

Cancer patterns and trends in Central and South America

Sierra MS, Abriata G, Barrios E, Bravo LE, Cueva P, Fernández L, Piñeros M, Rebelo M, de Vries E, Forman D.

Cancer Prevention Recommendations for Latin America and the Caribbean: Scoping Meeting.
Washington, DC. 24-25 April 2017



International Agency for Research on Cancer



Overview

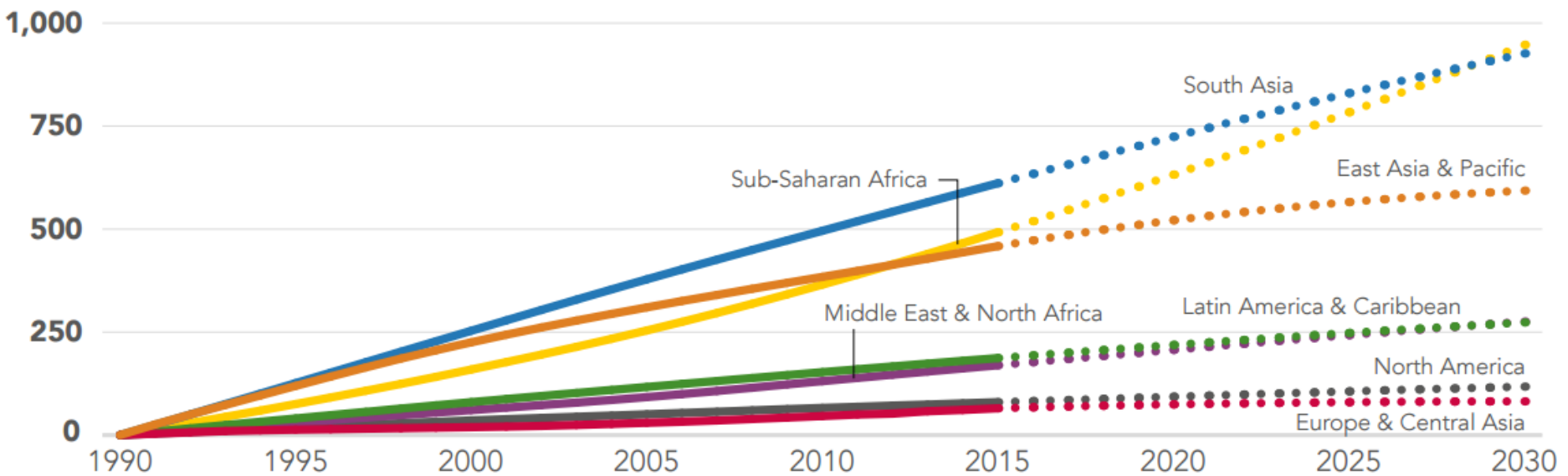
- ▶ Culture
- ▶ Race/ethnicity
- ▶ Geography
- ▶ Diets
- ▶ Causes of mortality
- ▶ Health care systems



Drivers of the epidemiological transition

Population growth

Increase in population since 1990, projected from 2015 (millions)

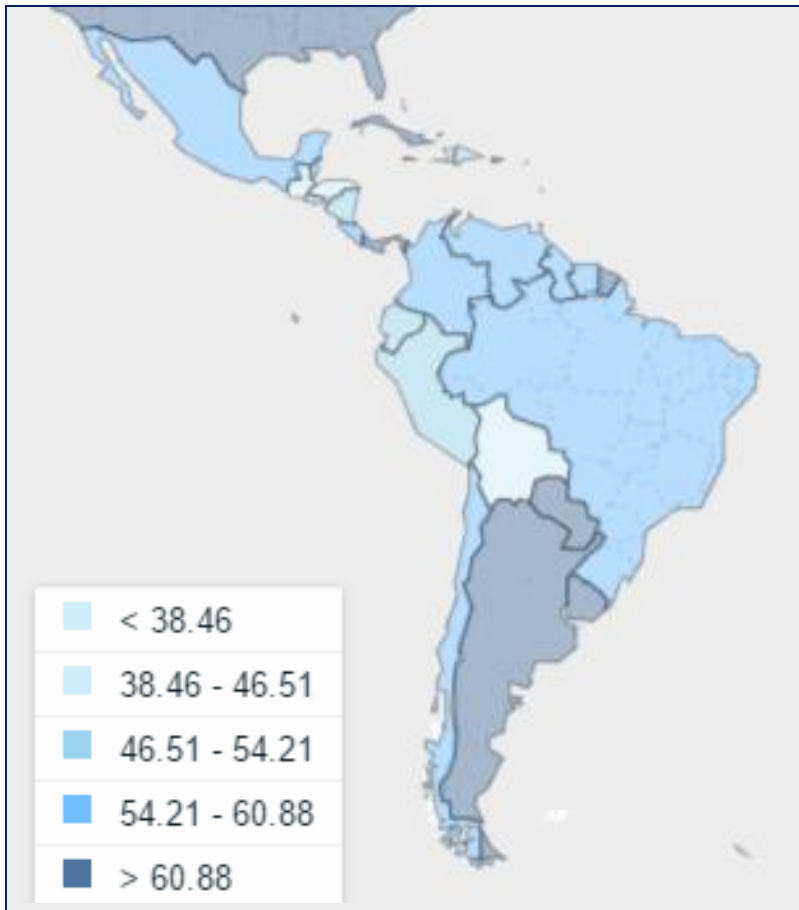


Source: World Bank Health, Nutrition, and Population Statistics: Population estimates and projections; WDI (SP.POP.TOTL).

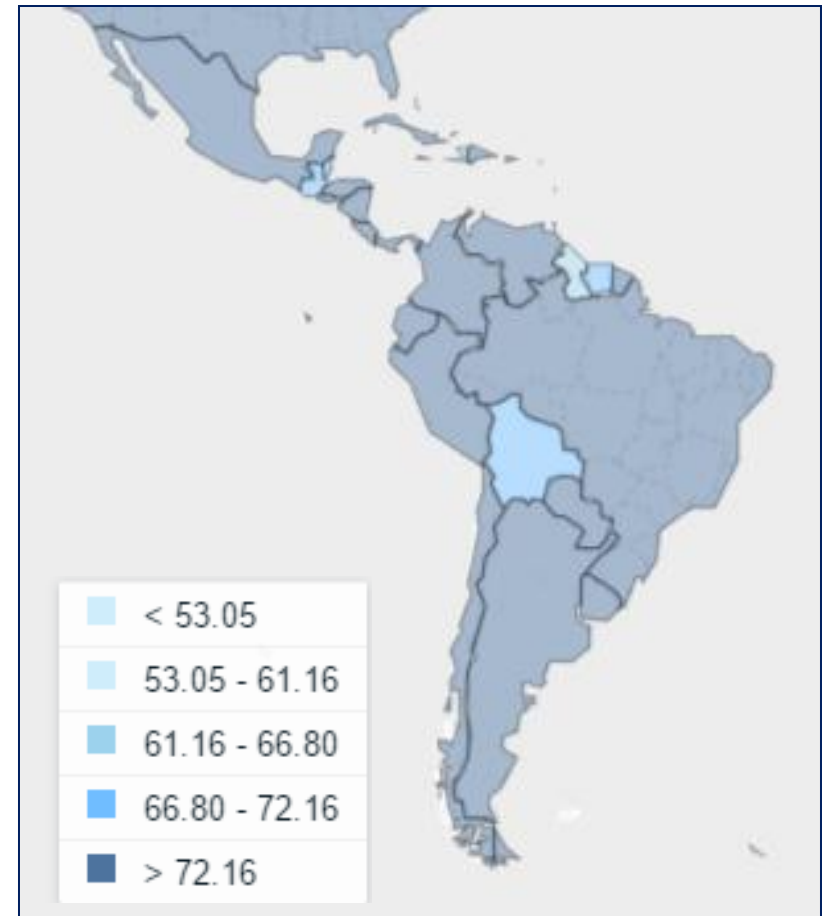
Drivers of the epidemiological transition

Life expectancy

1960



2015

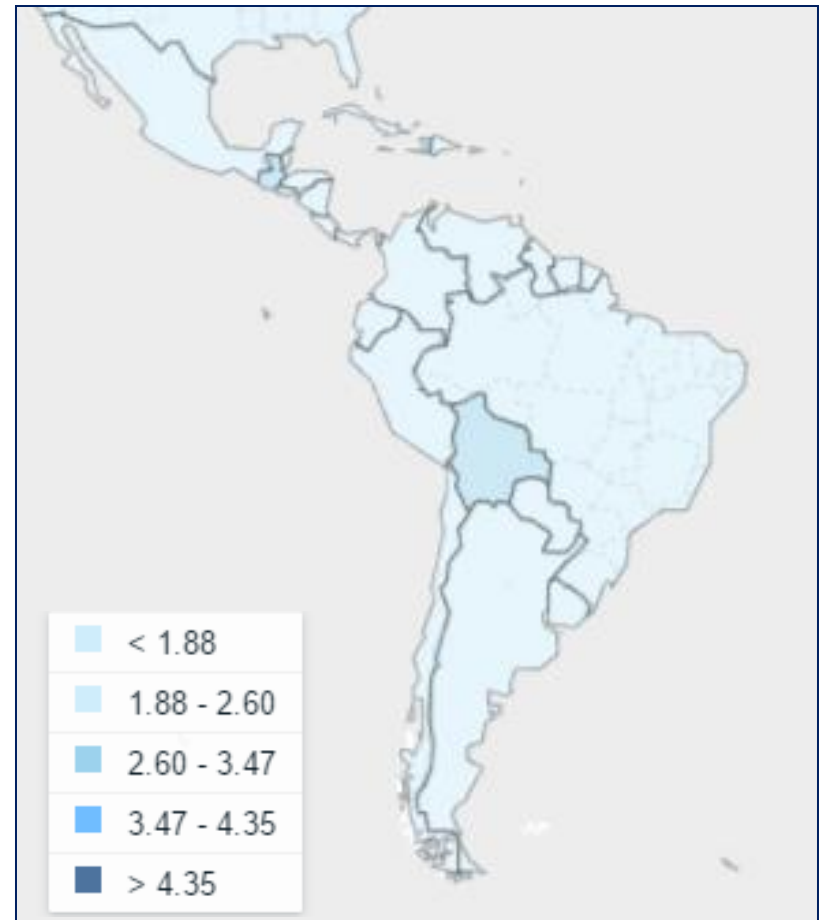
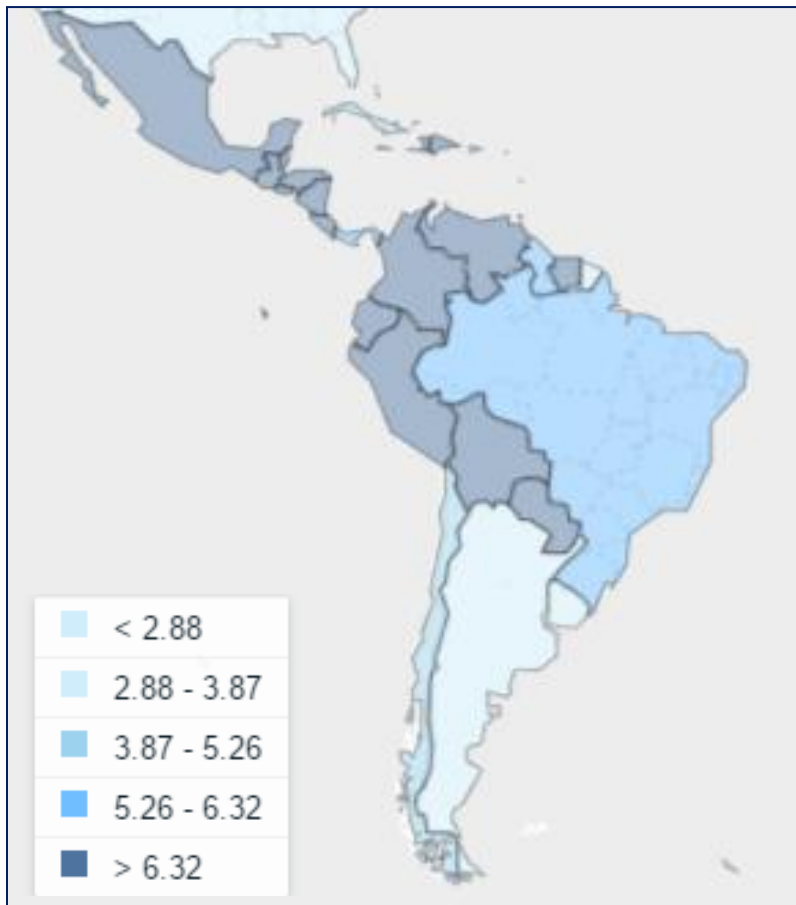


Drivers of the epidemiological transition

Fertility rate, total (births per woman)

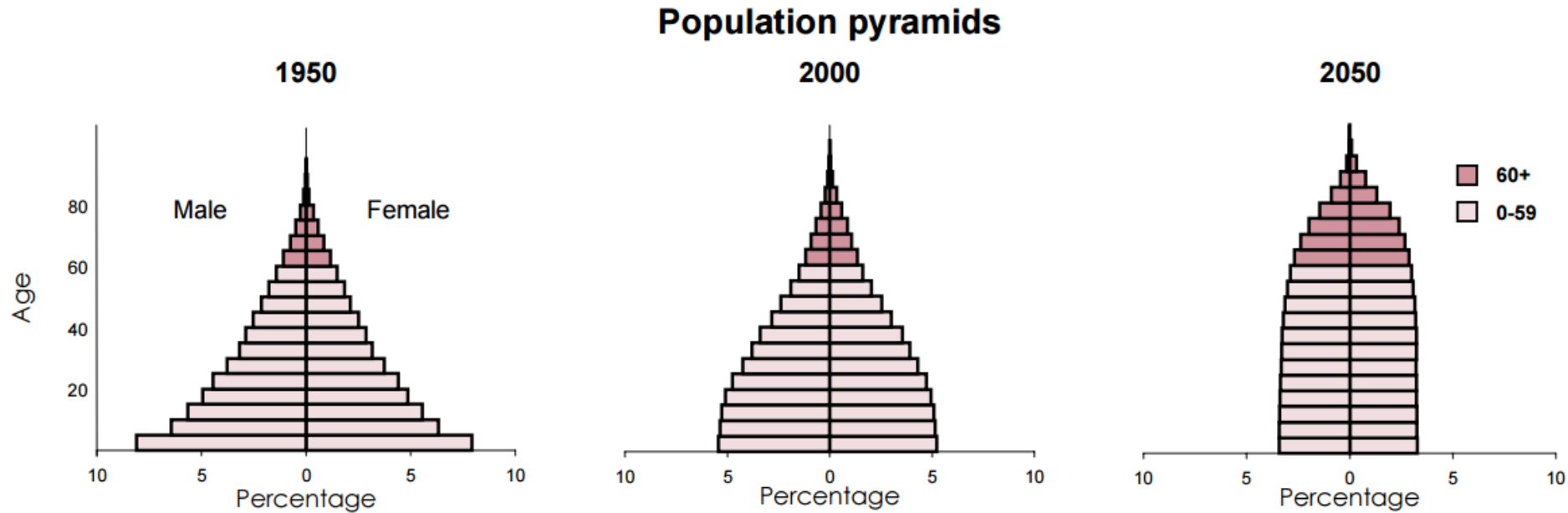
1960

2015



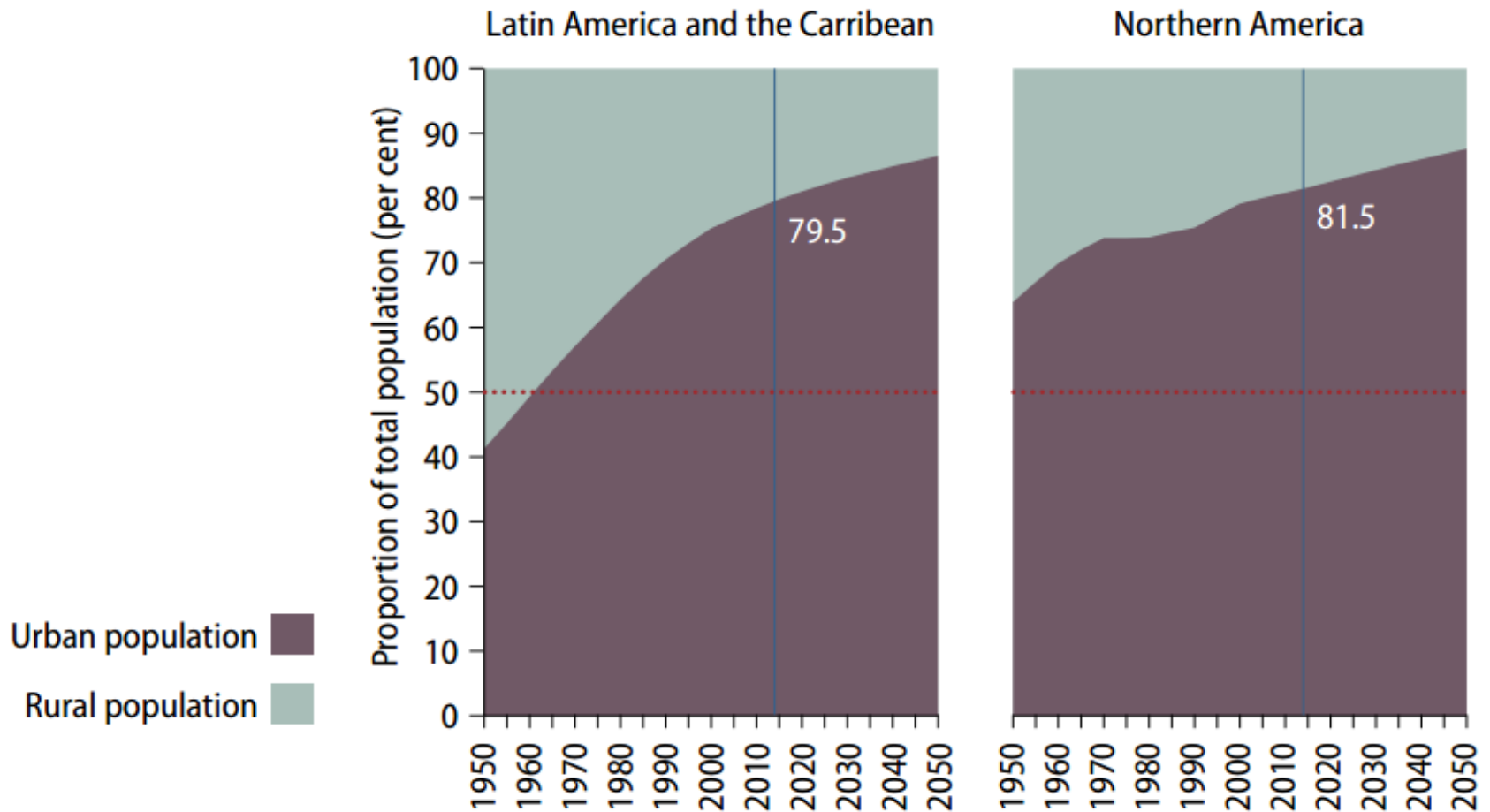
Drivers of the epidemiological transition

Population ageing



Drivers of the epidemiological transition

Urban and rural population



Epidemiologic transition in Central and South America and the Caribbean

- ▶ ↓ Mortality due to communicable, maternal, and perinatal diseases
- ▶ ↑ Mortality due to non-communicable diseases (NCDs), including cancer
 - ▶ NCDs accounted for 50–87% of total deaths in 2008
 - ▶ Cancer accounted for 8–25% of the total NCD burden
 - ▶ Significant economic impact for governments
- ▶ **Cancer estimates for Central and South America**
 - ▶ 2012 estimations:
 - ▶ 1 million new cancer cases & 550,000 cancer deaths
 - ▶ 2030 estimations:
 - ▶ 1.7 million new cases & 1 million cancer deaths

Cancer Incidence in Five Continents (CI5) Geographical Coverage



Ever in CI5
No
Yes

US, Puerto Rico (I-VIII, X)
Jamaica, King & St. Andrew (I-IV, X)
France, Martinique (V-X)

Cancer in Central and South America

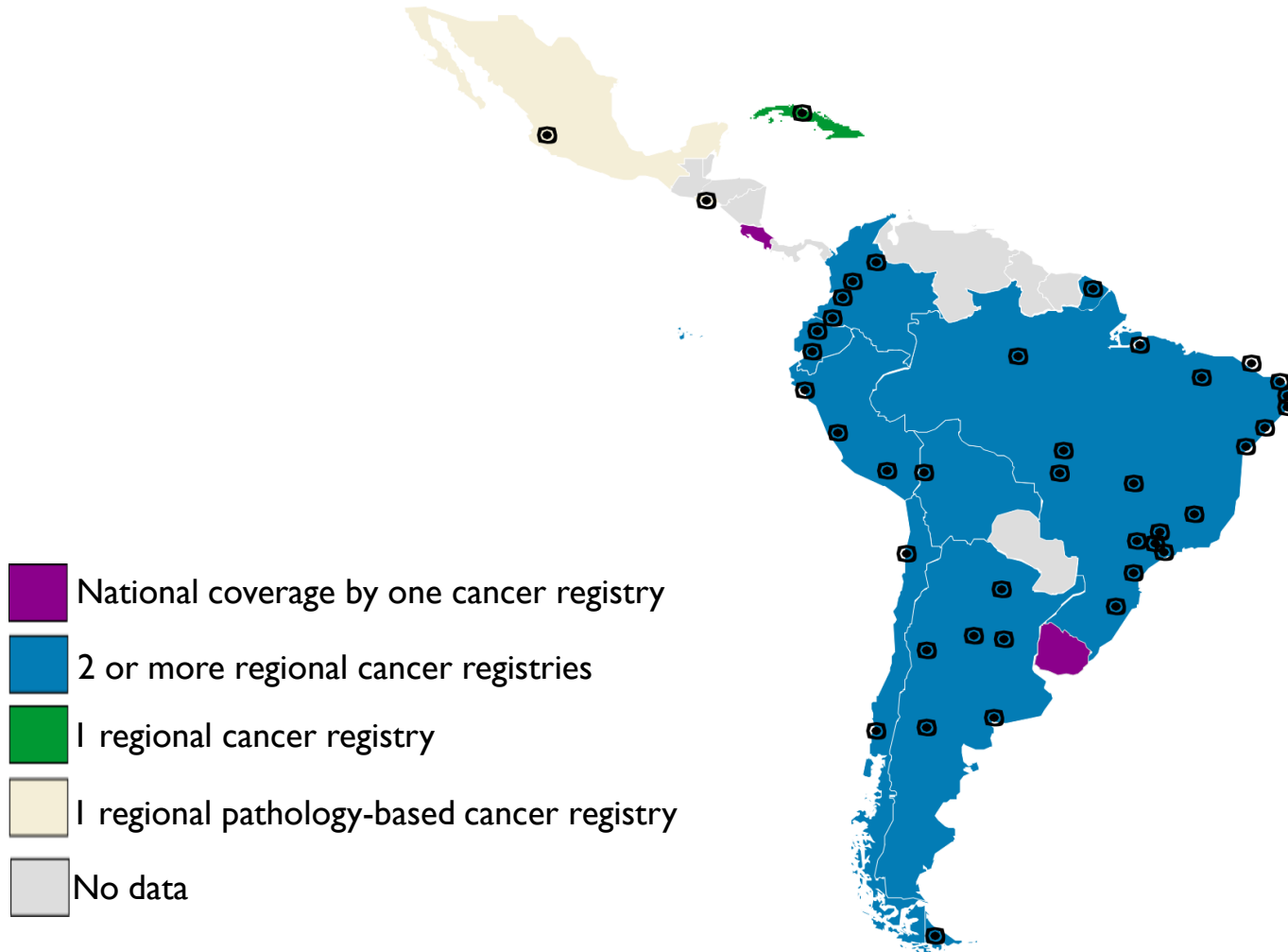
▶ Objective

- ▶ To provide an overview of current geographic patterns and trends of cancer incidence and mortality in the Central and South American region (including Cuba) in the 21st century.

Methodology

Methodology

Cancer Registry Data Contributors



Methodology

National Mortality Data (WHO)



Methodology

- ▶ **Human development index (HDI), 2010⁽¹⁾**
 - ▶ Low ($\text{HDI} \leq 0.46$)
 - ▶ Medium ($0.46 < \text{HDI} \leq 0.63$)
 - ▶ High ($0.63 < \text{HDI} \leq 0.75$)
 - ▶ Very high (all remaining countries)
- ▶ **Data analysis**
 - ▶ Estimated World population age-standardized incidence (ASR) and mortality (ASMR) rates per 100,000 person-years using the direct method ⁽²⁾
 - ▶ National ASRs are aggregated data from the available cancer registries using a weighted average of local rates

(1) United Nations Development Programme and the Institut national de la statistique et des études économique

(2) Doll R, et al. CI5-I. 1966

Cancer Rankings

using age-standardized (World) rates

	HDI	Cancer	Cancer	Cancer	Cancer	Cancer
CENTRAL AMERICA						
Country (Period)	VH	1 to 5	6 to 10	11 to 15	16 to 20	21 to 25
Country (Period)	H	1 to 5	6 to 10	11 to 15	16 to 20	21 to 25
Country (Period)	M	1 to 5	6 to 10	11 to 15	16 to 20	21 to 25
SOUTH AMERICA						
Country (Period)	VH	1 to 5	6 to 10	11 to 15	16 to 20	21 to 25
Country (Period)	H	1 to 5	6 to 10	11 to 15	16 to 20	21 to 25
Country (Period)	M	1 to 5	6 to 10	11 to 15	16 to 20	21 to 25

HDI, Human development index

VH, very high (HDI>0.75)

H, high (0.63<HDI≤0.75)

M, medium (0.46<HDI≤0.63)

Results

Sierra et al. <http://dx.doi.org/10.1016/j.canep.2016.07.013>

Cancer Rankings

Cancer incidence* among males (2003-07)

Males	HDI	Prostate	Lung	Colorectal	Stomach	NHL	Other & unsp.	Oropharynx	Bladder	Leukaemia	Kidney	Oesophagus	Liver	Brain, CNS	Testis	Gallbladder	Larynx
CENTRAL AMERICA																	
Costa Rica	H	1	4	3	2	6	5	10	9	8	12	17	7	13	14	20	15
Cuba † (2004-07)	H	2	1	3	7	8	9	5	6	11	14	13	15	10	23	21	4
El Salvador (1999-03)	M	3	8	7	1	6	2	5	10	4	20	11	18	12	17	15	9
Mexico † (2006-10)	H	1	3	2	5	4	7	12	6	8	9	18	23	11	10	19	13
SOUTH AMERICA																	
Argentina †	VH	1	2	3	4	8	5	12	6	10	7	9	16	15	14	17	13
Bolivia † (2011)	M	1	7	2	4	3	8	6	12	15	9	11	10	20	16	5	22
Brazil †	H	1	3	2	4	10	6	5	7	11	13	8	16	12	19	20	9
Chile †	VH	1	2	4	3	14	8	15	5	11	6	10	13	17	7	9	18
Colombia †	H	1	3	4	2	5	6	10	8	7	13	16	11	9	17	19	12
Ecuador †	H	1	5	4	2	3	7	19	8	6	13	18	9	11	10	12	21
French Guyana † (2003-08)	H	1	2	5	4	6	11	3	7	10	17	8	9	12	25	19	15
Peru † (2001-05)	H	1	3	4	2	5	7	15	9	6	8	18	11	10	13	14	19
Uruguay (2005-07)	H	1	2	3	6	8	4	9	5	13	7	11	17	14	15	18	12

*Age-standardized (World) rate per 100,000

† Incidence rates were estimated using aggregated data from regional cancer registries

HDI, Human development index; VH, very high (HDI>0.75); H, high (0.63<HDI≤0.75); M, medium (0.46<HDI≤0.63)

Cancer mortality* among males (2003-07)

Males	HDI	Stomach	Prostate	Lung	Colorectal	Liver	Other & uns.	Leukaemia	Pancreas	Oesophagus	Oropharynx	NHL	Brain, CNS	Larynx	Kidney	Bladder	Gallbladder
CENTRAL AMERICA																	
Belize	H	3	1	2	5	4	-	8	6	5	9	11	7	10	12	17	18
Costa Rica	H	1	2	4	5	5	3	6	7	12	10	8	9	14	15	11	16
Cuba (2004-07)	H	5	2	1	4	10	3	9	8	7	6	13	11	4	15	12	17
El Salvador (1999-03)	M	1	2	3	7	4	-	5	7	8	9	13	6	11	12	15	10
Guatemala	M	1	2	4	7	3	-	5	8	9	7	12	6	11	13	15	10
Mexico (2006-10)	H	4	1	2	6	5	3	7	6	12	14	8	10	11	9	13	15
Nicaragua	M	2	1	4	5	3	-	5	6	13	9	8	7	12	10	14	11
Panama	H	3	1	2	4	5	-	4	6	10	9	8	7	13	12	14	15
SOUTH AMERICA																	
Argentina	VH	4	3	1	4	8	2	9	5	6	13	12	14	11	7	10	15
Brazil	H	3	2	1	5	6	-	10	8	4	5	11	7	9	13	12	15
Chile	VH	1	3	2	5	6	4	10	8	7	15	11	14	16	9	12	5
Colombia	H	1	3	2	5	5	4	6	7	9	12	10	8	11	15	13	14
Ecuador	H	1	2	3	6	4	-	5	6	9	12	7	8	14	11	13	10
Paraguay	M	3	2	1	4	8	-	4	7	5	6	9	11	10	12	13	16
Peru (2001-2005)	H	1	2	3	5	4	-	5	7	11	14	6	8	15	10	13	9
Suriname	M	4	1	2	4	3	-	7	5	9	10	8	6	13	14	11	18
Uruguay (2005-07)	H	3	2	1	3	14	-	11	4	5	8	10	13	9	6	7	16
Venezuela	H	3	1	2	4	4	-	5	6	11	9	8	10	7	12	13	15

*Age-standardized (World) rate per 100,000

HDI, Human development index; VH, very high (HDI>0.75); H, high (0.63<HDI≤0.75); M, medium (0.46<HDI≤0.63)

Cancer incidence* among females (2003-07)

Females	HDI	Breast	Cervix uteri	Colorectal	Stomach	Thyroid	Lung	Other & unsp.	Gallbladder	Ovary	Corpus uteri	NHL	Leukaemia	Liver	Brain, CNS	Pancreas	Oropharynx	Kidney	Bladder
CENTRAL AMERICA																			
Costa Rica	H	1	3	4	2	5	10	6	14	8	7	9	11	13	15	12	18	16	19
Cuba † (2004-07)	H	1	4	3	11	5	2	7	22	8	6	9	14	15	12	10	13	16	17
El Salvador (1999-03)	M	2	1	9	4	6	11	3	7	12	8	10	5	16	14	19	13	24	15
Mexico † (2006-10)	H	1	2	3	11	5	9	6	13	4	8	7	10	21	12	18	17	15	16
SOUTH AMERICA																			
Argentina †	VH	1	2	3	9	10	6	4	15	5	7	8	12	19	14	11	20	13	16
Bolivia † (2011)	M	2	1	4	7	5	9	11	3	6	8	12	14	15	17	13	10	20	18
Brazil †	H	1	3	2	7	4	6	5	18	8	9	10	12	21	13	14	11	17	16
Chile †	VH	1	3	4	6	7	5	8	2	10	15	13	12	16	18	14	21	11	9
Colombia †	H	1	2	3	4	5	7	6	12	8	11	9	10	16	13	14	15	18	20
Ecuador †	H	1	2	5	4	3	11	10	8	7	12	6	9	13	15	14	19	17	18
French Guyana † (2003-08)	H	1	2	3	5	9	6	11	21	7	4	8	10	16	19	17	12	15	14
Peru † (2001-05)	H	1	2	4	3	8	5	9	10	7	12	6	11	14	15	13	16	17	19
Uruguay (2005-07)	H	1	3	2	9	8	5	4	15	7	6	11	13	22	14	10	19	12	17

*Age-standardized (World) rate per 100,000

† Incidence rates were estimated using aggregated data from regional cancer registries

HDI, Human development index; VH, very high (HDI>0.75); H, high (0.63<HDI≤0.75); M, medium (0.46<HDI≤0.63)

Cancer mortality* among females (2003-07)

Females	HDI	Breast	Cervix uteri	Stomach	Lung	Colorectal	Liver	Other & unsp	Leukaemia	Pancreas	Ovary	Gallbladder	Brain, CNS	Corpus uteri	NHL	Oropharynx
CENTRAL AMERICA																
Belize	H	2	1	5	4	8	3	-	8	6	14	9	10	7	13	17
Costa Rica	H	1	4	2	5	4	8	3	7	6	9	12	11	13	10	16
Cuba (2004-07)	H	2	4	9	1	3	7	3	8	6	11	17	10	5	12	13
El Salvador (1999-03)	M	2	1	4	11	7	16	-	5	19	12	7	14	8	10	13
Guatemala	M	5	3	1	4	7	2	-	6	8	12	9	7	16	14	10
Mexico (2006-10)	H	2	3	5	6	8	4	1	9	7	8	10	12	17	11	18
Nicaragua	M	4	1	2	5	5	3	-	6	-	9	7	10	15	11	14
Panama	H	1	2	3	4	4	7	-	5	6	9	12	8	11	10	14
SOUTH AMERICA																
Argentina	VH	1	3	7	4	3	10	2	8	5	6	9	12	15	11	18
Brazil	H	1	2	4	3	4	7	-	9	6	8	10	5	14	12	13
Chile	VH	2	6	4	5	7	9	3	10	7	8	1	15	16	11	20
Colombia	H	2	3	4	5	6	6	1	7	9	8	10	11	16	12	14
Ecuador	H	3	2	1	5	6	4	-	6	7	9	8	10	12	11	15
Paraguay	M	2	1	3	4	3	8	-	5	6	7	9	11	10	12	14
Peru (2001-05)	H	3	2	1	5	6	4	-	6	8	9	7	11	12	10	15
Suriname	M	2	1	7	3	4	4	-	8	9	5	12	6	11	10	14
Uruguay (2005-07)	H	1	3	5	2	2	18	-	8	4	6	10	13	15	7	16
Venezuela	H	2	1	4	3	5	5	-	8	7	6	10	11	12	9	15

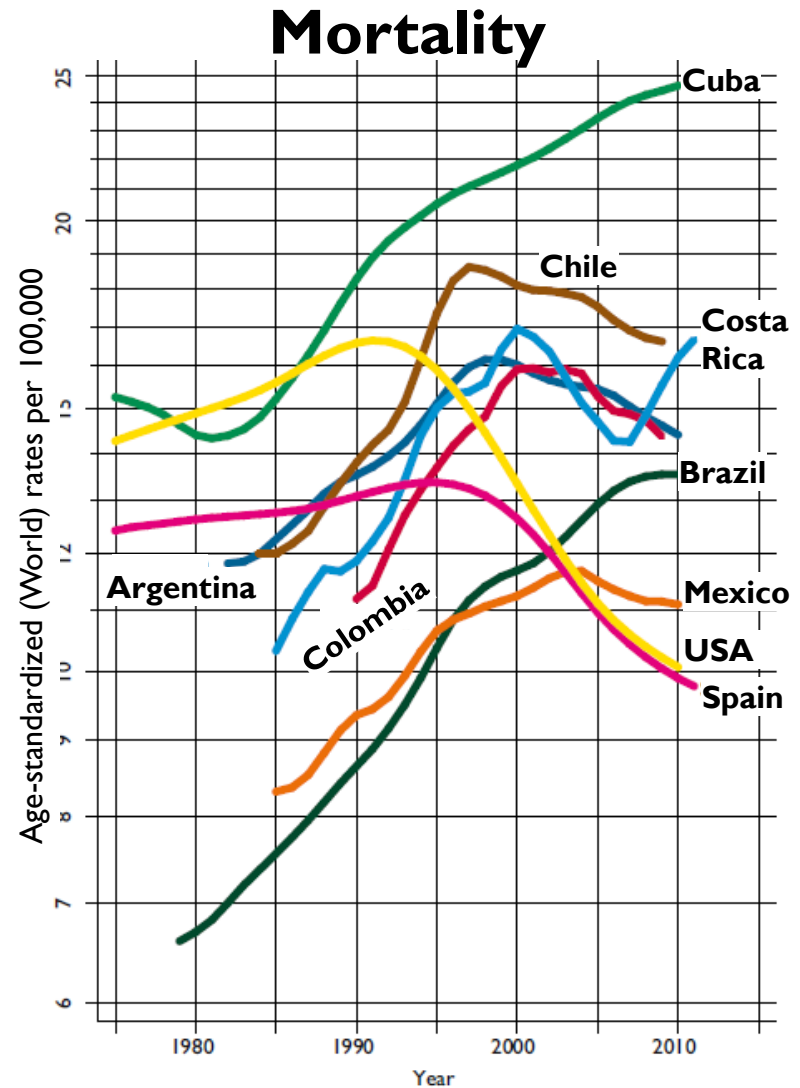
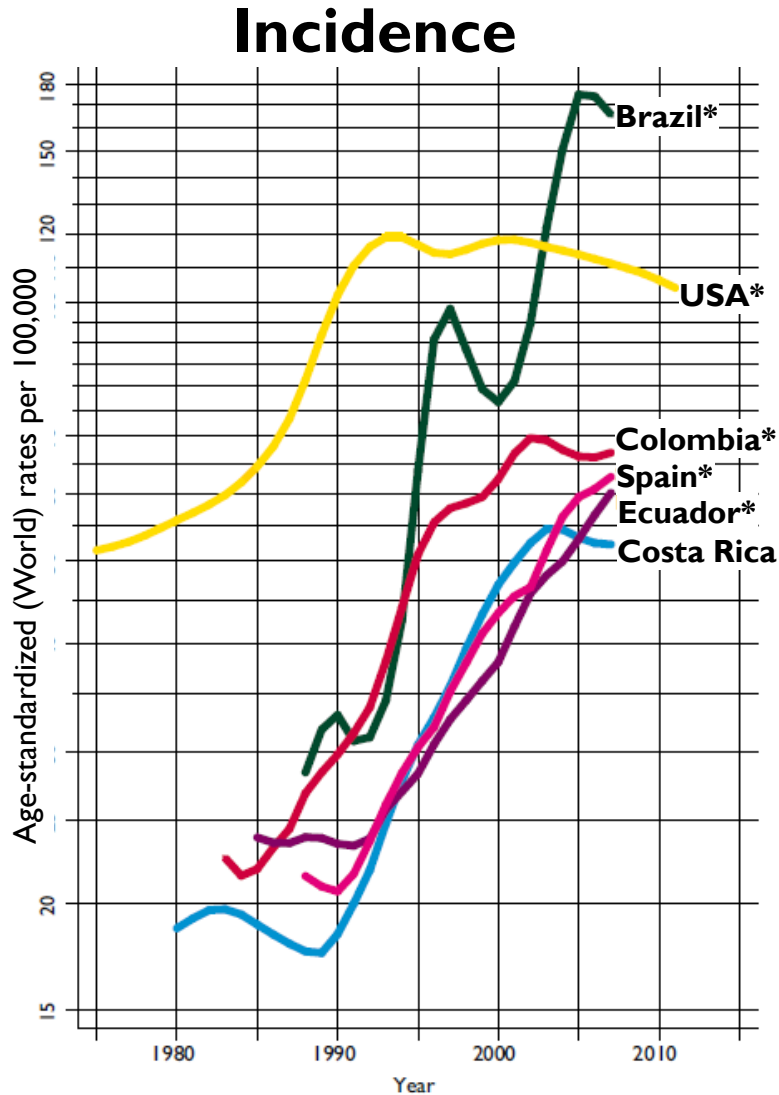
*Age-standardized (World) rate per 100,000

HDI, Human development index; VH, very high (HDI>0.75); H, high (0.63<HDI≤0.75); M, medium (0.46<HDI≤0.63)

Cancer Trends in Selected Countries

Bray & Piñeros. Salud Publica Mex. 2016 Apr;58(2):104-17

Trends in age-standardized (World) rates of **prostate cancer**

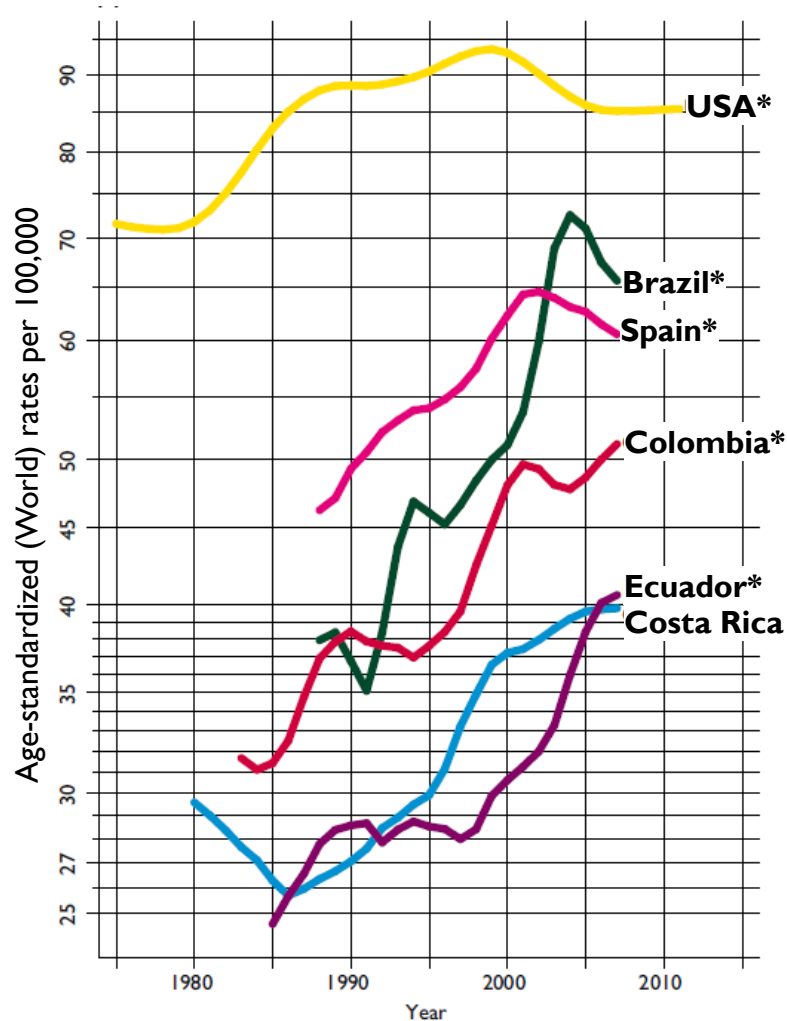


* Regional registries

Bray & Piñeros. Salud Publica Mex. 2016 Apr;58(2):104-17

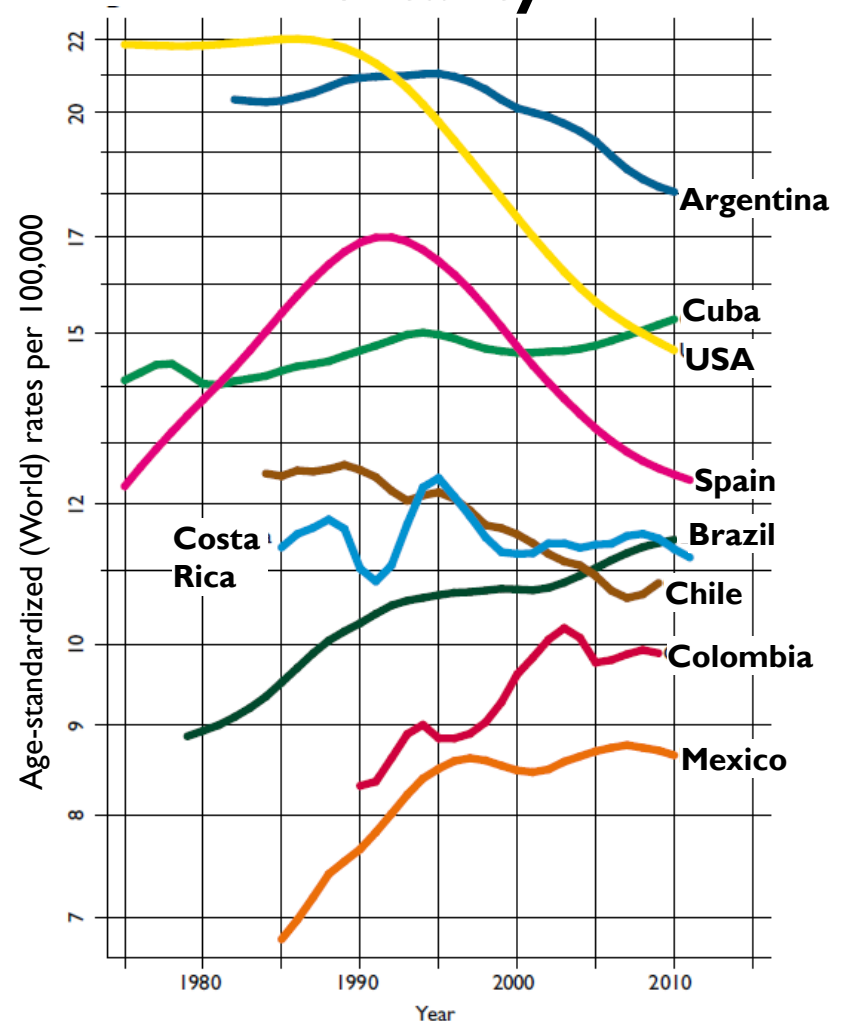
Trends in age-standardized (World) rates of female breast cancer

Incidence



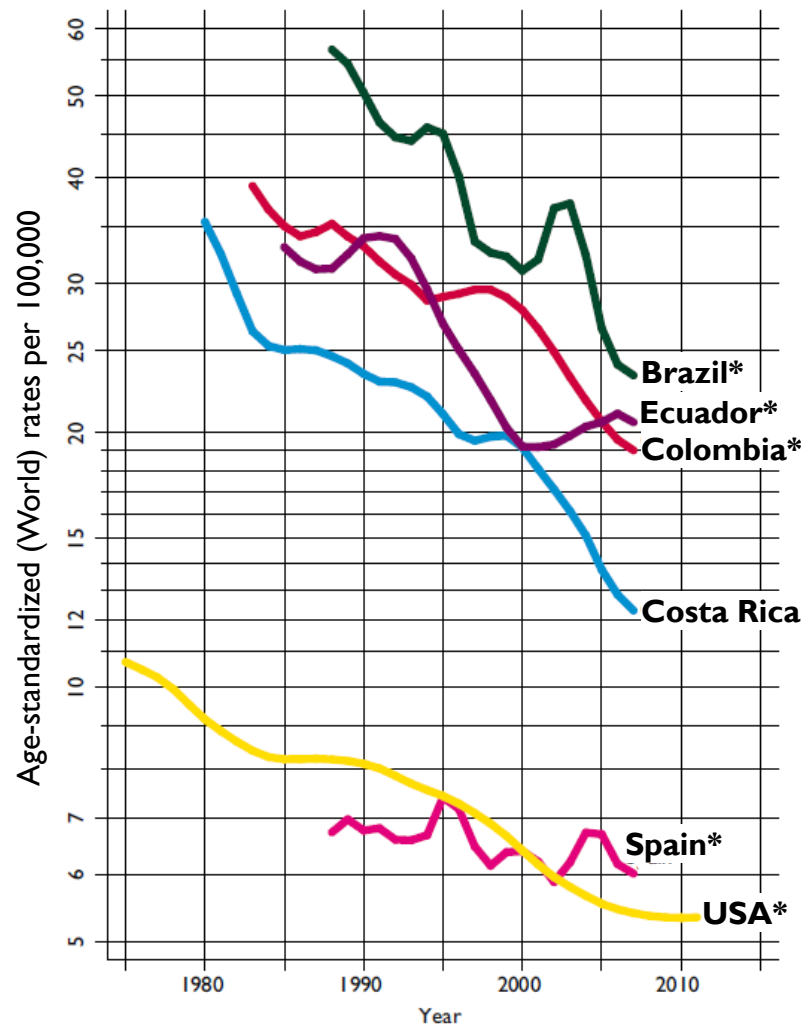
* Regional registries

Mortality



Bray & Piñeros. Salud Publica Mex. 2016 Apr;58(2):104-117

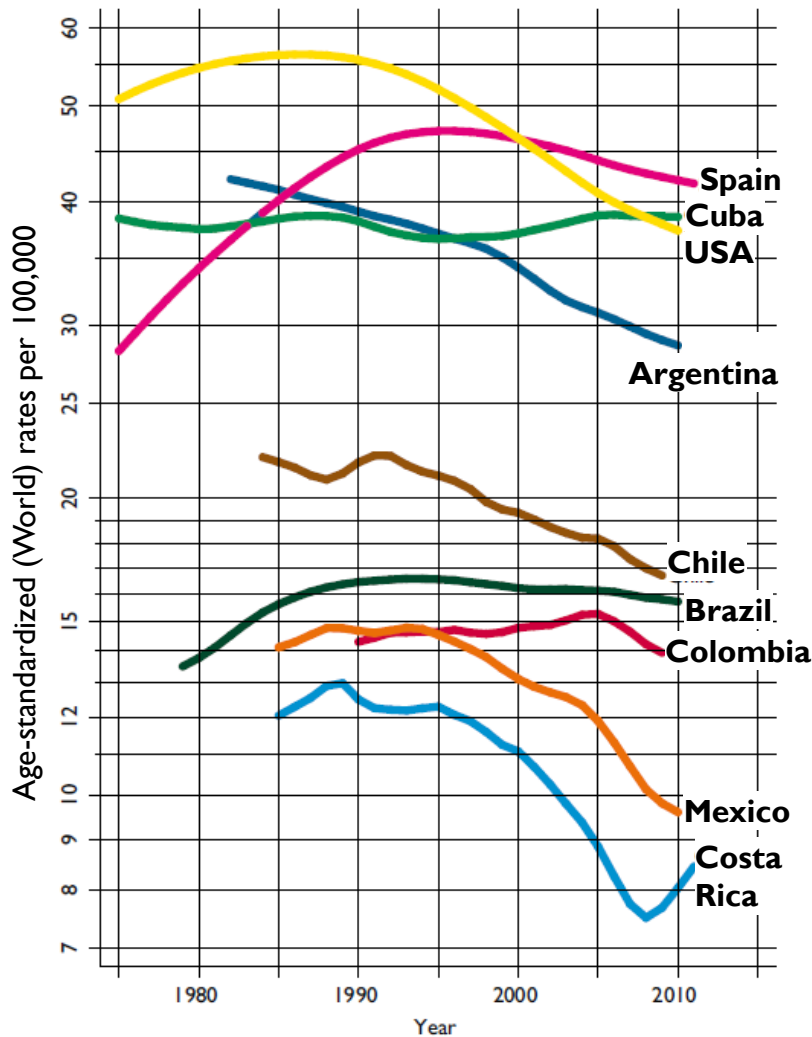
Trends in age-standardized (World) incidence rates of **cervical** cancer



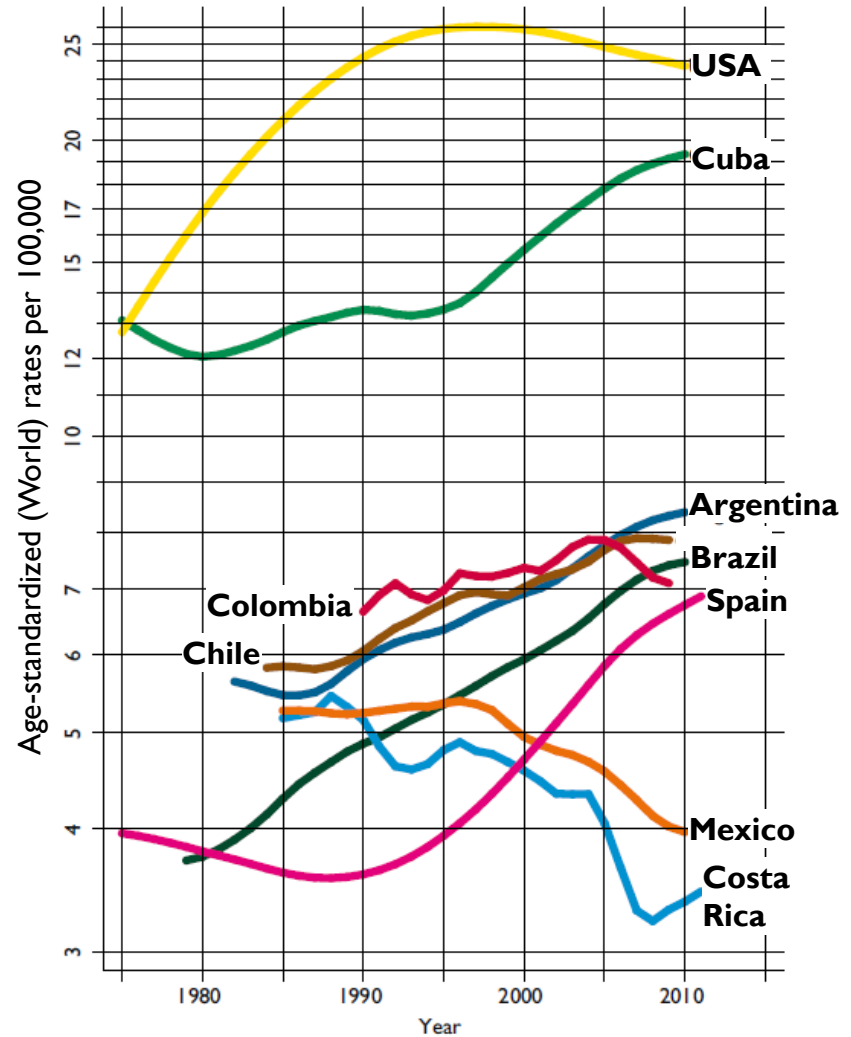
* Regional registries

Trends in age-standardized (World) mortality rates of lung cancer

Males

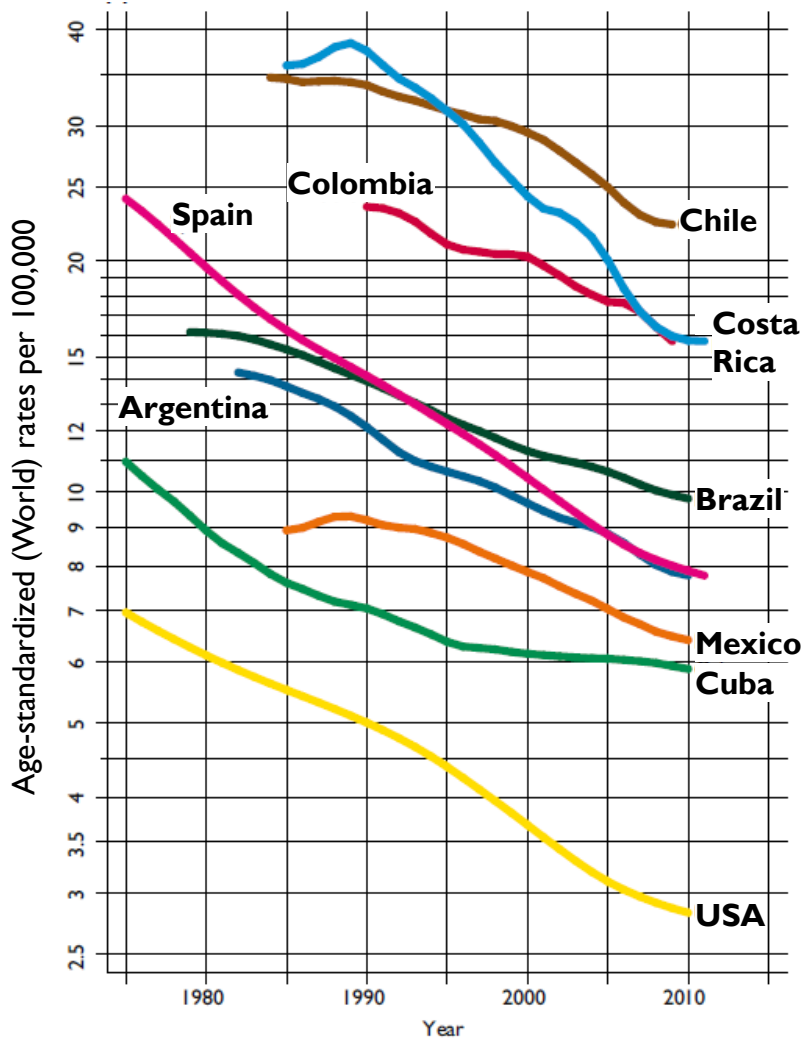


Females

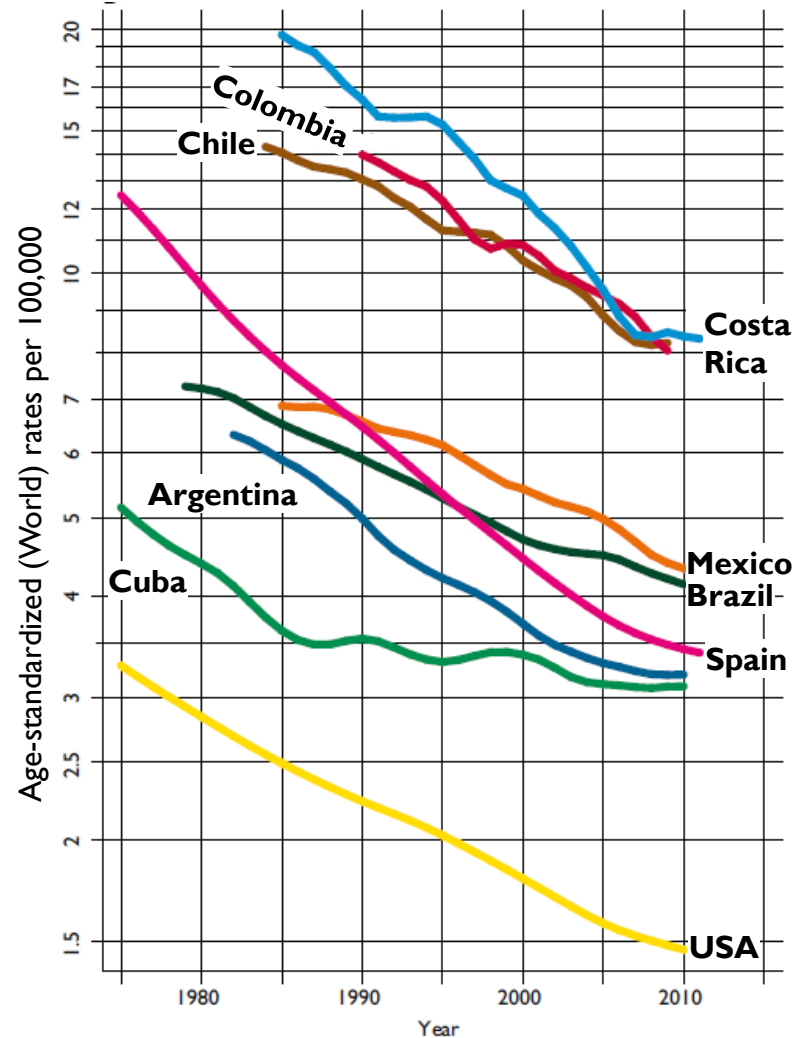


Trends in age-standardized (World) mortality rates of **stomach** cancer

Males

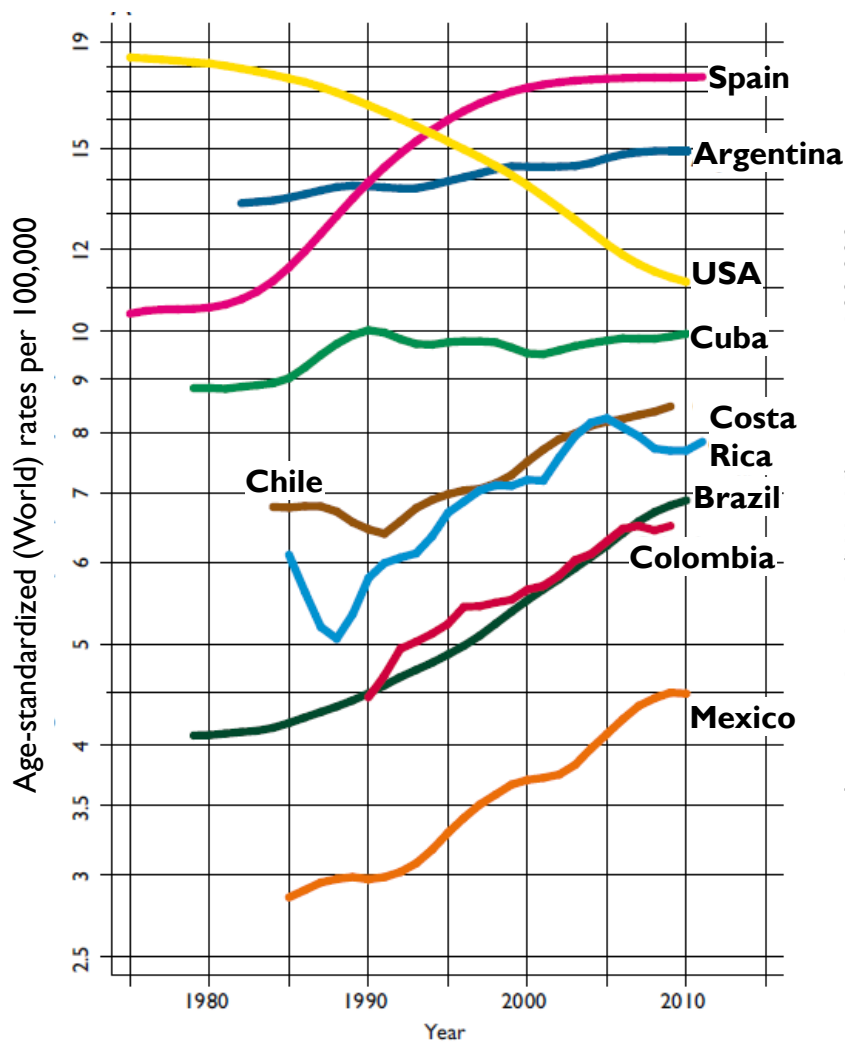


Females

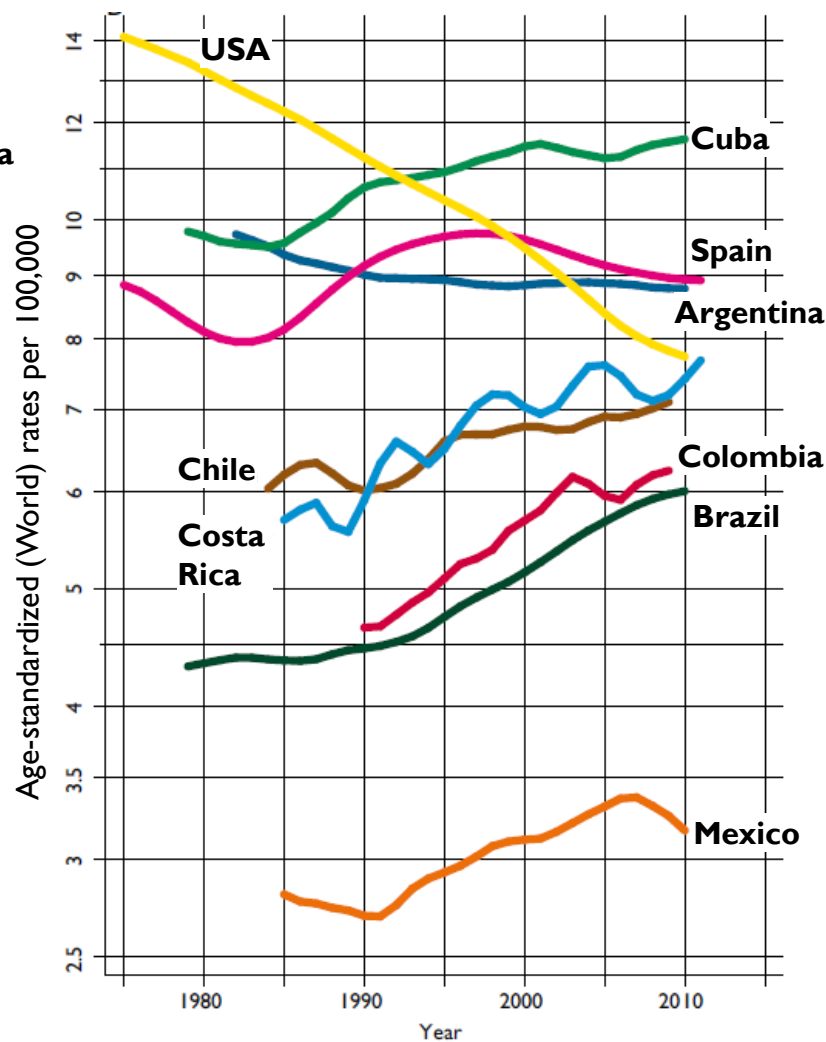


Trends in age-standardized (World) mortality rates of colorectal cancer

Males



Females



Cancer Risk Factors

Major cancer risk factors in Central and South America

Lifestyle

Tobacco } 26% of all CA deaths
84% of all lung CA deaths

Alcohol



Overweight } 15%* all new CA cases
Obesity }

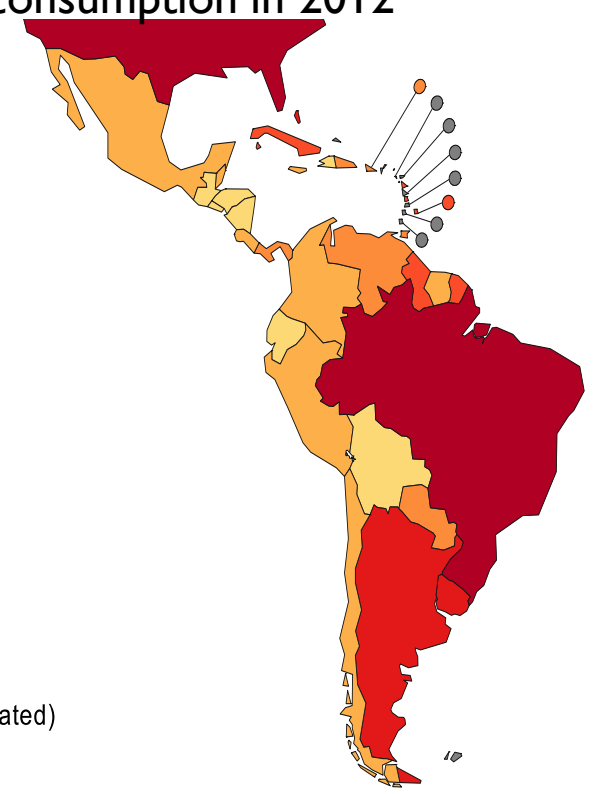
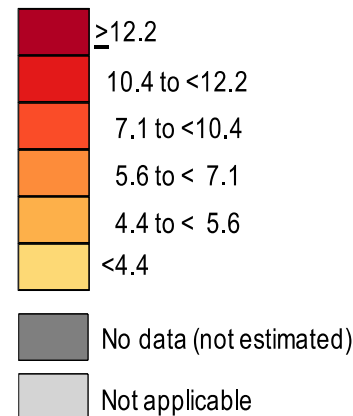
Diet

Red meat, processed meat

Dietary fiber (protective)

Cancer incident cases attributed to alcohol consumption in 2012

Age-standardized new cancer cases per 100,000 people



Courtesy: Dr Kevin Shield <shieldk@fellows.iarc.fr>

~ 1/3 of all cancer cases could be prevented by avoiding lifestyle risk factors

*High-BMI-related cancers (oesophageal adenocarcinoma, colorectum, pancreas, kidney, gallbladder, postmenopausal-breast, corpus uteri, and ovary)

Major cancer risk factors in Central and South America

Infections

Helicobacter pylori (*H. pylori*)

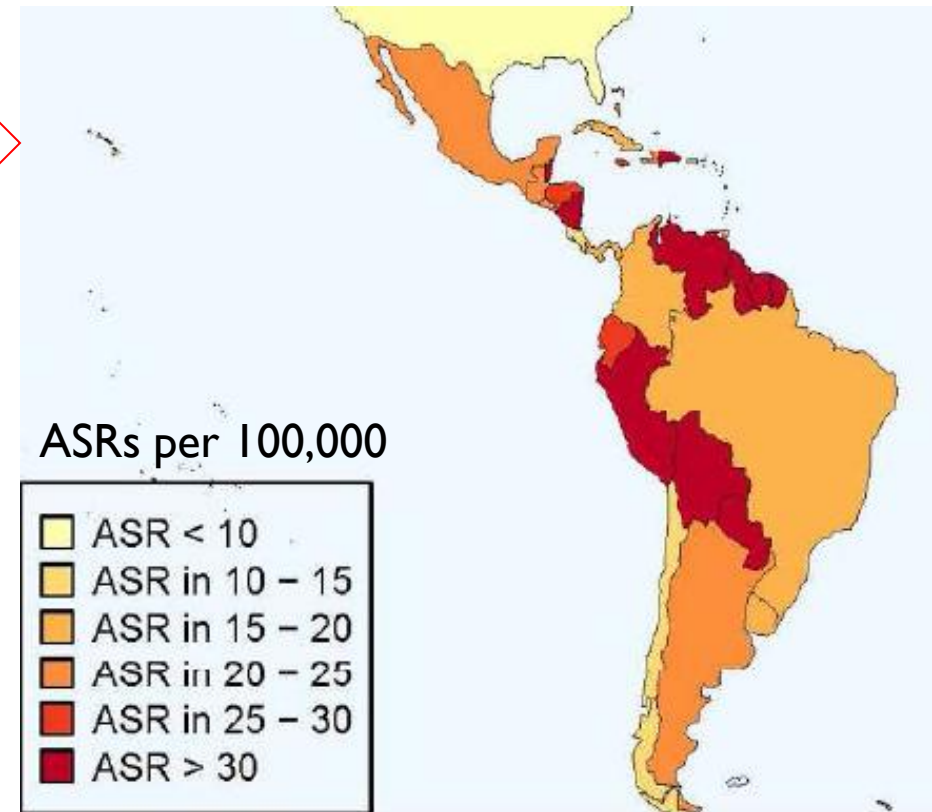
Human papillomavirus (HPV)

Hepatitis C virus (HCV)

Hepatitis B virus (HBV)

18% of all new CA cases

Cervix cancer incident cases attributed to HPV in 2012



Other potential risk factors associated with an increased risk of cancer in Central and South America

Infections

Human T-cell lymphotropic virus type I (HTLV-I)

Epstein-Barr virus (EBV)

Human herpes virus type 8 (HHV-8)

Human immunodeficiency virus type I (HIV-I)

Aflatoxins

Schistosoma haematobium

Opisthorchis viverrini (Liver flukes)

Helicobacter sp.

Salmonella typhi (?)**

Occupational exposures

Production of coal/coke

Coal-tar pitch

Rubber production

Hematite mining

Arsenic

Asbestos

Painting

Radiation

Environmental exposures

Household coal combustion emissions

Lifestyle (Diet)

b-carotene supplements (high doses)

Very hot beverages (>65° C)*

*Probably carcinogenic to humans

**Not classified by the IARC Monographs Programme

Conclusions

Conclusions

- ▶ Central and South America carries a double-burden of cancer, with elevated rates of infection- and lifestyle-related cancers
- ▶ Regional differences in cancer incidence and mortality patterns and trends may reflect:
 - ▶ Differences across HDI levels
 - ▶ Exposure to common risk factors
 - ▶ H. pylori infection, HPV, smoking, alcohol use
 - ▶ Detection practices
 - ▶ Deficiencies in prevention, early detection and/or disease management

Conclusions

- ▶ Opportunities to reduce the cancer burden in the future through resource-dependent interventions
 - ▶ Implementation and/or strengthening of tobacco and alcohol control policies
 - ▶ Vaccination against HPV
 - ▶ Self collection based HPV testing for cervical cancer
- ▶ Improvement of the quality and coverage of cancer registration is crucial to guide and evaluate future cancer control policies and programmes
 - ▶ Lack of national coverage (except in Costa Rica and Uruguay)

Taking action

International Agency for Research on Cancer



Map of IARC Regional Hubs



Data source: GICR
Map production: IARC
World Health Organization

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.



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Acknowledgements

IARC Fellowship

- ▶ This work was undertaken during the tenure of a Postdoctoral Fellowship to Dr Mónica S. Sierra from The International Agency for Research on Cancer, partially supported by the European Commission FP7 Marie Curie Actions – People – Co-funding of regional, national and international programmes (COFUND)

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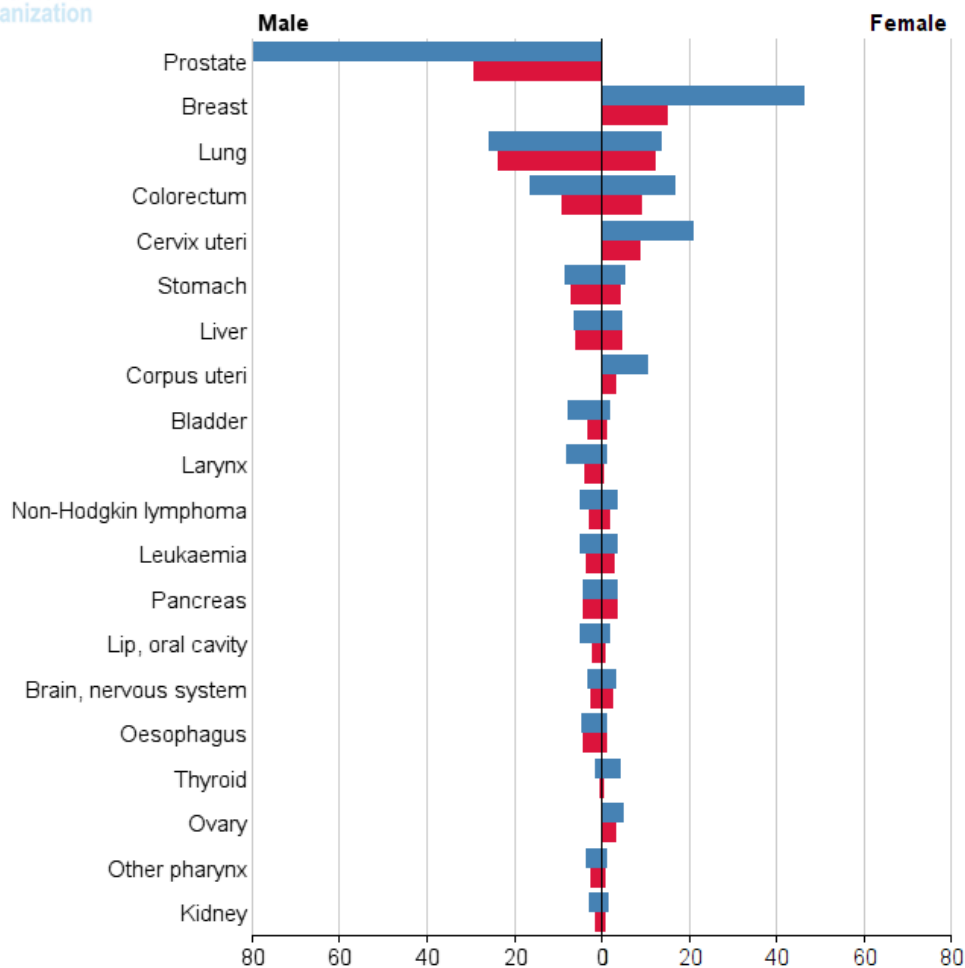
Burden of cancer in the Caribbean

International Agency for Research on Cancer

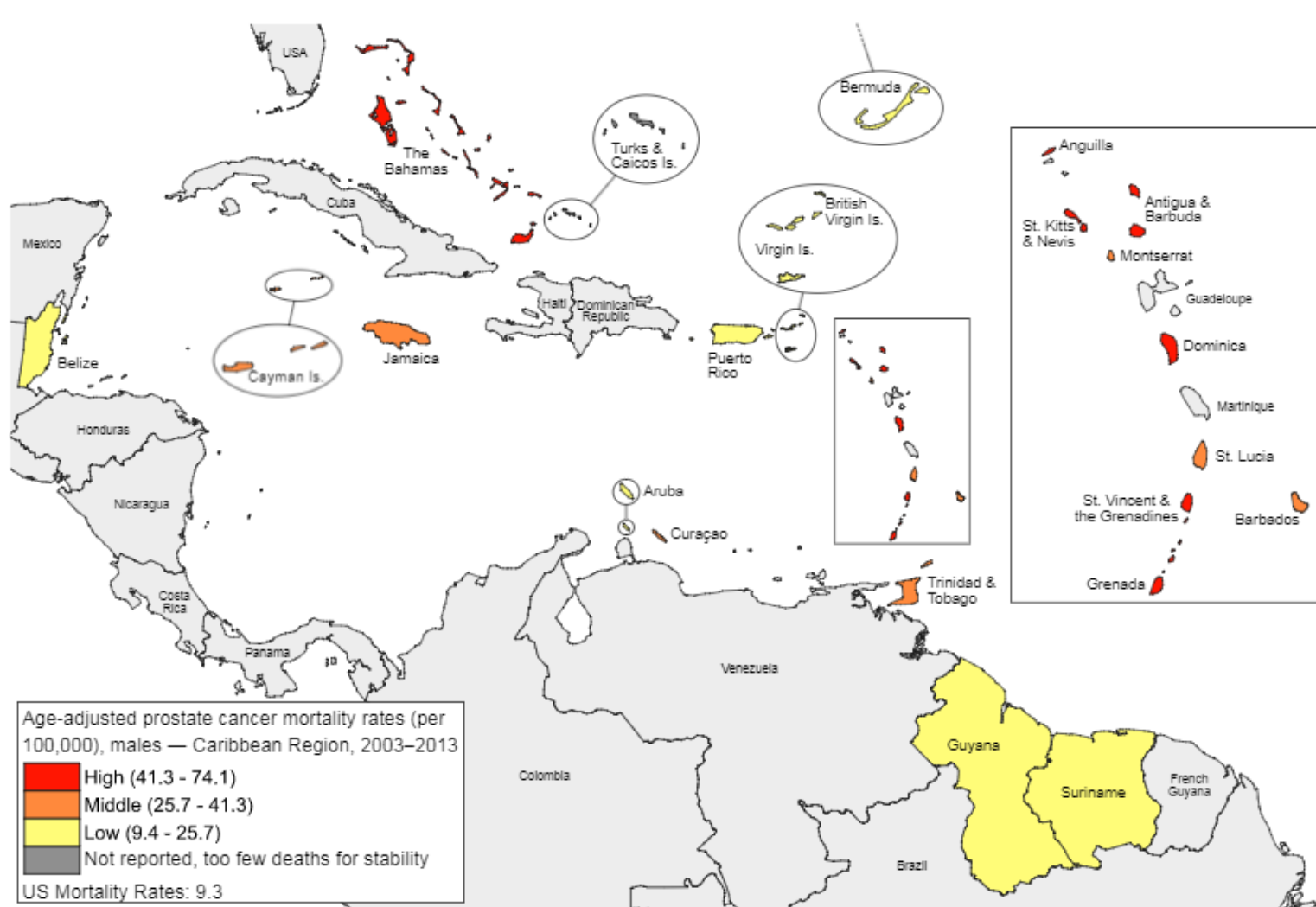


World Health Organization

Caribbean
ASR (W)



Age-adjusted **prostate** cancer mortality rates (per 100,000), males — Caribbean Region, 2003–2013



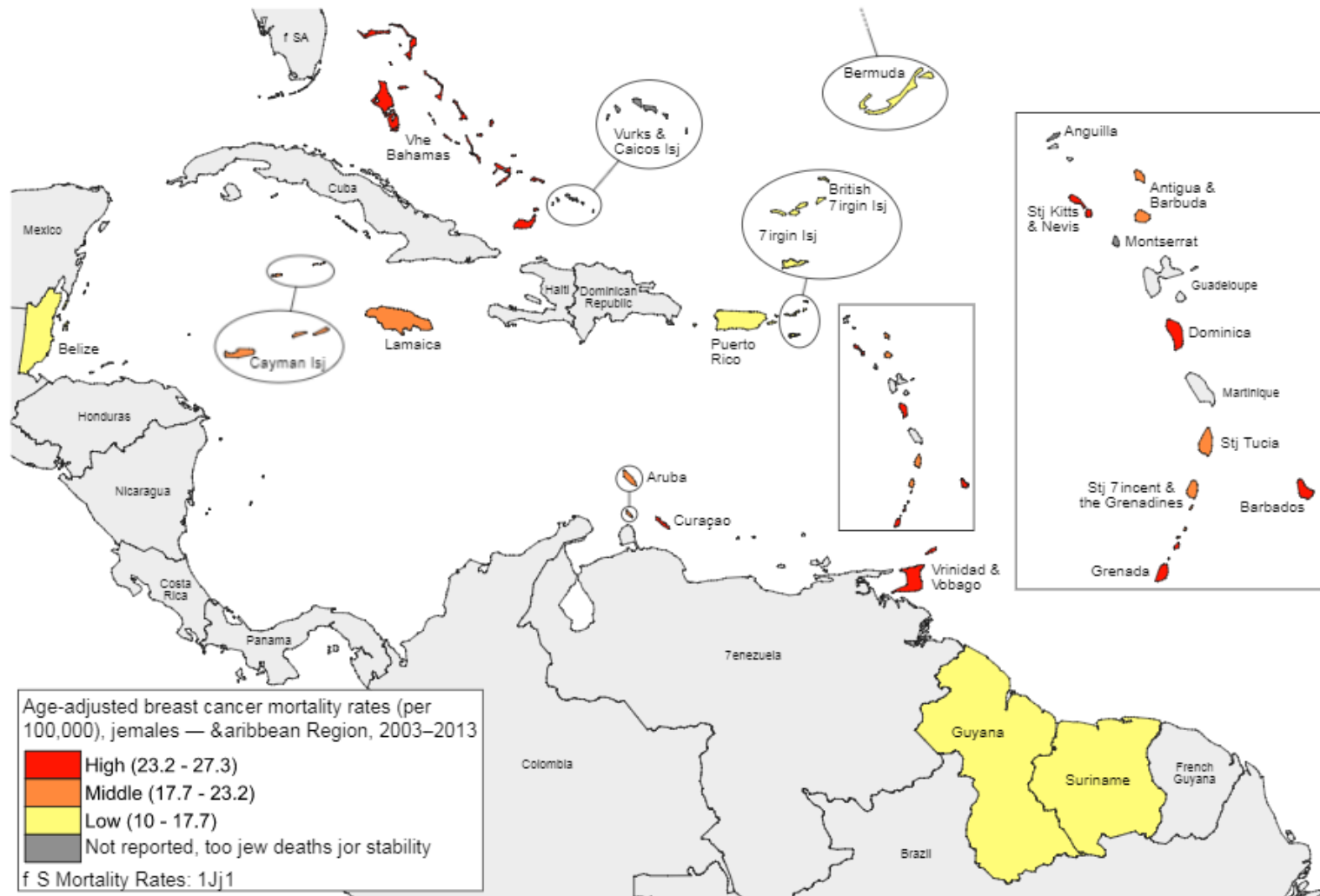
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Data source: CARPHA, NCHS
Map production: IARC
World Health Organization



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Age-adjusted **breast** cancer mortality rates (per 100,000), females — Caribbean Region, 2003–2013



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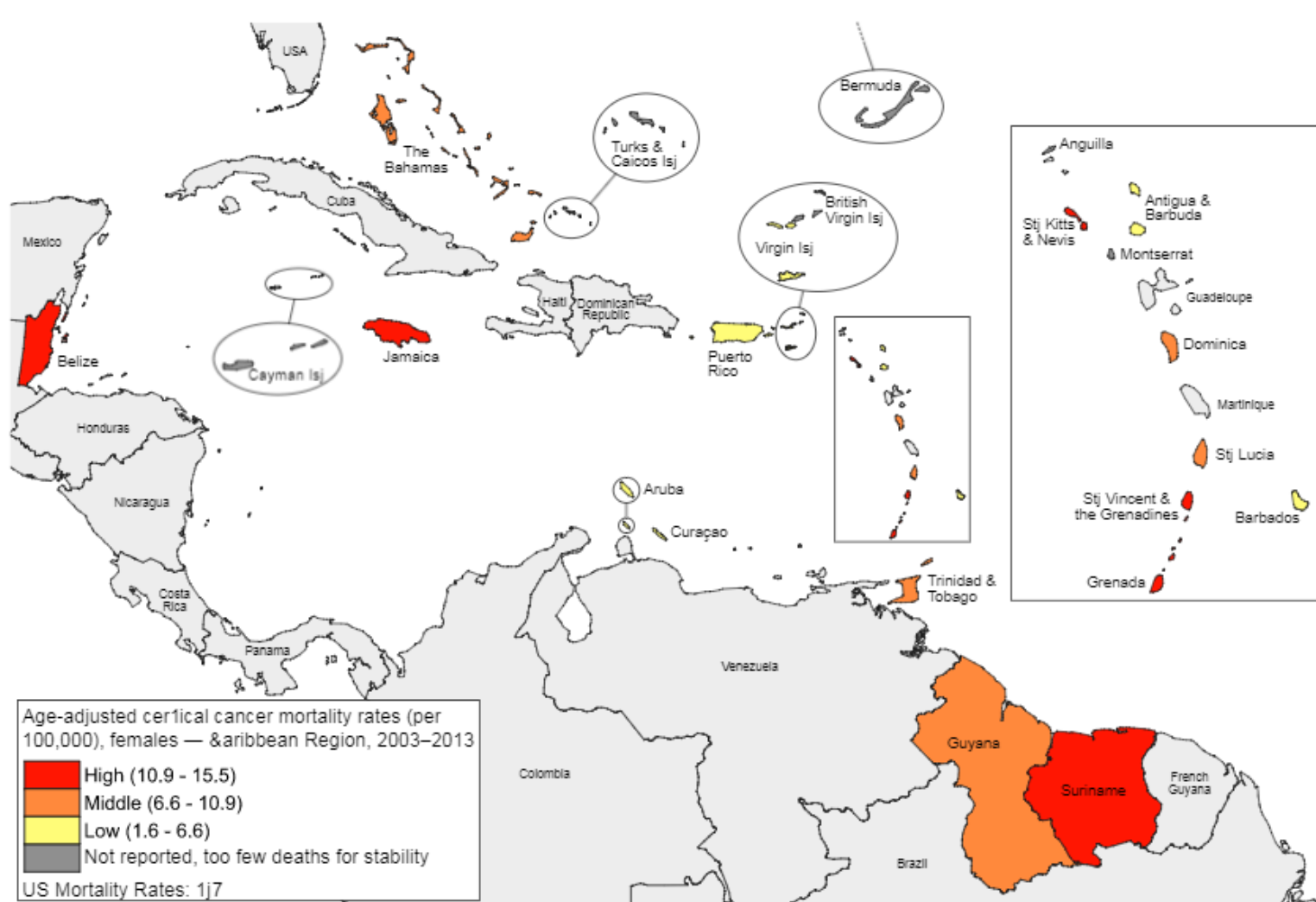
Data source: CARPHA, NCHS
Map production: IARC
World Health Organization



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Age-adjusted **cervical** cancer mortality rates (per 100,000), females — Caribbean Region, 2003–2013



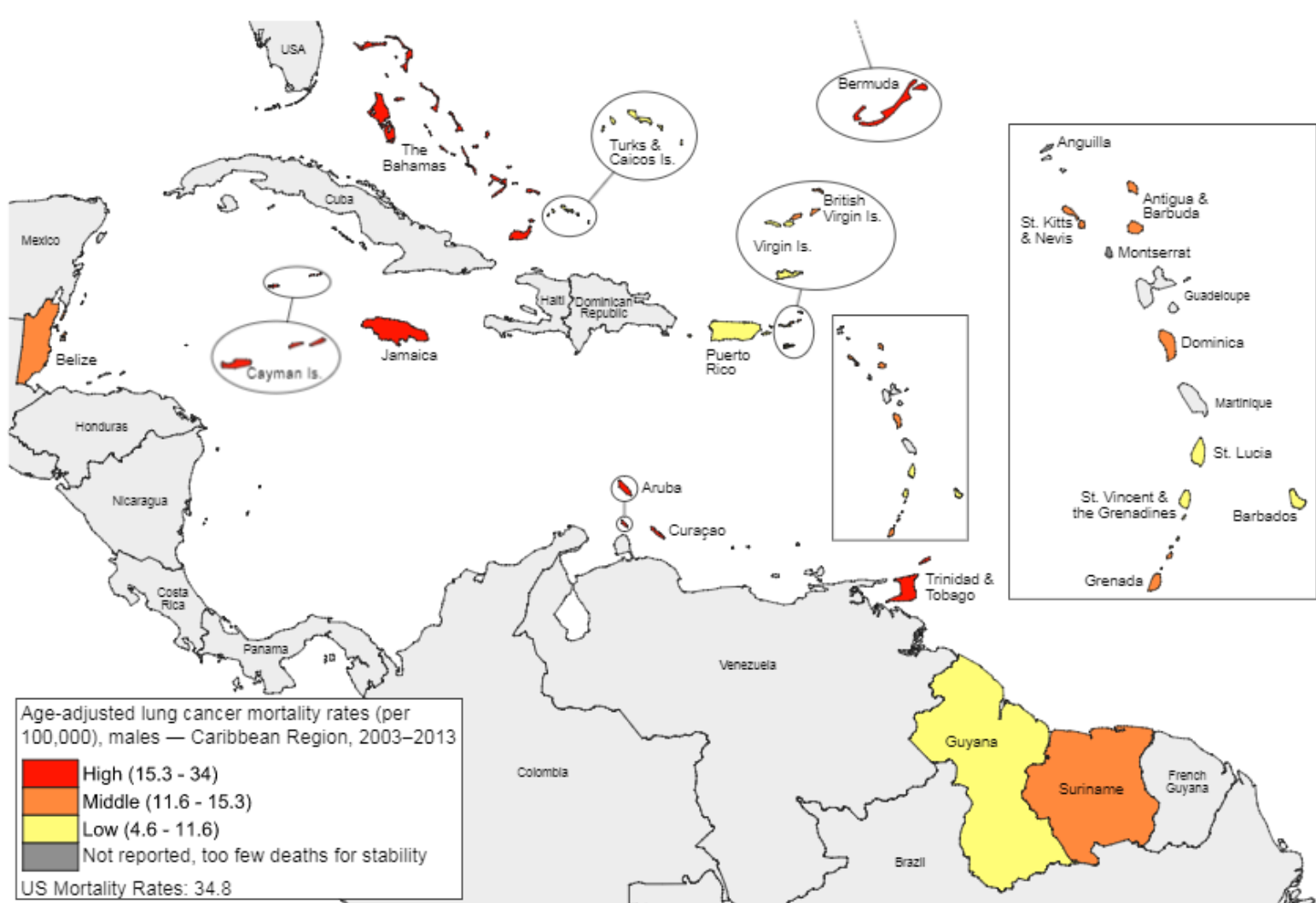
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Age-adjusted **lung** cancer mortality rates (per 100,000), males — Caribbean Region, 2003–2013



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