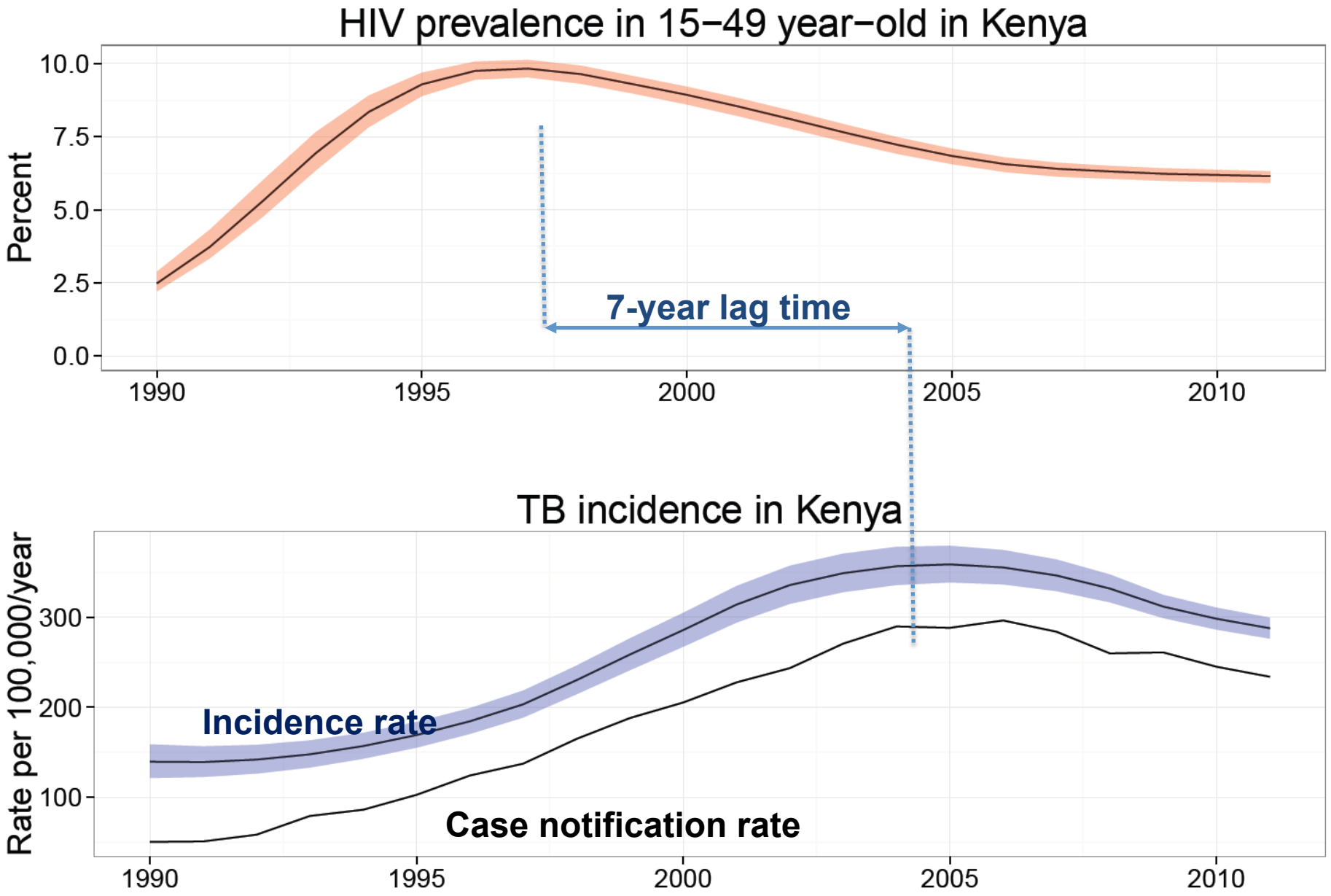
Exposure to SO_2 increases risk of TB (*Korean J Intern Med* 2014; **29**: 183–90.)

Model	Male RR[a] (95% CrI)	Female RR[a] (95% CrI)
PM_{10}, μg/m³	0.98 (0.94–1.02)	1.01 (0.97–1.06)
O_3, ppb	0.99 (0.94–1.03)	1.01 (0.97–1.05)
CO, ppb	0.99 (0.95–1.03)	1.01 (0.98–1.04)
NO_2, ppb	1.00 (0.96–1.05)	1.01 (0.98–1.05)
SO_2, ppb	1.07 (1.03–1.12)	1.02 (0.98–1.07)

Impact of an interquartile increase in pollutant concentration on the incidence of tuberculosis

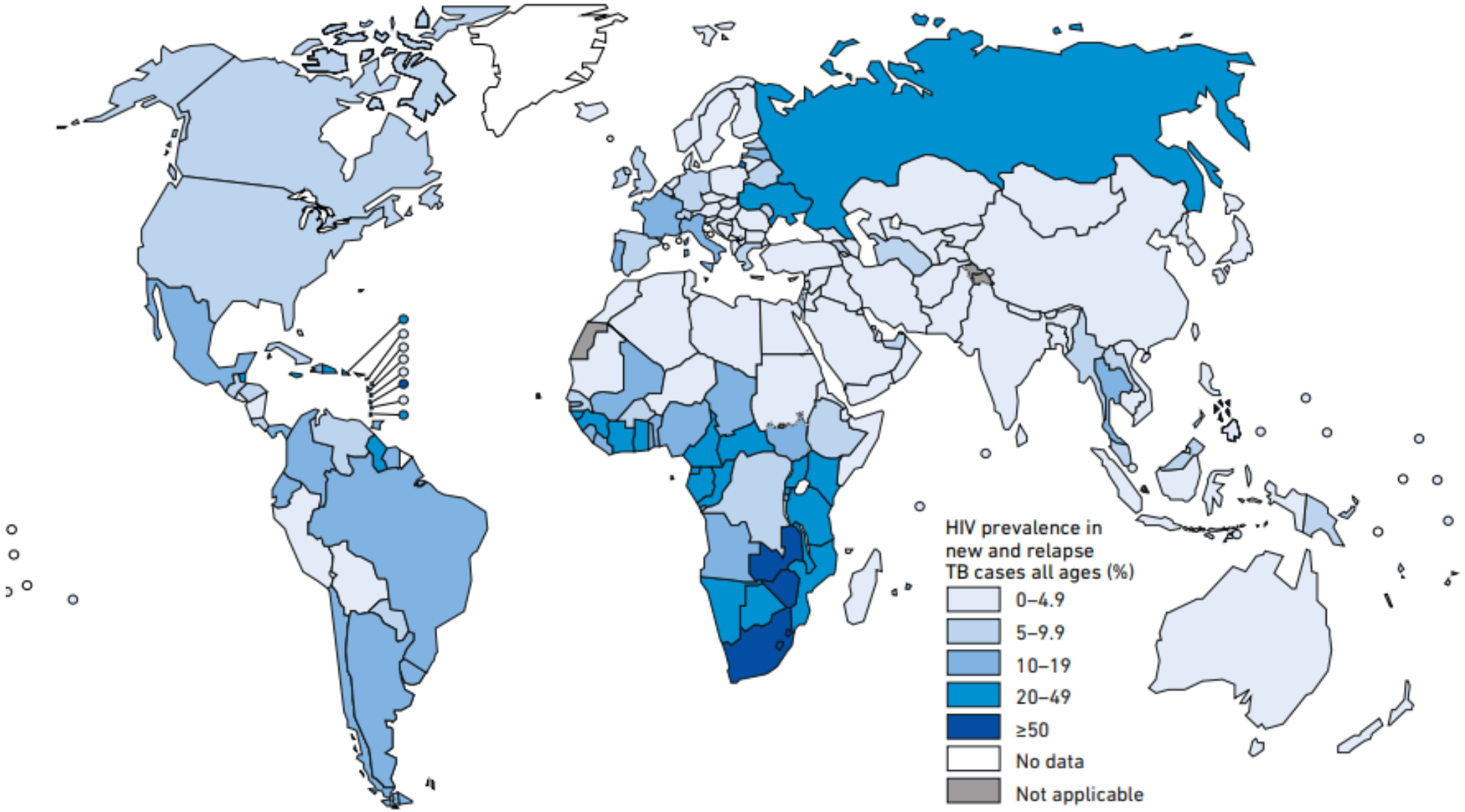

9 out of 10 people worldwide breathe polluted air
#AirPollution

Impact of the HIV epidemic on TB



0.92 million HIV+ TB cases in 2017

9% of TB cases



Global TB and HIV, 2017

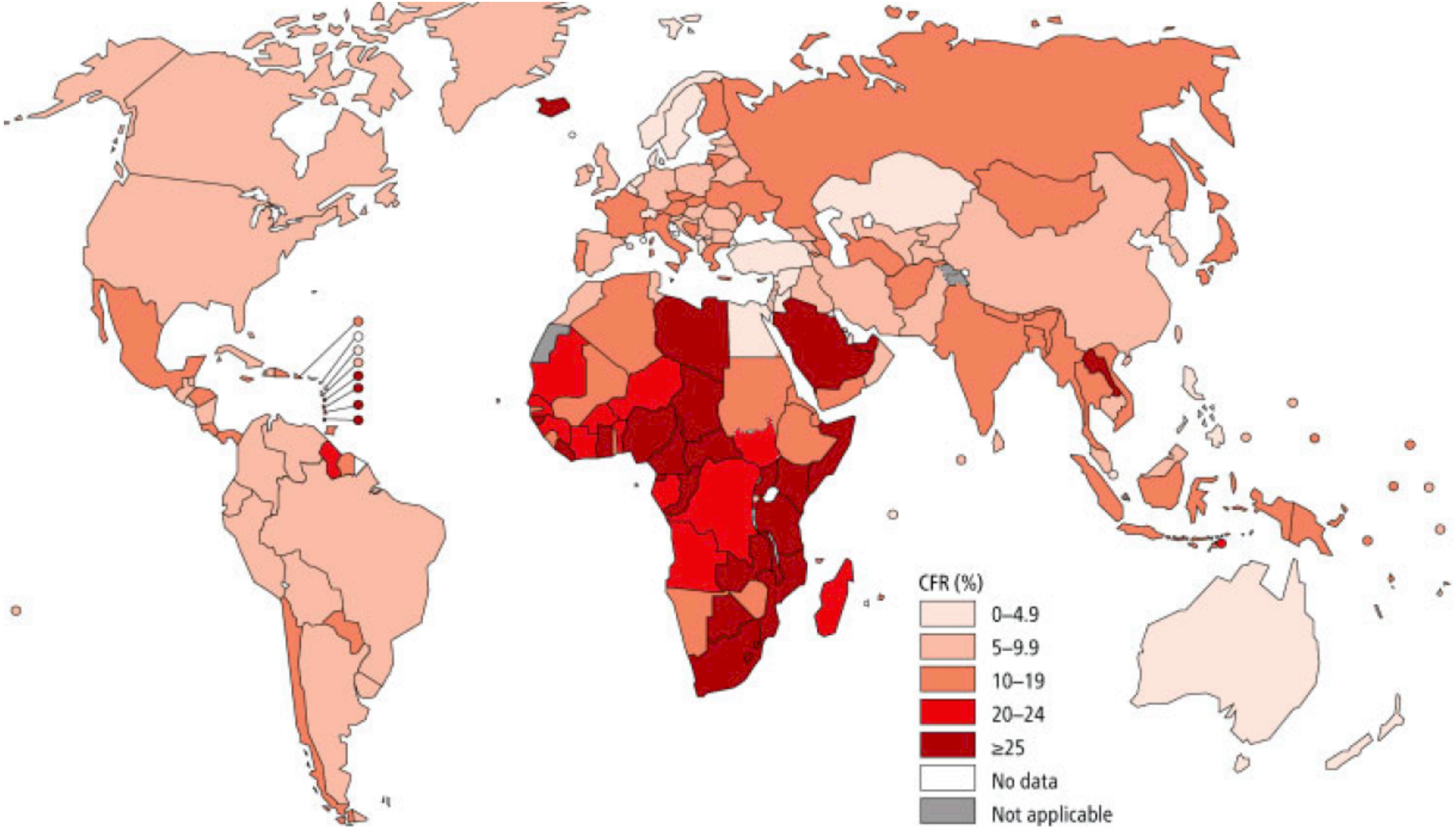
0.92 million new TB cases HIV+
36.9 million HIV+ people
Incidence of TB = 0.92/36.9 = **2.5% person-yr**

9.1 million new TB cases HIV-
7.49 billion HIV- people
Incidence of TB = 9.1/7.49/10 = **0.12% person-yr**

TB incidence rate ratio = 2.5 / 0.12 = **20.4**

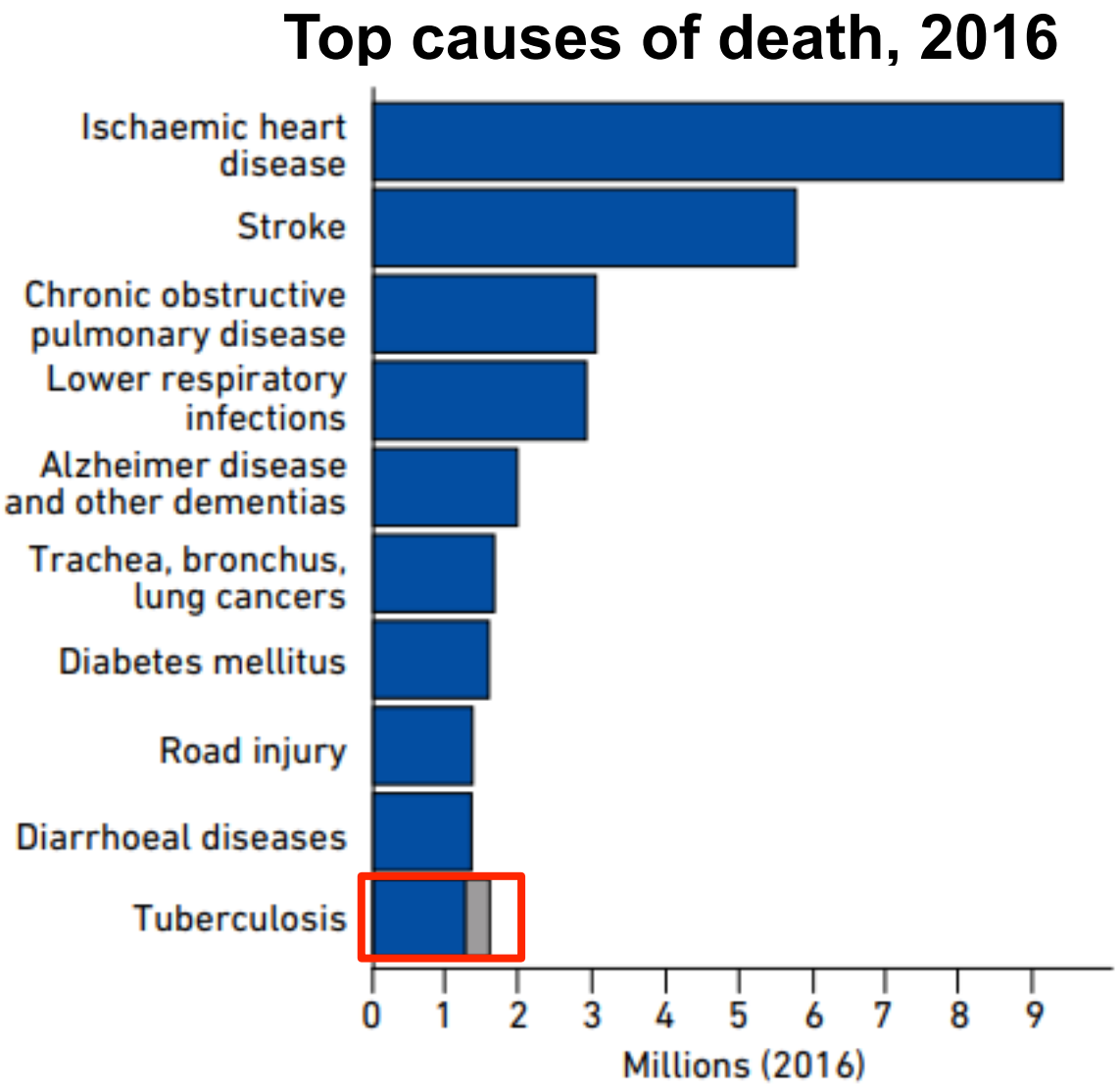
TB mortality (2017)

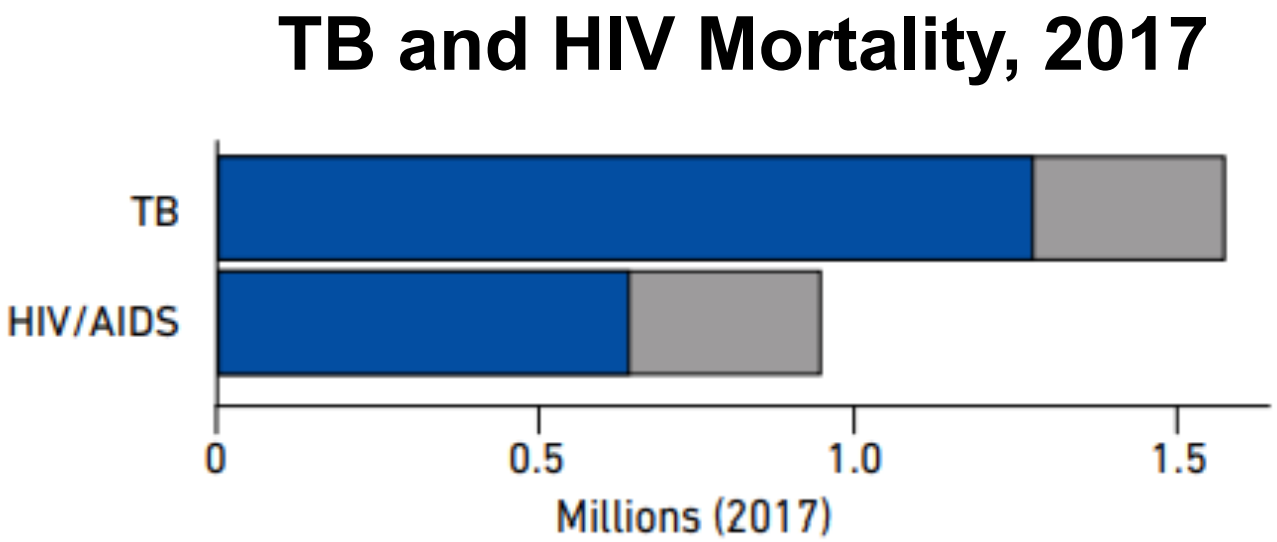
	HIV-	HIV+
Incident cases	9.1m	0.92m
TB deaths	1.27m	0.3m
Case Fatality Ratio (CFR)	1.27 / 9.1 = **14%**	0.3 / 0.92 = **33%**



Estimates of the TB case fatality ratio, including HIV-negative and HIV-positive patients, 2016

TB first cause of death among infectious diseases





In grey: TB/HIV deaths

Funding and Research
HIV >>> TB

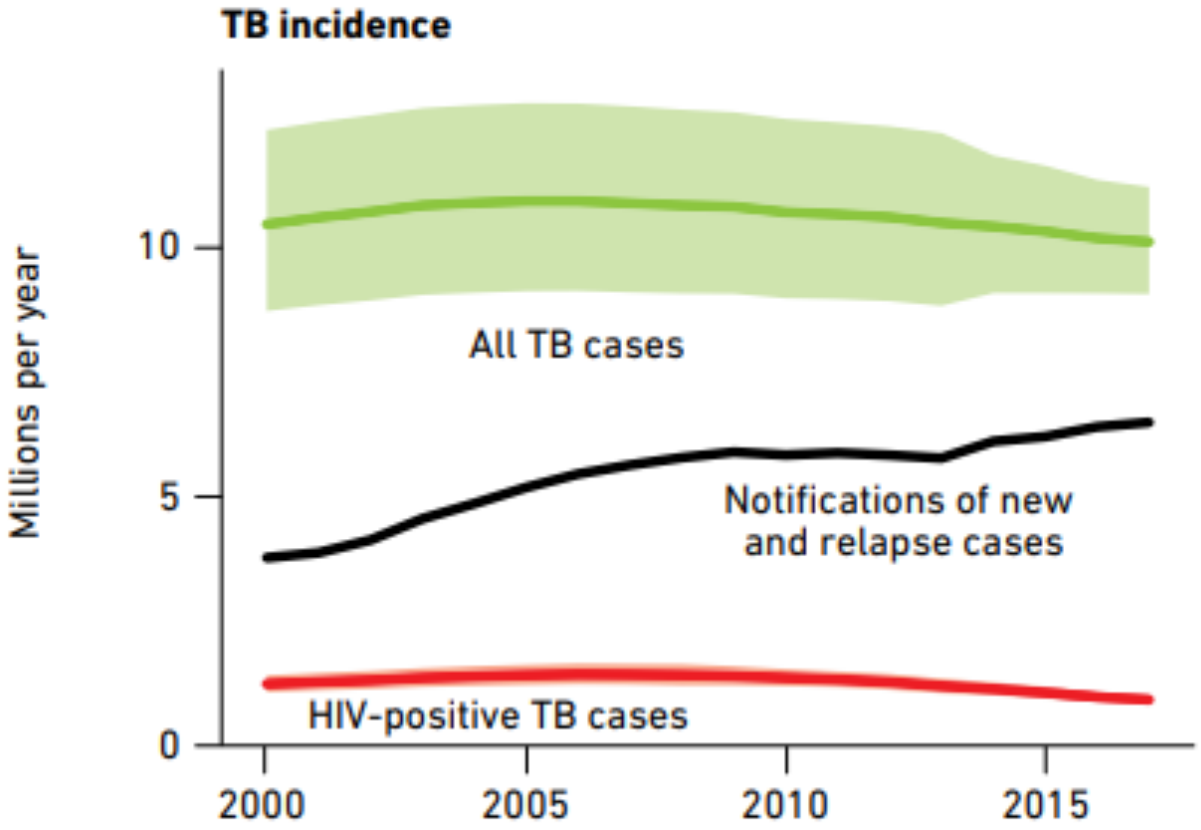
TB incidence rate declining 2%/year

Why is the decline so slow?

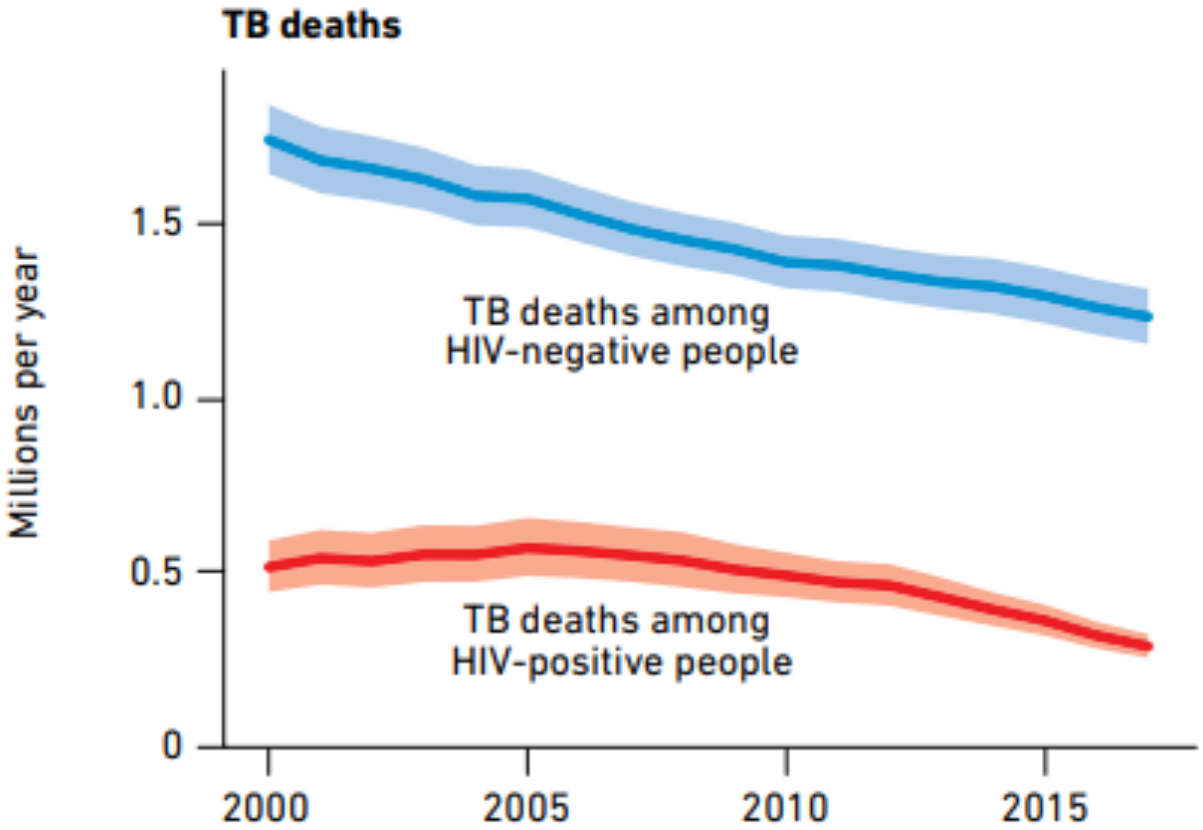
1. Global aging, large infection pool (1.7 billion people)
2. Rise of diabetes, pollution, crowding, urban population in slums, poverty
3. Low case detection and cure, drug resistance, HIV

Global trends in TB burden

10 million new cases (2017)

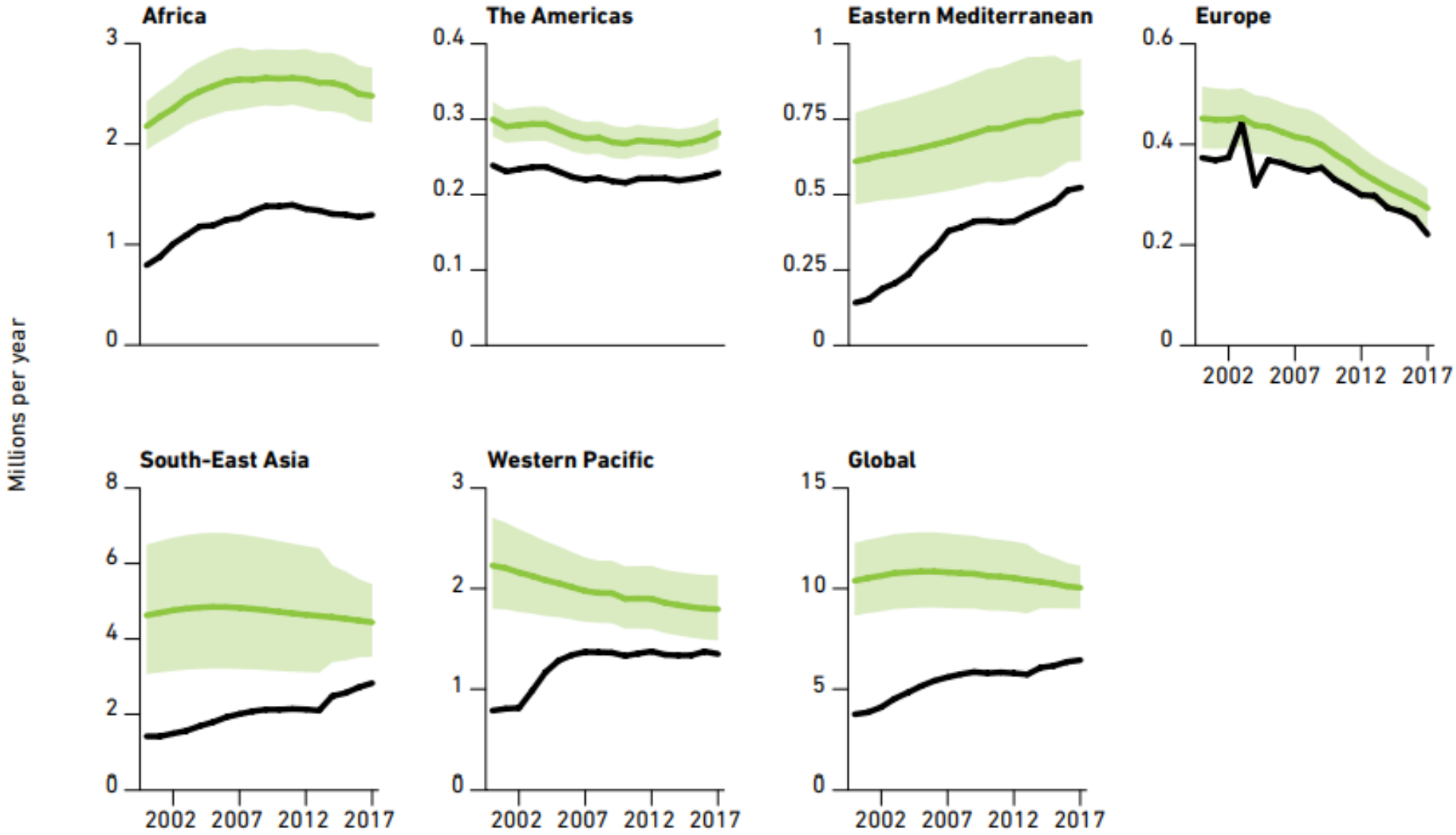


1.6 million TB deaths (2017)

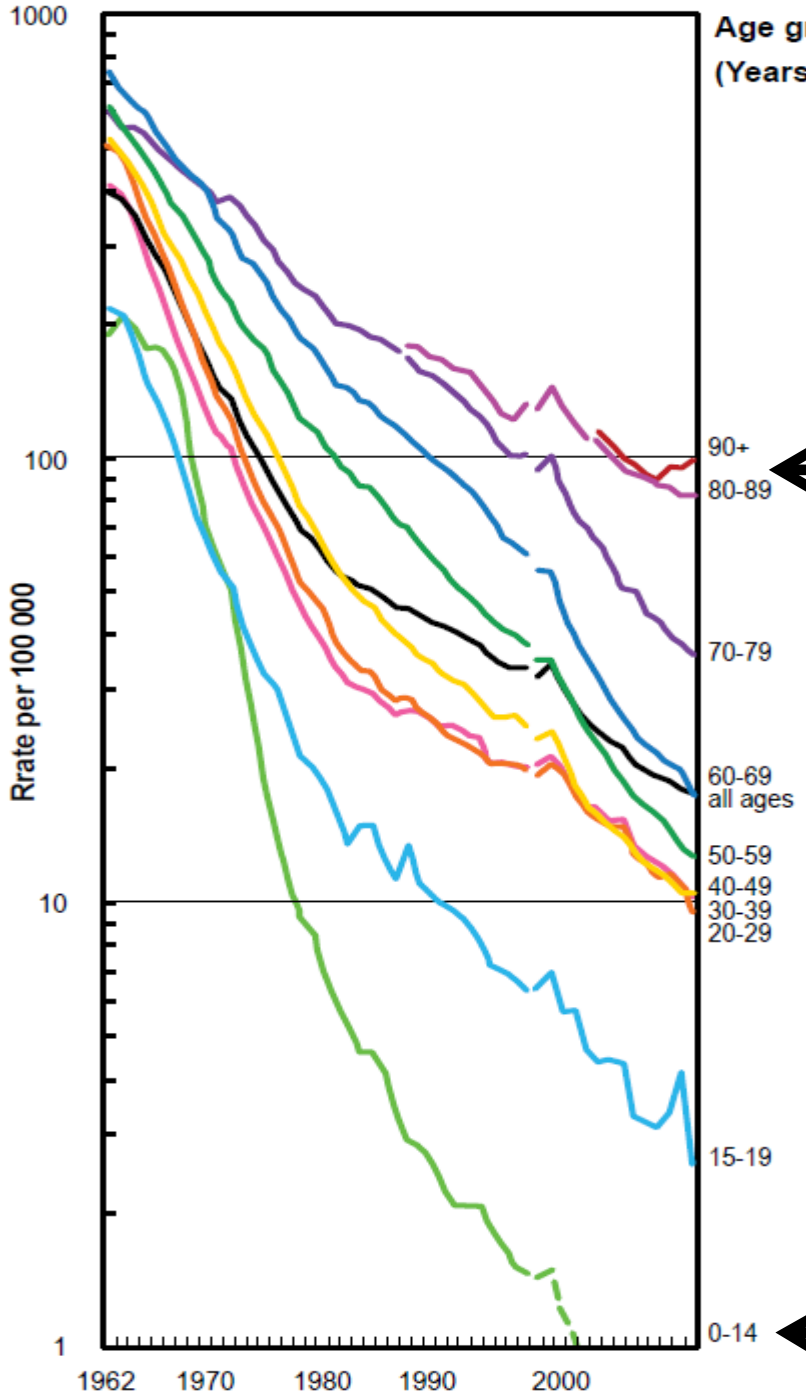


6.4 million notified/treated cases, but

10 million incident cases estimated



Slow death of the TB epidemic in Japan



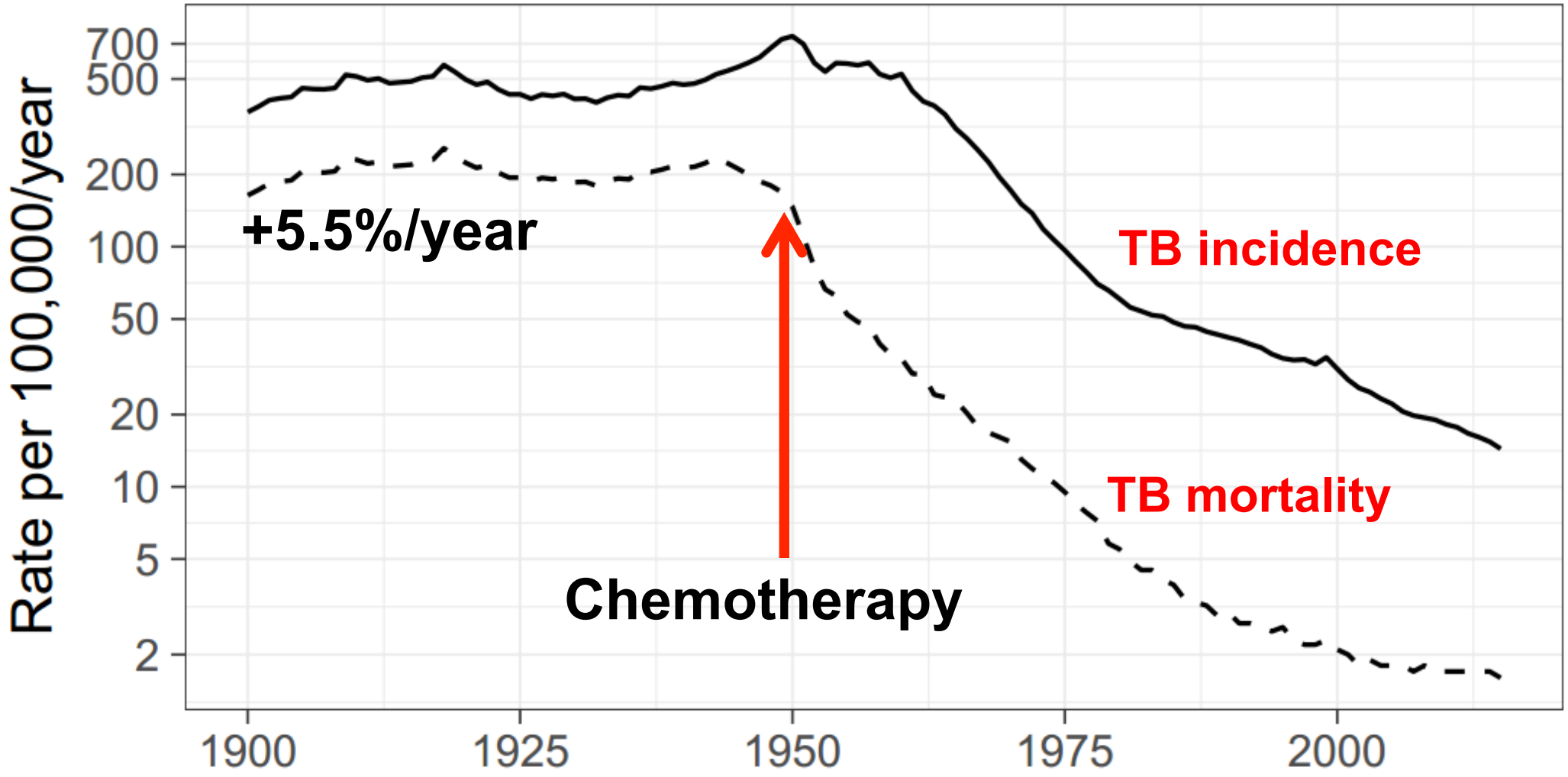
1 case per 1000 elderly people
= 100/100,000

The Large Reservoir of Latent TB

2 orders of magnitude

1 case per 100,000 children
transmission nearly stopped

Worsening of the TB epidemic during the industrial revolution in **Japan**

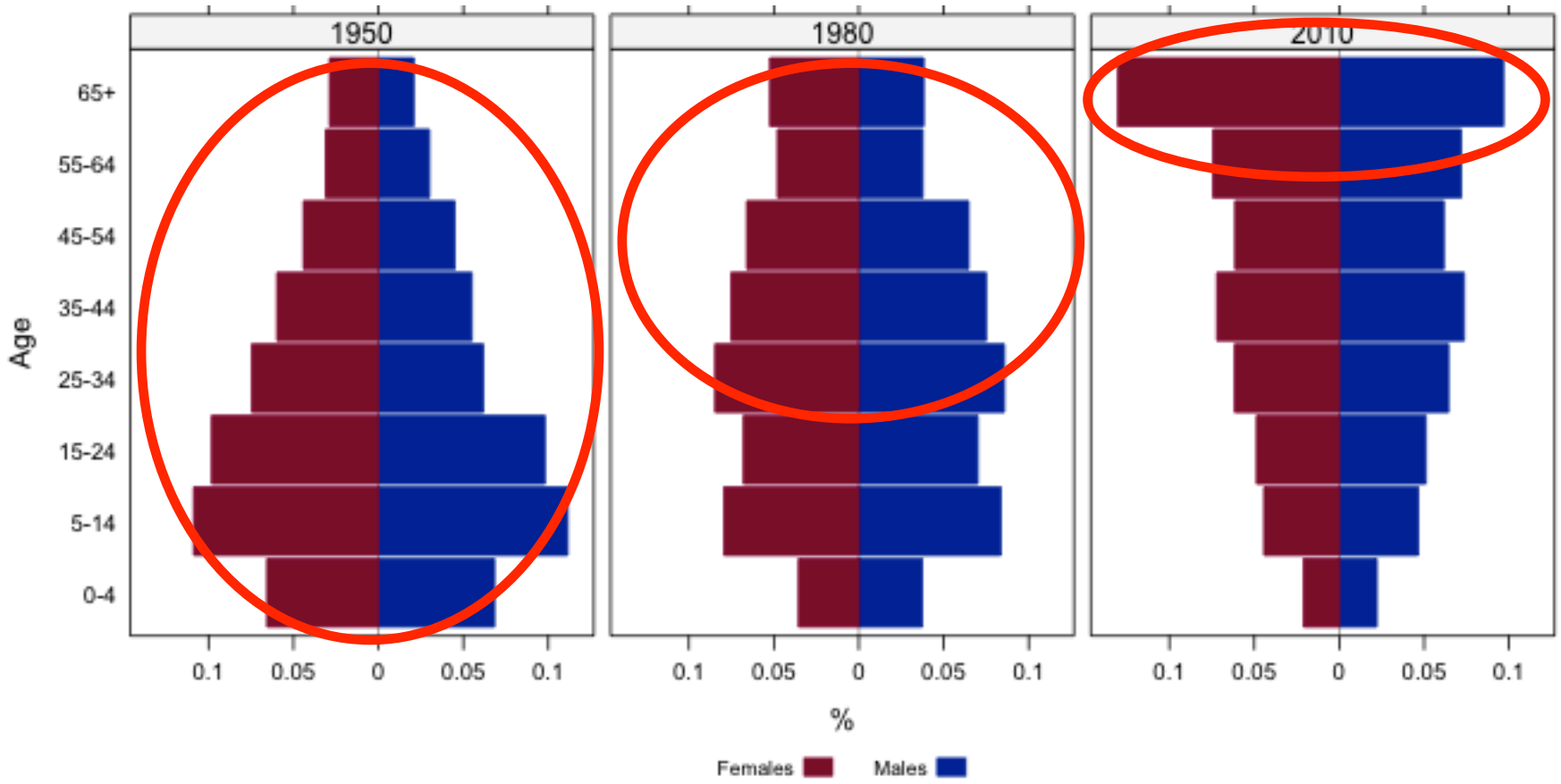


Demographic transition in Japan

High prevalence of infection in nearly all age groups

High prevalence of infection in 30+ year old

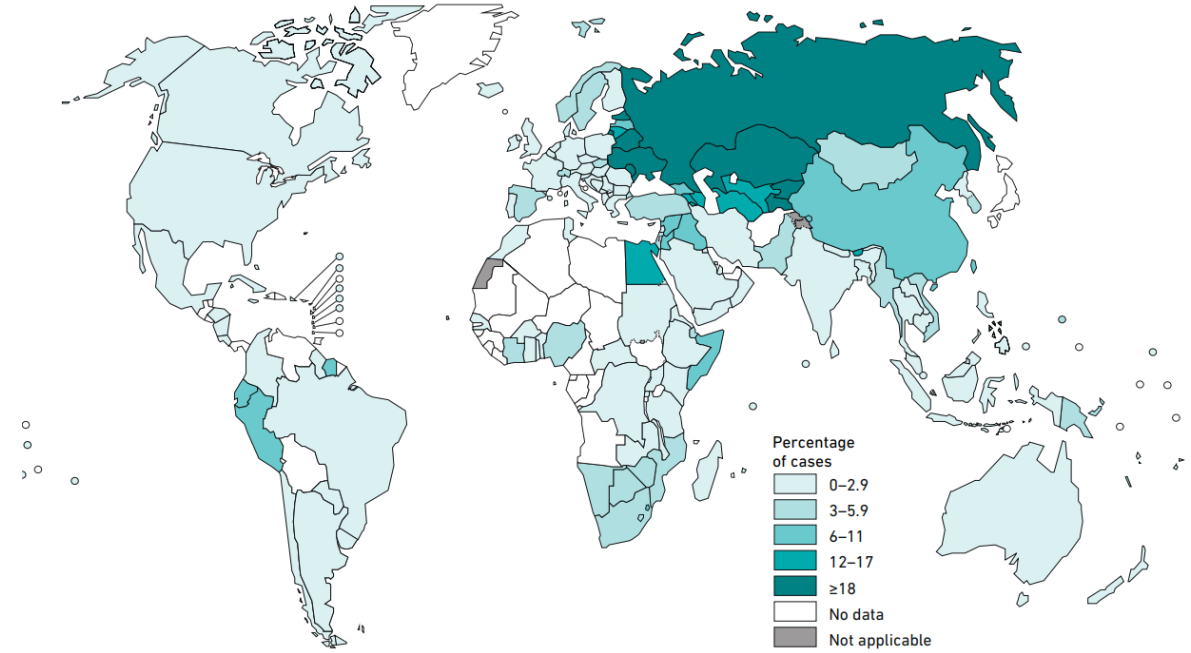
High incidence of disease in 60+ year old



TB drug resistance (2017)

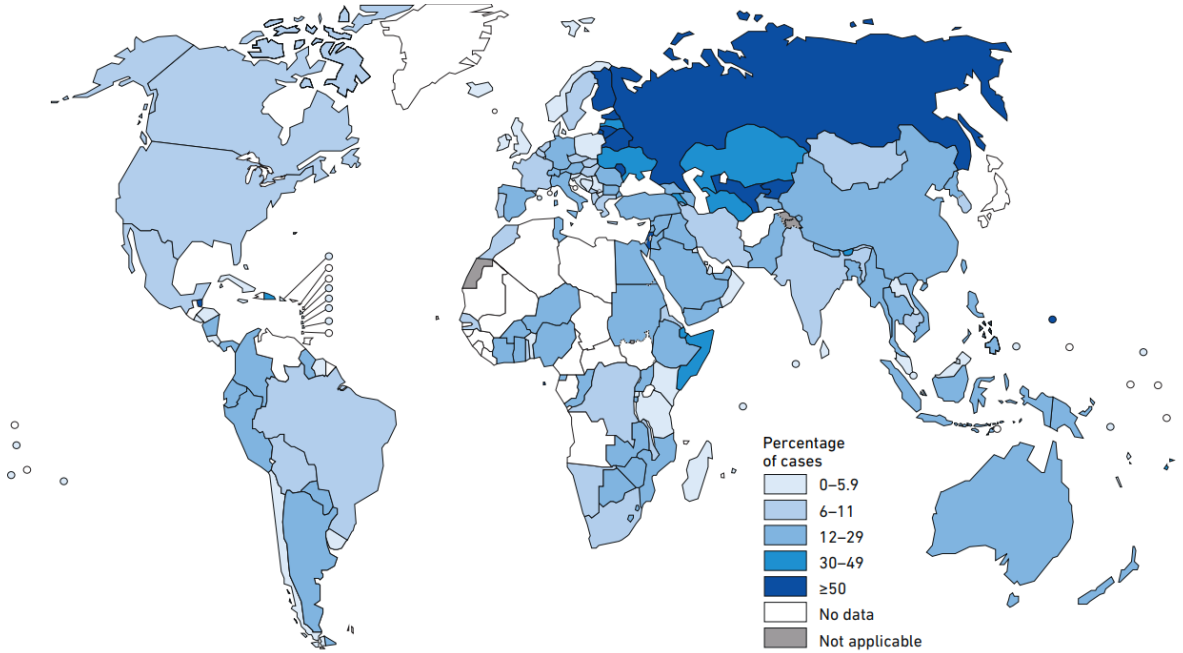
MDR/RR-TB: 558,000 new cases per year (82% MDR)

8.5% of people reported with MDR/RR-TB have XDR-TB



RR-TB in **new** cases (2017)

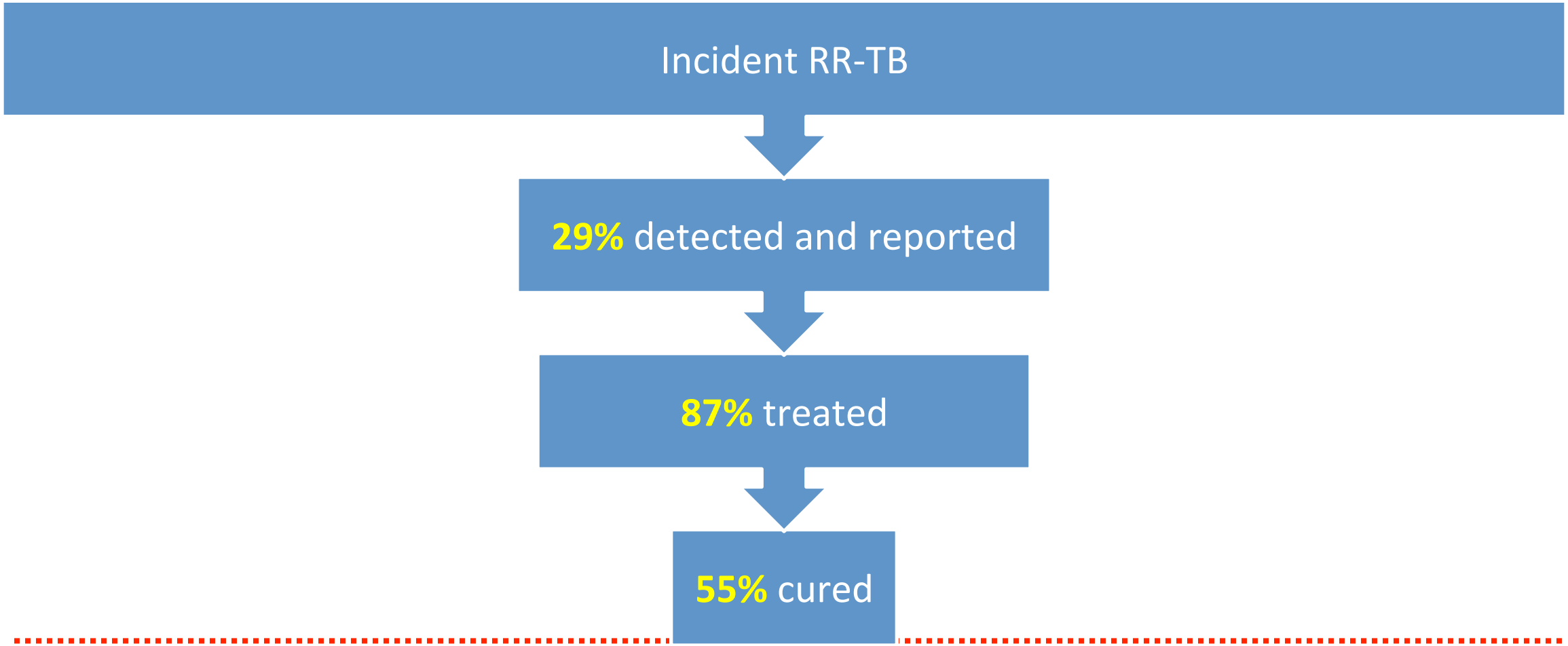
3.5 (2.5 - 4.7)%



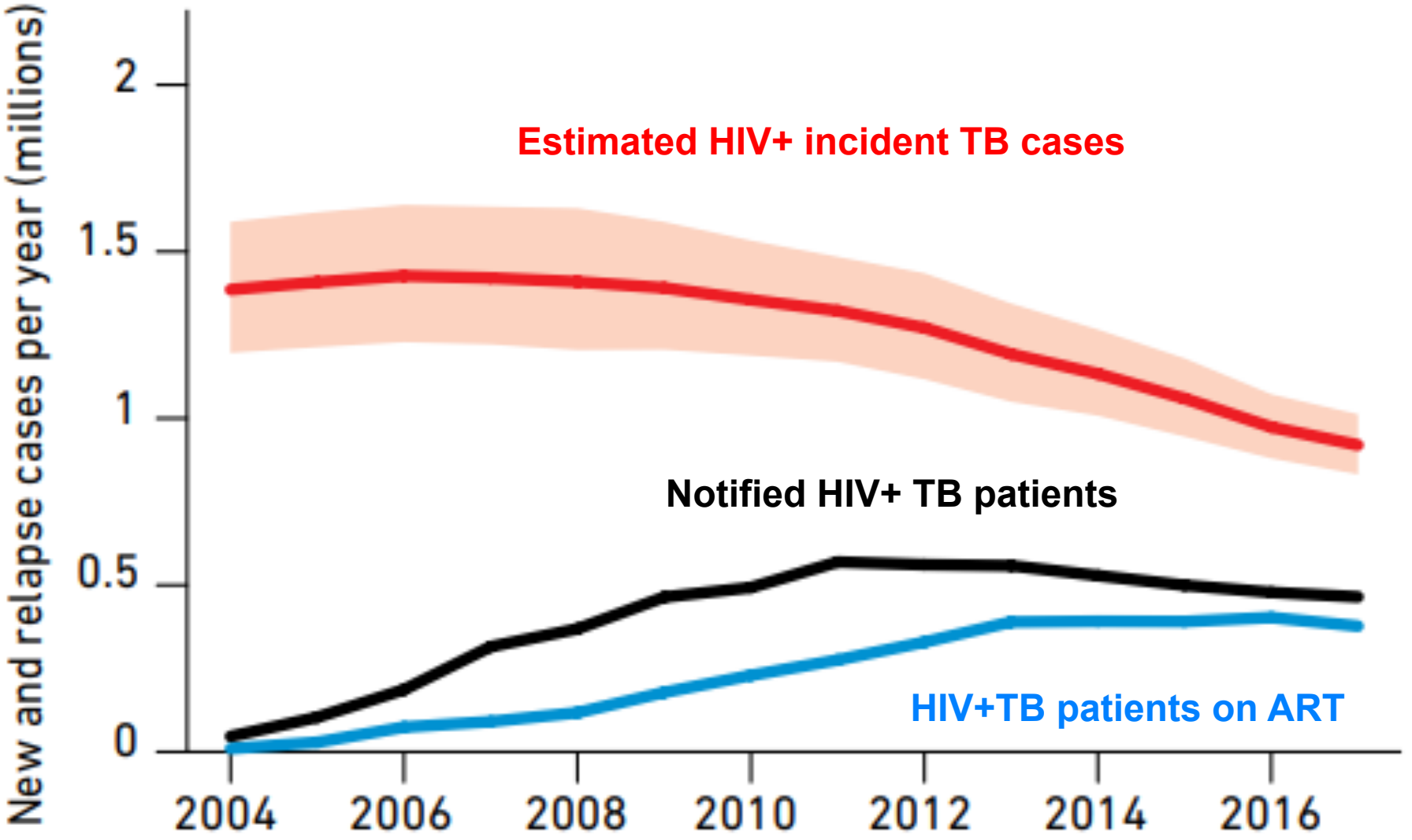
RR-TB in **retreatment** cases (2017)

18 (6.3 - 34)%

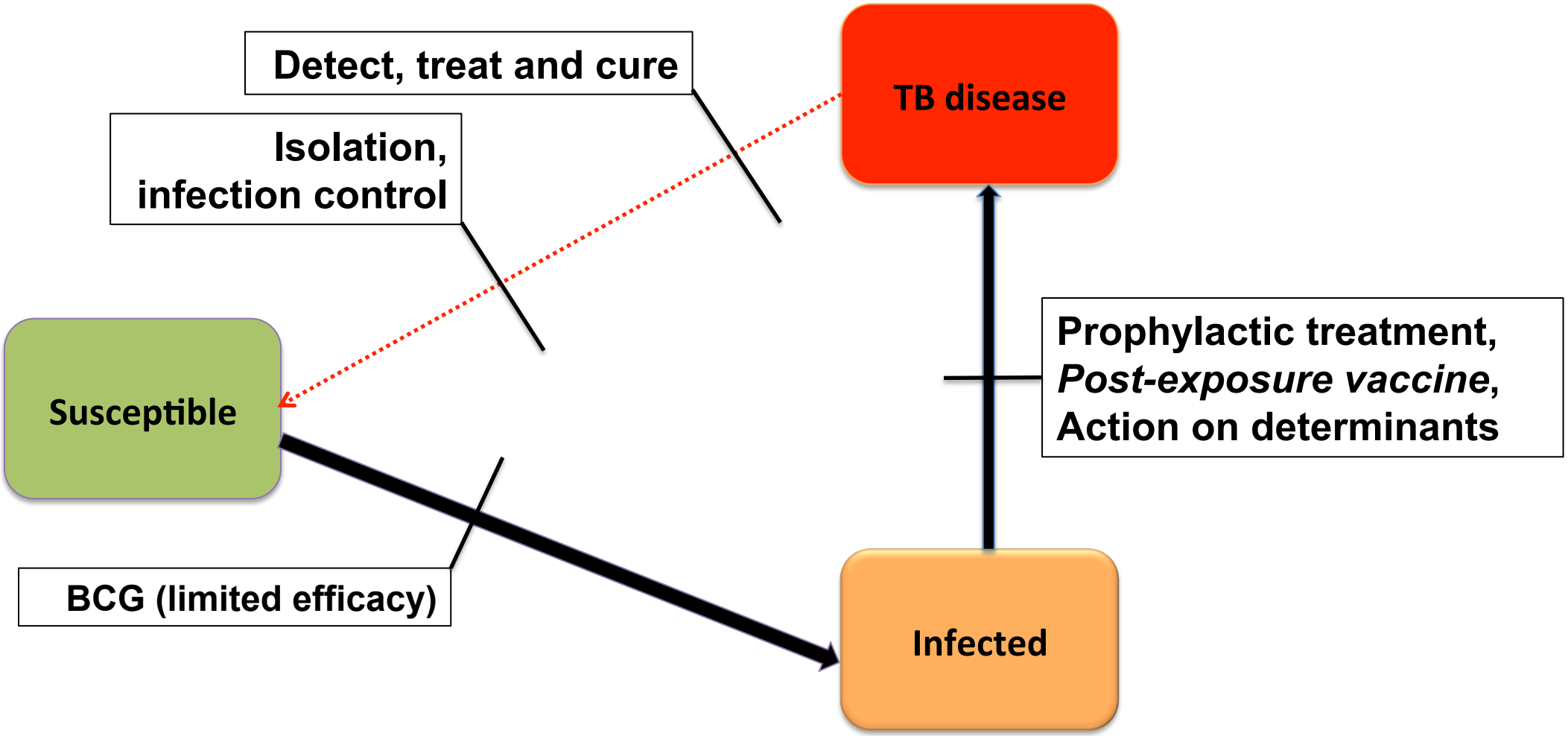
RR-TB care cascade



TB/HIV: Anti-retroviral coverage gap



Principles of TB control



Ending the global TB epidemic