

Global Longevity Governance Landscape

50 Countries Big Data
Comparative Analysis of
Longevity Progressiveness

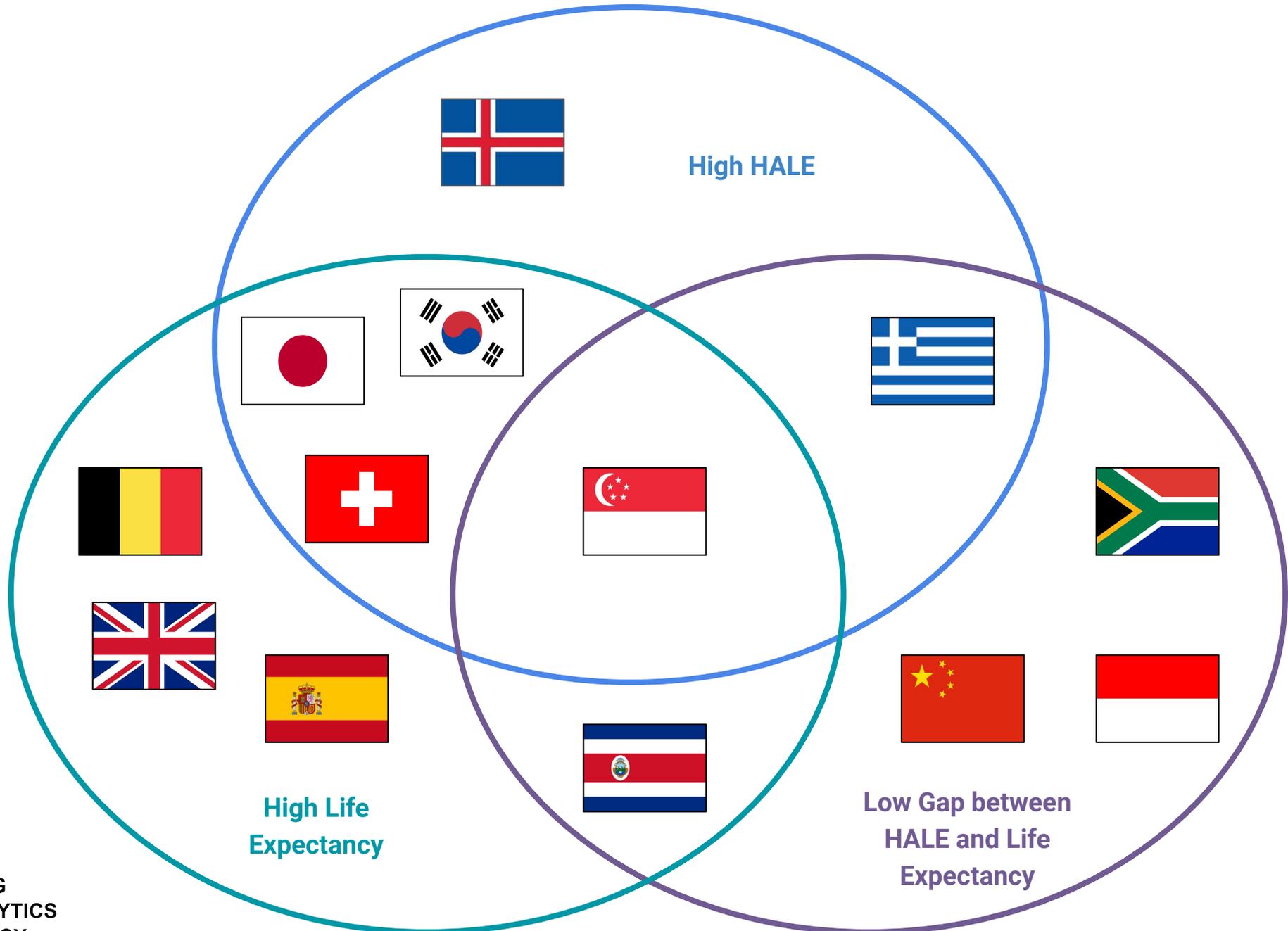


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Health-Adjusted Life Expectancy Specification Framework



50 Countries - Analysis of Levels of Longevity Progressiveness

1	Argentina	13	Estonia	26	Japan	39	Saudi Arabia
2	Australia	14	Finland	27	Luxembourg	40	Singapore
3	Austria	15	France	28	Malta	41	Slovakia
4	Belgium	16	Germany	29	Mexico	42	Slovenia
5	Brazil	17	Greece	30	Netherlands	43	South Africa
6	Canda	18	Hong-Kong, SAR	31	New Zealand	44	Spain
7	Chile	19	Iceland	32	Norway	45	Sweden
8	China	20	India	33	Panama	46	Switzerland
9	Costa Rica	21	Indonesia	34	Poland	47	Turkey
10	Cuba	22	Iran	35	Portugal	48	United Arab Emirates
11	Czech Republic	23	Ireland	36	Qatar	49	United Kingdom
12	Denmark	24	Israel	37	Republic of Korea	50	United States of America
		25	Italy	38	Russian Federation		

Global Healthy Longevity Landscape Overview

50 Countries:
 High HALE and Life Expectancy - 17
 Medium HALE and Life Expectancy - 18
 Low HALE and Life Expectancy - 15

Health-Adjusted Life Expectancy (HALE), used here as a measure of Healthy Longevity, is the average number of years an individual can expect to live free of chronic age-related disease



High HALE and Life Expectancy

Medium HALE and Life Expectancy

Low HALE and Life Expectancy

Global Healthy Longevity Landscape Overview

50 Countries:
 Big Gap between HALE and LE - 23
 Medium Gap between HALE and LE - 18
 Small Gap between HALE and LE - 9

Health-Adjusted Life Expectancy (HALE), used here as a measure of Healthy Longevity, is the average number of years an individual can expect to live free of chronic age-related disease



Small Gap between HALE and Life Expectancy

Medium Gap between HALE and Life Expectancy

Big Gap between HALE and Life Expectancy

Establishing a Framework for Healthy Longevity

Life expectancy is increasing all around the world. While there have been obvious fluctuations in the dynamics of this statistically measured demographic indicator, life expectancy at birth overall has been steadily increasing for many years. It has more than doubled in the last two centuries.

This increase was previously driven by reductions in infant mortality. But since around the 1950s, the main factor of steady increase has been reductions in mortality at older ages. This has contributed to the ageing of the population and critical changes in age distribution, which can be described with old-age dependency ratio.

The major problem with merely increasing life expectancy is that it also increases morbidity because people live long enough to get more age-related disease, disability, dementia, and dysfunction. Many serious diseases have increased prevalence with age, including cancer, heart disease, stroke, respiratory disease, kidney disease, dementia, arthritis, and osteoporosis.

Consequently, it is unclear why countries are investing so much money in research focused on reducing death rates in the elderly, if the consequence is advancing ageing, that can be described as the increase in disability years, plus pension, and social and medical costs, in an unsustainable way.

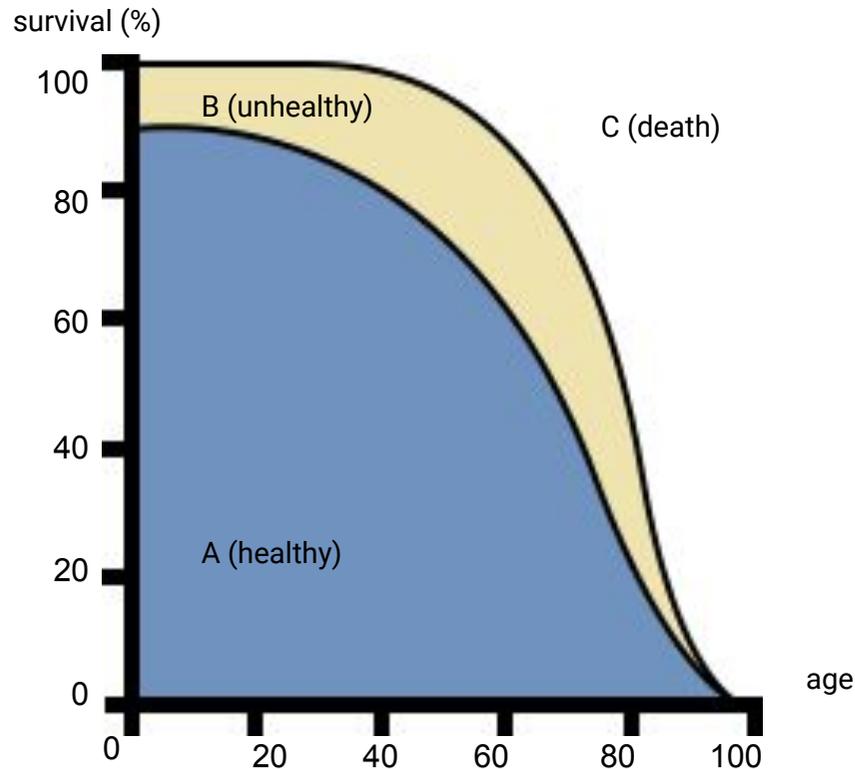
Ageing is caused by many different processes, that is why healthy longevity goes far beyond demographic characteristics and medical research problems on how to increase the quantity of life.

This paper seeks to identify which health system characteristics, socio-economic factors, and environmental conditions are likely to increase health-adjusted life expectancy and improve the quality of life.

The analysis is based on the **200 parameters** that define healthy longevity across the chosen **50 countries** and their impact on the gap between health-adjusted life expectancy and life expectancy at birth.

Why HALE?

Health-adjusted Life Expectancy Specification



Graph shows:

A = time lived in good health

C = time lost due to premature mortality

Life expectancy = A + B

Health expectancy indicators (e.g. healthy life expectancy and HALE) = A + f(B)

Health gaps indicators (e.g. DALYs) = C + g(B)

Disability-adjusted life expectancy (DALE) integrates data on mortality, long-term institutionalization and activity limitations in the population and represents a comprehensive index of population health status. Thus, the emphasis is not exclusively on the length of life, but also on the quality of life. **Quality-Adjusted Life Year (QALY)** specifically refers to the balance between the length of time someone lives and the quality of life in terms of the absence of disease.

Director of the National Institutes of Health (NIH) Francis Collins, have called **DALYs** and similar metrics like the **QALY (DALY = Lifetime - QALY)** “only partially successful in providing the kind of information that policy-makers need,” and urged the NIH to fund the “development and application of more rigorous models.”

HALE provides a summary of overall health conditions for a population, which are in turn an integral part of development. While communicable diseases such as HIV/AIDS, tuberculosis and malaria continue to cause substantial loss of health and mortality in developing countries, particularly African countries, non-communicable diseases and injuries are responsible for more than half of all lost years of healthy life in developing as well as developed countries. HALE thus provides a more complete picture of the impact of morbidity and mortality on populations, than DALY, QALY or simple Life Expectancy alone.

Goals of the Research

This report aims to answer the following questions:

- What specific features of healthcare systems, socio-economic conditions, environmental factors affect public health?
- How does the impact of factors differ across countries?
- What constellation of factors contributes the most to healthy longevity?
- Which factors are the main drivers of disability adjusted years?
- What countries are leaders in longevity governance?
- Why disproportionate healthcare expenditures in the United States contributes to bad health care system performance and reduction in life expectancy in recent years?
- Why the health care system in Singapore is considered to be one of the most efficient in the world?
- What can be done to improve HALE in each country globally?

Global Longevity Governance Landscape is an analytical report that focuses on 50 countries Big Data comparative Analysis of longevity progressiveness. The goal is to find and determine metrics and methods that could better assess the health status and capture effectiveness of healthcare system in terms of rising trend of longevity.

Nowadays such complex indicators as life expectancy and health-adjusted life expectancy goes beyond the traditional measures of demographic potential of a particular countries, major causes of death, and probabilities of premature death (based on life tables).

Report Structure

The Introduction begins by defining each of the HALYs, explaining why HALE may be the most useful of the HALY metrics, and the normal difference between HALE and life expectancy, and then lists data sources to be used in the analysis that follows.

Ranking of Countries provides a detailed methodology for ranking countries according to their healthy longevity-determining factors, divided into five groups: Economy, Health and Healthcare, Society, Demography, Environment and Infrastructure and then provides longevity ranking and scores for each of sub-rankings.

Main Patterns identifies the patterns that emerge across the countries, providing healthcare system overviews, healthcare expenditures, eHealth efficiency and air pollution across countries with high medium and low HALE and life expectancies.

Singapore and USA Healthy Longevity Comparison summarises specific features of healthcare systems and derives factors that affect public health both in Singapore and the United States. The main focus is made on healthcare system efficiency of Singapore and disproportionate healthcare expenditures in the U.S.

Singapore and Hong Kong Healthy Longevity Comparison compares determining factors of healthy longevity between Hong Kong, SAR and Singapore. The emphasis is made on healthcare accessibility and affordability of healthcare provision.

Life Expectancy Slowdown examines potential explanations for the slowdown in improvements in recent years across chosen countries.

Public Spendings and Healthcare Efficiency shows that changes in demography and health conditions are putting pressure on public finance. Yet, a considerable part of this health expenditure makes little or no contribution to improving people's health.

HALE and Supercentenarian Distributions discusses the distribution of centenarians across nations.

Meteorological Analysis Impact briefly analyses the effects of climate on HALE in every world region.

Healthy Longevity and Metabesity discusses the relationship between healthy longevity and non-communicable diseases that have common metabolic roots.

Analytical Methodology explains in detail the analytical process behind the report, beginning by illustrating the multiple layers of metrics and then methodologies for ratios, growth rates, growth rates of ratios, meteorological analysis impact and indexes of health status, society, retirement, immunization, economy and mental health.

Recommendations and Conclusions chapter identifies the key findings and provides guidance on improving the HALE factors in each country, listed according to the size of the HALE \ Life Expectancy gap in each.

Key Findings of the Special Case Study

The lowest and highest HALE indicators were observed in the **USA (68.5 years)** and **Singapore (76.2 years)** respectively. GDP per capita, health spending per capita, urban population, age-friendly cities and communities, population density, consumer price index, mental health and diseases, total fertility rate, crude birth rate, medical technologies in 50 countries were revealed as the **correlates of HALE**.

In general, HALE is affected by many groups of factors such as: socioeconomic status, demography, income, wellbeing, the quality of the health system and the ability of people to access it, health behaviours such as tobacco and excessive alcohol consumption, poor nutrition and lack of exercise, social factors, genetic factors and environmental factors including overcrowded housing, lack of clean drinking water and adequate sanitation.

Underlying world trends in difference between healthy life expectancy and life expectancy at birth show a general improvement. However, **healthy life expectancy has remained much lower than life expectancy in all countries**.

Moreover, this study shows that the adverse **effect of climate change** on human habitat, migration and health threaten average life span and HALE. The effect of climate change on life expectancy deserves great attention for three important reasons. First, the duration of rainy season has shortened in the country in the last two decades, creating drier land, causing environmental problems, health and adaptation challenges. Second, countries are currently experiencing unusual environmental issues which provide serious health risks to people. Third, many developing countries lack the skill, technology and resources to handle climate change related problems like the developed countries. Hence, the outcome of the present research can aid in taking proactive measures which will put in check diurnal temperature variation, daily mean air temperature, relative humidity and dew point for HALE increasing.

Also, one of the main factors affecting HALE is obesity. **There is a clear relationship between HALE and percentage of adult population that is obese**. Therefore, people with extreme obesity had a dramatic reduction in life expectancy compared with people of normal weight.

Key Findings of the Special Case Study

Countries with **high HALE and Life Expectancy** and a small gap between these indicators are **Singapore and Hong Kong**. One of the most important factors of life expectancy in this group of countries is wealth - economic stability, high level of self-reported health, access to the best health care. Affluent countries also tend to have low rates of violent crime and civil unrest. However, among 50 considered countries there are some exceptions. For example, **the USA spending is the highest**, but this country ranks not in the top in the world for its levels of health care.

In countries with **low HALE and Life Expectancy (e.g. Iran, Turkey, Slovakia, India etc)** the combination of factors that contribute to the general health standards of these countries include not only the availability and quality of the healthcare facilities, but quality of food and pollution regulations as well.

It must be noted that the **countries that have the highest life expectancy and HALE indicators are generally the most developed countries**.

A group with countries which have **medium HALE and Life Expectancy** includes mostly EU members: **Belgium, Denmark, Germany, Portugal** etc. Their HALE and Life Expectancy indicators continue to increase each year. These gains in longevity can be attributed to a number of factors, including improved education, socio-economic conditions and lifestyle, as well as progress in health care. However, this growth in the performance is insufficient to reach the leading position in the HALE countries ranking.

The bottom line is this: It is no coincidence that among the 50 countries on the list there is a relatively long life expectancy compared to other countries. Instead, it is precisely because of many common characteristics that the citizens of these countries can achieve a long and healthy life, and the further development of such characteristics may allow developing countries to also increase their HALE and Life Expectancy.

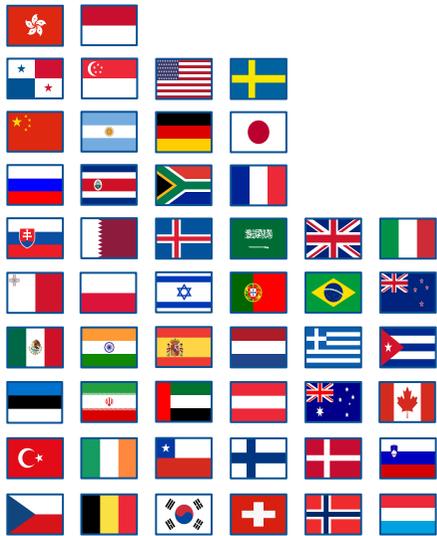
Big Data Comparative Analysis Framework

Big Data comparative analysis is based on the specific nature of parameters and their relationships that determine the development of healthy longevity progressiveness across countries of different levels of economic development and income group.

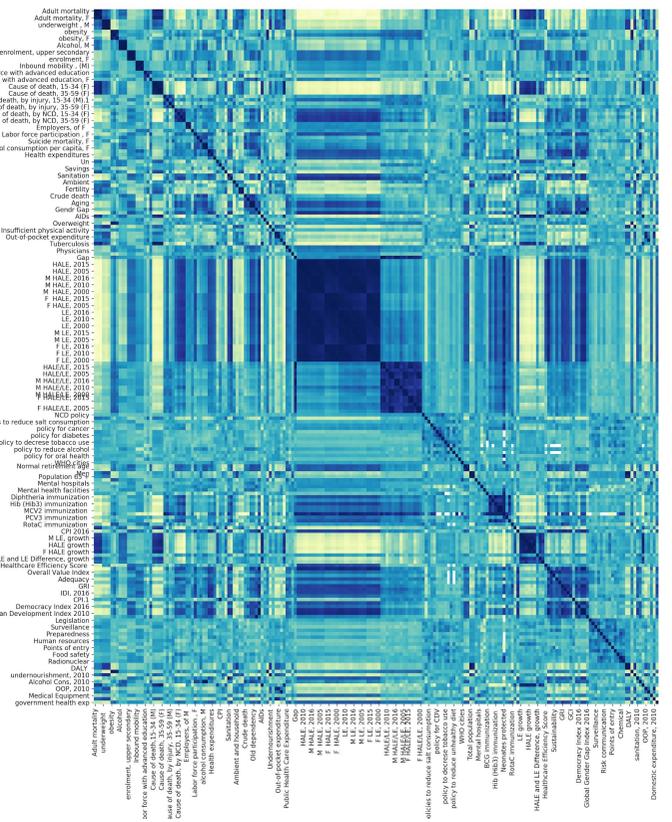
50 Countries

6 Layers and 200 Parameters

Correlations between patterns



Cause of death, 15-34 (M)	Improved Water	government health exp	Female HALE growth	Human Development Index 2010	Domestic health expenditure	undernourish... 2010	IDI, 2016	Adequacy	Female LE, 2016	Male HALE growth	Female LE, 2015					
Health Status	Environment and Infrastructure	Healthcare	Healthcare	Human Capital	Healthcare	Life Style	Human Capital	Healthcare	Demography	Healthcare	Demography					
Tuberculosis	Hib (Hib3) immunization	Female LE, growth	Male LE, 2005	Female LE, 2000	obesity	Male LE, growth	Public Health Care Expenditure	Health expenditures	Normal retirement age	Male LE, 2000	Cause of death, by injury, 15-34 (M),1					
Health Status	Healthcare	Healthcare	Demography	Demography	Life Style	Healthcare	Healthcare	Economy	Economy	Demography	Health Status					
Cause of death, 15-34 (F)	Cause of death, by NCD, 35-59 (F)	LE, 2015	AIDs	PCV3 Immunization	Crude birth rate	Overall Value Index	CPI 2015	Points of entry	OOD, 2010	Mental health facilities	Murder rate	Female HALE and LE Difference, growth				
Cause of death, 15-34 (F)	Health Status	Demography	Health Status	Education Index	Healthcare	Demography	Healthcare	Economy	Healthcare	Healthcare	Economy	Healthcare				
Health Status	HALE growth	LE, 2005	Hib3 Immunization	Economy	Economy	Economy	Health Status	Healthcare	Health Status	Healthcare	Demography	Male HALE, 2015				
Cause of death, 35-59 (M)	Healthcare	Demography	Healthcare	Economy	Economy	Health Status	Healthcare	Health Status	Healthcare	Demography	Health Status	Health Status				
Cause of death, 35-59 (M)	Adult mortality, M	Adult mortality, M	Ambient and household	Normal retirement age Men	Male HALE, 2010	HALE, 2000	Population 65+	Cause of death, by NCD, 15-34 (M)	Female HALE, 2000	HALE, 2016	Labor force with advanced education, F	Net migration	Underwe...			
Health Status	Adult mortality, M	Adult mortality, M	Environment and Infrastructure	GRI	HALE, 2005	Demography	Demography	Demography	Health Status	Health Status	Health Status	Life Style	Life Style			
Cause of death, 35-59 (F)	Health Status	Health Status	Environment and Infrastructure	HALE, 2005	Demography	Demography	Demography	Demography	Health Status	Health Status	Health Status	Life Style	Life Style			
Health Status	Male LE, 2010	Human Development	HAQ (The Healthcare Access and Quality Index) - 2016	Human Capital	Health Status	Obesity, F	Labor force with advanced education	Cause of death, by injury, 15-34 (M)	DALY	Health Status	Healthcare	Healthcare	Healthcare			
Health Status	Male LE, 2010	Human Development	HAQ (The Healthcare Access and Quality Index) - 2016	Human Capital	Health Status	Obesity, F	Labor force with advanced education	Cause of death, by injury, 15-34 (M)	DALY	Health Status	Healthcare	Healthcare	Healthcare			
Obesity, M	Demography	Human Capital	Healthcare	Health Status	LE growth	Life Style	Total population	Healthcare Efficiency Score	Policy for chronic respiratory...	Cause of death, by NCD, 15-34 (F)	Policy to decrease tobacco...	Risk care...	Alcohol consum... per capita, F	Zoono...	Labor force partici...	
Obesity, M	Demography	Human Capital	Healthcare	Health Status	LE growth	Life Style	Total population	Healthcare Efficiency Score	Policy for chronic respiratory...	Cause of death, by NCD, 15-34 (F)	Policy to decrease tobacco...	Risk care...	Alcohol consum... per capita, F	Zoono...	Labor force partici...	
Life Style	AIDs, 2010	Human Development Index 2016	Domestic expenditure, 2010	Overweight	Healthcare	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status
Life Style	AIDs, 2010	Human Development Index 2016	Domestic expenditure, 2010	Overweight	Healthcare	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status
Adult mortality, F	Health Status	Human Capital	Healthcare	Life Style	Healthcare	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status
Adult mortality, F	Health Status	Human Capital	Healthcare	Life Style	Healthcare	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status
Life Style	MCV1 immunization	Cause of death, by NCD, 15-34 (F)	Undernourish...	Cause of death, by NCD, 35-59 (M)	HALE, 2010	Unemplo...	Risk of catastroph... 2000	Healthcare	Human resources	Alcohol, M	WHO age-friendl...	Policy for head Policy	Health...	Envi...	Health...	Health...
Life Style	MCV1 immunization	Cause of death, by NCD, 15-34 (F)	Undernourish...	Cause of death, by NCD, 35-59 (M)	HALE, 2010	Unemplo...	Risk of catastroph... 2000	Healthcare	Human resources	Alcohol, M	WHO age-friendl...	Policy for head Policy	Health...	Envi...	Health...	Health...
Life Style	MCV1 immunization	Cause of death, by NCD, 15-34 (F)	Undernourish...	Cause of death, by NCD, 35-59 (M)	HALE, 2010	Unemplo...	Risk of catastroph... 2000	Healthcare	Human resources	Alcohol, M	WHO age-friendl...	Policy for head Policy	Health...	Envi...	Health...	Health...
GAI	MCV2 immunization	Overweight, 2010	Sanitation and Infrastructure	Male HALE and LE Difference, growth	HALE, 2015	Female HALE, 2016	Physical activity public awareness...	Alcohol, M	Democ... Index	Urban...	Scienc... mort...	Scienc... mort...	Scienc... mort...	Scienc... mort...	Scienc... mort...	Scienc... mort...
GAI	MCV2 immunization	Overweight, 2010	Sanitation and Infrastructure	Male HALE and LE Difference, growth	HALE, 2015	Female HALE, 2016	Physical activity public awareness...	Alcohol, M	Democ... Index	Urban...	Scienc... mort...	Scienc... mort...	Scienc... mort...	Scienc... mort...	Scienc... mort...	Scienc... mort...
Human Capital	Healthcare	Life Style	Demography	Infrastructure	Healthcare	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status
Human Capital	Healthcare	Life Style	Demography	Infrastructure	Healthcare	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status	Health Status



Global Healthy Longevity 6 Layer Analytical Framework

200 analyzed parameters are divided into 6 layers which differ based on the nature of the parameters they consist of. Effectiveness ratios are derived metrics from absolute values and ratios. Effectiveness ratio indicates how effective longevity governance has been in using financial resources to generate an acceptable increase in health-adjusted life expectancy and improvement of the quality of life.



Analytical Methodology

The focus of this study was primarily on 6 levels of analysis and aimed at detecting actual changes and interrelations between nearly **200** parameters.

The quantitative data analysis in this case study includes approximately **10 000 numerical values to indicate trends in Longevity**. Therefore, the six step approach was used to conduct this systematic search:

1. Providing of statistical analysis for **absolute values**.
2. **Indexes** research.
3. **Ratios** estimating.
4. Counting of **growth rates**.
5. **Growth rates of ratios** valuation.
6. Deep analysis of **effectiveness ratios**.

The Analytical Methodology is needed to develop health system performance indicators, data collection strategies and tools for monitoring at national and global levels. Key metrics are used to evaluate what factors have the greatest influence on HALE and life expectancy in a particular country from the ranking. This metrics system is a well-defined performance measurement that is used to analyze and optimize all relevant healthcare processes to increase the level of industry effectiveness.

Therefore, metrics which are covered by this case study could be applied for the assessment of healthcare systems and strategies for health improvement. With their complex and tangible indicators, these metrics can be used for deep analysis of the current state of a country, its prospects and overall industry optimization. The secondary data sources are reliable and accurate: local health authorities, government, WHO, OECD, The World Bank.

Big Data Analysis

Absolute Values, Indices, Ratios

Absolute Values										Ratios																																																																																																																																																																																																																																																																																																																					
General Health Status										Mental Health (per 100 000 population)																																																																																																																																																																																																																																																																																																																					
Both Sexes HALE	Male HALE	Female HALE	Both Sexes Life Expectancy	Male Life Expectancy	Female Life Expectancy	Both Sexes HALE/Life Expectancy Difference	Male HALE/Life Expectancy Difference	Female HALE/Life Expectancy Difference		Mental Hospitals	Mental Health Units in General Hospitals	Mental Health Daycare Facilities																																																																																																																																																																																																																																																																																																																			
Government Healthcare Policies										Immunization (%)																																																																																																																																																																																																																																																																																																																					
Existence of an Operational, Multisectoral National NCD Policy, Strategy or Action Plan that Integrates Several NCDs and their Risk Factors			Existence of a Set of Time-Bound National Targets Based on WHO Guidance for NCDs			Existence of any Policies to Reduce Population Salt Consumption			Implementation of Physical Activity Public Awareness Program			Existence of Operational Policy/Strategy/Action Plan for Cancer			BCG Immunization Coverage among 1-Year-Olds			Diphtheria, Pertussis, Tetanus and Poliovirus (DTP3) Immunization Coverage among 1-Year-Olds			Polio (IPV) Immunization Coverage among 1-Year-Olds			Measles Containing Vaccine (MCV2) Second Dose (MCV2) Immunization Coverage by Age Nationally Recommended Age			Meningococcal Vaccine (MCV) Immunization Coverage among 1-Year-Olds			Pneumococcal Vaccine (PCV) Immunization Coverage among 1-Year-Olds			Polio (OPV) Immunization Coverage among 1-Year-Olds			Health Spending (Health Expenditure) as % of GDP																																																																																																																																																																																																																																																																																											
Existence of Operational Policy/Strategy/Action Plan for Cardiovascular Diseases			Existence of Operational Policy/Strategy/Action Plan for Diabetes			Existence of Operational Policy/Strategy/Action Plan for Chronic Respiratory Diseases			Existence of Operational Policy/Strategy/Action Plan to Decrease Tobacco Use			Existence of Operational Policy/Strategy/Action Plan for Cancer			Measles Containing Vaccine (MCV2) Second Dose (MCV2) Immunization Coverage by Age Nationally Recommended Age			Meningococcal Vaccine (MCV) Immunization Coverage among 1-Year-Olds			Pneumococcal Vaccine (PCV) Immunization Coverage among 1-Year-Olds			Polio (OPV) Immunization Coverage among 1-Year-Olds			Health Spending (Health Expenditure) as % of GDP																																																																																																																																																																																																																																																																																																				
Existence of Operational Policy/Strategy/Action Plan to Reduce the Harmful Use of Alcohol			Existence of Operational Policy/Strategy/Action Plan to Reduce Unhealthy Diet Related to NCDs			Existence of Operational Policy/Strategy/Action Plan for Oral Health			Stand-Alone Law for Mental Health			Stand-Alone Policy or Plan for Mental Health			GDP per Capita (Current US\$)			Adjusted Savings: Net National Savings (% of GNI)			Unemployment Rate (%)			Healthcare			Healthcare Expenditure as % of GDP																																																																																																																																																																																																																																																																																																				
Number of WHO Age Friendly Cities and Communities			Early Retirement Age Women			Early Retirement Age Men			Normal Retirement Age Women			Normal Retirement Age Men			GDP per Capita (Current US\$)			Adjusted Savings: Net National Savings (% of GNI)			Unemployment Rate (%)			Healthcare			Healthcare Expenditure as % of GDP																																																																																																																																																																																																																																																																																																				
Retirement and Ageing										Economy																																																																																																																																																																																																																																																																																																																					
Demography										Healthcare																																																																																																																																																																																																																																																																																																																					
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Environment and Infrastructure										Mental Health																																																																																																																																																																																																																																																																																																																					
Total Population										Current Health Expenditure per Capita (Current US\$)										Public Health Care Expenditure (as % of GDP)										Prevalence of Overweight among Adults (BMI ≥ 25) (Age-Standardized Estimate) (%)										Prevalence of Underweight among Adults (BMI < 18.5) (Age-Standardized Estimate) (%)										Prevalence of Diabetes (Age-Standardized Estimate) (%)										Prevalence of Hypertension (Age-Standardized Estimate) (%)										Prevalence of Stroke (Age-Standardized Estimate) (%)										Prevalence of Heart Disease (Age-Standardized Estimate) (%)										Prevalence of Cancer (Age-Standardized Estimate) (%)										Prevalence of Tuberculosis (Age-Standardized Estimate) (%)										Prevalence of HIV/AIDS (Age-Standardized Estimate) (%)										Prevalence of Malaria (Age-Standardized Estimate) (%)										Prevalence of Diphtheria (Age-Standardized Estimate) (%)										Prevalence of Pertussis (Age-Standardized Estimate) (%)										Prevalence of Tetanus (Age-Standardized Estimate) (%)										Prevalence of Polio (Age-Standardized Estimate) (%)										Prevalence of Measles (Age-Standardized Estimate) (%)										Prevalence of Rubella (Age-Standardized Estimate) (%)										Prevalence of Hepatitis B (Age-Standardized Estimate) (%)										Prevalence of Hepatitis C (Age-Standardized Estimate) (%)										Prevalence of Tuberculosis (Age-Standardized Estimate) (%)										Prevalence of HIV/AIDS (Age-Standardized Estimate) (%)										Prevalence of Malaria (Age-Standardized Estimate) (%)										Prevalence of Diphtheria (Age-Standardized Estimate) (%)										Prevalence of Pertussis (Age-Standardized Estimate) (%)										Prevalence of Tetanus (Age-Standardized Estimate) (%)										Prevalence of Polio (Age-Standardized Estimate) (%)										Prevalence of Measles (Age-Standardized Estimate) (%)										Prevalence of Rubella (Age-Standardized Estimate) (%)										Prevalence of Hepatitis B (Age-Standardized Estimate) (%)										Prevalence of Hepatitis C (Age-Standardized Estimate) (%)									
Country										Population of Adults with ADRs (%)										Annual Cigarette Consumption (per capita)										Prevalence of Overweight among Adults (BMI ≥ 25) (Age-Standardized Estimate) (%)										Prevalence of Underweight among Adults (BMI < 18.5) (Age-Standardized Estimate) (%)										Prevalence of Diabetes (Age-Standardized Estimate) (%)										Prevalence of Hypertension (Age-Standardized Estimate) (%)										Prevalence of Stroke (Age-Standardized Estimate) (%)										Prevalence of Heart Disease (Age-Standardized Estimate) (%)										Prevalence of Cancer (Age-Standardized Estimate) (%)										Prevalence of Tuberculosis (Age-Standardized Estimate) (%)										Prevalence of HIV/AIDS (Age-Standardized Estimate) (%)										Prevalence of Malaria (Age-Standardized Estimate) (%)										Prevalence of Diphtheria (Age-Standardized Estimate) (%)										Prevalence of Pertussis (Age-Standardized Estimate) (%)										Prevalence of Tetanus (Age-Standardized Estimate) (%)										Prevalence of Polio (Age-Standardized Estimate) (%)										Prevalence of Measles (Age-Standardized Estimate) (%)										Prevalence of Rubella (Age-Standardized Estimate) (%)										Prevalence of Hepatitis B (Age-Standardized Estimate) (%)										Prevalence of Hepatitis C (Age-Standardized Estimate) (%)																																																																																																																							
Sunshine Hours										Population of Adults with ADRs (%)										Annual Cigarette Consumption (per capita)										Prevalence of Overweight among Adults (BMI ≥ 25) (Age-Standardized Estimate) (%)										Prevalence of Underweight among Adults (BMI < 18.5) (Age-Standardized Estimate) (%)										Prevalence of Diabetes (Age-Standardized Estimate) (%)										Prevalence of Hypertension (Age-Standardized Estimate) (%)										Prevalence of Stroke (Age-Standardized Estimate) (%)										Prevalence of Heart Disease (Age-Standardized Estimate) (%)										Prevalence of Cancer (Age-Standardized Estimate) (%)										Prevalence of Tuberculosis (Age-Standardized Estimate) (%)										Prevalence of HIV/AIDS (Age-Standardized Estimate) (%)										Prevalence of Malaria (Age-Standardized Estimate) (%)										Prevalence of Diphtheria (Age-Standardized Estimate) (%)										Prevalence of Pertussis (Age-Standardized Estimate) (%)										Prevalence of Tetanus (Age-Standardized Estimate) (%)										Prevalence of Polio (Age-Standardized Estimate) (%)										Prevalence of Measles (Age-Standardized Estimate) (%)										Prevalence of Rubella (Age-Standardized Estimate) (%)										Prevalence of Hepatitis B (Age-Standardized Estimate) (%)										Prevalence of Hepatitis C (Age-Standardized Estimate) (%)																																																																																																																							
Diurnal Temperature Variation										Population of Adults with ADRs (%)										Annual Cigarette Consumption (per capita)										Prevalence of Overweight among Adults (BMI ≥ 25) (Age-Standardized Estimate) (%)										Prevalence of Underweight among Adults (BMI < 18.5) (Age-Standardized Estimate) (%)										Prevalence of Diabetes (Age-Standardized Estimate) (%)										Prevalence of Hypertension (Age-Standardized Estimate) (%)										Prevalence of Stroke (Age-Standardized Estimate) (%)										Prevalence of Heart Disease (Age-Standardized Estimate) (%)										Prevalence of Cancer (Age-Standardized Estimate) (%)										Prevalence of Tuberculosis (Age-Standardized Estimate) (%)										Prevalence of HIV/AIDS (Age-Standardized Estimate) (%)										Prevalence of Malaria (Age-Standardized Estimate) (%)										Prevalence of Diphtheria (Age-Standardized Estimate) (%)										Prevalence of Pertussis (Age-Standardized Estimate) (%)										Prevalence of Tetanus (Age-Standardized Estimate) (%)										Prevalence of Polio (Age-Standardized Estimate) (%)										Prevalence of Measles (Age-Standardized Estimate) (%)										Prevalence of Rubella (Age-Standardized Estimate) (%)										Prevalence of Hepatitis B (Age-Standardized Estimate) (%)										Prevalence of Hepatitis C (Age-Standardized Estimate) (%)																																																																																																																							
Relative Humidity										Population of Adults with ADRs (%)										Annual Cigarette Consumption (per capita)										Prevalence of Overweight among Adults (BMI ≥ 25) (Age-Standardized Estimate) (%)										Prevalence of Underweight among Adults (BMI < 18.5) (Age-Standardized Estimate) (%)										Prevalence of Diabetes (Age-Standardized Estimate) (%)										Prevalence of Hypertension (Age-Standardized Estimate) (%)										Prevalence of Stroke (Age-Standardized Estimate) (%)										Prevalence of Heart Disease (Age-Standardized Estimate) (%)										Prevalence of Cancer (Age-Standardized Estimate) (%)										Prevalence of Tuberculosis (Age-Standardized Estimate) (%)										Prevalence of HIV/AIDS (Age-Standardized Estimate) (%)										Prevalence of Malaria (Age-Standardized Estimate) (%)										Prevalence of Diphtheria (Age-Standardized Estimate) (%)										Prevalence of Pertussis (Age-Standardized Estimate) (%)										Prevalence of Tetanus (Age-Standardized Estimate) (%)										Prevalence of Polio (Age-Standardized Estimate) (%)										Prevalence of Measles (Age-Standardized Estimate) (%)										Prevalence of Rubella (Age-Standardized Estimate) (%)										Prevalence of Hepatitis B (Age-Standardized Estimate) (%)										Prevalence of Hepatitis C (Age-Standardized Estimate) (%)																																																																																																																							
Daily Mean Air Temperature										Population of Adults with ADRs (%)										Annual Cigarette Consumption (per capita)										Prevalence of Overweight among Adults (BMI ≥ 25) (Age-Standardized Estimate) (%)										Prevalence of Underweight among Adults (BMI < 18.5) (Age-Standardized Estimate) (%)										Prevalence of Diabetes (Age-Standardized Estimate) (%)										Prevalence of Hypertension (Age-Standardized Estimate) (%)										Prevalence of Stroke (Age-Standardized Estimate) (%)										Prevalence of Heart Disease (Age-Standardized Estimate) (%)										Prevalence of Cancer (Age-Standardized Estimate) (%)										Prevalence of Tuberculosis (Age-Standardized Estimate) (%)										Prevalence of HIV/AIDS (Age-Standardized Estimate) (%)										Prevalence of Malaria (Age-Standardized Estimate) (%)										Prevalence of Diphtheria (Age-Standardized Estimate) (%)										Prevalence of Pertussis (Age-Standardized Estimate) (%)										Prevalence of Tetanus (Age-Standardized Estimate) (%)										Prevalence of Polio (Age-Standardized Estimate) (%)										Prevalence of Measles (Age-Standardized Estimate) (%)										Prevalence of Rubella (Age-Standardized Estimate) (%)										Prevalence of Hepatitis B (Age-Standardized Estimate) (%)										Prevalence of Hepatitis C (Age-Standardized Estimate) (%)																																																																																																																							
Dew Point										Population of Adults with ADRs (%)										Annual Cigarette Consumption (per capita)										Prevalence of Overweight among Adults (BMI ≥ 25) (Age-Standardized Estimate) (%)										Prevalence of Underweight among Adults (BMI < 18.5) (Age-Standardized Estimate) (%)										Prevalence of Diabetes (Age-Standardized Estimate) (%)										Prevalence of Hypertension (Age-Standardized Estimate) (%)										Prevalence of Stroke (Age-Standardized Estimate) (%)										Prevalence of Heart Disease (Age-Standardized Estimate) (%)										Prevalence of Cancer (Age-Standardized Estimate) (%)										Prevalence of Tuberculosis (Age-Standardized Estimate) (%)										Prevalence of HIV/AIDS (Age-Standardized Estimate) (%)										Prevalence of Malaria (Age-Standardized Estimate) (%)										Prevalence of Diphtheria (Age-Standardized Estimate) (%)										Prevalence of Pertussis (Age-Standardized Estimate) (%)										Prevalence of Tetanus (Age-Standardized Estimate) (%)										Prevalence of Polio (Age-Standardized Estimate) (%)										Prevalence of Measles (Age-Standardized Estimate) (%)										Prevalence of Rubella (Age-Standardized Estimate) (%)										Prevalence of Hepatitis B (Age-Standardized Estimate) (%)										Prevalence of Hepatitis C (Age-Standardized Estimate) (%)																																																																																																																							

Overall, there are 6 levels of proprietary metrics, which differ based on the nature of the parameters they consist of. Together, they comprise 200 separate metrics.

Indicators, their growth rates and their ratios are calculated separately and then integrated in the final metrics system.

The whole of the metrics can also be subdivided into 2 categories based on the logic of the parameters, namely:

- Stimulators (variables that favorably affect average life expectancy and health-adjusted life expectancy);
- Destimulators (variables that negatively affect average life expectancy and health-adjusted life expectancy).

Thus, the ranking system reflects both strengths and opportunities of different countries regarding the development of healthcare system and strategies for health improvement. It can be applied for the evaluation of the current state of a country, as well as of its prospects.

Ratios			Growth Rates of Ratios, CAGR (6 years)		
Demography			Economy		
Population Growth Rate, %	Total Fertility Rate (per Woman)	Crude Birth Rate (per 1 000 People)	GDP (per Capita)	Adjusted Savings: Net National Savings (% of GNI)	Income Gap Coefficient
Crude Death Rate (per 1 000 People)	Population Density, Number of People/km2	Age Dependency Ratio	Healthcare Expenditure		
Total Age Dependency Ratio (per 1000 of Working-Age Population)	Population over 65 (%)	Age Dependency Ratio, Old	Current Health Expenditure per Capita (Current US\$)	Public Health Care Expenditure (as % of GDP)	
Urban Population (% of Total)	Senior Poverty Ratio		Domestic Private Health Expenditure (% of Current Health Expenditure)	Out-of-Pocket Expenditure (% of Current Health Expenditure)	
Life Expectancy and HALE, CAGR (6 years)			General Health Status		
Both Sexes Life Expectancy	Male Life Expectancy	Female Life Expectancy	Population of Adults with ADR (%)	Alcohol Consumption (per capita)	
Male HALE	Both Sexes HALE	Female HALE	Prevalence of Overweight Among Adults (BMI ≥ 25) (Age-Standardized Estimate) (%)	Prevalence of Undernourishment (% of population)	
Both Sexes HALE and Life Expectancy Difference	Female HALE	Male HALE and Life Expectancy Difference	Environment		
Female HALE and Life Expectancy Difference	Human Development Index Score		Proportion of Population Exposed to PM2.5 Concentration of Fine Particulate Matter (PM2.5)		

Absolute values are enhanced by relative ones, and the use of both in combination enables a clearer understanding of interconnections between the parameters and provides the opportunity to investigate what factors have the greatest influence on HALE and life expectancy in a particular country.

There is multicollinearity between some metrics. It is caused by use of dummy variables and by the inclusion of a variable which is computed from other variables in the data set.

Each level of metrics is based upon the extension, further subdivision or comparative combination of the metrics in the preceding level, or is derived from insights provided by them.

The research is based on open source data and information given by WHO, OECD, The World Bank, and different institutions of each specific country.

200 Analysed Parameters per country

Socio-economic Conditions

1. Adjusted net enrolment rate female, 2016
2. Adjusted net enrolment rate male, 2016
3. Adjusted savings: net national savings (% of GNI), 2010
4. Adjusted savings: net national savings (% of GNI), 2016
5. Average salary (US\$), 2016
6. Average salary growth rate, %
7. Balance of trade (US\$), 2016
8. Both Sexes HALE, 2016
9. Both Sexes Life Expectancy, 2016
10. Consumer Price Index, 2016
11. Democracy Index, 2016
12. Early retirement age Men
13. Early retirement age Women
14. Easy Doing Business, 2016
15. Education Index, 2016
16. Educational attainment at least Bachelor's female, 2016
17. Educational attainment at least Bachelor's male, 2016
18. Financial institution account female, 2016
19. Financial institution account male, 2016
20. GDP per Capita (current US\$), 2010
21. GDP per Capita (current US\$), 2016
22. GDP (current US\$), 2010
23. GDP (current US\$), 2016
24. GDP growth rate, %
25. Global Competitiveness Index Score, 2016-2017
26. Global Gender Gap Index, 2016
27. Human Development Index, 2010
28. Human Development Index, 2016
29. Inclusive Development Index Score, 2017
30. Income Gini coefficient - Inequality in income or consumption 2010 (World Bank estimate)
31. Income Gini coefficient - Inequality in income or consumption 2016 (World Bank estimate)
32. Key interest rate (%), 2016
33. Labor force participation rate, % of male population ages 15-64 (modeled ILO estimate), female
34. Labor force participation rate, % of male population ages 15-64 (modeled ILO estimate), male
35. Labor force with advanced education female, 2016
36. Labor force with advanced education, male, 2016
37. Minimum wage (US\$), 2016
38. Net ODA received (% of GNI) % of people 65+ in employment
39. Normal retirement age Men
40. Normal retirement age Women
41. Number of WHO age friendly cities and communities
42. Primary education, 2016
43. Tourism, % of GDP
44. Unemployed persons, 2016
45. Unemployment rate, %

Demography

46. Age Dependency Ratio, 2010
47. Age Dependency Ratio, 2016
48. Age over 65, % (by 2010) Size of aged demographic
49. Age over 65, % (by 2016) Size of aged demographic
50. Crude birth rate (per 1 000 people), 2010
51. Crude birth rate, 2016
52. Crude death rate (per 1 000 people), 2010
53. Crude death rate, 2016
54. Fertility rate, 2016
55. Global Gender Gap Index 2016
56. Life expectancy both sexes, 2000
57. Life expectancy both sexes, 2001
58. Life expectancy both sexes, 2002
59. Life expectancy both sexes, 2003
60. Life expectancy both sexes, 2004
61. Life expectancy both sexes, 2005
62. Life expectancy both sexes, 2006
63. Life expectancy both sexes, 2007
64. Life expectancy both sexes, 2008
65. Life expectancy both sexes, 2009
66. Life expectancy both sexes, 2010
67. Life expectancy both sexes, 2011
68. Life expectancy both sexes, 2012
69. Life expectancy both sexes, 2013
70. Life expectancy both sexes, 2014
71. Life expectancy both sexes, 2015
72. Life expectancy both sexes, 2016
73. Life expectancy female, 2010
74. Life expectancy female, 2016
75. Life expectancy male, 2010
76. Life expectancy male 2016
77. Net migration
78. Total population
79. Population density, number of people/km2
80. Population growth rate, %
81. Population over 65, 2016 (%)
82. Senior Poverty Ratio
83. Total age dependency ratio (per 1000 of working-age population)
84. Total fertility rate (per woman)
85. Urban Population (% of Total)

Health Care and Health Status

86. Adult mortality rate, 2016	107. HALE both sexes, 2000	139. Mortality rate attributed to household and ambient air pollution, age-standardized (per 100,000 population)
87. Adult mortality rate female, 2016	108. HALE both sexes, 2001	140. Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (per 100,000 population)
88. Adult mortality rate male, 2016	109. HALE both sexes, 2002	141. Out-of-pocket expenditure, 2010
89. Alcohol Consumption per Capita (litres of pure alcohol), 2010	110. HALE both sexes, 2003	142. Out-of-pocket expenditure (% of current health expenditure), 2016
90. Alcohol Consumption per Capita (litres of pure alcohol), 2016	111. HALE both sexes, 2004	143. Physicians (per 100.000 People)
91. Anemia pregnant, 2016	112. HALE both sexes, 2005	144. Population of Adults with AIDs (%), 2010 and 2016
92. Anemia reproductive, 2016	113. HALE both sexes, 2006	145. Prevalence of anemia among pregnant women (%)
93. Annual Cigarette Consumption (per Capita), 2010	114. HALE both sexes, 2007	146. Prevalence of anemia among women of reproductive age (% of women ages 15-49)
94. Annual Cigarette Consumption (per Capita), 2016	115. HALE both sexes, 2008	147. Prevalence of insufficient physical activity among adults aged 18+, 2016
95. Biomedical engineers density (per 10 000 population), 2017	116. HALE both sexes, 2009	148. Prevalence of obesity (% of population), 2016
96. Cause of death by communicable diseases both sexes, 2016	117. HALE both sexes, 2010	149. Prevalence of obesity female (% of population), 2016
97. Cause of death by communicable diseases female, 2016	118. HALE both sexes, 2011	150. Prevalence of obesity male (% of population), 2016
98. Cause of death by communicable diseases male, 2016	119. HALE both sexes, 2012	151. Prevalence of overweight among adults, BMI \geq 25 (age-standardized estimate) (%), 2010
99. Cause of death, by injury, ages 35-59, % of relevant age group (2016)	120. HALE both sexes, 2013	152. Prevalence of overweight among adults, BMI \geq 25 (age-standardized estimate) (%), 2016
100. Cause of death, by injury, ages 35-59, % of relevant age group female (2016)	121. HALE both sexes, 2014	153. Prevalence of undernourishment (% of population), 2010
101. Cause of death, by injury, ages 35-59, % of relevant age group male (2016)	122. HALE both sexes, 2015	154. Prevalence of undernourishment (% of population), 2016
102. Cause of death by non-communicable diseases both sexes, 2016	123. HALE both sexes, 2016	155. Prevalence of underweight (% of population), 2016
103. Cause of death by non-communicable diseases female, 2016	124. Healthcare Access and Quality Index), 2016	156. Prevalence of underweight female (% of population), 2016
104. Cause of death by non-communicable diseases male, 2016	125. DALY rates per 100 000 population, 2010	157. Prevalence of underweight male (% of population), 2016
105. Current health expenditure per capita (current US\$), 2010	126. DALY rates per 100 000 population, 2016	
106. Current health expenditure per capita (current US\$), 2016	127. Domestic general government health expenditure	
	128. Domestic private health expenditure (% of current health expenditure), 2010	
	129. Domestic private health expenditure (% of current health expenditure), 2016	
	130. Inbound mobility rate, 2016(%)	
	131. Inbound mobility rate female, 2016 (%)	
	132. Inbound mobility rate male, 2016 (%)	
	133. Female HALE, 2016	
	134. Incidence of tuberculosis (per 100 000 population per year), 2016	
	135. Medical Equipment (per 1.000.000), 2013	
	136. Male HALE, 2016	
	137. Mortality caused by road traffic injury (per 100,000 people)	
	138. Mortality from CVD, cancer, diabetes or CRD between exact ages 30 and 70 (%)	

200 Analysed Parameters per country

Health Care and Health Status

- 158. Public Health Care Expenditure (as % of GDP), 2010
- 159. Public Health Care Expenditure (as % of GDP), 2016
- 160. Risk of catastrophic expenditure for surgical care (% of people at risk), 2016
- 161. Road traffic injury, 2016
- 162. Smoking prevalence (% of population), 2016
- 163. Smoking prevalence female (% of female population), 2016
- 164. Smoking prevalence male (% of male population), 2016
- 165. Suicide mortality rate both sexes, 2016
- 166. Suicide mortality rate female, 2016
- 167. Suicide mortality rate male, 2016
- 168. Total alcohol consumption both sexes, 2016
- 169. Total alcohol consumption female, 2016
- 170. Total alcohol consumption male, 2016

Health Care Policy

- 171. Existence of a set of time-bound national targets based on WHO guidance for NCDs (Yes - 1 / No - 0), 2016
- 172. Existence of an operational, multisectoral national NCD policy, strategy or action plan that integrates several NCDs and their risk factors (Yes - 1 / No - 0), 2017
- 173. Existence of any policies to reduce population salt consumption (Yes - 1 / No - 0), 2017
- 174. Existence of operational policy/strategy/action plan for cancer (Yes - 1 / No - 0), 2017
- 175. Existence of operational policy/strategy/action plan for cardiovascular diseases (Yes - 1 / No - 0)
- 176. Existence of operational policy/strategy/action plan for chronic respiratory diseases (Yes - 1 / No - 0)
- 177. Existence of operational policy/strategy/action plan to decrease tobacco use (Yes - 1 / No - 0)
- 178. Existence of operational policy/strategy/action plan for diabetes (Yes - 1 / No - 0) Existence of operational policy/strategy/action plan for oral health (Yes - 1 / No - 0)
- 179. Existence of operational policy/strategy/action plan to reduce the harmful use of alcohol (Yes - 1 / No - 0)
- 180. Existence of operational policy/strategy/action plan to reduce physical inactivity (Yes - 1 / No - 0)
- 181. Existence of operational policy/strategy/action plan to reduce unhealthy diet related to NCDs (Yes - 1 / No - 0)
- 182. Implementation of physical activity public awareness program (Yes - 1 / No - 0), 2017
- 183. Stand-alone law for mental health (Yes - 1 / No - 0)
- 184. Stand-alone policy or plan for mental health (Yes - 1 / No - 0)

Environmental Factors

- 185. Ambient air pollution, concentration of fine particulate matter PM2.5 (ug/m3), 2010
- 186. Ambient air pollution, concentration of fine particulate matter PM2.5 (ug/m3), 2016
- 187. Ambient and household air pollution attributable death rate (per 100 000 population), 2010
- 188. Ambient and household air pollution attributable death rate (per 100 000 population), 2016
- 189. Daily maximum air temperature, 2016
- 190. Daily mean air temperature, 2016
- 191. Daily minimum air temperature, 2016
- 192. Dew point, 2016
- 193. Diurnal temperature variation calculations, 2016
- 194. People using safely managed sanitation services (% of population), 2010
- 195. People using safely managed sanitation services (% of population), 2015
- 196. Population Using Improved Water Sources (%)
- 197. People using at least basic sanitation services (% of population)
- 198. People using at least basic drinking water services (% of population)
- 199. Relative humidity, 2016
- 200. Sunshine hours, 2016

Data Sources

Data collection is an essential stage of the research. Accurate data collection is essential to maintaining the integrity of research. To answer relevant questions of the working paper and evaluate outcomes, data used for this analysis was collected from credible sources. These include the following:

World Health Organization

OECD Data

World Bank Open Data

Government Reports

Peer-Reviewed Scientific Publications

International Labour Organization

E-Government Development Index

Human Development Index

UNdata

Corruption Perceptions Index

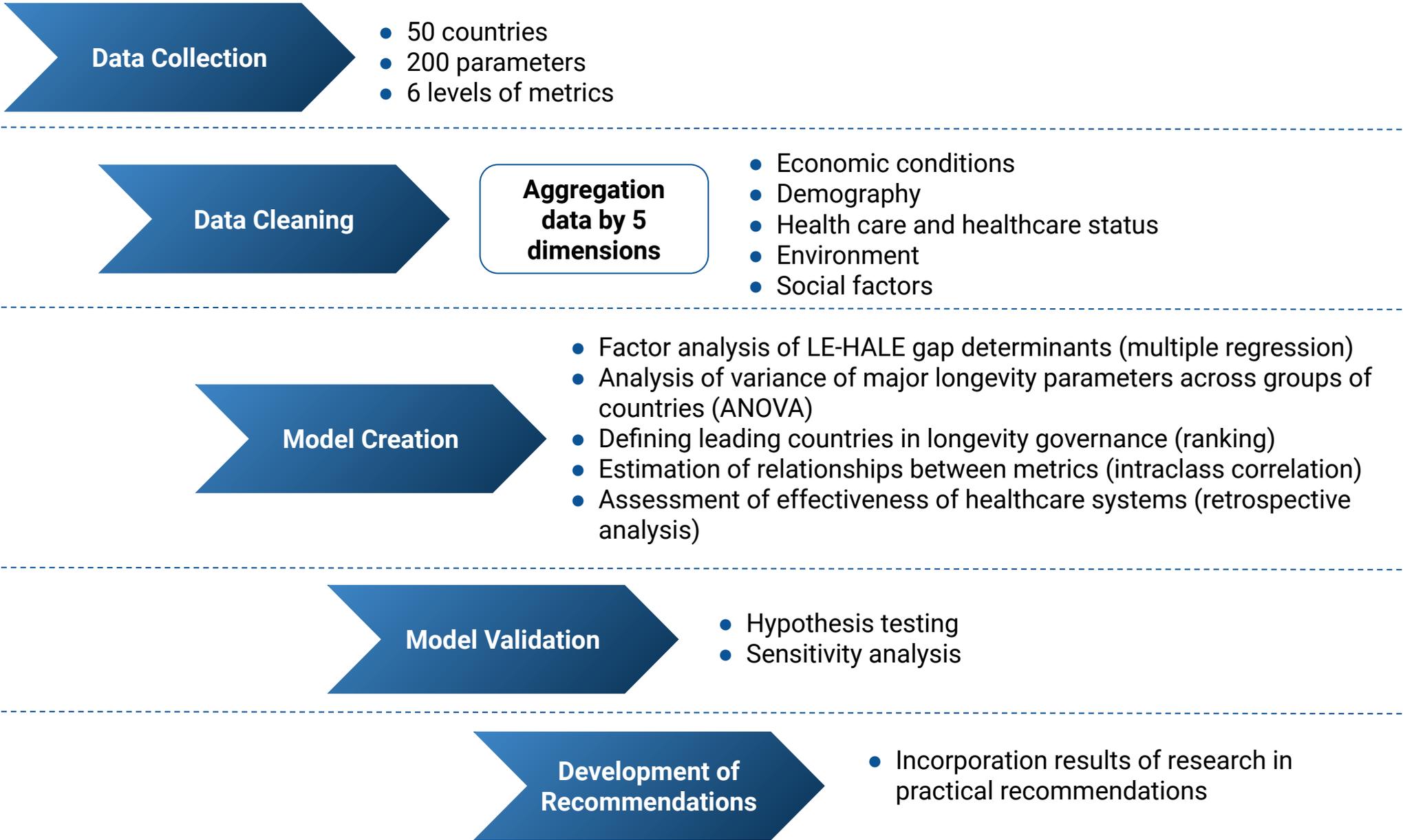
The Observatory of Economic Complexity

RAND Corporation

The Economist Intelligence Unit

Bloomberg Healthiest Country Index

Big Data Comparative Analysis of Healthy Longevity



Health-Adjusted Life Expectancy and Life Expectancy

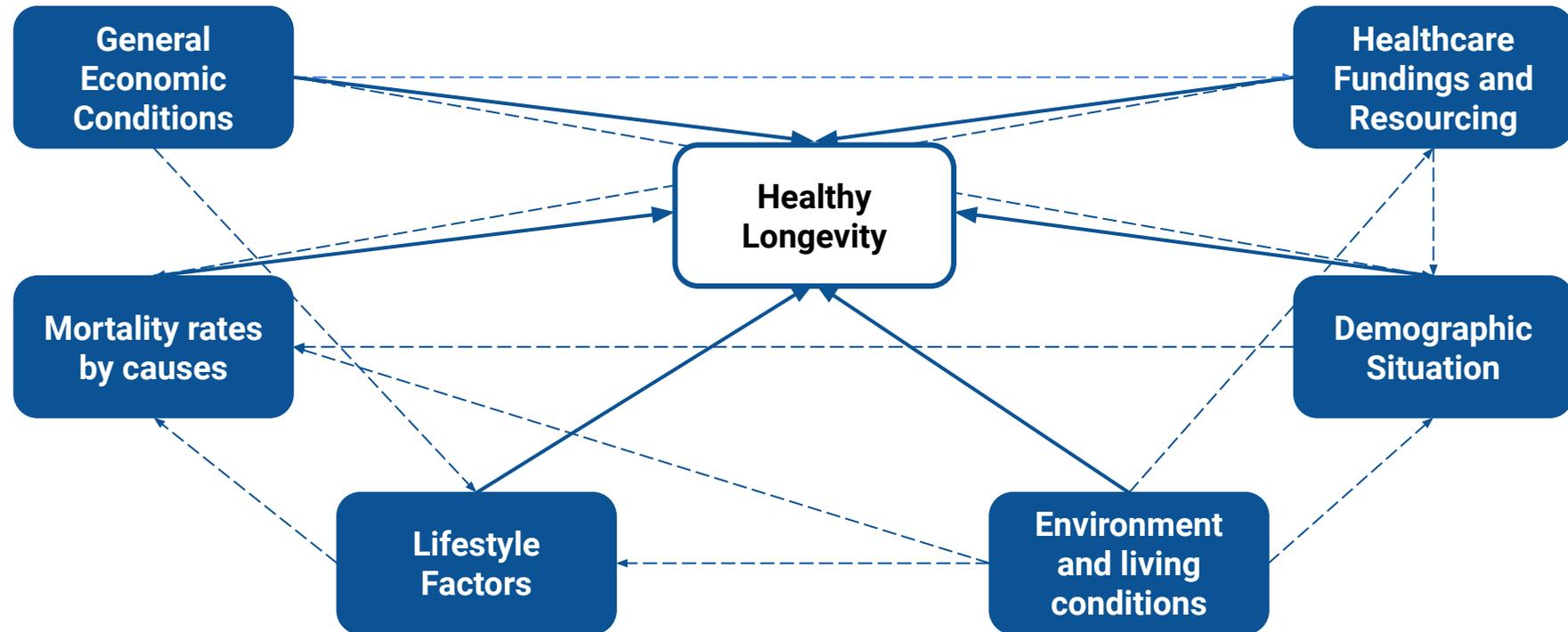
HALE and Life Expectancy (LE)	Countries	GAP
High HALE and LE	Australia, Austria, Canada, France, Italy, Luxembourg, Norway, Switzerland, Sweden, Republic of Korea	Big GAP between HALE and Life Expectancy
Medium HALE and LE	Belgium, Chile, Czech Republic, Denmark, Finland, Germany, Ireland, Slovenia	
Low HALE and LE	Estonia, United Arab Emirates, United States of America	
High HALE and LE	Iceland, Israel, Japan, New Zealand, Spain, United Kingdom of Great Britain and Northern Ireland	Medium GAP between HALE and Life Expectancy
Medium HALE and LE	Cuba, Greece, Malta, Netherlands, Portugal, Qatar	
Low HALE and LE	Brazil, India, Mexico, Poland, Slovakia, Saudi Arabia, Iran, Turkey	
High HALE and LE	Hong Kong, Singapore	Small GAP between HALE and Life Expectancy
Medium HALE and LE	China, Costa Rica, Panama	
Low HALE and LE	Argentina, Indonesia, Russia, South Africa	

This table represents the distribution of countries by their Health Adjusted Life Expectancy (HALE) and estimated average life expectancy (LE) and the gap. The gap is measured as absolute difference between life expectancy and HALE in a particular country.

Countries are distributed unevenly, because the major countries are developed countries with approximately the same level of development and welfare.

As can be seen, there are 10 countries in the group that combines a high level of HALE and LE and a big gap between the two indicators, which makes it the biggest group in the sample.

Longevity Determining Factors

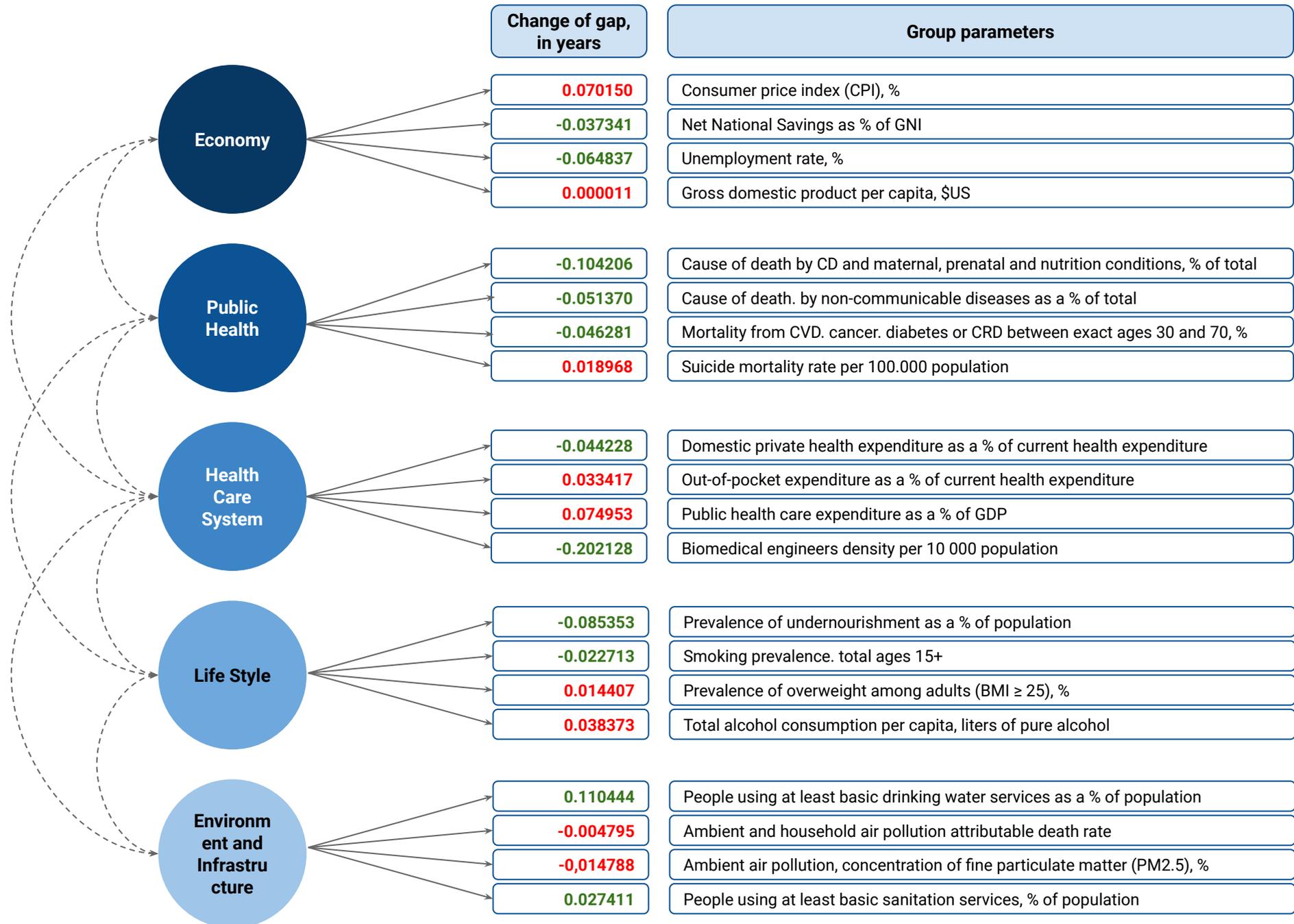


The Network Graph is used to display relations between various factors that determine Longevity. All parameters are divided into six pillars: general economic conditions, mortality rates, lifestyle factors, environment, demography and healthcare.

The graph itself visualizes how metrics are interconnected with each other. The relationship between them are displayed with lines. Bold arrows indicate direct impact on longevity. Dashed lines reveal multicollinearity, interconnection between metrics across different groups.

To determine longevity factors that affect gap between life expectancy at birth health-adjusted life expectancy, we have built five different models to identify unmixed impact of each individual group of factors on the gap.

Comparative Longevity Analysis



HALE and Life Expectancy

Health-Adjusted Life Expectancy (HALE), used here as a measure of Healthy Longevity, is the average number of years an individual can expect to live free of chronic age-related disease.

Life expectancy (LE) at birth reflects the overall mortality level of a population. It summarizes the mortality pattern that prevails across all age groups in a given year – children and adolescents, adults and the elderly.

HALE, 2016

HALE/GAP between HALE and LE, 2016

76.2		Singapore	6.7
74.8		Japan	9.4
73.8		Spain	9.3
73.5		Switzerland	9.8
73.0		South Korea	9.7
72.9		Israel	9.4
72.1		Netherlands	9.5
71.9		United Kingdom	9.2
68.7		China	7.4
68.5		USA	10.0



Source:

WHO

HALE and GDP

Health-Adjusted Life Expectancy (HALE), used here as a measure of Healthy Longevity, is the average number of years an individual can expect to live free of chronic age-related disease.

Gross domestic product (GDP) per capita is a measure of a country's economic output that accounts for its number of people. It divides the country's gross domestic product by its total population. That makes it the best measurement of a country's standard of living.

HALE, 2016

GDP per Capita (Thousand \$) 2016

76.2		Singapore	56.7
74.8		Japan	38.8
73.8		Spain	26.6
73.5		Switzerland	80.0
73.0		South Korea	26.7
72.9		Israel	37.4
72.1		Netherlands	46.0
71.9		United Kingdom	40.5
68.7		China	8.1
68.5		USA	57.9



Source:

WHO

HALE and Public Health Care Expenditure

Health-Adjusted Life Expectancy (HALE), used here as a measure of Healthy Longevity, is the average number of years an individual can expect to live free of chronic age-related disease.

Public health care expenditure consists of recurrent and capital spending from government (central and local) budgets, external borrowings and grants (including donations from international agencies and nongovernmental organizations), and social (or compulsory) health insurance funds.



Source:

WHO

HALE and Prevalence of Overweight among Adults

Health-Adjusted Life Expectancy (HALE), used here as a measure of Healthy Longevity, is the average number of years an individual can expect to live free of chronic age-related disease.

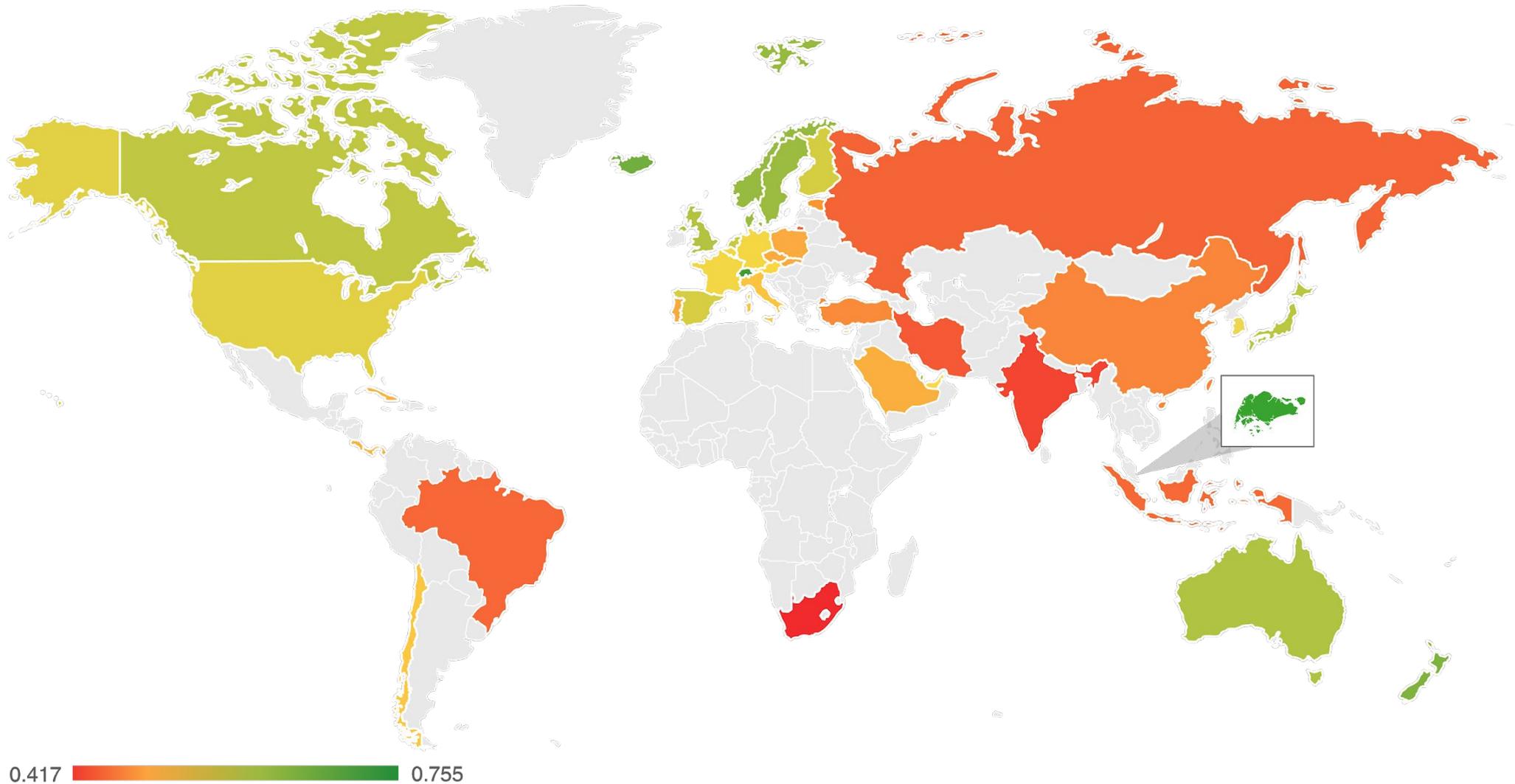
Body mass index (BMI) is a value derived from the mass (weight) and height of a person. The BMI is defined as the body mass divided by the square of the body height, and is universally expressed in units of kg/m², resulting from mass in kilograms and height in metres.

HALE, 2016

Prevalence of Overweight among Adults, BMI ≥ 25 (Age-Standardized Estimate) (%)

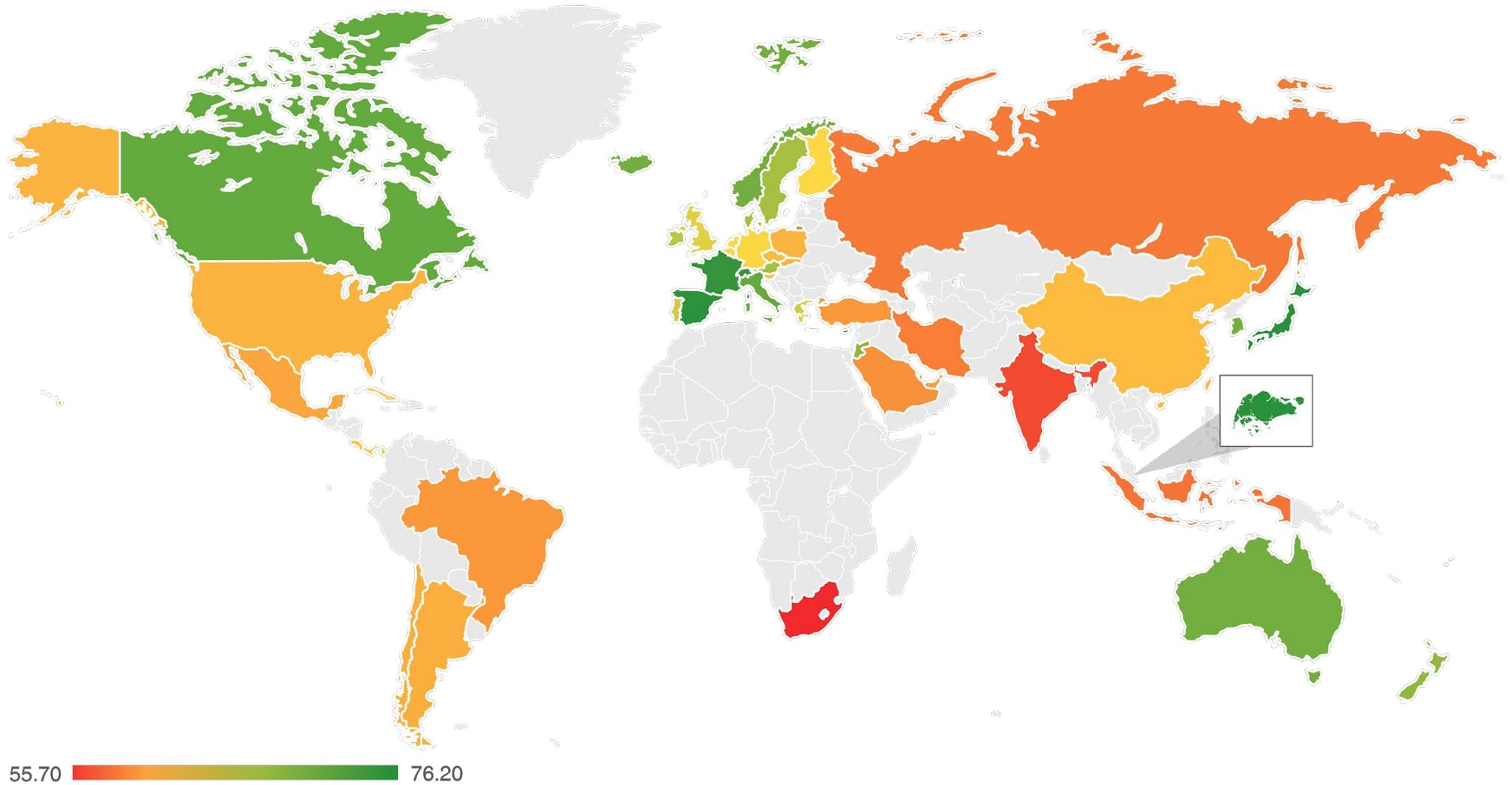
76.2		Singapore	31.8
74.8		Japan	27.2
73.8		Spain	61.6
73.5		Switzerland	54.3
73.0		South Korea	30.3
72.9		Israel	64.3
72.1		Netherlands	58.7
71.9		United Kingdom	63.7
68.7		China	32.1
68.5		USA	67.9

Final Rankings of the Level of HALE and Gap



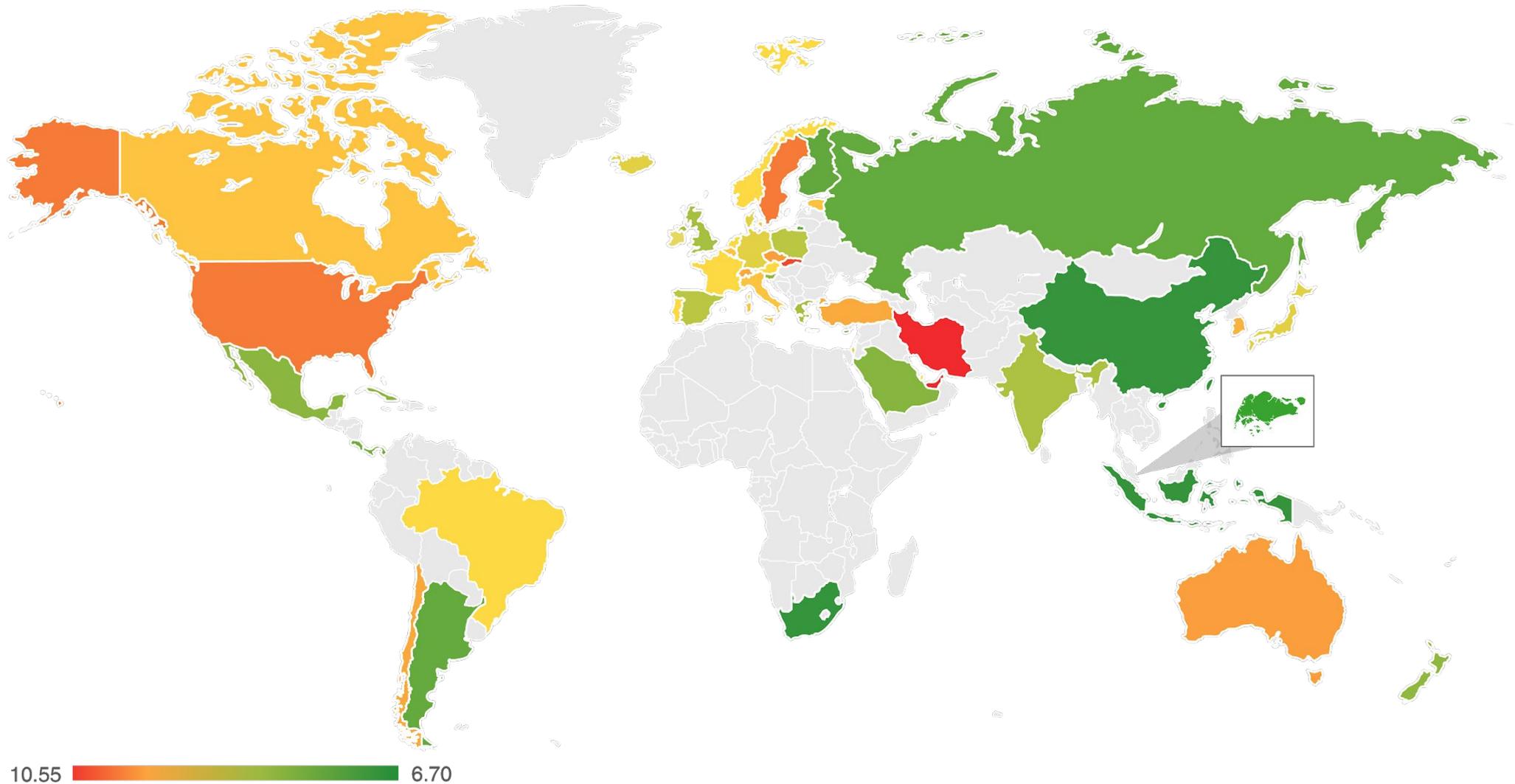
Health-Adjusted Life Expectancy (HALE), used here as a measure of Healthy Longevity, is the average number of years an individual can expect to live free of chronic age-related disease.

Healthy Longevity Heat Map



Healthy Longevity relates here to the number of years that a person live without serious health problems or injuries.

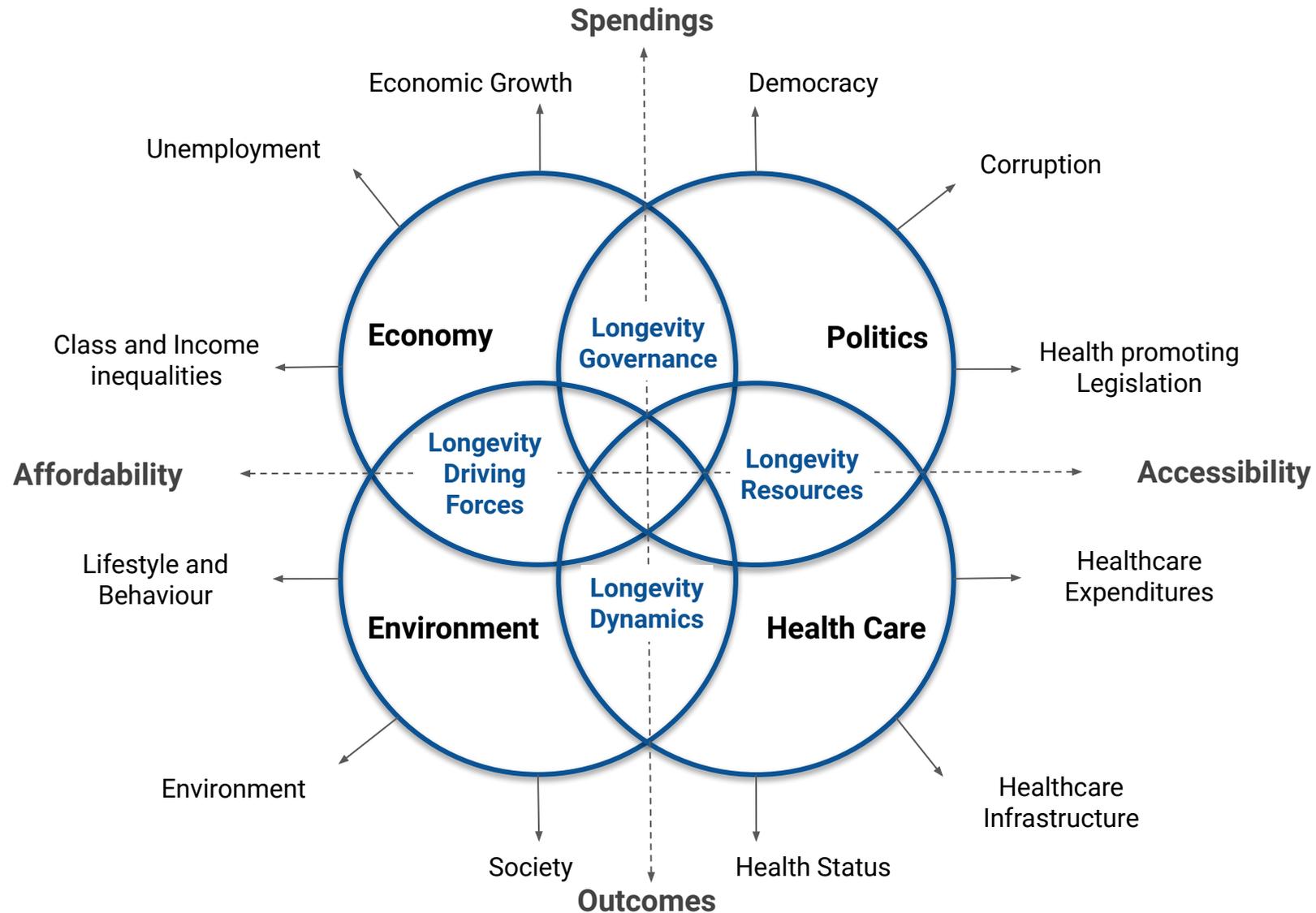
Country Ranking by Size of Gap Between Healthy Longevity and Life Expectancy



Health-Adjusted Life Expectancy (HALE), used here as a measure of Healthy Longevity, is the average number of years an individual can expect to live free of chronic age-related disease.

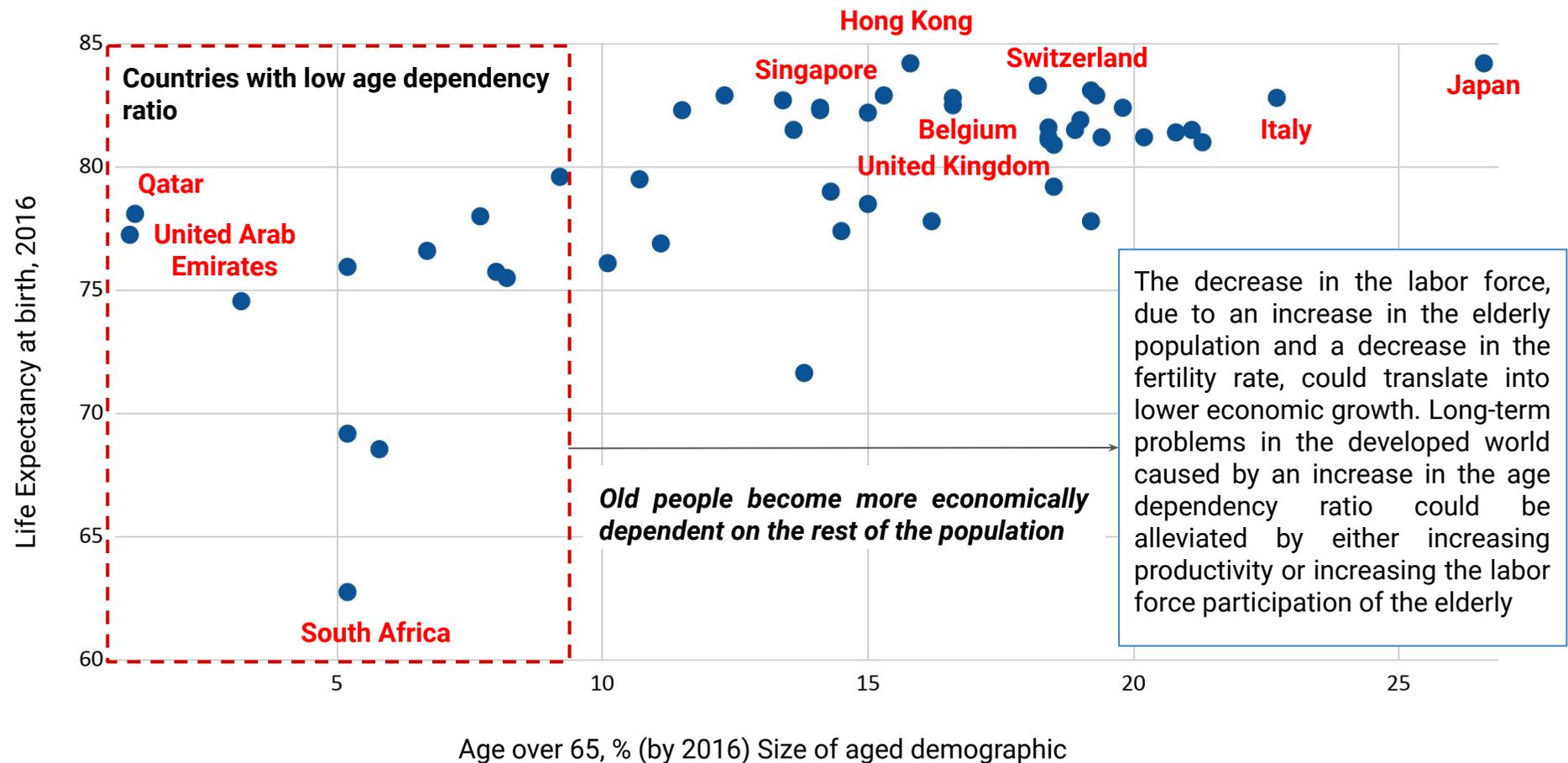
Life expectancy (LE) at birth reflects the overall mortality level of a population. It summarizes the mortality pattern that prevails across all age groups in a given year – children and adolescents, adults and the elderly.

Healthy Longevity Progressiveness



Healthy Longevity progressiveness is important for driving economic progress and competitiveness—both for developed and developing economies. Today longevity is about social inclusiveness, high quality of life, technical innovations in care delivery and medical treatment, and modified business and governmental models.

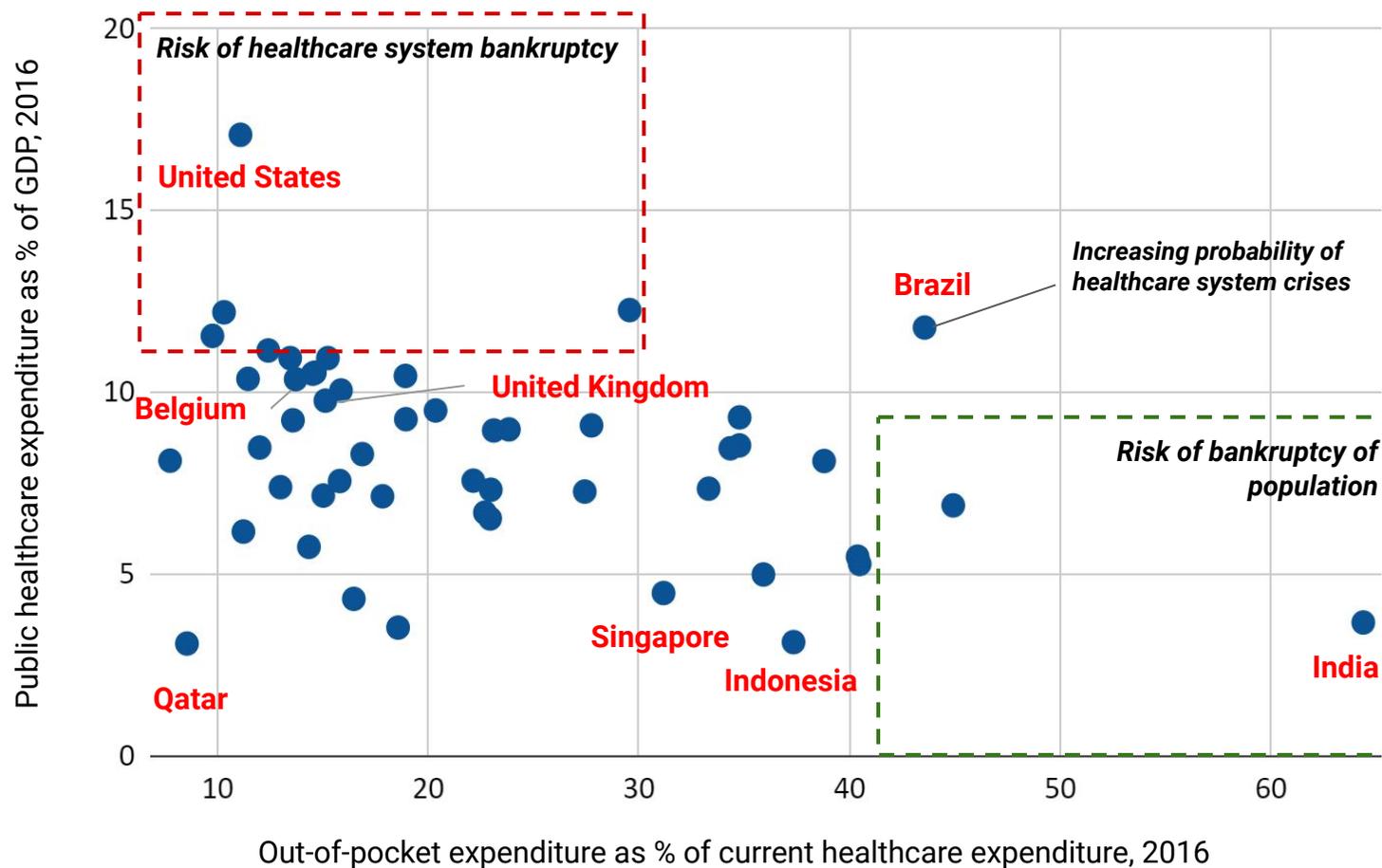
Life Expectancy and Ageing Population



Life expectancy is increasing all around the world. Since around the 1950s, the main factor of steady increase has been reductions in mortality at older ages. This has contributed to the ageing of the population and critical changes in age distribution. Ageing population contributes to high life expectancy and increase in gap between life expectancy and HALE.

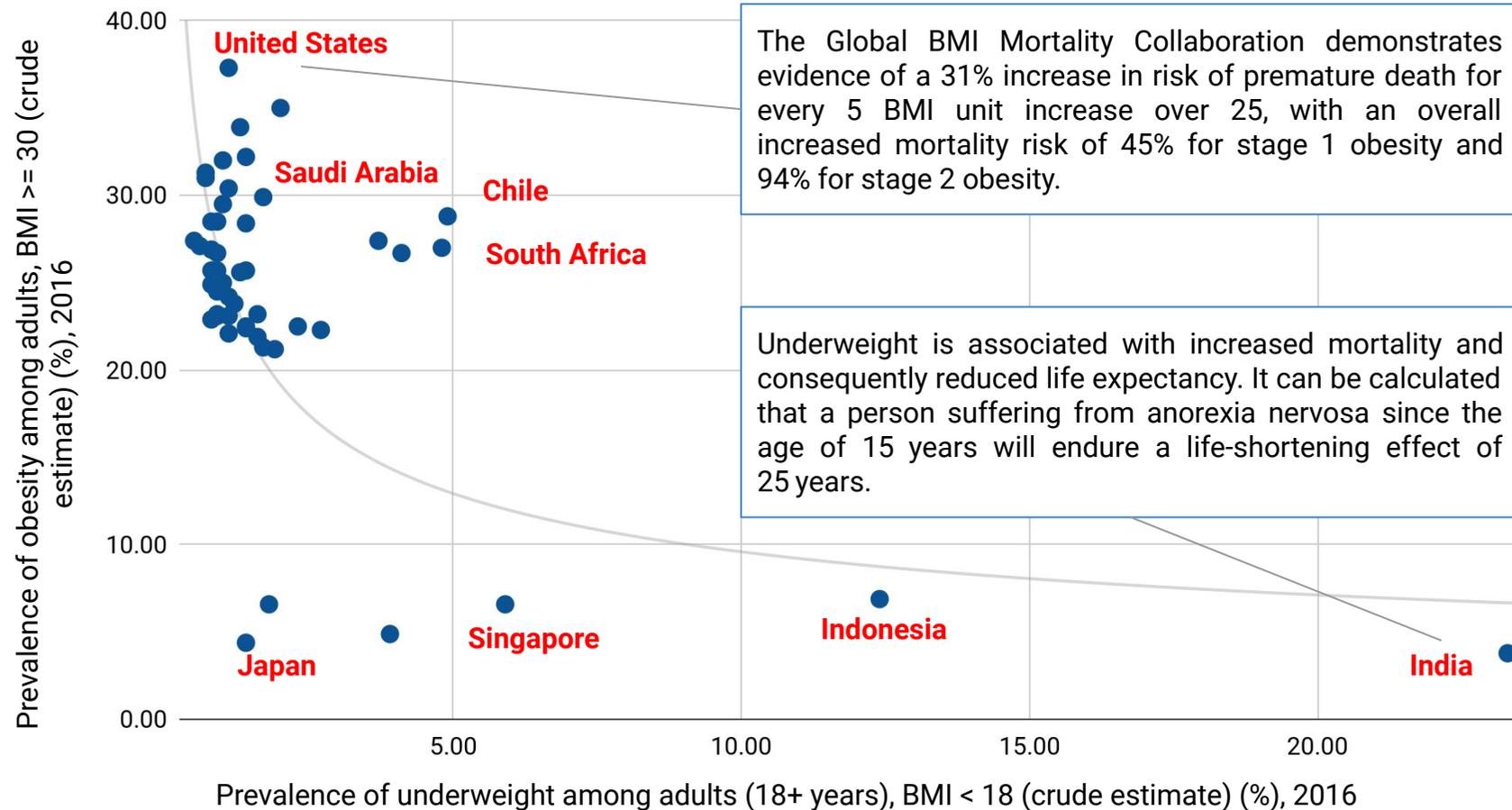
The major problem with merely increasing life expectancy is that it also increases morbidity because people live long enough to get more age-related disease, disability, dementia, and other dysfunctions.

Public Healthcare Expenditure vs Out-of-pocket Expenditure



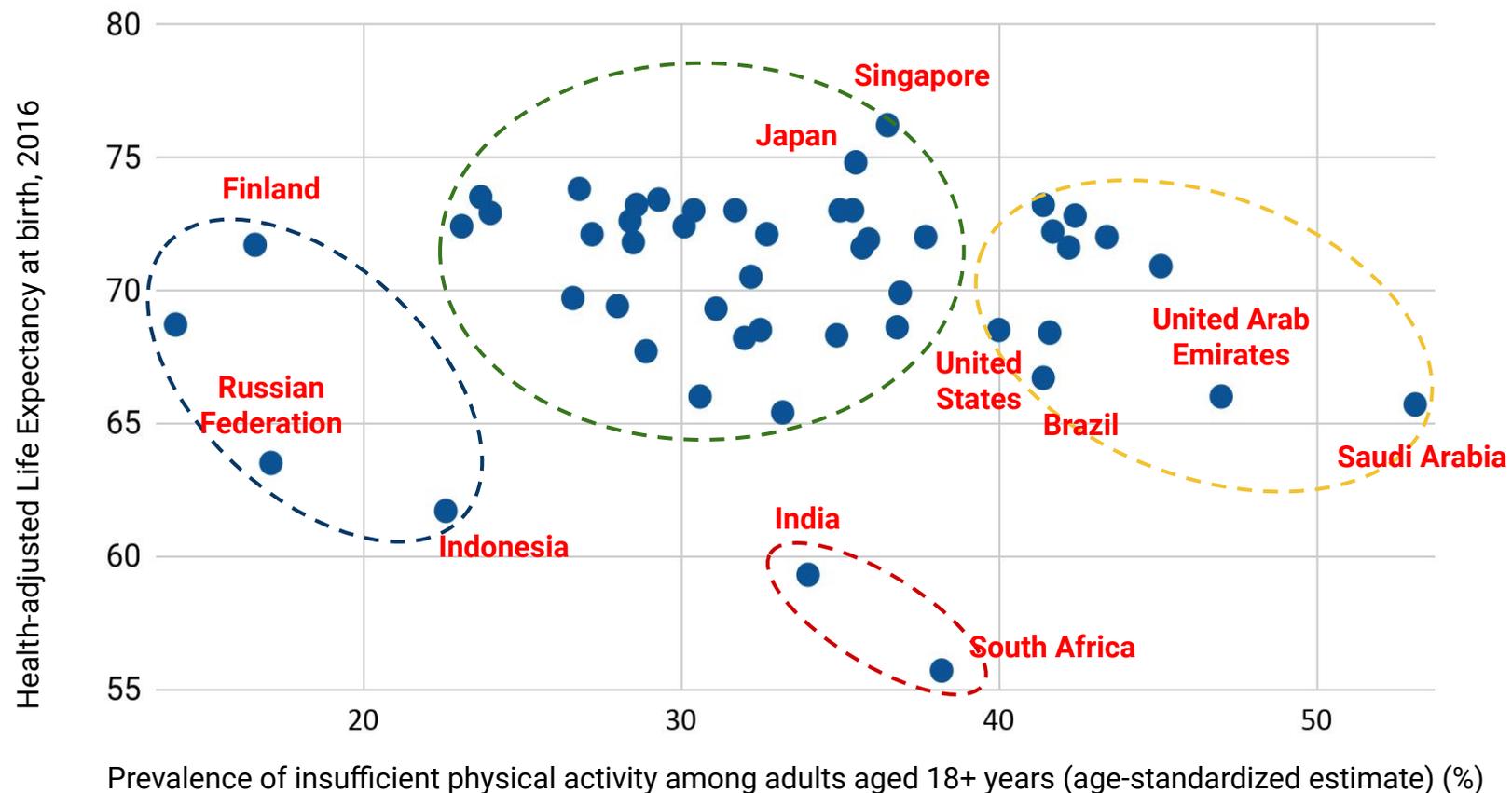
Unregulated direct charges often constitute a major access barrier to needed health care and contribute to high out-of-pocket payments generating problems of financial protection. Out-of-pocket payments absorb household's financial resources and make healthcare unaffordable for low socioeconomic groups as a result large discrepancies appears in healthcare status. In contrast, public spending on health is central to universal health coverage and social protection, but there is no clear trend of. In the United States high healthcare expenditure is a result of high administrative cost and corruption in healthcare.

Obesity and Underweight among Adults



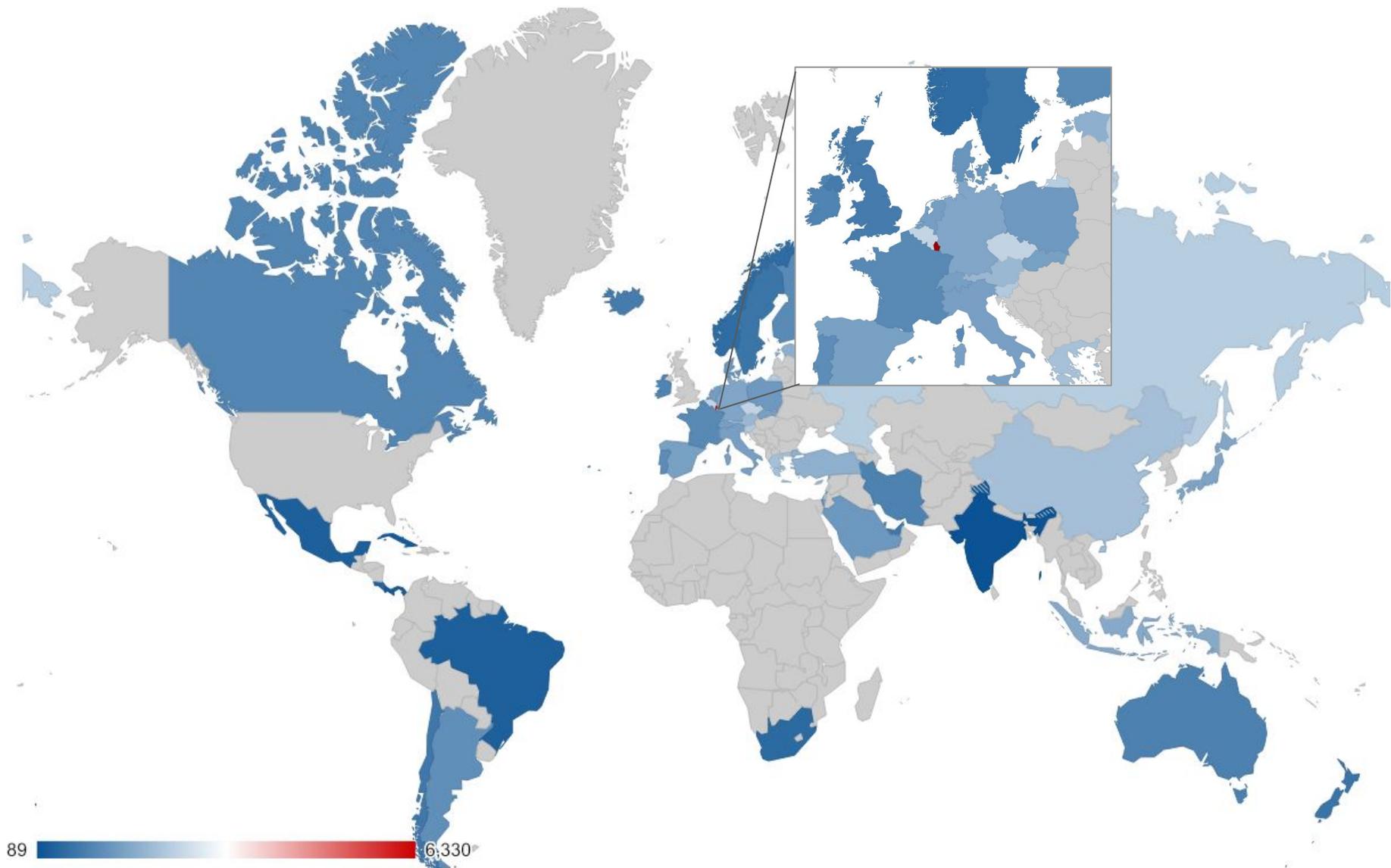
Low level of adult obesity does not always correspond to the healthier lifestyle. Low-income countries, such as India and Indonesia have low level of obesity because people suffer from underweight and poor nutrition. Countries with high level of HALE can be also divided into two groups. Major developed countries have high level of obesity and bigger gap between life expectancy and HALE. Overweight increases the risk of other diseases and health problems, such as heart disease, diabetes, high blood pressure and certain cancers. Another group consists of two major players: Japan and Singapore. Developed countries have both low level of underweight and overweight that lead to reduction of behavioral risk factors and burden of non-communicable diseases.

Insufficient Physical Activity and Healthy Longevity



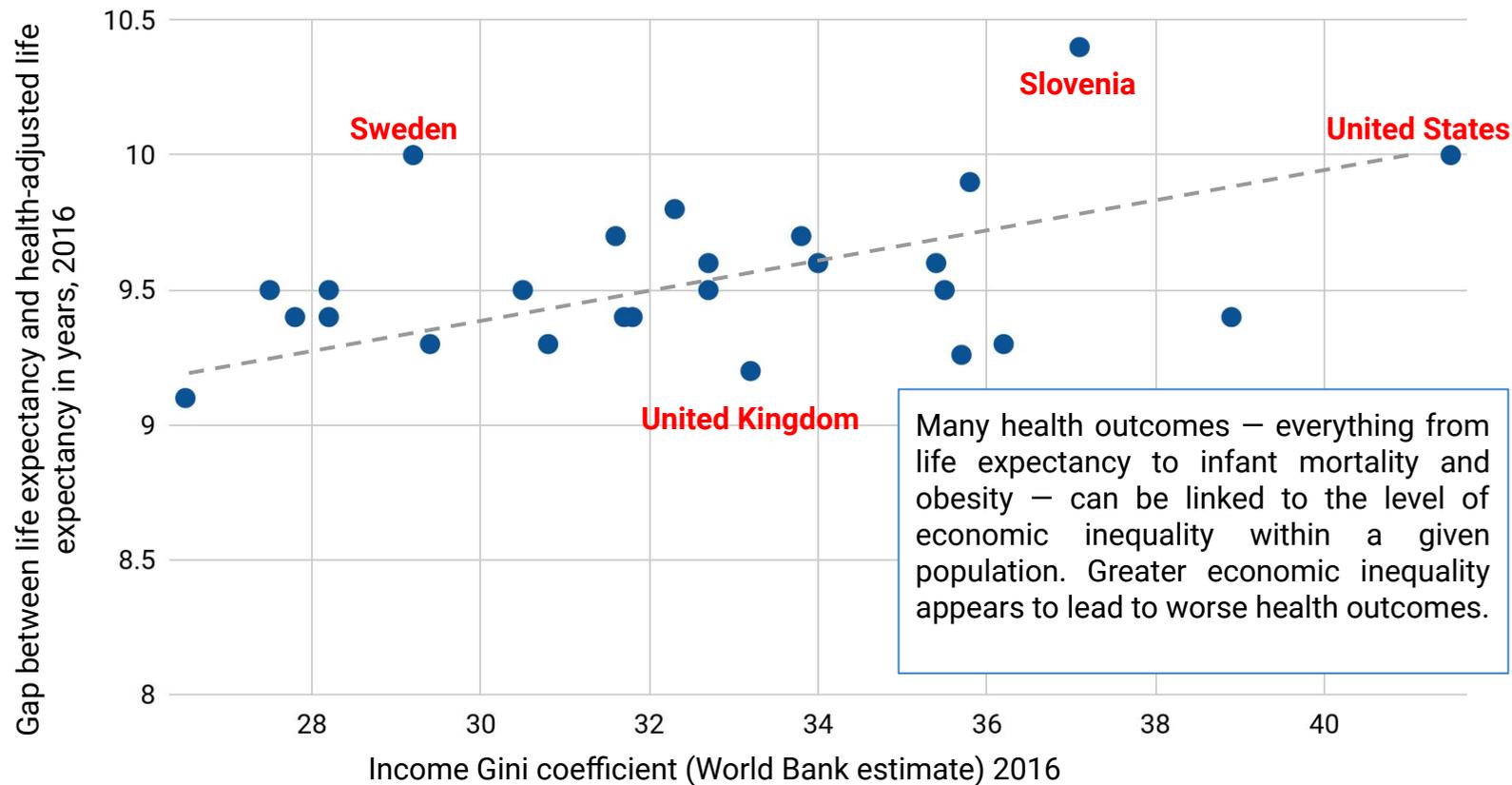
Insufficient activity levels present a risk of adverse health outcomes including obesity. Sedentary lifestyle increases the risk of heart disease, obesity, and other health problems, and is associated with low socioeconomic status. Data from the World Health Organization indicate that 40% of adults in the U.S. have insufficient physical activity in 2016, compared to 33.6% on average in comparable 50 countries. The higher-than average rates of physical inactivity in the U.S. and other countries from the initiated cluster may contribute in some ways to the higher disease burden from cardiovascular conditions. Other countries have low or middle percentage of adults that do not intake enough exercises but still level of HALE varies significantly. Though rates of disease burden caused by these conditions have improved across other countries, they still cause fairly large negative impact on HALE.

Annual Cigarette Consumption



The highest level of annual cigarette consumption per capita is in Luxembourg. There is negative correlation between smoking and HALE across countries. Smoking leads to disease and disability and harms nearly every organ of the body. Smoking causes cancer, heart disease, stroke, lung diseases, diabetes, and chronic obstructive pulmonary disease (COPD), which includes emphysema and chronic bronchitis.

Socio-Economic Inequality and Gap between Life Expectancy and HALE



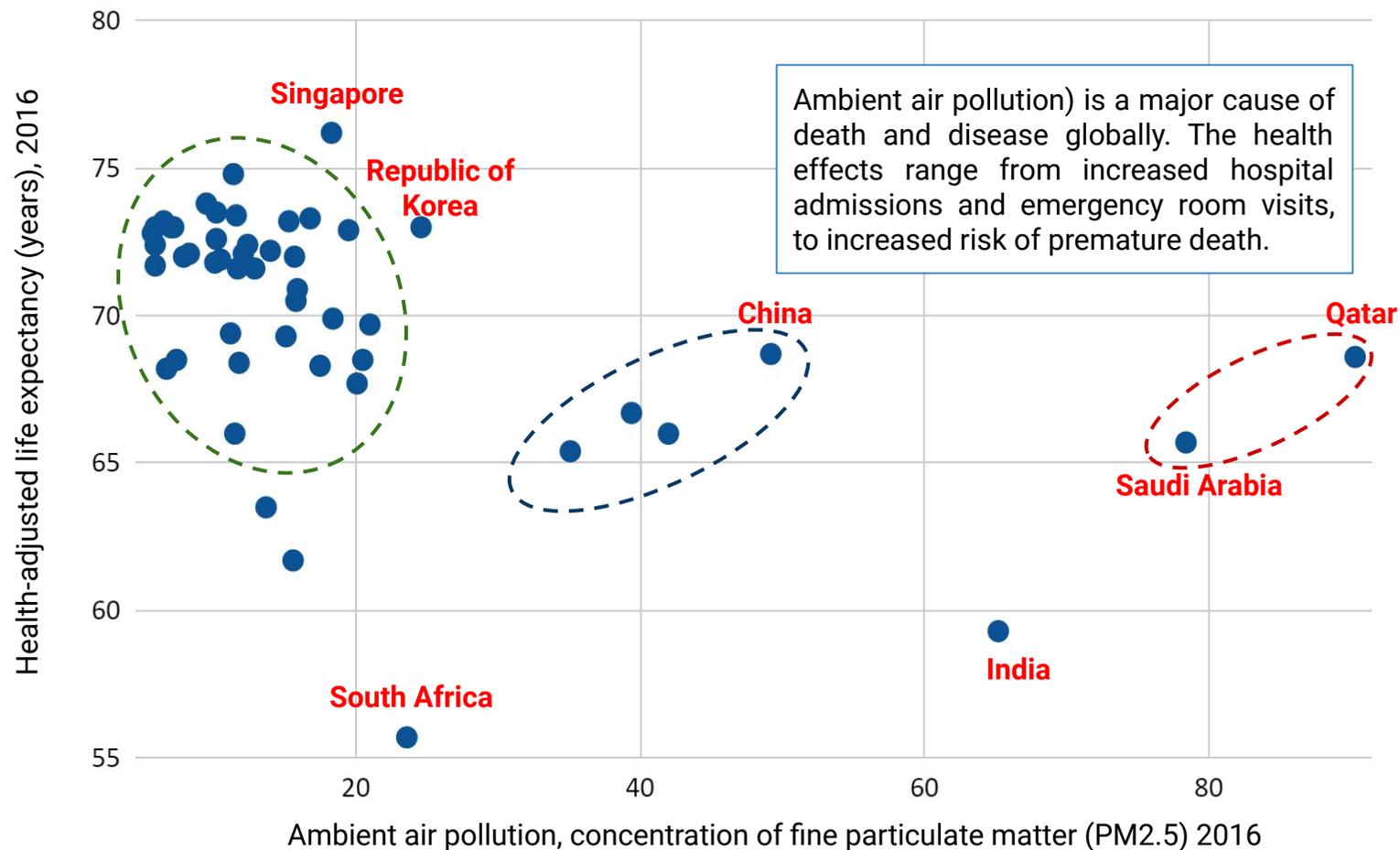
The populations of comparably sizable and wealthy countries are aging more rapidly, with larger percentages of their populations over the age of 65. Life expectancy can be influenced by a number of factors, including those within the domain of the health system (e.g., quality of care, access to preventive health services) as well economic, behavioral, and environmental factors that may be outside the control of the health system (e.g. poverty, lifestyle, violence, and accidents). Among developed countries the U.S. has a higher degree of income inequality than any comparably wealthy and sizable country. People who are lower income are less likely than people with higher incomes to report being in good health, and there is a growing disparity in the life expectancies of low and high income.

Source:

World Bank

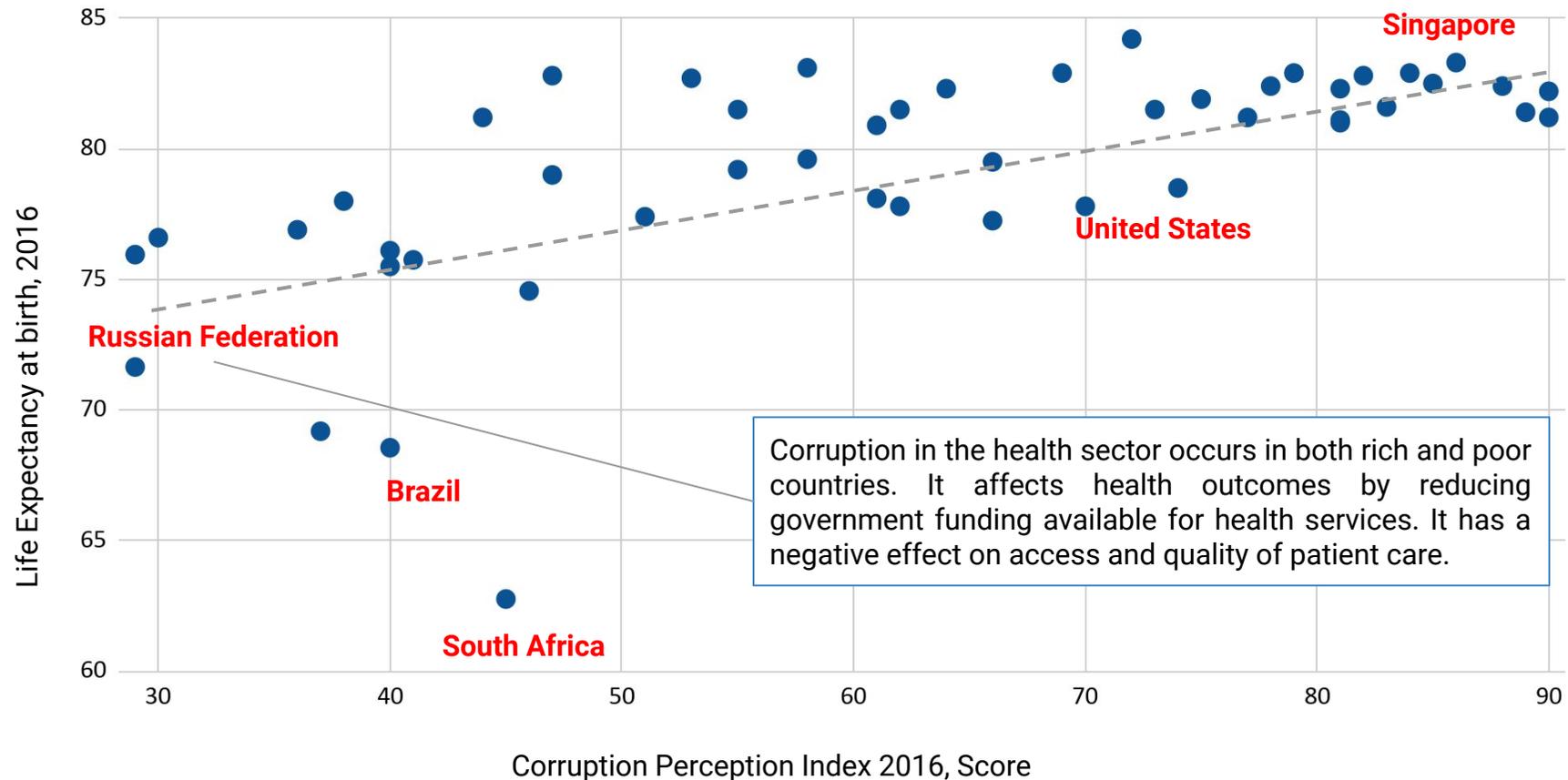
WHO

Mortality Attributable to Ambient Air Pollution



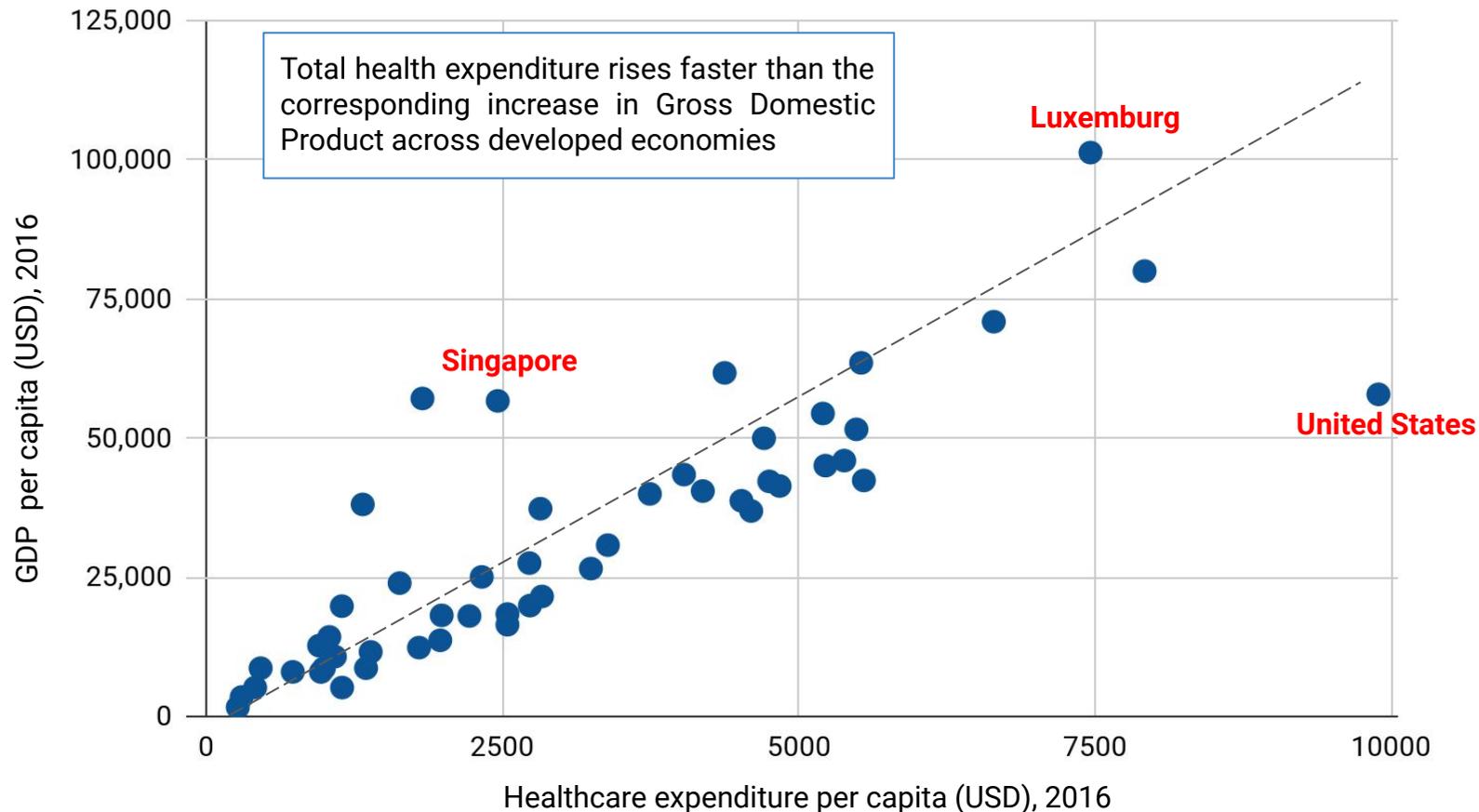
In general, countries with higher level of ambient air pollution have lower level of health-adjusted life expectancy. Countries can be divided into several groups. Saudi Arabia and Qatar are world's largest natural gas and oil exports and ones of the richest countries in the world (measured by GDP per capita). The largest exporter in the world China relates to another group with United Arab Emirates, Turkey and Iran. The largest group includes developed countries with high HALE and low level of air pollution. Because industrial policies in high-income countries target Sustainable Development Goals and reduction of harmful human impact on environment.

Life Expectancy and Corruption Perception



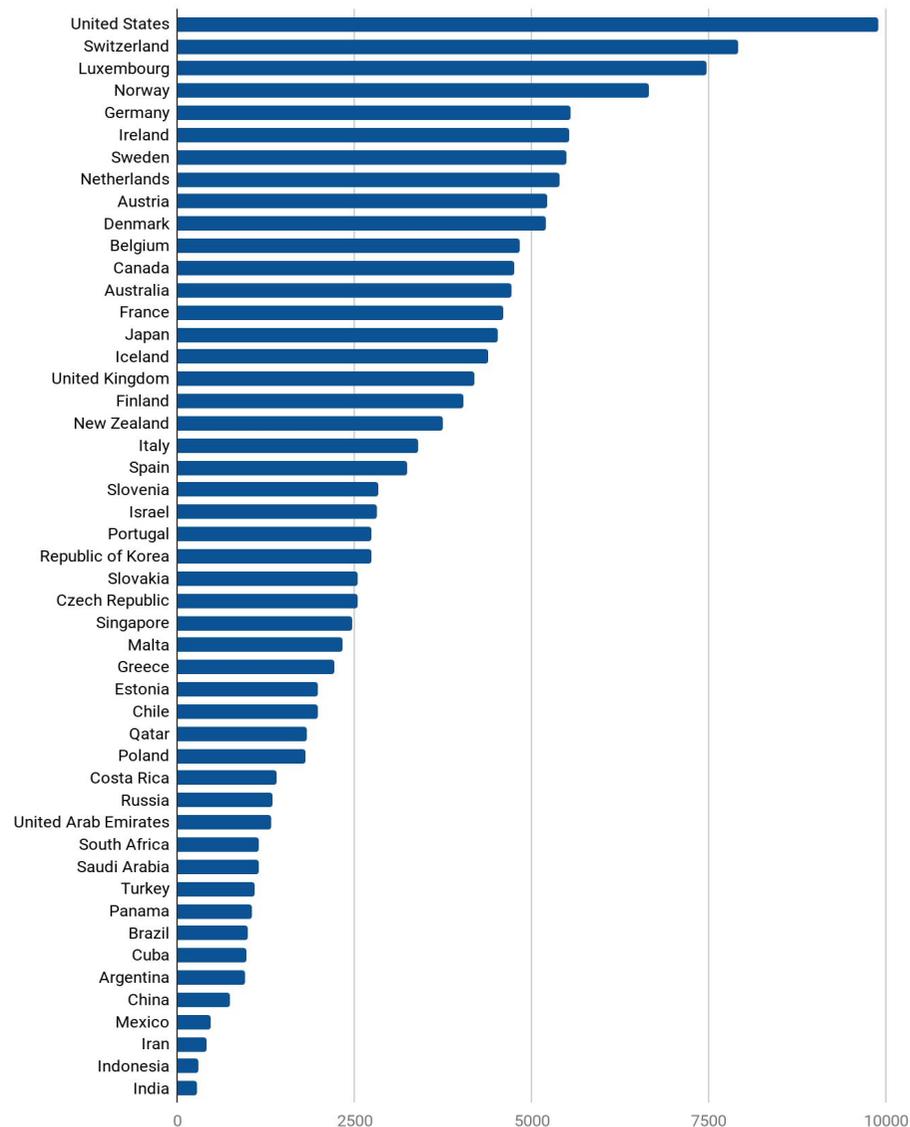
Life expectancy at birth steady increases with reduction of corruption level across countries. The problem of corruption in healthcare is of a multidimensional nature. Corruption may be involved, for example, in construction of health centres/hospitals, purchase of instruments, supply of medicines and goods, overbilling in insurance claims and even appointment of healthcare professionals. High level of corruption corresponds to wasteful spendings in healthcare, low efficiency and high administrative costs. Corruption leads to large waiting time and unaffordability of preventive services for population.

Healthcare Spendings and GDP per capita



This chart collection takes a look at how spendings on healthcare are correlated with GDP per capita. The analysis looks at 2016 health and economic data from the World Bank and Organization of Economic Cooperation and Development (OECD). As would be expected, wealthy countries like the United States, Norway, Switzerland, Luxemburg, and Sweden, tend to spend more per person on health care and related expenses than lower income countries such as India, Brazil, South Africa and Indonesia. However, even as a high income country, the U.S. spends more per person on health than comparable countries. Comparing health spending in countries is complicated, as each country has unique political, economic, and social attributes that contribute to its spending.

Healthcare Expenditures per capita by Country



Healthcare expenditure per capita (USD), 2016

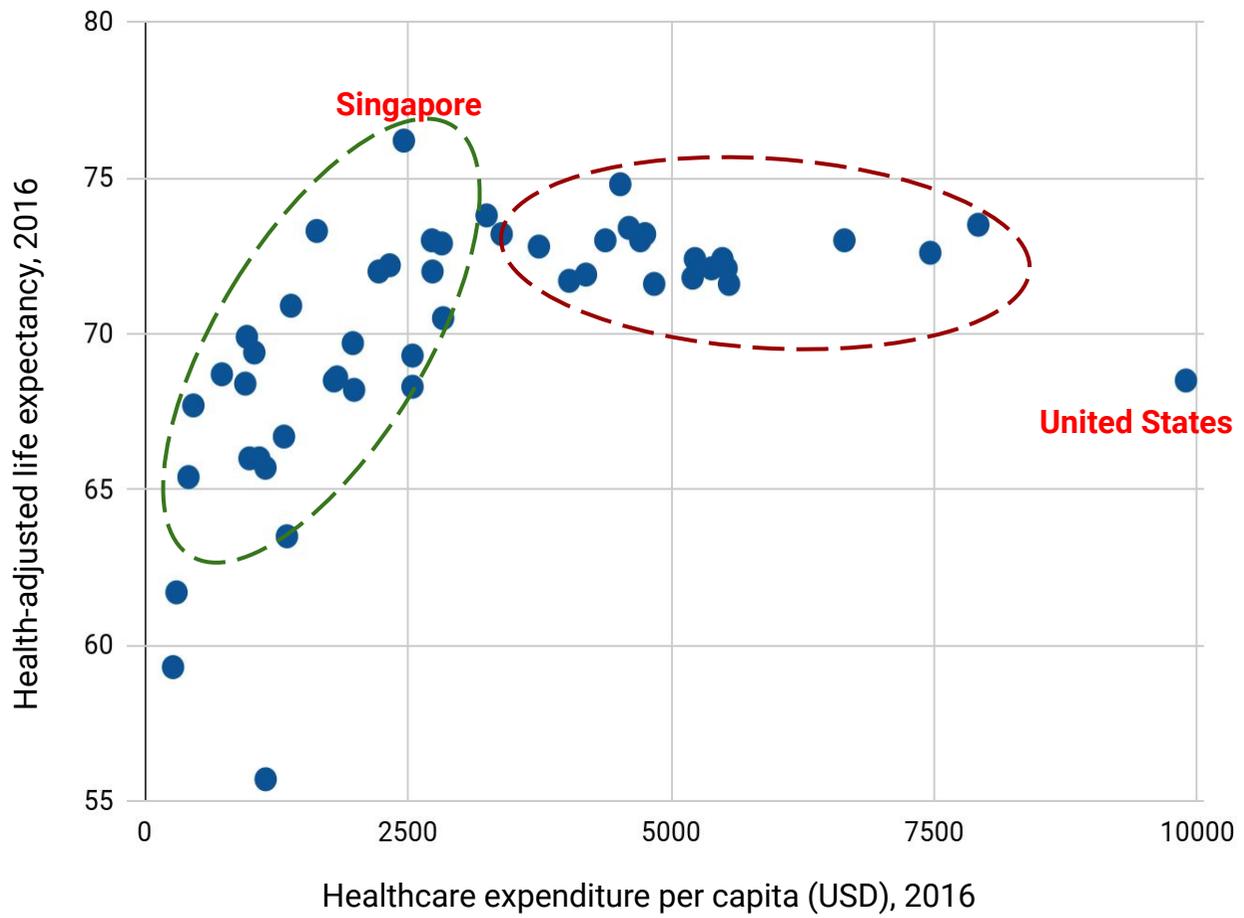
The financial resources that a country devotes to health care and how this changes over time and is a result of a wide array of social and economic factors, as well as financing and organisational structure of country's health system.

The United States spends more on health care than any other country in the world, and a large share of that spending comes from the federal government. Relative to the size of its wealth, the United States spends a disproportionate amount on health care. Compared with the other G7 countries United States spends almost 80% more than Germany and more than twice on healthcare per person in Japan, Canada and France. In the medium term, the US Center for Medicare and Medicaid Services (CMS) expect health spending growth above that of GDP in the United States, driven on by faster growing medical prices.

Per capita spending on health across countries continued to grow in 2016 following the trend of recent years. This comes after the slowdown between 2009 and 2011 caused by the global financial crisis.

Away from Europe, in Singapore health spendings are projected to grow faster than GDP, implying the potential growth of private healthcare. The increase will be focused on research and development for pharmaceutical products, medical devices and laboratory services.

Healthcare Spending and Health-adjusted Life Expectancy



As we can see there is no linear relationship between the life expectancy and healthcare expenditures. It means that more public expenditures on healthcare do not guarantee healthier and longer life.

The graph we could divide into two main groups. The first group include developing countries, such as India, Brazil, Russian Federation, Argentina. There increase in public spending contributes to increase in healthy life.

The second group is developed countries. Wealthy countries spend more per person on health care and related expenses than lower income countries which does not lead to increase in life expectancy.

The most evident difference in effectiveness of government expenditures on healthcare is between United States and Singapore. These countries are approximately of the same level of wealth, GDP per capita equals 57 904,2 and 56 724,2 USD respectively in 2016, but lower healthcare spending per capita in Singapore contribute to higher Health Adjusted Life Expectancy (HALE) comparing to United States.

This chart collection takes a look at how spending on healthcare are correlated with Health – Adjusted Life Expectancy. The analysis looks at 2016 health data from OECD and World Health Organization.

Singapore's Health Care System Beats the United States's in its Efficiency, Affordability and Quality

The United States spends a disproportionate amount on health care, comparing to Singapore, but HALE is relatively low

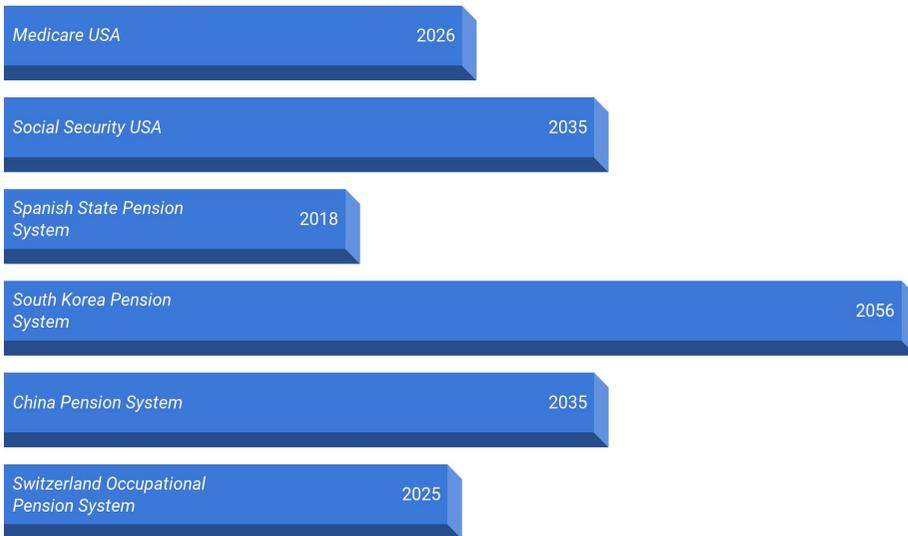
Singapore	United States
HALE: 76.2	HALE: 68.5
HALE GAP: 6.7	HALE GAP: 10.0
Life Expectancy: 82.9	Life Expectancy: 78.5
Healthcare Efficiency Rank: #2	Healthcare Efficiency Rank: #25
Healthcare Spending: 4.5% GDP	Healthcare Spending: 18% GDP

Singapore spends much less per person on healthcare than the United States, \$ 2,462 and \$ 10,224 in 2017 respectively. Its citizens also pay more out of pocket comparing to Americans. Out-of-pocket expenditures as % of current health expenditure are 31.17% and 11.09% respectively. But in Singapore health costs are relatively cheap.

There are wasteful spending in healthcare financing in the United States. About one quarter of health care cost is associated with administration, which is far higher than in any other country. Another major difference in health costs between the US and every other developed nation is the cost of drugs. In most countries, the government negotiates drug prices with the drug makers, but when Congress created Medicare Part D, it specifically denied Medicare the right to use its power to negotiate drug prices.

Big gap between life expectancy and health-adjusted life expectancy in the United States is caused by high disparity health status across different socio-economic group. Major diseases share four risk factors: tobacco use, the harmful use of alcohol, unhealthy diets, and physical inactivity. These are called modifiable risk factors that can lead to cardiovascular disease, the leading NCD in terms of premature deaths.

Insolvency Predictions for Government-Funded Schemes



Source:

Bloomberg

Reuters

Financial Times

Singapore's Health Care System Beats Hong Kong's in its Efficiency and Affordability

Healthcare Outcomes Metrics (2016)			
Country	Life Expectancy	Infant Mortality per 1 000 population	Maternal Mortality per 100 000 population
Singapore	82.8	2.1	10.0
Hong Kong	84.2	1.5	1.8
Healthcare Spending & Affordability (2016)			
Country	Government Health Spendings, %	Government Health Spendings, as % of Budget	Out-of-pocket Expenditure as % of GNI
Singapore	54	14	1.5
Hong Kong	50	12	1.9
Healthcare Accessibility (2016)			
Country	Doctors per 10 000 population	Nurses per 1 000 population	Hospital Beds per 1 000 population
Singapore	23.1	7.1	2.5
Hong Kong	20.0	7.9	3.7

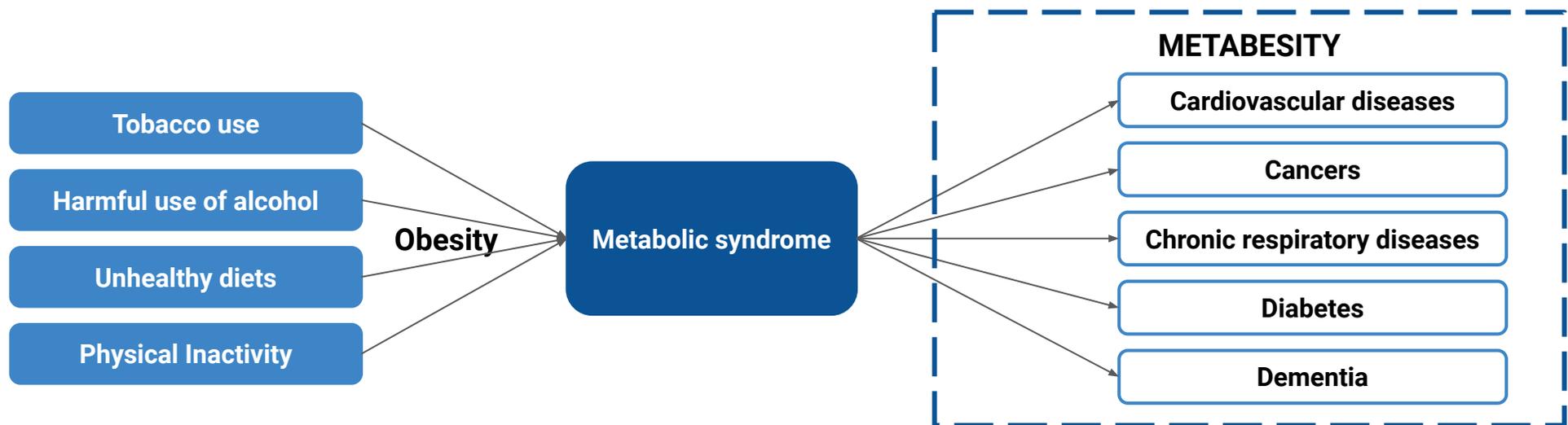
Both citizens of Singapore and Hong Kong enjoy high-quality healthcare, live long lives with low maternal and infant mortality rates. Singapore is known for having exceptional medical care and an enviable health insurance system. In contrast, Hong Kong has expensive private healthcare that is not affordable for lower socio-economic groups. Singapore has the 5th highest rate of physicians and nurses per capita, suggesting that health services are abundant. Hong Kong has shortage of doctors and other health professionals in public sector. In Hong Kong, the elderly population is particularly vulnerable, facing significant difficulties in accessing primary healthcare services.

Influence of Age on the Prevalence and Components of Metabesity and the Association with Mortality Risk Factors

Noncommunicable diseases (NCDs), also known as chronic diseases, tend to be of long duration and are the result of a combination of genetic, physiological, environmental and behavior factors. Such diseases have common metabolic roots, and their interconnection can be called “**metabesity.**”

The main types of NCDs are cardiovascular diseases (such as heart attacks and stroke), cancers, chronic respiratory diseases (such as chronic obstructive pulmonary disease and asthma) and diabetes. These conditions are often associated with older age groups. Among age-related changes are also dementia and severe memory loss that are considered to be not part of the normal aging process.

The prevalence of NCDs are considered to be a “**slow motion disaster.**” Noncommunicable diseases are driven by forces that include unplanned urbanization, globalization of unhealthy lifestyles and population aging. Unhealthy diets and a lack of physical activity may show up in people as raised blood pressure, increased blood glucose, overweight and obesity. These are called “metabolic risk factors” and can lead to cardiovascular disease, the leading NCD with regard to premature deaths. All risk factors of NCDs lie in non-health sectors, requiring collaboration across all of government and all of society to combat them.



Longevity Ranking of 50 Countries

Rank	Country	Score
1	Singapore	0.755
2	Hong Kong	0.750
3	Israel	0.744
4	Switzerland	0.731
5	Iceland	0.708
6	Luxembourg	0.707
7	United States	0.704
8	New Zealand	0.702
9	Norway	0.692
10	Sweden	0.690
11	Qatar	0.689
12	Denmark	0.687
13	Ireland	0.683
14	Australia	0.682
15	United Kingdom	0.681
16	Japan	0.678
17	Canada	0.676
18	Netherlands	0.673
19	Finland	0.668
20	Spain	0.667
21	Malta	0.661
22	Republic of Korea	0.659
23	France	0.657
24	Germany	0.657
25	Belgium	0.655

Rank	Country	Score
26	United Arab Emirates	0.655
27	Austria	0.651
28	Panama	0.645
29	Chile	0.636
30	Italy	0.633
31	Costa Rica	0.632
32	Slovenia	0.620
33	Cuba	0.617
34	Saudi Arabia	0.610
35	Poland	0.607
36	Mexico	0.607
37	Portugal	0.605
38	Czech Republic	0.602
39	Argentina	0.594
40	Slovakia	0.589
41	Estonia	0.586
42	Turkey	0.568
43	Greece	0.564
44	China	0.563
45	Indonesia	0.525
46	Brazil	0.521
47	Russia	0.517
48	Iran	0.502
49	India	0.468
50	South Africa	0.417

Inequality in health, education and income levels of population across countries is increasing between top-ranked, high-income countries and bottom-ranked, predominantly low-income countries.

The countries doing best in the Ranking have social and economic policies to improve healthcare systems, and wellbeing, decrease disease burden and engage healthy lifestyle. They have long-standing social welfare policies on better access to healthcare, as well as, minimization of behavioural risk factors including smoking and alcohol use, as well as diet and low physical activity.

At the same time, bottom-rank low-income countries care about their citizens less than countries doing best in the Ranking. It comes out medicine, insurances, policies, dealing with economics issues. This complex is a reason to inequality in health.

Singapore Example



General metrics

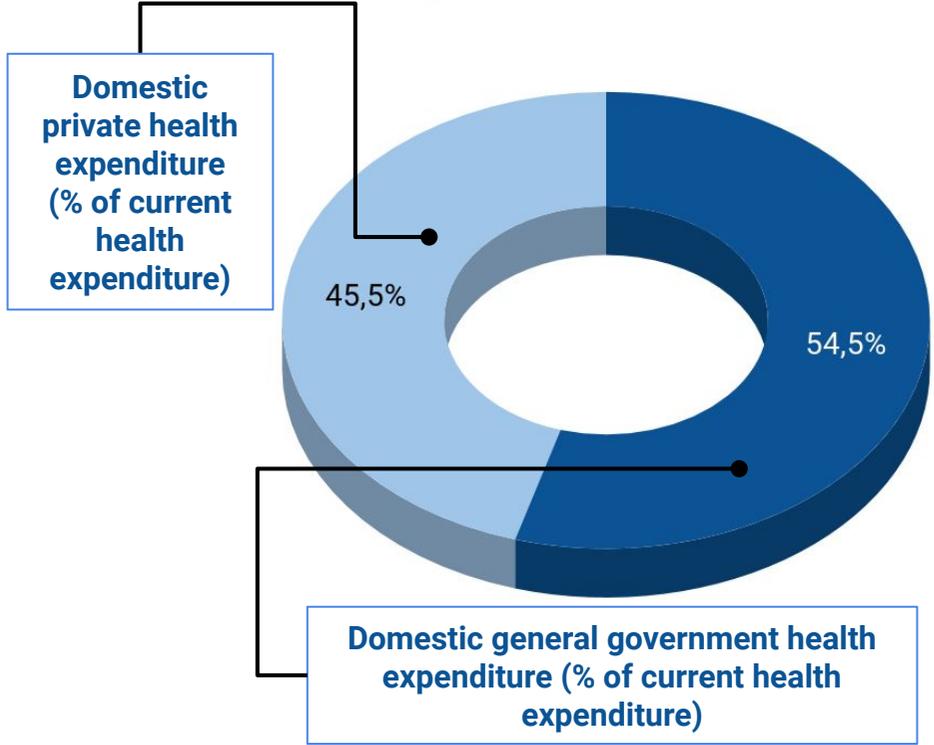
HALE	Both Sexes HALE (2016)	76.2 years
	HALE/Life Expectancy Difference 2016	6.7
Economy	GDP per Capita, Current Prices (2016)	56.72 thousand (\$)
	Annual GDP Growth (2016)	3 %
Healthcare	Current Health Expenditure per Capita (2016)	2.46 thousand (\$)
	Public Health Care Expenditure 2016	4.47 % of GDP
Retirement	Age Dependency Ratio 2016	38
	Population over 65, 2016	12.3 %
	Number of WHO Age Friendly Cities and Communities	1
General Health Status	Alcohol Consumption per Capita (Litres of Pure Alcohol) 2016	2
	Annual Cigarette Consumption (Units per Capita) 2016	851
	Prevalence of Overweight among Adults 2016 (Age-Standardized Estimate)	31.8 % of adults

Longevity-Related Indices

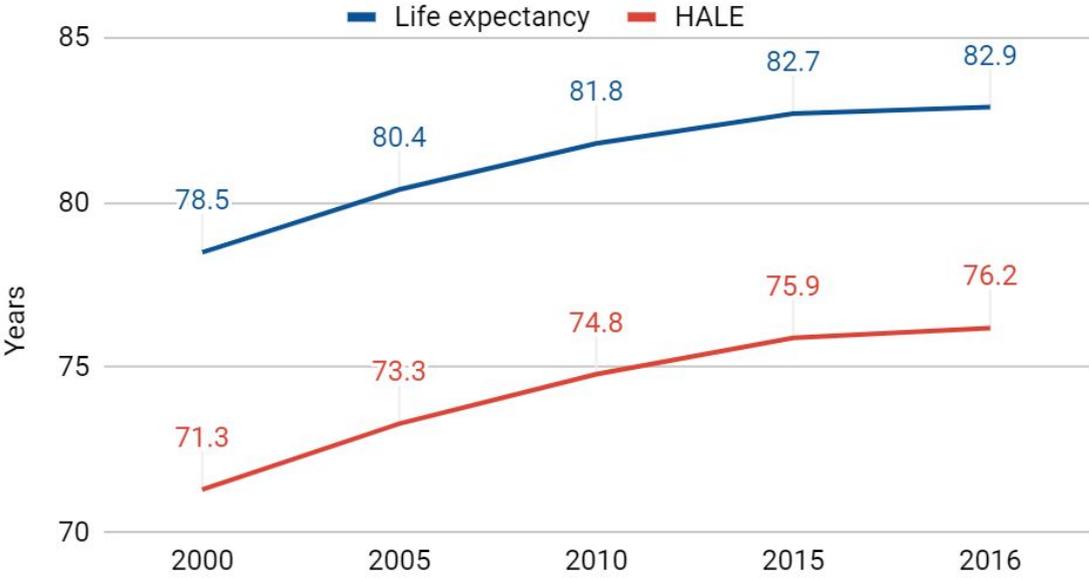


- The Healthcare Access and Quality Index -2016: **91**
- Human Development Index 2016: **0.93**
- E-Government Development Index 2016: **0.88**
- Corruption Perceptions Index 2016: **84**
- Global Gender Gap Index 2016: **0.71**
- Democracy Index 2016: **6.38**

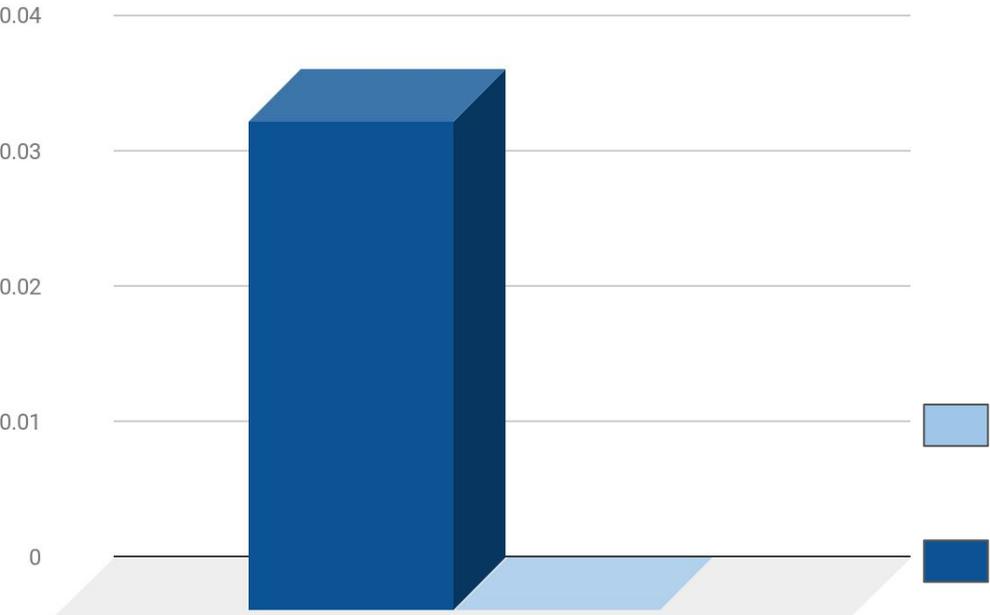
Current Healthcare Expenditure



Life Expectancy and Health-adjusted Life Expectancy



Effectiveness ratios



Chronic disease care is a critical part of people's health. Patients should be persuaded in regards to exercise, diet and lifestyle change: all important for chronic disease control. Caregivers and patients should be empowered through education, information and communication. Further implementation of eHealth initiatives will lead to the reduction of the number of patient visits to hospitals for routine checks, which will free up healthcare resources, enabling healthcare staff to better manage their time and focus on priorities.

HALE and Life Expectancy Difference CAGR (6 years)/Current health expenditures per capita (current US\$), CAGR (6 years)

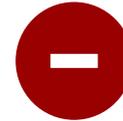
HALE CAGR (6 years)/Current health expenditures per capita (current US\$), CAGR (6 years)

SWOT Analysis of Healthcare in Singapore Example



STRENGTHS

- There is a single electronic health record (EHR) in use across the whole country, which makes everything very well-tuned.
- Developed healthcare infrastructure comprises a combination of public 'polyclinics' and hospitals and private medical clinics and hospitals to provide high quality treatment.
- Deliver care to people, focusing on quality, efficiency and cost.
- Developed universal healthcare coverage. Coverage is funded through a combination of government subsidies and private individual savings.



WEAKNESSES

- Healthcare system relies heavily on institutions
- Certain life-saving procedures result in some of the highest hospital bills that even insurance protection can not fully alleviate.
- Small population size that limits healthcare system potential.
- Despite subsidies long-term care is expensive.
- Out-of-pocket costs make up almost 37% of total healthcare expenditure in Singapore. **This figure is almost 3 times as high as the high-income country average and 1.4x higher than the East Asia & Pacific average.**



OPPORTUNITIES

- Favorable managing regulations and business environment
- Provision of subsidies to Singaporeans to reduce disparities and obtain treatment at private primary care providers.
- Building a sophisticated national electronic health record system, that collects, reports, and analyzes information to aid in formulation of policy, monitoring of implementation, and sharing of patient records.
- Utilizing their strength in the artificial intelligence industry for meaningful improvements in medical care.



THREATS

- The challenge of funding Singapore's escalating healthcare needs.
- Increasing competition for talent and labor.
- Increasing complexity and costs associated with advancing technology, equipment, treatment and training.
- The trend towards smaller nuclear families.
- Ageing places a great burden on many fronts including health infrastructure, insurance premiums, caregiving professionals and private finances.
- Environmental pollution problems.

Analysis of Strengths and Weaknesses of Health Care System in Singapore Example



- Singapore gets a lot of attention because of the way it pays for its health care system. What's less noticed is its delivery system. Primary care, which is mostly at low cost, is provided mostly by the private sector.
- Government control applies to public health initiatives. Officials began to worry about diabetes, so they acted. School lunches have been improved. Regulations have been passed to make meals on government properties and events healthier. In Singapore, campaigns have encouraged drinking water, and healthier food choice labels have been mandated. The country, with control over its food importation, even got beverage manufacturers to agree to reduce sugar content in drinks to a maximum of 12 percent by 2020.
- Relatively low level of obesity and decreasing level of overweight among adults. In 2017, 36.2% of Singaporeans aged 18 to 69 are overweight. This is a drop from 2010, when a national survey found 40.1% of adults were overweight.
- The polyclinics is focused on efficiency. They have been designed to process as many patients as quickly as possible.



- There is need to face illnesses that are more typical of this region. In Singapore, about one in five children suffer from asthma. While Singapore itself is not a significant producer of air pollution, neighbouring countries Malaysia and Indonesia still practice slash-and-burn agriculture, as well as intensive logging and heavy industrial manufacturing. This air pollution causes "smog cough", difficulty breathing, respiratory irritation and even asthma.
- Environmental conditions cause negative impact on health-adjusted life expectancy and life expectancy at birth itself. Singapore has high UV levels all year round due to its proximity to the equator, with the UV index (ranging from 0 to extreme levels of 11 and beyond) soaring as high as 9 in some months.
- Singapore has the second-highest proportion of diabetics among developed nations, with one out of nine Singaporeans between 18 and 69 years old being affected by the disease.
- Due to more sedentary lifestyles among Singaporeans, childhood obesity is on the rise.

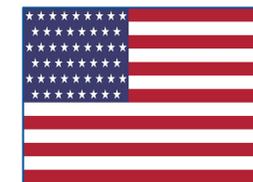
Recommendations for Singapore

Example

- **Minimising out-of-pocket medical costs.** Medisave forms only a very small part of total expenditures. The should ensure that basic services remain affordable for everybody.
- **Plan and implement developmentally appropriate programs in school-aged environments, encourage social media responsibility to maintain social network and develop inclusive society for elderly.**
- **Focus on health status of elderly.** Health status is one of the most important indicators of well-being, and it predicts a large proportion of societal expenditures on health and social services for the elderly. It depends on individual lifestyle factors, social and community networks, general socioeconomic. Health status is also reciprocally affected by social and political policies and programs.
- **There is a need to do a better job educating medical students and medical residents on how to adapt to an era of technology-enabled healthcare.**
- **Promote research and initiate a wider utilization of Artificial Intelligence for preventive medicine.** Research is vital in providing the knowledge needed to improve health outcomes and reduce inequalities.
- **Identifying and modifying or avoiding key risk factors for diseases, including diabetes, cardiovascular diseases and respiratory conditions.** It can be caused by lack of exercise, ageing, an unhealthy diet and environmental pollution. If left untreated, it may lead to more serious conditions such as kidney failure, coronary heart disease, blindness and even the need for amputations. Initiate strategies to improve the health of the nation, promote the importance of focusing on socio-demographic factors to ensure delivery of healthy newborns and decrease the burden of mortality factors.
- **Manage to maintain modest overall spending.** Singapore has to calibrate a developed portfolio of targeted tools to address specific problems to respond to aging in the coming years. The coordinated use of these tools ensures that healthcare providers compete on affordability and quality, and that total costs remain relatively low.

United States of America

Example



General metrics

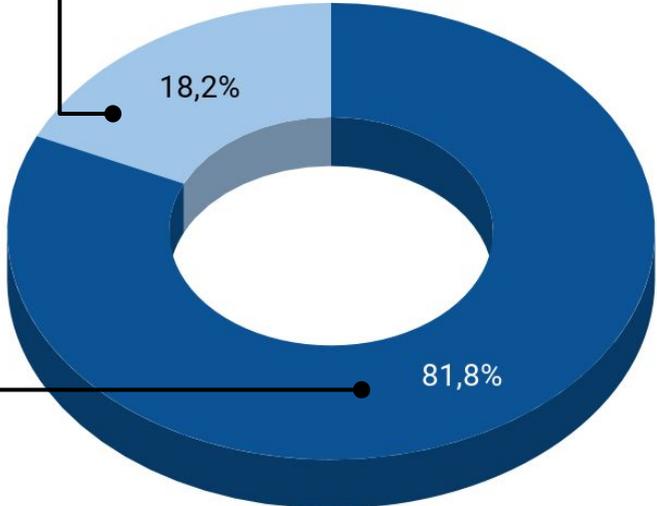
HALE	Both Sexes HALE (2016)	68.5 years
	HALE/Life Expectancy Difference 2016	10
Economy	GDP per Capita, Current Prices (2016)	57.90 thousand (\$)
	Annual GDP Growth (2016)	1.6 %
Healthcare	Current Health Expenditure per Capita (2016)	9.87 thousand (\$)
	Public Health Care Expenditure 2016	17.07 % of GDP
Retirement	Age Dependency Ratio 2016	52
	Population over 65, 2016	15 %
	Number of WHO Age Friendly Cities and Communities	357
General Health Status	Alcohol Consumption per Capita (Litres of Pure Alcohol) 2016	9.8
	Annual Cigarette Consumption (Units per Capita) 2016	1016
	Prevalence of Overweight among Adults 2016 (Age-Standardized Estimate)	67.9 % of adults

Longevity-Related Indices

- The Healthcare Access and Quality Index -2016: **89**
- Human Development Index 2016: **0.92**
- E-Government Development Index 2016: **0.84**
- Corruption Perceptions Index 2016: **74**
- Global Gender Gap Index 2016: **0.72**
- Democracy Index 2016: **7.98**

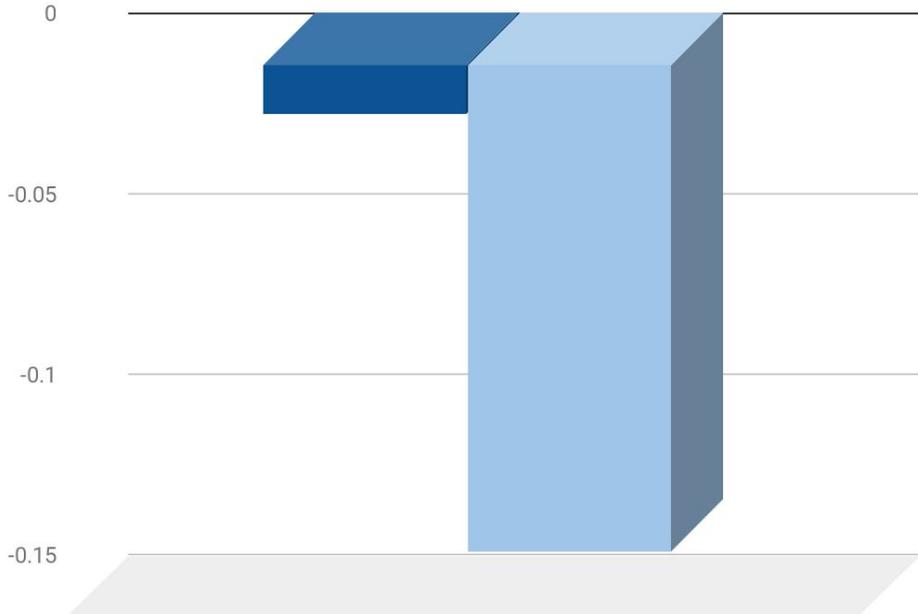
Current Healthcare Expenditure

Domestic private health expenditure (% of current health expenditure)

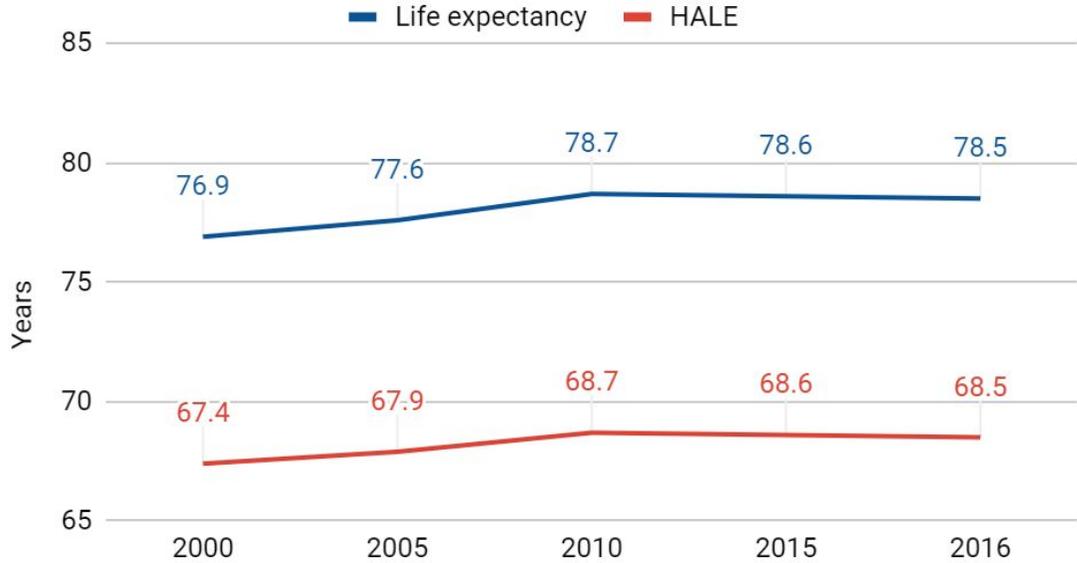


Domestic general government health expenditure (% of current health expenditure)

Effectiveness ratios



Life Expectancy and Health-adjusted Life Expectancy



In order to improve their National Healthy Longevity and Health-Adjusted Life Expectancy (HALE) the government of United States should prioritize the development of a competitive Longevity Industry Development Plan, prioritize Healthy Longevity as a major national priority item, improve health insurance for poor population to reduce income-based healthcare inequalities, and allocate more healthcare dollars to preventive medicine, early diagnosis of disease, healthy lifestyle programs, and Artificial Intelligence for preventive medicine in particular.

HALE and Life Expectancy Difference CAGR (6 years)/Current health expenditures per capita (current US\$), CAGR (6 years)

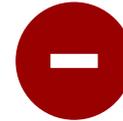
HALE CAGR (6 years)/Current health expenditures per capita (current US\$), CAGR (6 years)

SWOT Analysis of Healthcare in the United States Example



STRENGTHS

- Highly dedicated professional on all levels of health care system.
- Research, innovation and entrepreneurship.
- Healthcare system runs like a business system. Healthcare providers compete to get the most business to provide the best care, providing the choice for patients.
- In recent years the U.S. showed promise in the control of chronic conditions, smoking rates, the use of electronic files for record keeping, and in certain aspects of hospital and long-term care.



WEAKNESSES

- Roughly 20 to 25 % of American health care spending is wasteful.
- Poor access and affordability of healthcare insurance. People with lower incomes spend a significantly higher share of their family income towards premium contributions and out-of-pocket medical expenses.
- There are wide differences in the burden of disease at the state level. Specific diseases and risk factors, such as drug use disorders, high BMI, poor diet, high fasting plasma glucose level, and alcohol use disorders are increasing and warrant increased attention.



OPPORTUNITIES

- Prioritize and leverage the potential of specialty-specific analytics solutions to investigate drug utilization, treatment variability, clinical trial eligibility.
- Participatory medicine: empower individuals to be able to manage their own health.
- Utilization of Artificial Intelligence in longevity industry.
- Growth of regenerative medicine.
- Legislation to provide for comprehensive health insurance coverage for all United States residents and improved health care delivery.



THREATS

- Further increase in healthcare costs.
- Insolvency predictions for government-funded schemes
- Increase in financial burden on the patient, leading to larger medical debt
- Rise of systemic issues such as sick care. The health care delivery system reflects society's ills and reinforces them
- Income inequality continues to grow. In 2015, the top 1 percent of families in the United States made more than 25 times what families in the bottom 99 percent did.

Analysis of Strengths and Weaknesses of Health Care System in the United States Example



- The United States is renowned for its leadership in biomedical research, its cutting-edge medical technology, and its hospitals and specialists.
- The mortality rate for all cancers has fallen steadily, overall cancer death rate **fell by 26%** during 1991-2015.
- Dramatic progress in lowering mortality from diseases of the circulatory system. In the U.S., the mortality rate has fallen from 629 deaths per 100,000 population in 1980 to 257 in 2015.
- Strong private sector orientation facilitates ready access to all manner of services for those with stable coverage and strongly encourages on-going medical innovation by product manufacturers.
- High-quality services are available for those with good insurance.
- Major technological breakthroughs have occurred in treating numerous diseases.



- **According to World Health Organization Ranking: The World Health System**, the health care system of the United States is 37.
- The United States is one of the few developed nations that lacks universal healthcare.
- Problems with ensuring Americans' access to the system and providing quality care are a long-standing concern of policy makers and the public.
- High out-of-pocket expenses (**\$1,813 or 11%** of current healthcare expenditures in 2017) make health care services, pharmaceuticals, and medical supplies increasingly unaffordable.
- In the United States, health care delivery and financing are fragmented across thousands of health systems and payers and across government and the private sector, creating inefficiencies and coordination problems.
- Many Americans rely on emergency departments for acute, chronic, and even preventive care but not on preventive care itself. **According to a recent survey by the Commonwealth Fund**, patients in the U.S. visit the emergency department for conditions that could have been treated by a regular doctor or place of care nearby.

Recommendations for the United States

Example

- **Move to a life-course perspective in tackling the rising epidemic of “metabesity.”** Initiate strategies to improve the health of the nation, promote the importance of focusing on socio-demographic factors to ensure delivery of healthy newborns and decrease the burden of behavioral factors such as insufficient physical ability, overweight, alcohol abuse, smoking. This will stimulate policy initiatives that supplement income and improve educational opportunities, housing prospects, and social mobility as income is strongly associated with morbidity and mortality.
- **This shift from treatment to prevention is ultimately leading to a coming age of precision health.** Health care leaders must shift the nation’s “sick care” approach to care that is preventive and comprehensive. “Precision health” denotes the continuous stabilization of health and the maximum-obtainable maintenance of a young biological age via the routine application of micro-interventions in response to ongoing fluctuations in biomarkers of aging and health.
- **Holding health insurers accountable.** By focusing on insurers’ payment strategies and quantitative goals and results, closer scrutiny of health insurers can drive systemic reforms to improve safety, increase care coordination, boost prevention, and bring down costs for consumers and small businesses.
- **Utilizing strength of the United States in artificial intelligence industry leads to meaningful improvements in medical care.** Translating the tremendous growth in data into clinical insights falls into the hands of AI (artificial intelligence)/ML (machine learning) platforms. The rapid growth in investment in AI and cloud computing are beginning to create the foundations for the precision health market of the future. But apart from advanced research it is important to provide effective, low-cost treatments that work, triggering unnecessary treatments and higher costs down the line.
- **A public option health plan.** Providing Americans under 65 with the option of buying into Medicare or Medicaid could provide consumers with a cheaper alternative to commercial health insurance and ensure that there are coverage options for consumers who lose their employer-based coverage.

Conclusions

- I. **Nowadays such complex indicators as life expectancy and health-adjusted life expectancy go beyond the traditional measures of the demographic potential of a country.**

Longevity progressiveness is important for driving economic progress and competitiveness—both for developed and developing economies. Many governments are putting policies on longevity at the center of their growth strategies and budget planning. The definition of longevity has broadened—it is no longer quantitative increase in life expectancy at birth. Today longevity is about social inclusiveness, high quality of life, technical innovations in care delivery and medical treatment, and modified business and governmental models.

- II. **The prevalence of NCDs are considered to be a “slow motion disaster” and rising challenge for life expectancy and health-adjusted life expectancy dynamics.**

Noncommunicable diseases (NCDs) tend to be of long duration and are the result of a combination of genetic, physiological, environmental and behavioral factors. Such diseases have common metabolic roots. They are the major reason of the increasing risk of premature death and result in more disability years in older age.

- III. **All risk factors of NCDs lie in non-health sectors, requiring collaboration across all of government and all of society to combat them.**

Noncommunicable diseases are driven by forces that include unplanned urbanization, globalization of unhealthy lifestyles and population aging. Unhealthy diets and a lack of physical activity may show up in people as raised blood pressure, increased blood glucose, overweight and obesity. These are called metabolic risk factors that can lead to cardiovascular disease, the leading NCD in terms of premature deaths.

- IV. **Healthy Longevity progressiveness is about the public-private balance in health care system.**

It is important for longevity governance find effective combination of universal health coverage system, support from citizens and the private sector.

Conclusions

v. Low socioeconomic inequality and reduced disparity in health outcomes should be key goals in Healthy Longevity plans and healthcare policies.

Research shows that people living in more affluent areas live significantly longer than people living in deprived areas. Socio-economic inequalities in life expectancy are also widening in both sexes as a result of greater gains in life expectancy in less deprived populations. Many health outcomes – everything from life expectancy to infant mortality and obesity – can be linked to the level of economic inequality within a given population. Greater economic inequality appears to lead to worse health outcomes.

vi. Healthcare policies should be focused on the care delivery to improve healthcare outcomes and provide higher efficiency of healthcare expenditure.

Nowadays it is unclear why countries are investing so much money in research focused on reducing death rates in the elderly, if the consequence is advancing ageing, that can be described as the increase in disability years, plus pension, and social and medical costs, in an unsustainable way. The policy should be focused on health status for measuring efficiency ratio of healthcare system.

vii. A focus on national-level health status and its temporal trajectory is critical.

Health status is one of the most important indicators of well-being, and it predicts a large proportion of societal expenditures on health and social services for the elderly. It depends on individual lifestyle factors, social and community networks, general socioeconomic. Health status is also reciprocally affected by social and political policies and programs.

viii. Corruption in healthcare is a barrier for improvements of care delivery and indirectly affects the slowdown of both life expectancy and health-adjusted life expectancy growth.

Corruption significantly weakens overall health system performance, and has been found by multiple studies to have a significant negative impact on important health outcomes. Corruption is a major reason of high administrative costs and wasteful healthcare expenditures in clinical care, operational activities and governance. It results in long waiting periods, unmet needs of population and high level of satisfaction of healthcare system performance in general.

Conclusions

IX. There is an evident linkage between level of income and health status: wealthier nation healthier population.

Healthcare performance is strongly dependent on the economy, but also on the health systems themselves. Investment in health is not only a desirable, but also an essential priority for most societies. Health status depends on the development of healthcare infrastructure, medical facilities, high qualification of medical staff, provision of healthcare coverage and competition in private insurance sector. All four pillars of Healthy Longevity Progressiveness, accessibility, affordability, health outcomes and spendings, depends on economic conditions, successful provision of reforms. However, health systems face tough and complex challenges, in part derived from new pressures, such as ageing populations, growing prevalence of chronic illnesses, and intensive use of expensive yet vital health technologies.

X. Utilisation of Artificial Intelligence opportunities in preventive medicine to minimise costs and improve accessibility of healthcare services.

AI has great potential in terms of tackling the problem of bureaucracy and inefficient administration, relieving doctors from time-consuming administrative tasks and giving them more time to spend with their patients. By automating and improving processes, artificial intelligence can benefit both patients and medical staff. By optimising patient processing planning it can reduce the waiting time and length of stay for patients, and it can also help medical staff in their day-to-day work.

XI. Polluted environment and unfavorable climate conditions threaten average life span and health-adjusted life expectancy.

Countries are currently experiencing unusual environmental issues which provide serious health risks to people. Many developing countries lack the skill, technology and resources to handle climate change related problems like the developed countries. Hence, the outcome of the present research can aid in taking proactive measures which will put in check diurnal temperature variation, daily mean air temperature, relative humidity for Healthy Longevity increasing.

Strategic Consulting of Longevity Governance

In Q2 2019, following the appointment of Eric Kihlstrom (former Director of the **government-led £98 million Healthy Ageing Industrial Strategy Challenge Fund**) as its new Director, and becoming the main source of data and analytics for the UK **All-Party Parliamentary Group for Longevity**, Aging Analytics Agency began expanding the scope and focus of its efforts relating to deep industry analytics on the emerging front of the benchmarking and strategic consulting services relating to **government-led Longevity Industry** development and national policy efforts of various countries.

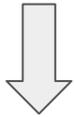
In early 2019, Aging Analytics Agency began shifting increasingly large proportions of its resources away from open-source landscape overviews and special case studies of the Longevity industries of various nations and towards **benchmarking** and **ranking** of the strength, relevance and proactivity of various entities including companies, investors, financial institutions and government initiatives within the Longevity sphere, leveraging the very broad and deep understanding of the global Longevity industry created through the production of tens of thousands of pages of global and regional landscape overviews from 2013 - 2018. in order to begin conducting **deeper, more targeted analytics**. Aging Analytics Agency is currently cooperating with a number of government departments and public sector bodies and authorities in the **UK, Singapore, Switzerland, Israel** and the **US** to create **advanced IT solutions, deep analytics, special case studies and composite sets of tangible recommendations and development plans for national industrial strategies**, science and technology policy, modernization and reforms in healthcare, frontier-technology sectors including Longevity, AI and Precision Health, and financial reforms relating to pension systems and insurance companies looking to transform the problem of ageing population into the opportunity of Healthy Longevity.

As per the example of the Singapore and the USA analysis below, which serves as an example of the scope and depth of our Longevity Policy analytical capabilities, Aging Analytics Agency is open to establishing strategic collaboration and consulting contracts with governments of progressive countries on projects and initiatives related to Longevity.

Longevity Governance	Recommendation Packs	Industrial Strategies	Precision Health
	Advanced IT Solutions	Analytics & Benchmarking	Modernization

2020: Global Longevity Governance Landscape Third Edition

National Longevity Development Plans Global Landscape Overview **First Edition**



- 12 countries in its analysis.
- The broad categories of a government initiative: different orders of magnitude; and the different areas of intervention, from the financial to the biomedical.
- Detailed project and initiative budget data analysis.
- Enhanced comparative analysis of government initiatives focused on ageing and Longevity.

Global Longevity Governance Landscape **Second Edition**



- 50 of countries in its analysis.
- 200 metrics (including a precise formulation for sub-metrics, metric categorization and metric weighting) and 10000 data points analyzed.
- Big data analysis of factors that affect gap between HALE and LE across countries .
- Full description of 50 countries' profiles, their strengths and weaknesses.
- Analysis of key problems that impede growth of countries profiled in this report.

Global Longevity Governance Landscape **Third Edition**



- 100 countries in its analysis.
- Detailed project and explanatory HALE factors analysis.
- Utilization of machine learning, including unsupervised (countries' clusterization) and supervised techniques (logistic regression).
- Comprehensive and precise understanding of the recent trend of development of Healthcare, and Longevity industries.
- Analysis of key features that increase investment attractiveness, and problems that impede growth of countries profiled in this report.



Link to the Report: www.aginganalytics.com/global-longevity-governance

E-mail: info@aginganalytics.com

Website: www.aginganalytics.com

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