



Wittgenstein Centre

FOR DEMOGRAPHY AND
GLOBAL HUMAN CAPITAL

Multi-dimensional population analysis

WIC Summer School 2016

Wolfgang Lutz



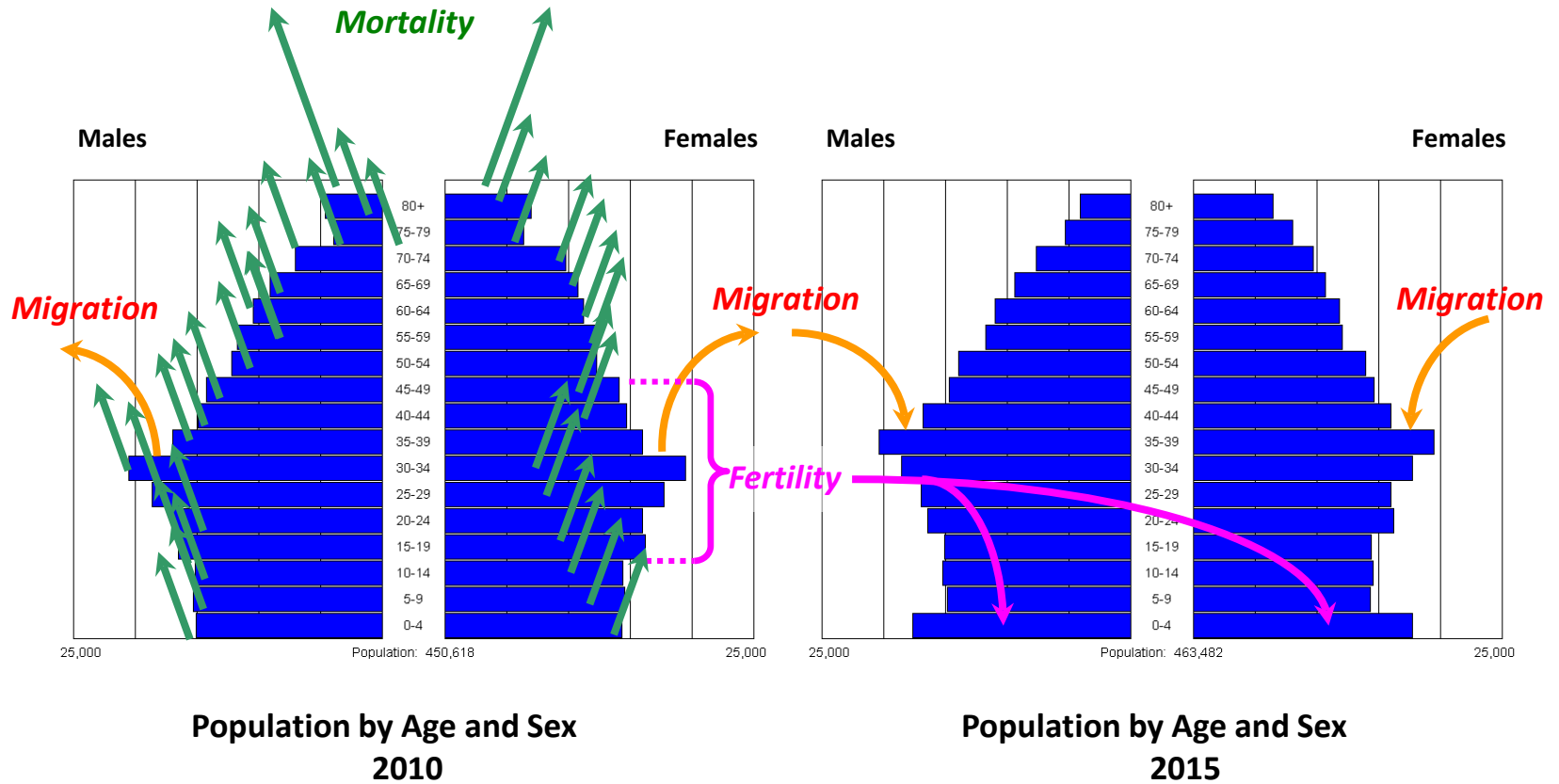
International Institute for
Applied Systems Analysis
www.iiasa.ac.at



Demography

- Mathematics of Groups of People
- Studies the changing size and composition of human populations
- Populations change through
 - Births (Fertility)
 - Deaths (Mortality)
 - Migration
- In the case of multi-dimensional analysis (more than age and sex structure), the models also include transition rates from one state to another.

The cohort-component projection method



Adding education to age and sex:

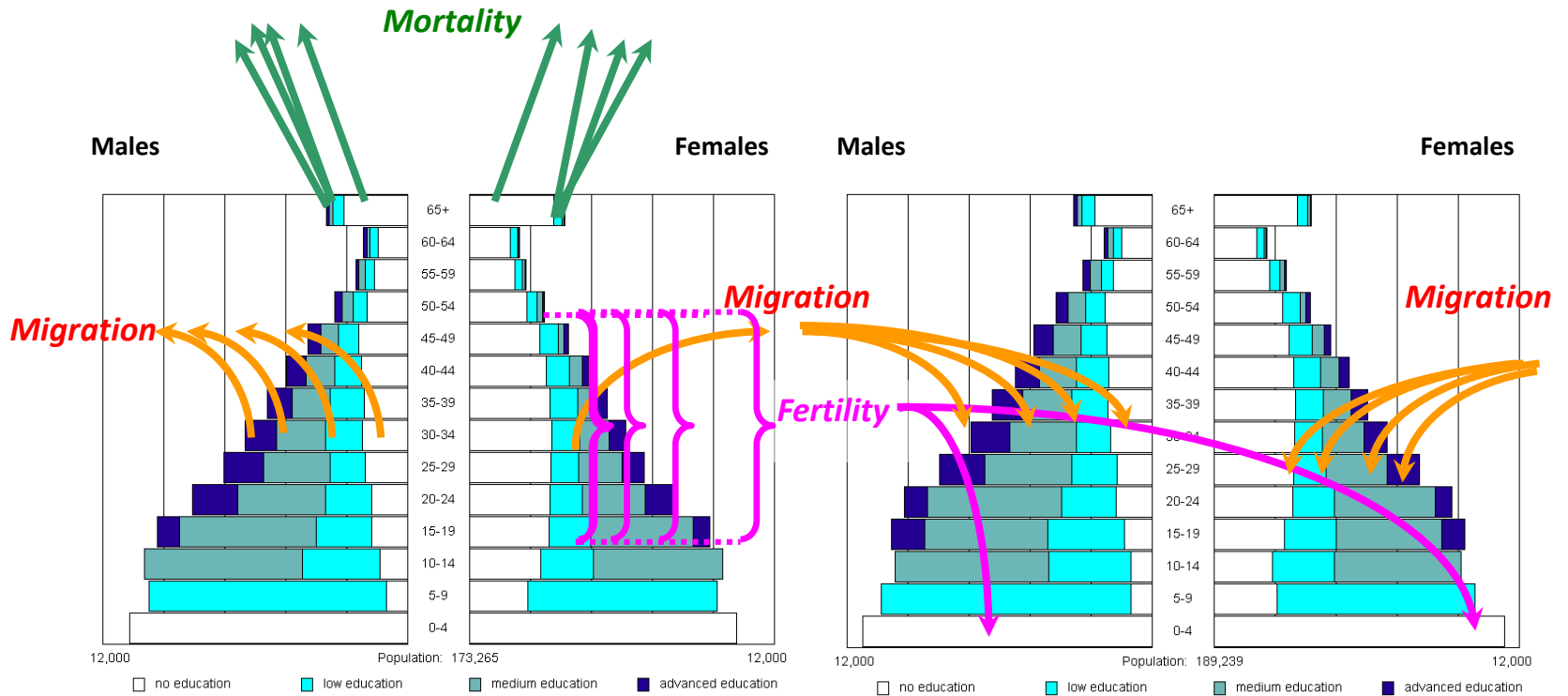
What is the education effect?

We have good reasons to assume “functional causality” from education to health and fertility. Education is not just a proxy for SES.

Age, sex, and education have all elements of social construction as well as physiological elements:

- Every learning experience builds new synapses in our brains and makes us “physiologically different” (Eric Kandel)
- Enhancement of cognitive skills
 - change risky behavior
 - extend personal planning horizon
 - learn from past damage
- Better access to relevant information
- Improvement of health and physical well-being

The multi-state projection method



**Population by Age, Sex, and Education
2010**

**Population by Age, Sex, and Education
2015**

Focus on the Human Resource Base for Sustainable Development

- Human Resources refer to the ability of people to help themselves and help others.
- They crucially depend on age, health, education, motivation, social networks etc.
- Education is central: Learning from the first day to old age (skills and empowerment).
- Formal education (school) is only one aspect of this that is fairly easy to measure.

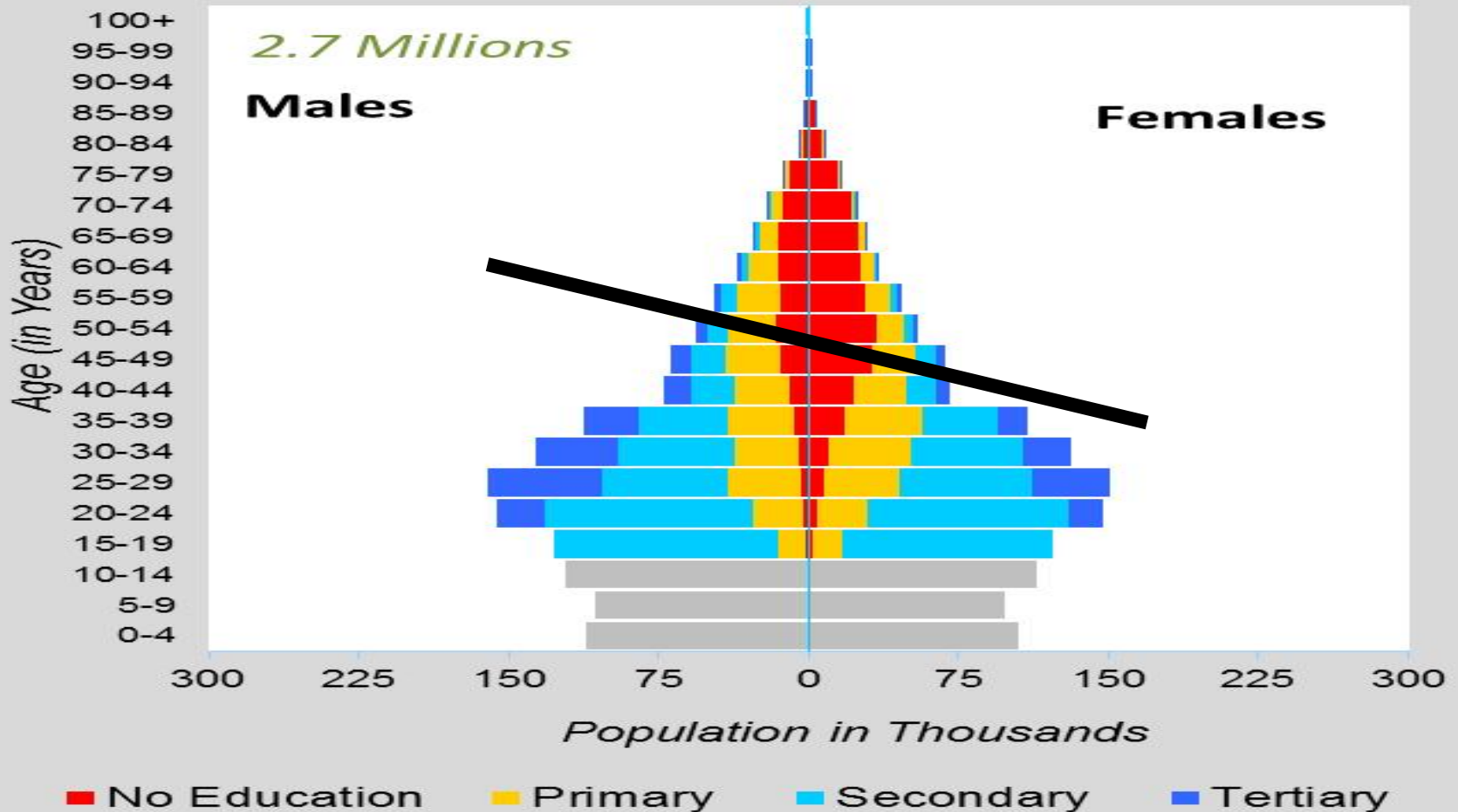
Human Capital = Population x Education (x Health)

- **Education:**
 - formal
 - quantity
 - quality
 - content
 - informal
- **Formal Education**
 - Education Flows – schooling - policy variable
 - Education Stocks** – change very slowly due to great momentum
- Measured by age, gender and
 - Mean years of schooling
 - Distribution by highest educational attainment

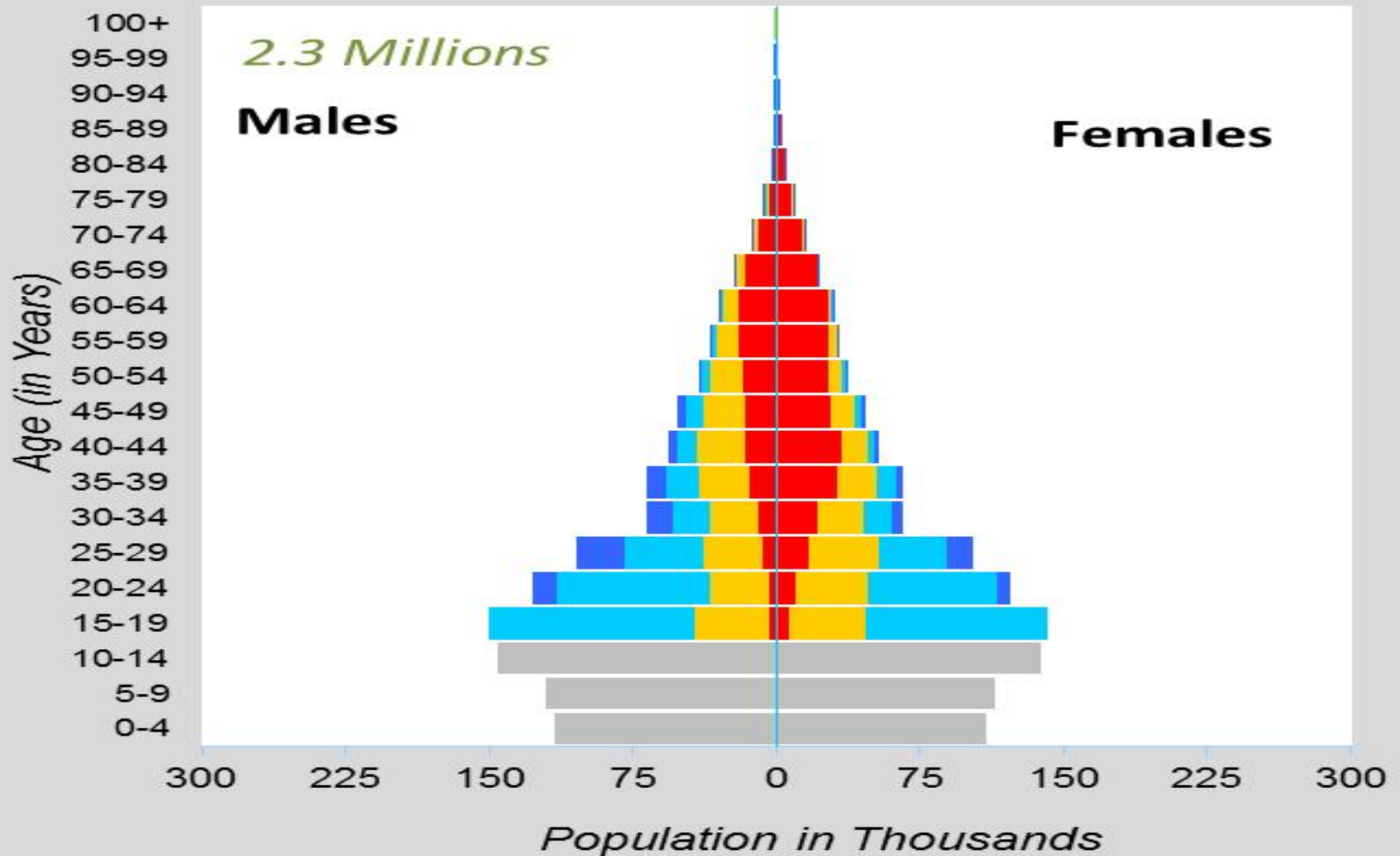
Singapore 1985: A society divided into two classes:

- * Modern highly educated and wealthy young
- * Uneducated and poor elderly

Singapore - 1985 BP

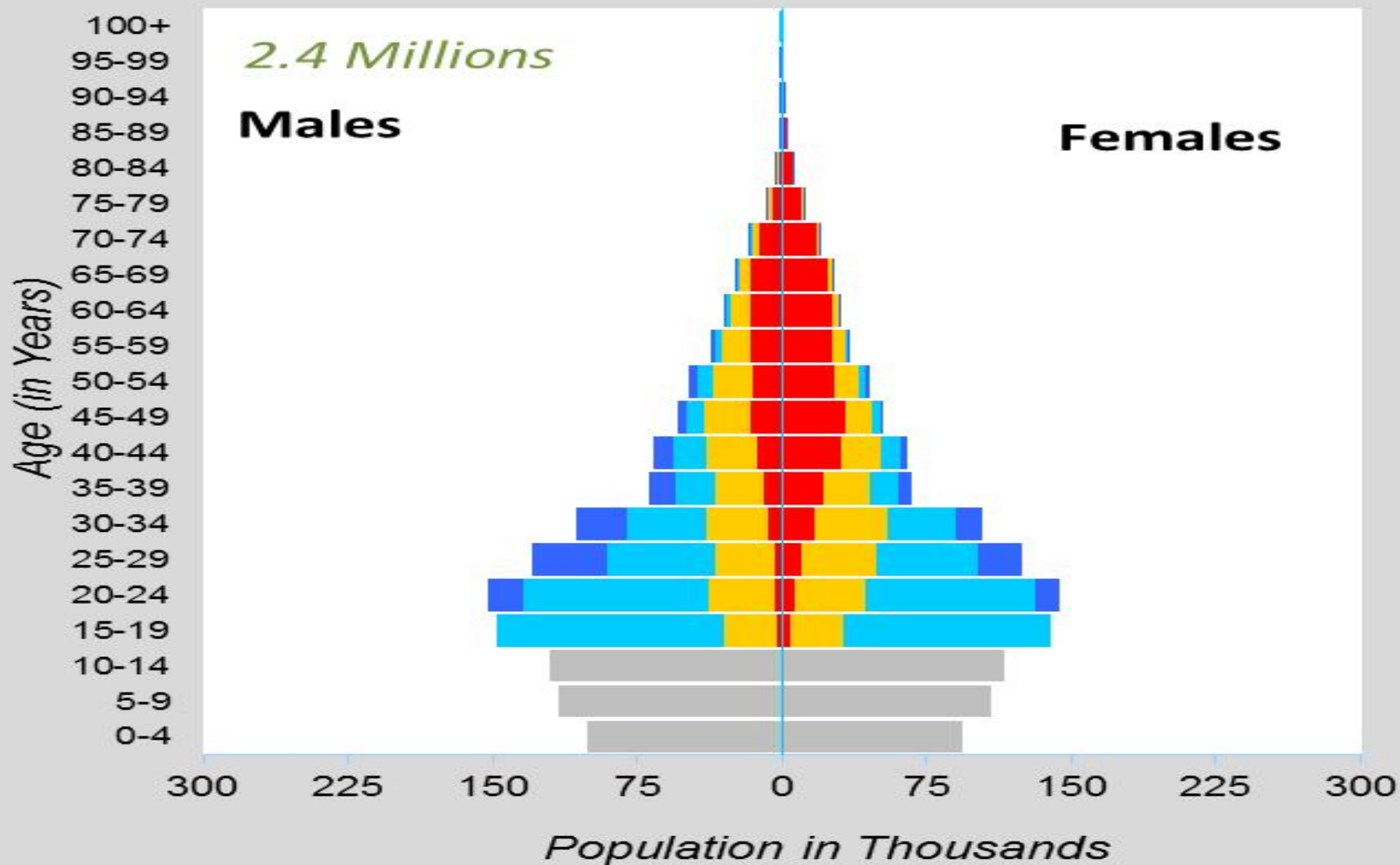


Singapore - 1975 BP



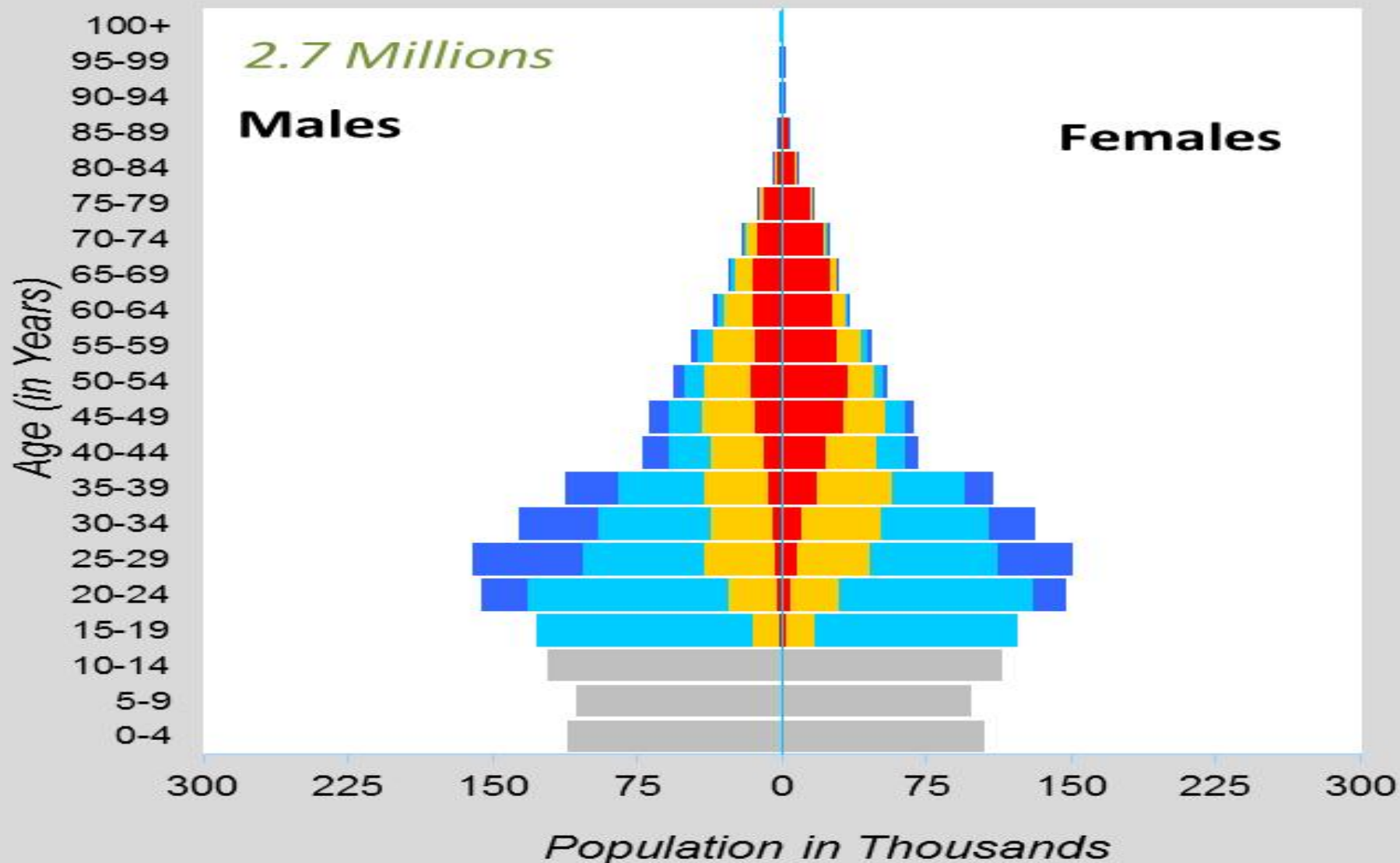
■ No Education ■ Primary ■ Secondary ■ Tertiary

Singapore - 1980 BP



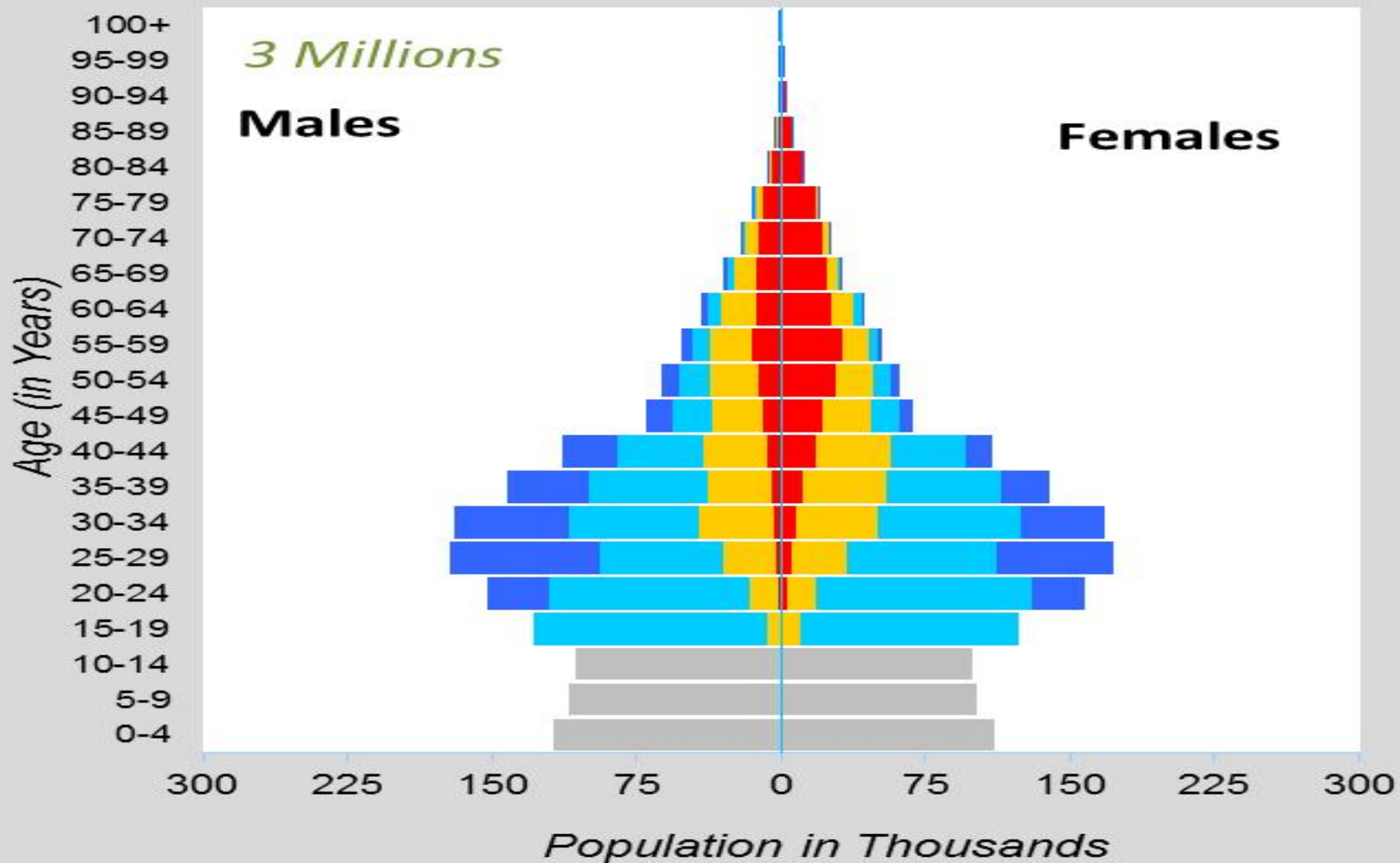
■ No Education ■ Primary ■ Secondary ■ Tertiary

Singapore - 1985 BP



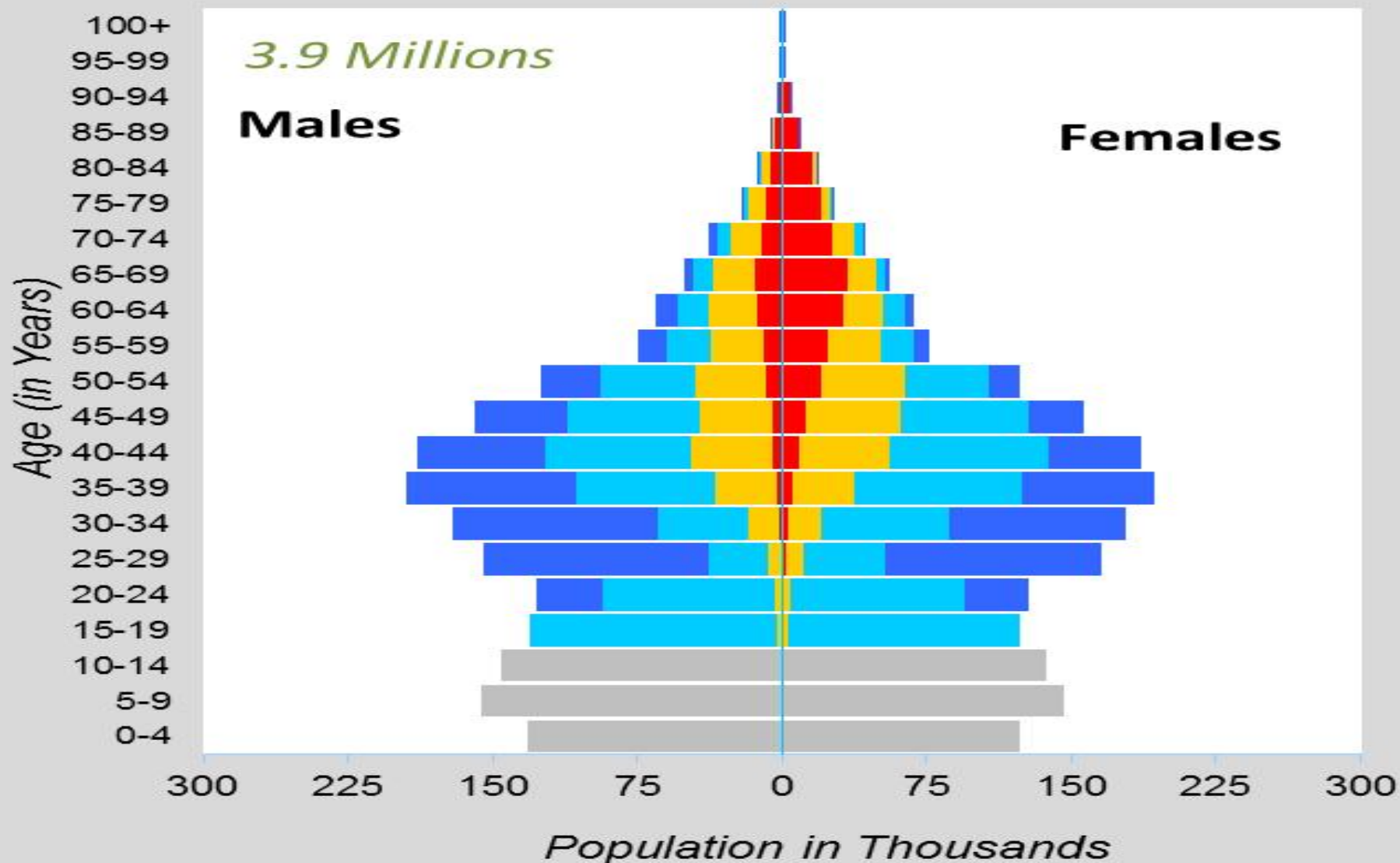
■ No Education ■ Primary ■ Secondary ■ Tertiary

Singapore - 1990 BP



■ No Education ■ Primary ■ Secondary ■ Tertiary

Singapore - 2000 BP



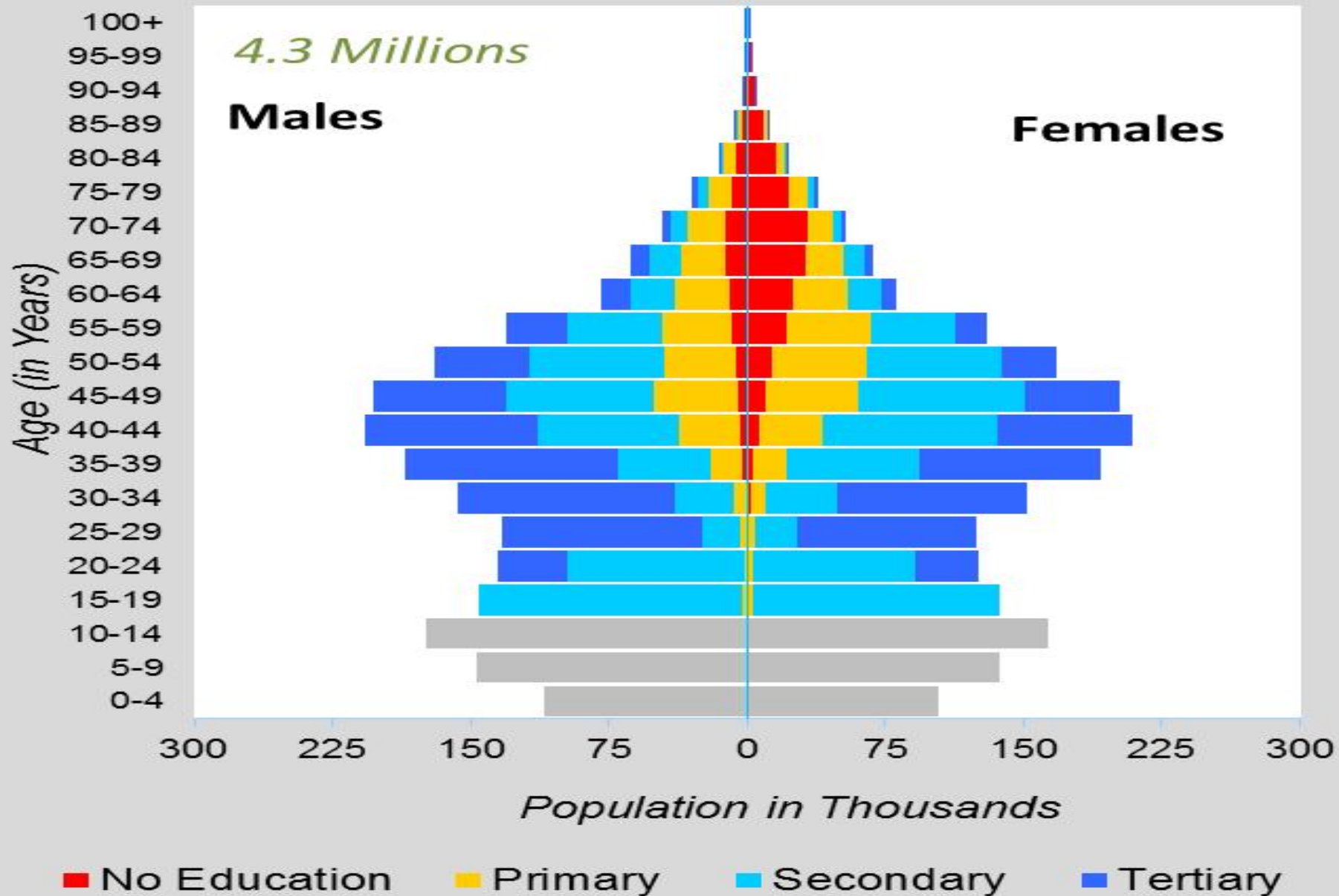
■ No Education

■ Primary

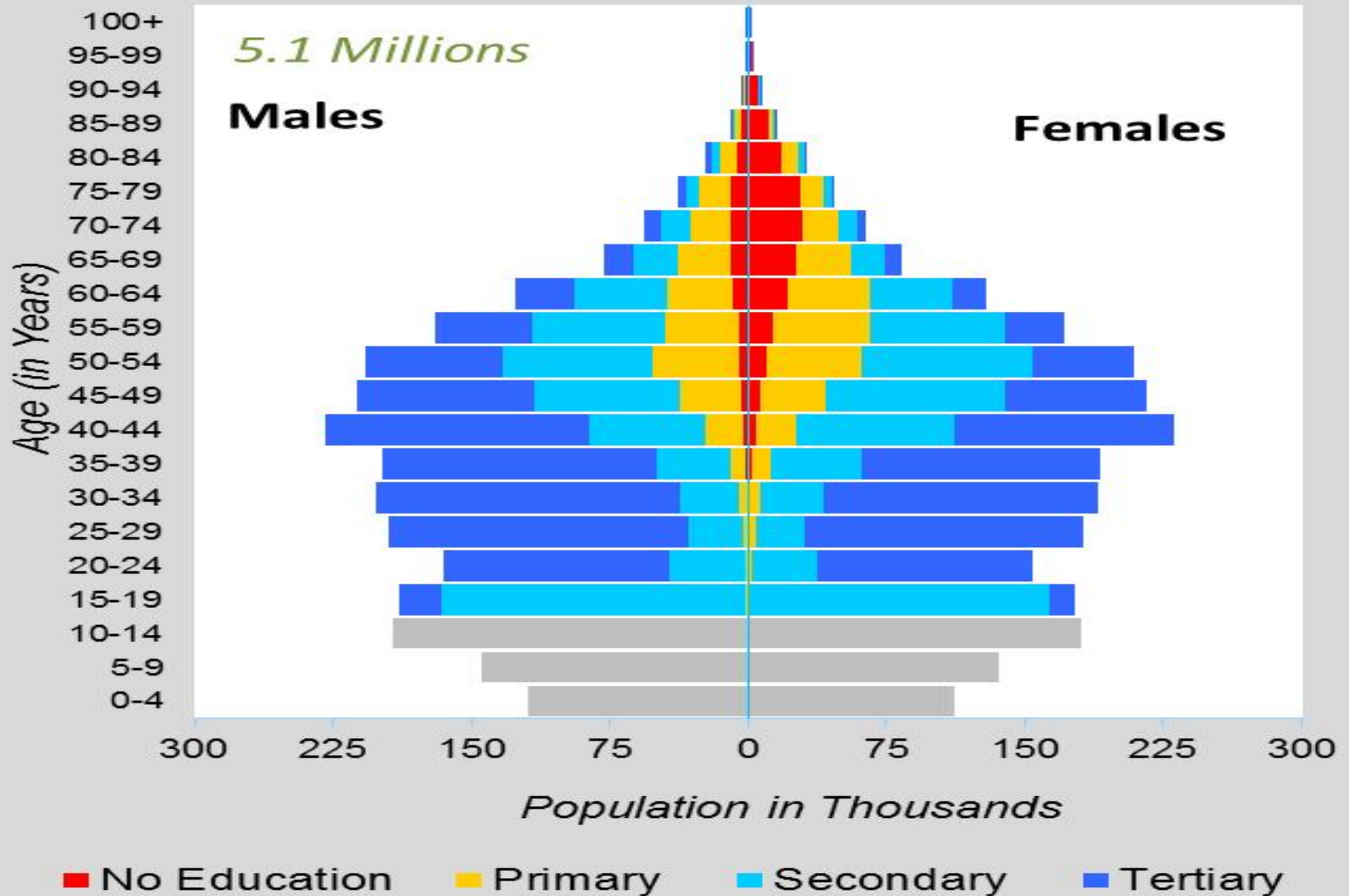
■ Secondary

■ Tertiary

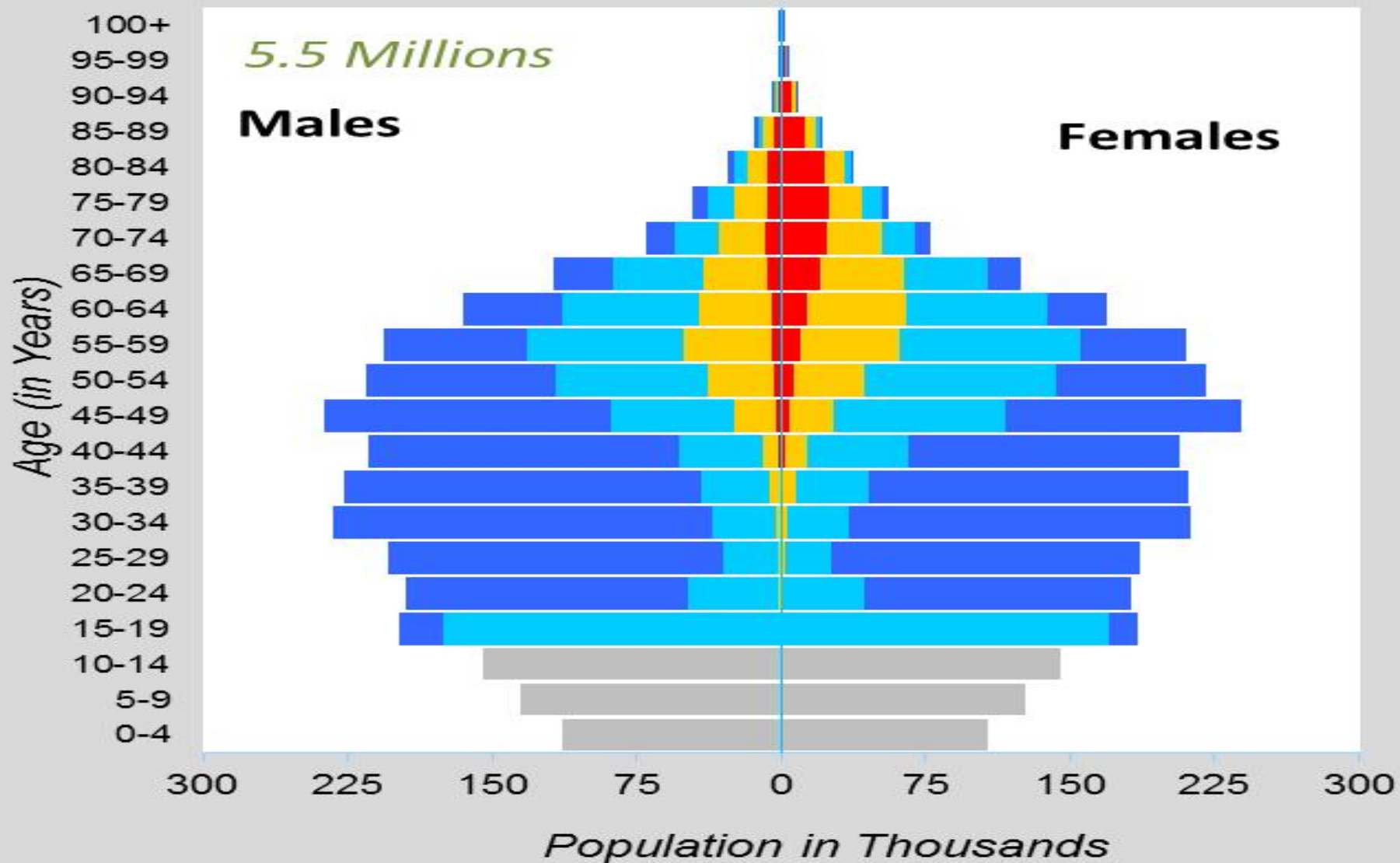
Singapore - 2005 BP



Singapore - 2010

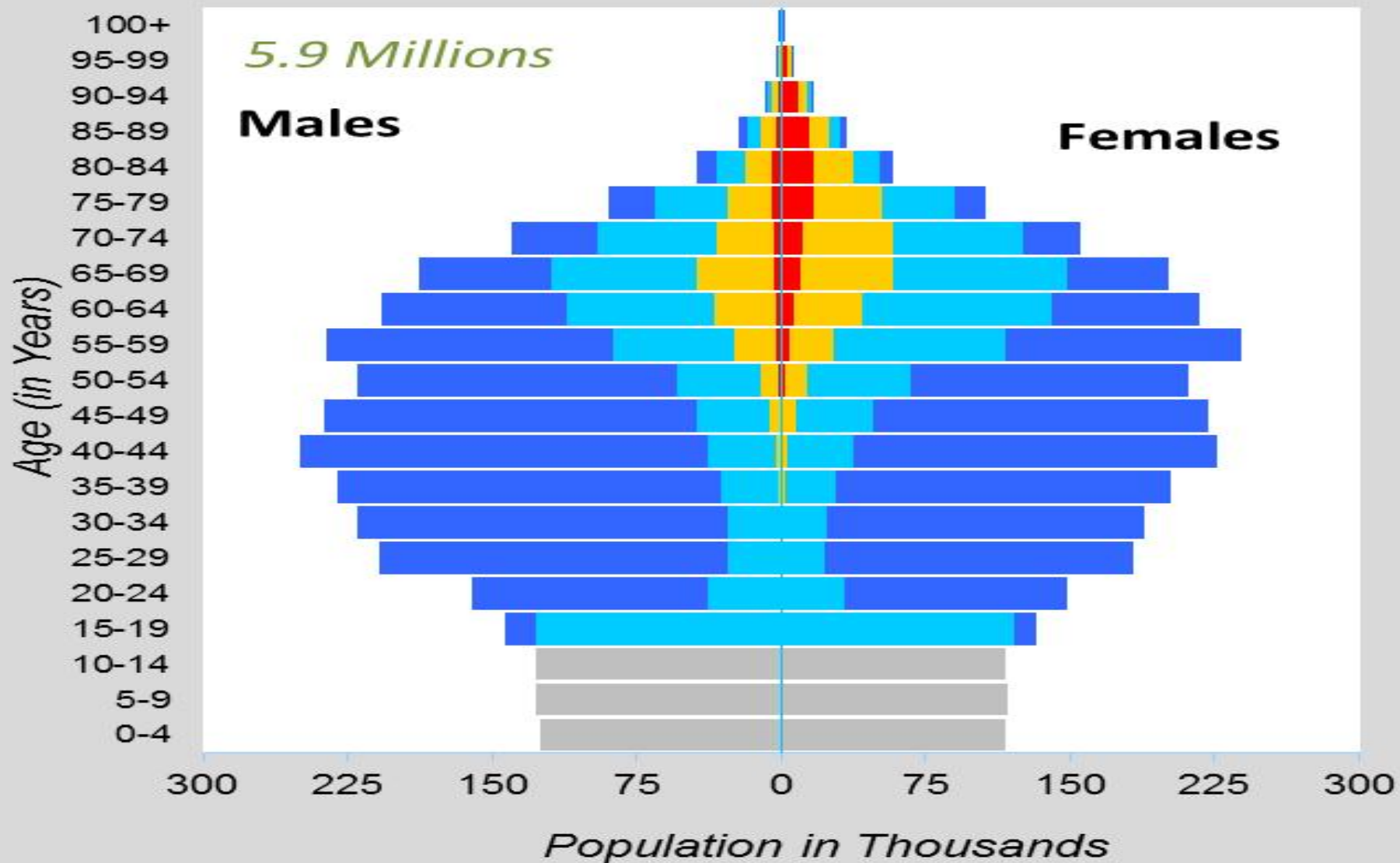


Singapore - 2015 SSP2



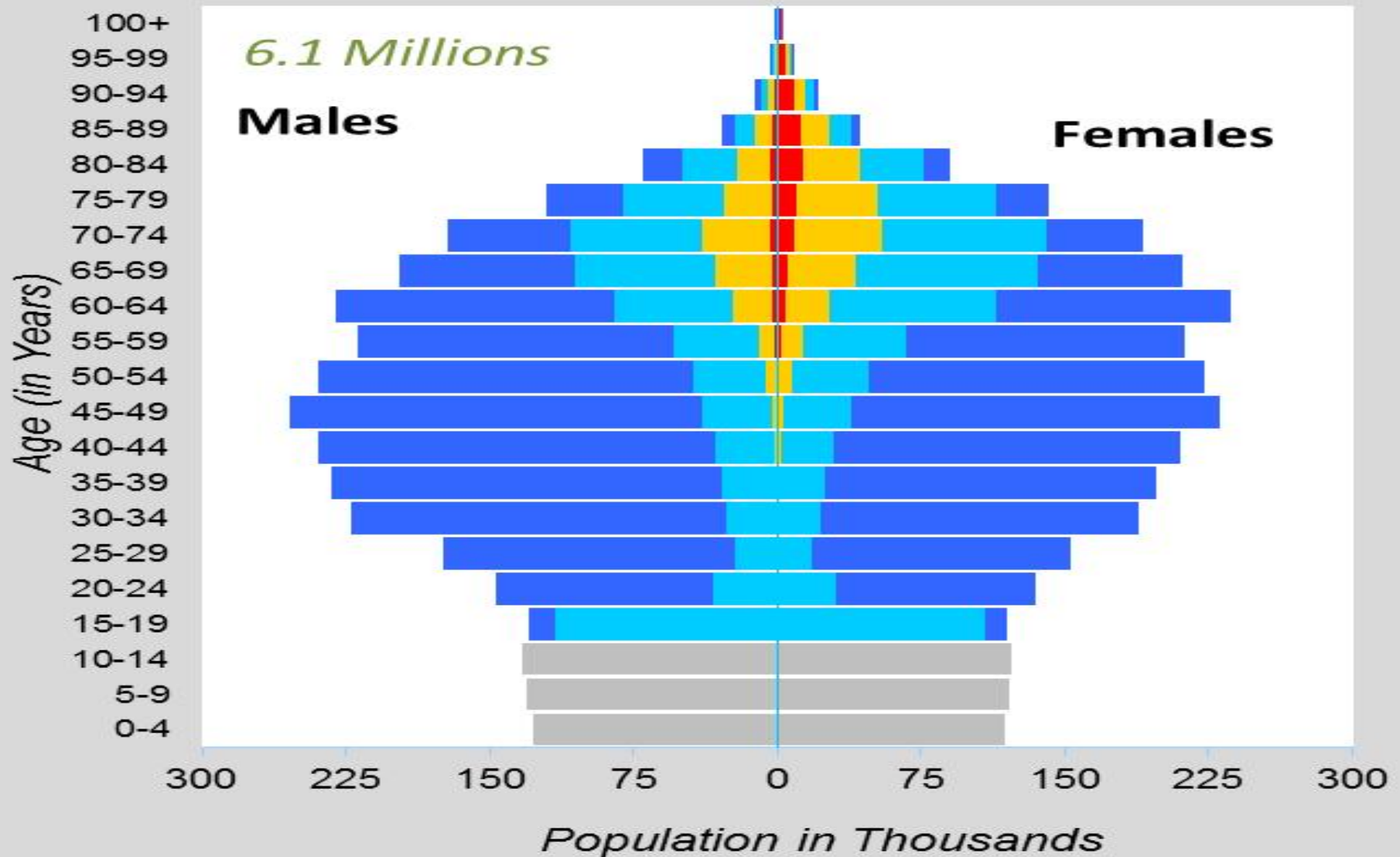
■ No Education ■ Primary ■ Secondary ■ Tertiary

Singapore - 2025 SSP2



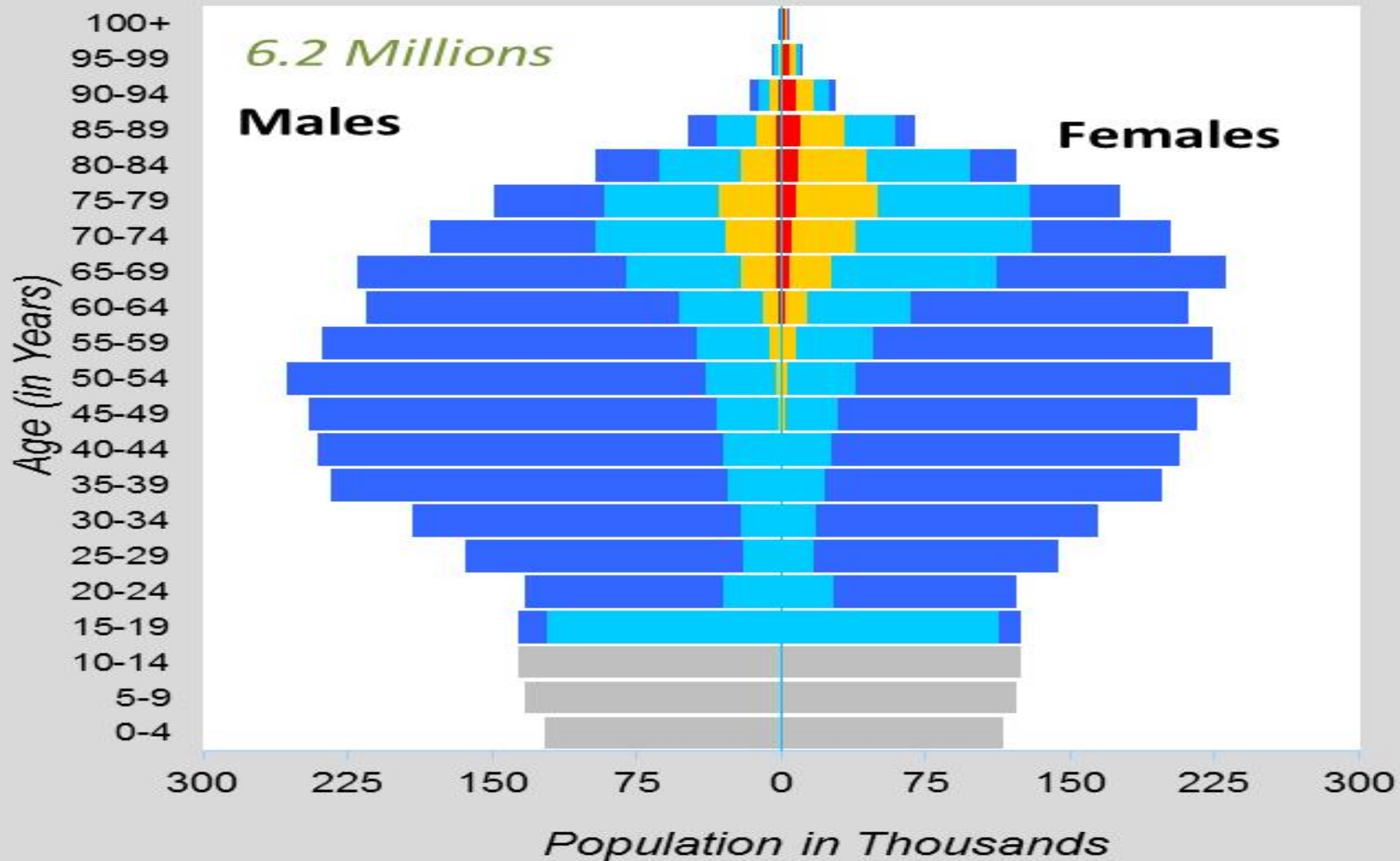
■ No Education ■ Primary ■ Secondary ■ Tertiary

Singapore - 2030 SSP2



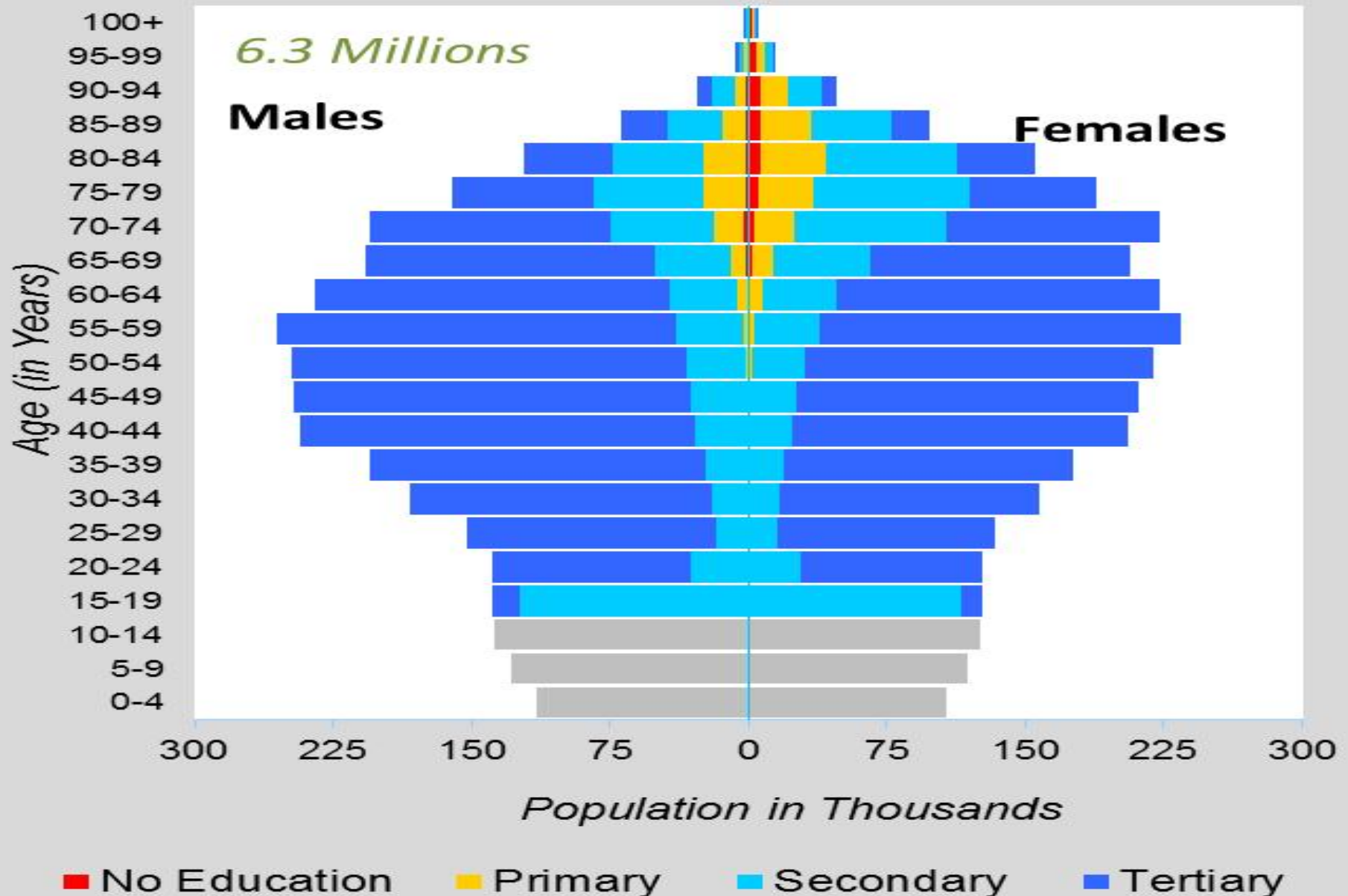
■ No Education ■ Primary ■ Secondary ■ Tertiary

Singapore - 2035 SSP2



■ No Education ■ Primary ■ Secondary ■ Tertiary

Singapore - 2040 SSP2



Adding education to age and sex in population analysis

Education is the most important source of observable population heterogeneity after age and sex.

This matters because:

- Almost universally during demographic transition more educated women have fewer children, have lower child mortality, and more educated adults live longer. Changing education composition **changes population forecasts**.
- Education is a crucial determinant of individual **empowerment and human capital**, is a key driver of socio-economic development (public health, economic growth, quality of institutions and democracy, and adaptive capacity to climate change).

OXFORD



Wittgenstein Centre
FOR DEMOGRAPHY AND
GLOBAL HUMAN CAPITAL
A COLLABORATION OF SAIT, YU, IASA, IFC

EXECUTIVE SUMMARY



WORLD POPULATION & HUMAN CAPITAL IN THE TWENTY-FIRST CENTURY

EDITED BY
WOLFGANG LUTZ | WILLIAM P. BUTZ | SAMIR KC



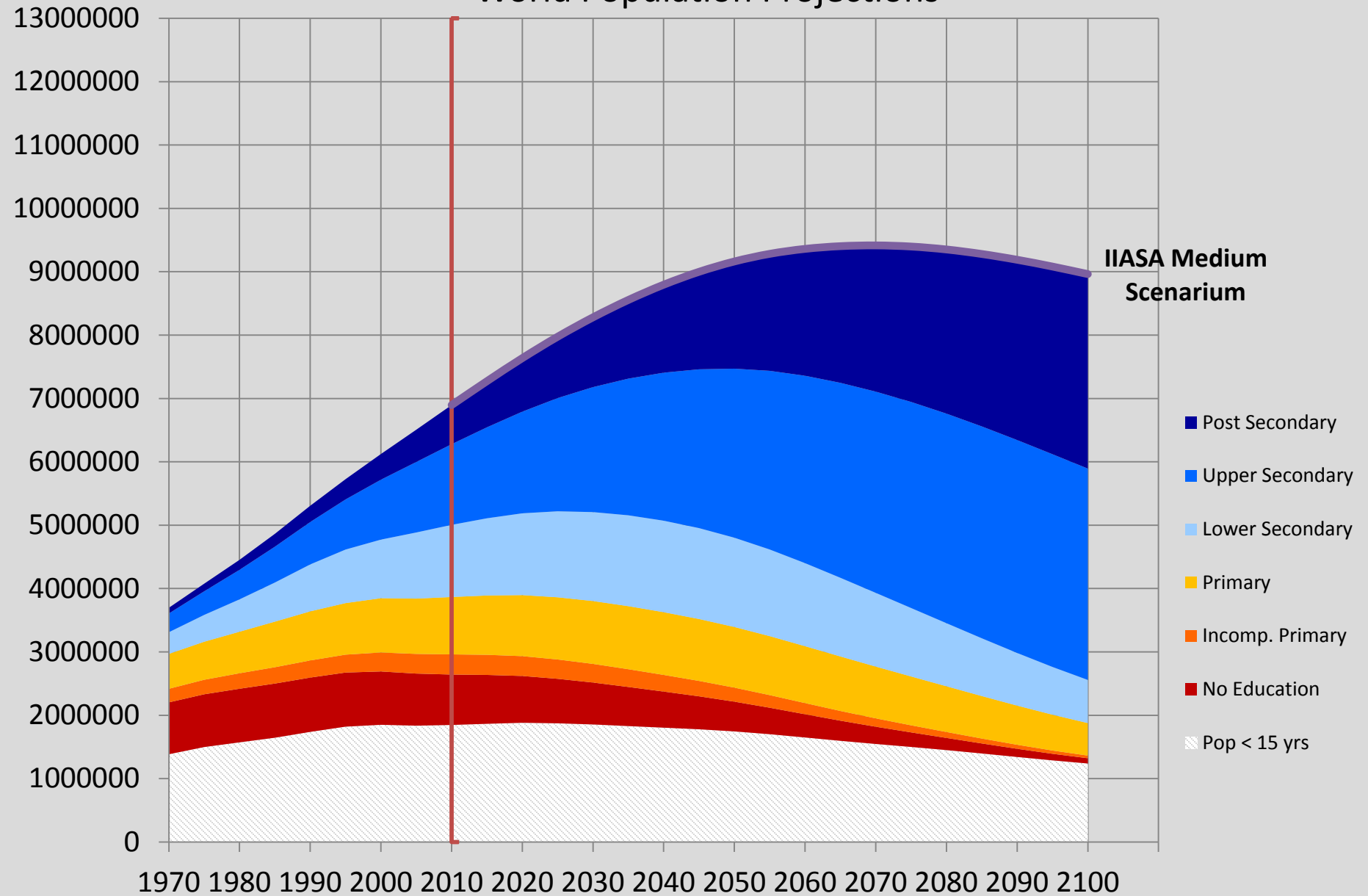
DEDICATED TO THE MEMORY OF NATHAN
KEYFITZ ON THE OCCASION OF HIS 100TH BIRTH
YEAR, 2013.

Oxford University Press

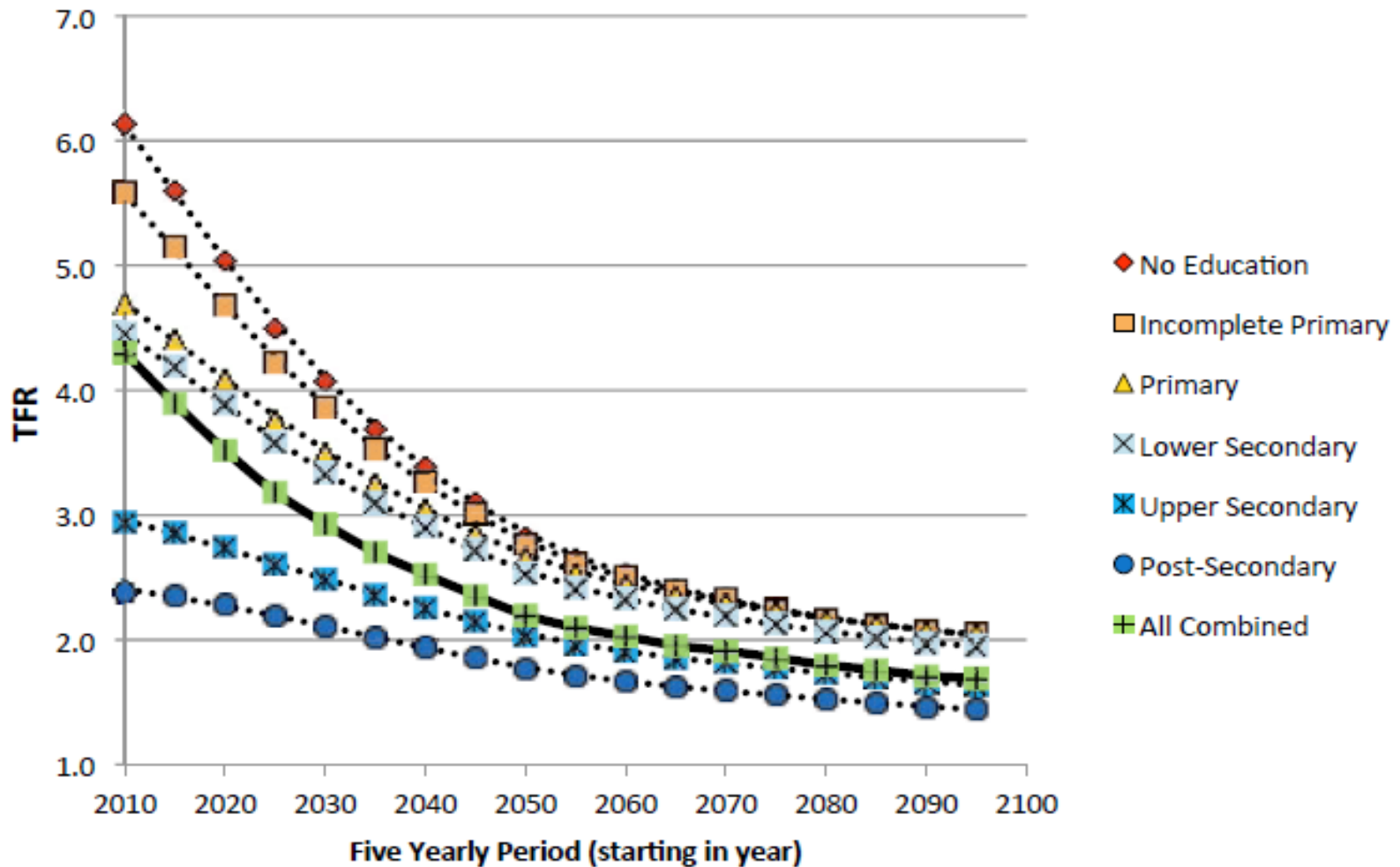
2014

1056 pages,
26 lead authors,
46 contributing authors,
550 expert assessments,
191 country tables

World Population Projections



Fertility by Education in Kenya Empirical (2010) and Assumed





REVIEW

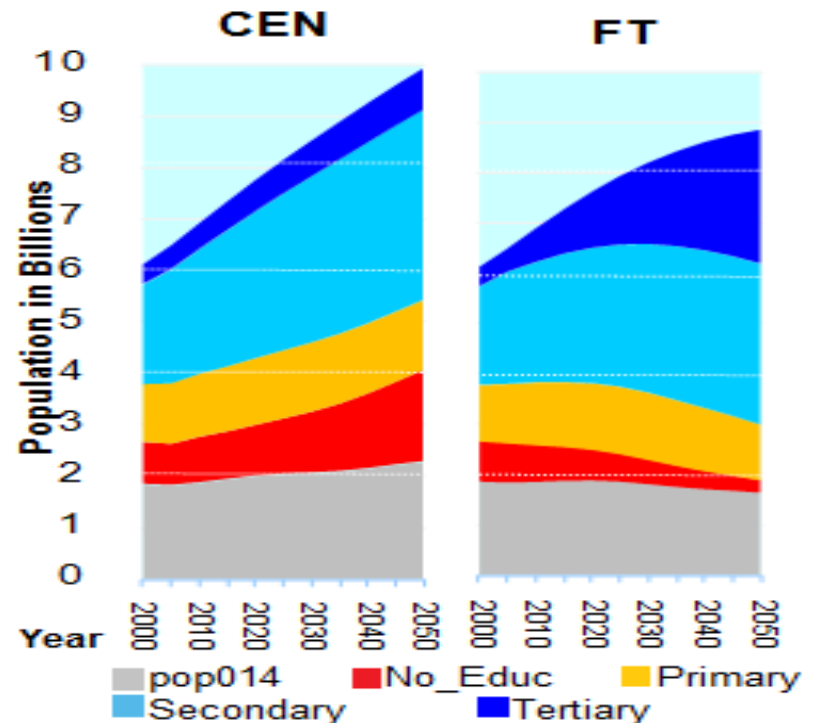
Global Human Capital: Integrating Education and Population

Wolfgang Lutz^{1,2,3,4*} and Samir KC^{1,2}

Almost universally, women with higher levels of education have fewer children. Better education is associated with lower mortality, better health, and different migration patterns. Hence, the global population outlook depends greatly on further progress in education, particularly of young women.

Assuming identical education-specific fertility trends different education scenarios make a difference of more than 1 billion people by 2050.

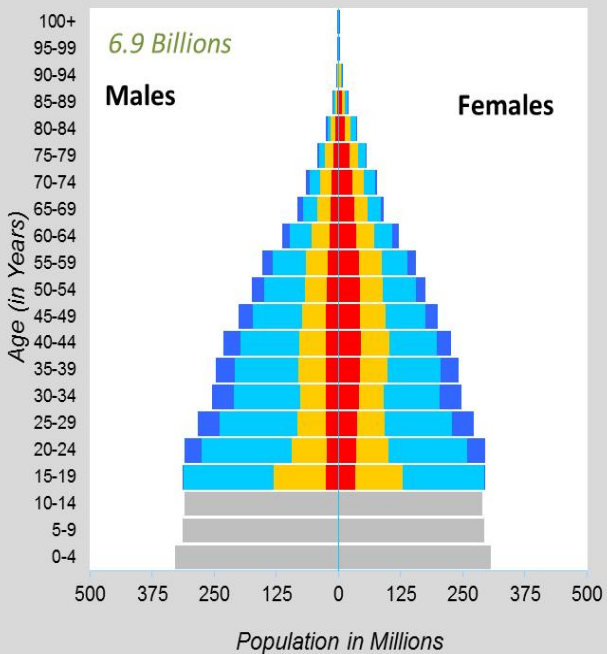
- CEN gives the world population trend according to the most pessimistic scenario assuming that no new schools will be built
- FT gives the most optimistic scenario assuming that countries can achieve the rapid education expansion that South Korea achieved



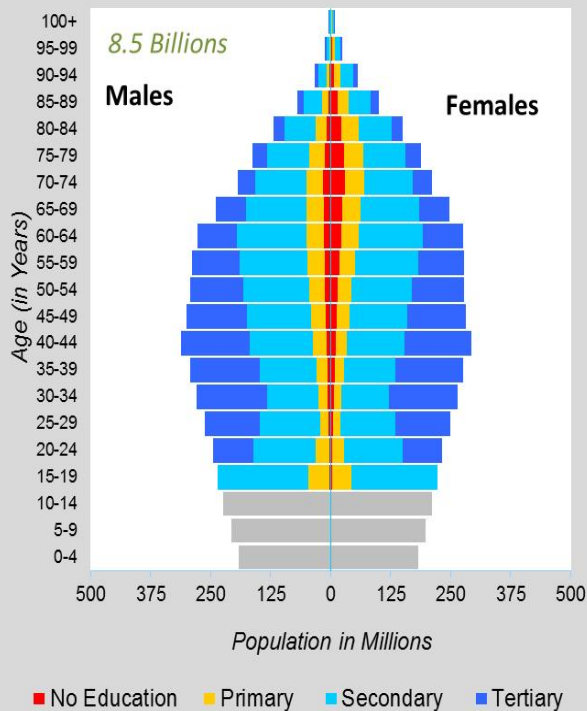
Rapid Development Scenario

Stalled Development Scenario

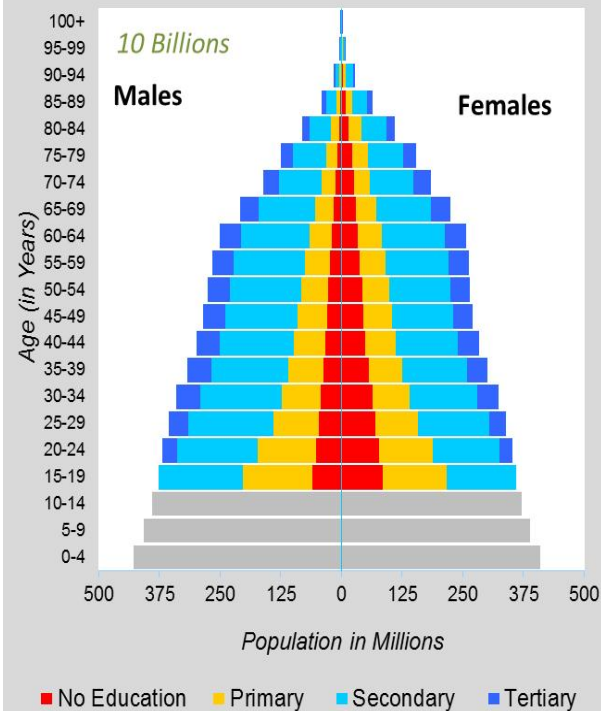
World - 2010



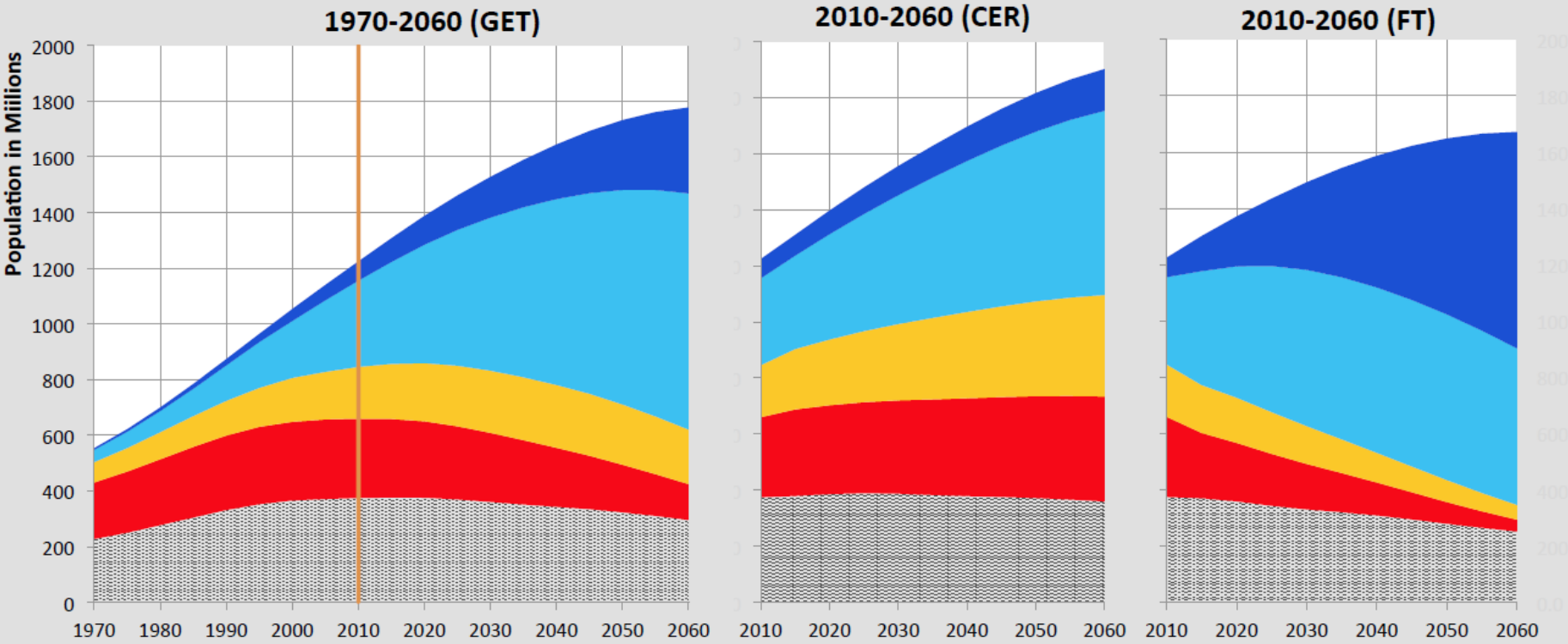
World - 2050 SSP1



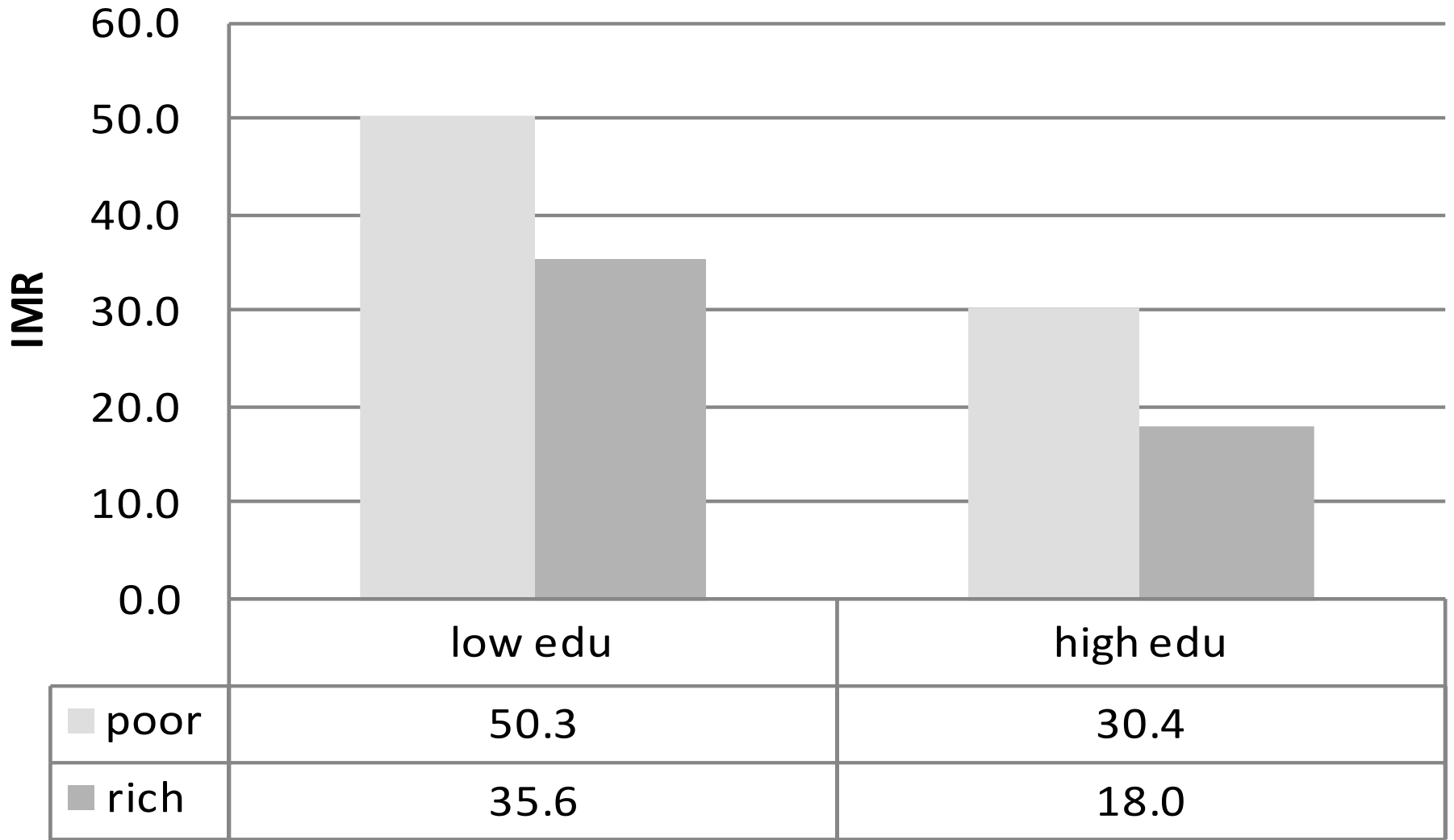
World - 2050 SSP3



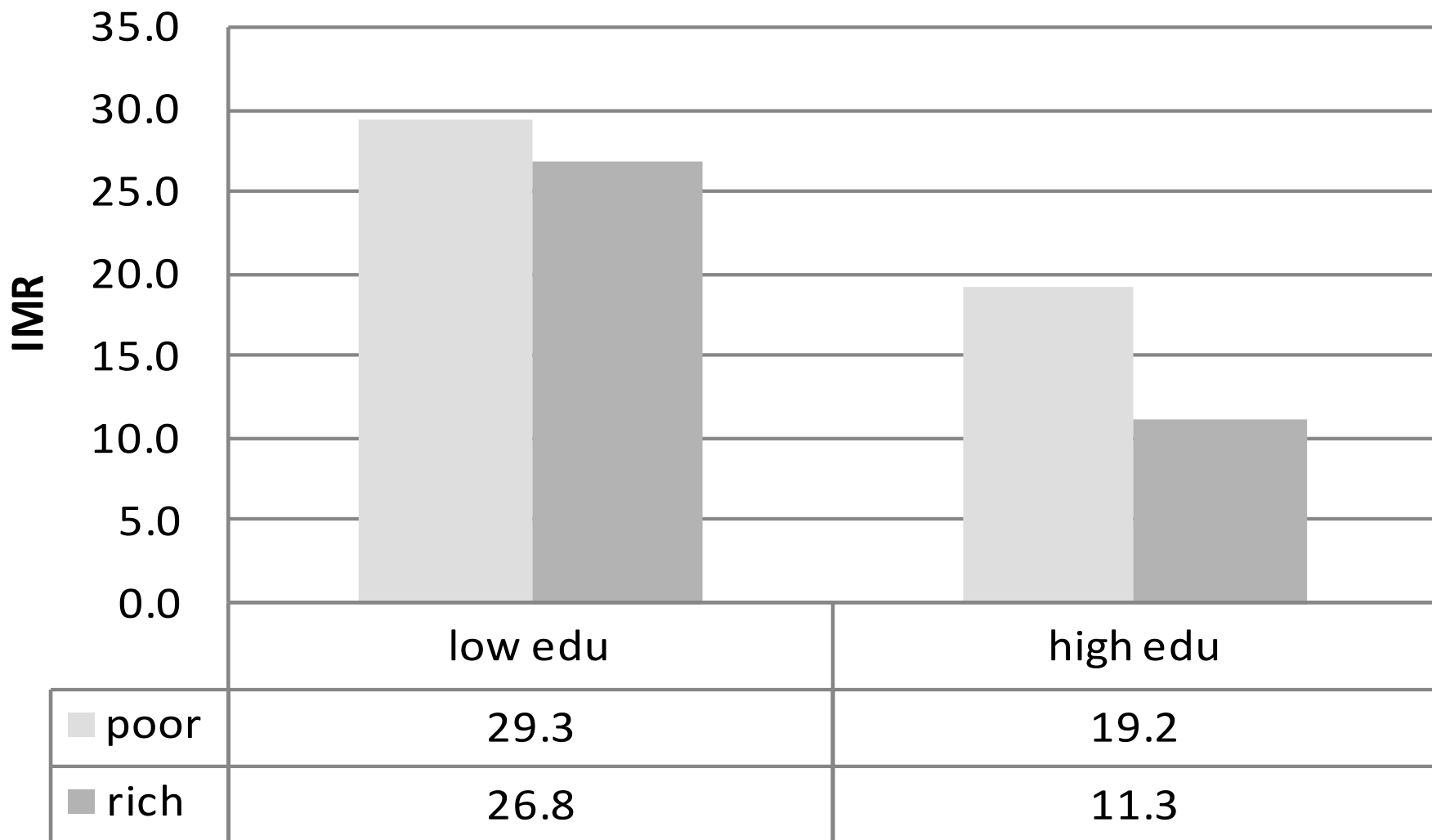
India: Alternative Population and Human Capital Scenarios



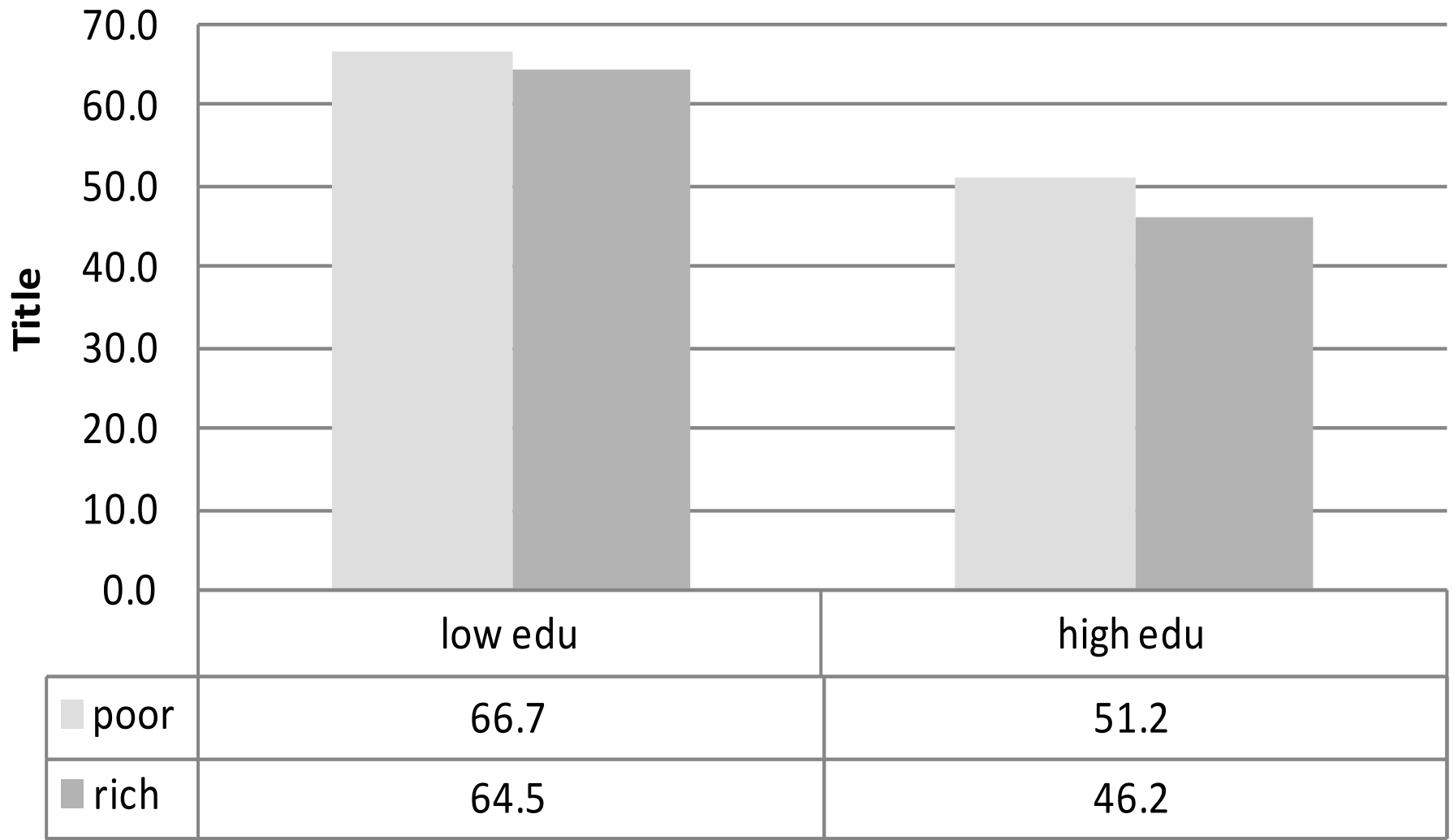
India



Indonesia



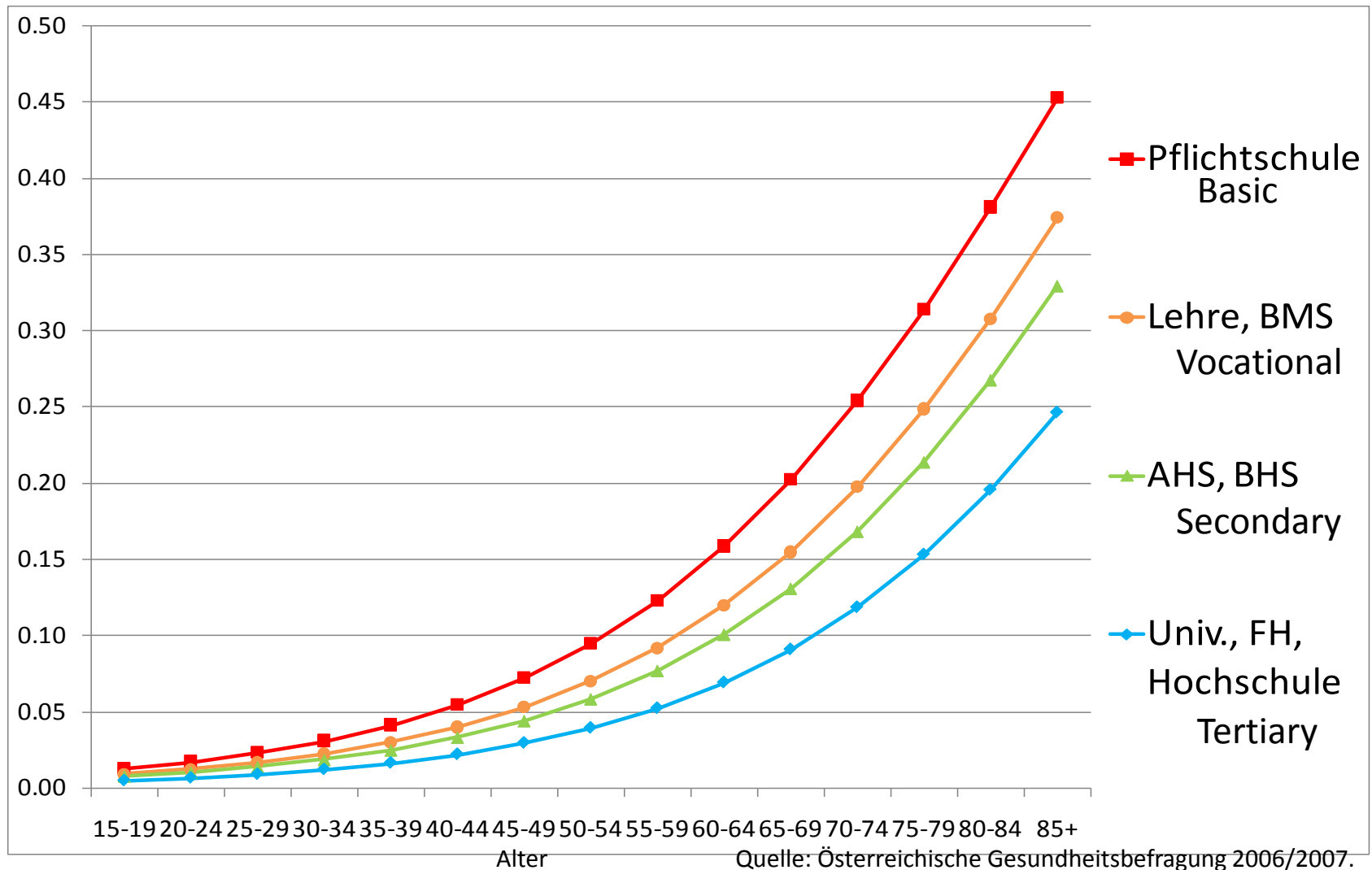
Malawi



Education and Health: Austria 2007: Proportion of women with strong disability for activities of daily life (Daly)



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ECONOMICS

The Demography of Educational Attainment and Economic Growth

Complementing primary education with secondary education in broad segments of the population is likely to give a strong boost to economic growth.

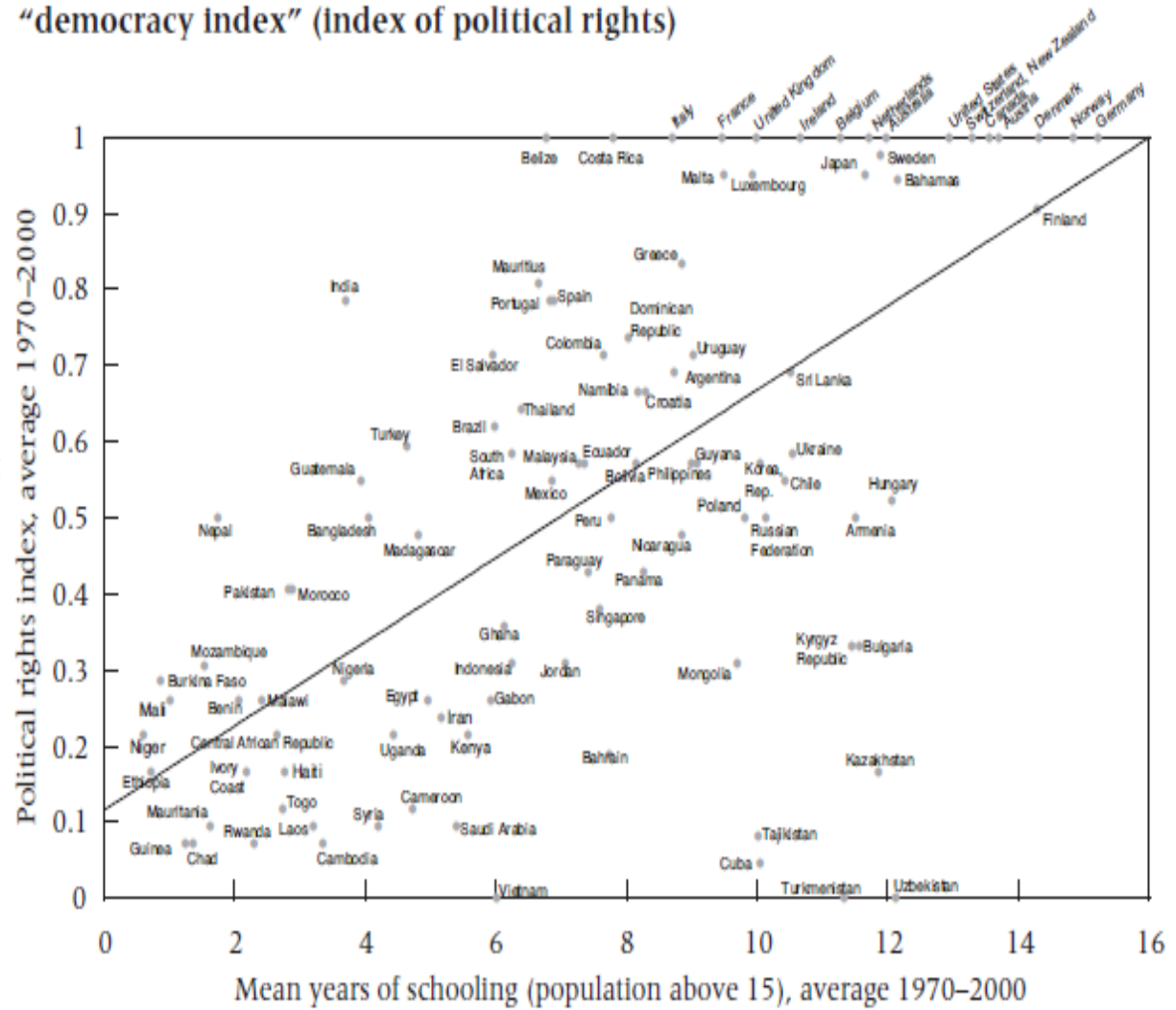
Wolfgang Lutz,^{1*} Jesus Crespo Cuaresma,² Warren Sanderson³ (all IIASA)

2015: Sustainable Development Goal 4:

.... *quality **primary and secondary** education for **all girls and boys***

Education is a key factor in enhancing democracy

FIGURE 3 Relationship between mean years of schooling and the "democracy index" (index of political rights)



Demography, Education, and Democracy: Global Trends and the Case of Iran

WOLFGANG LUTZ

JESÚS CRESPO CUARESMA

MOHAMMAD JALAL ABBASI-SHAVAZI

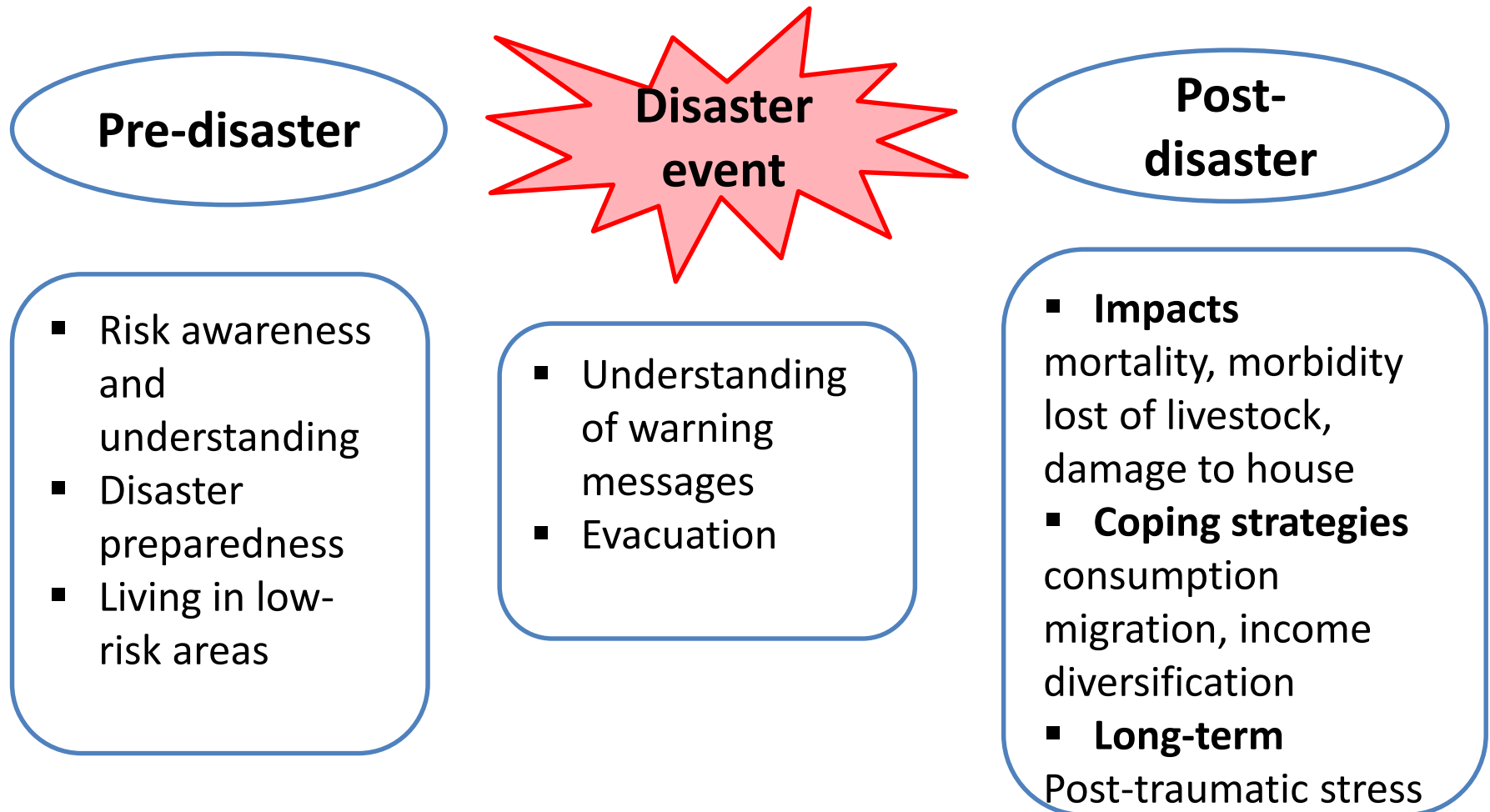


Special Issue in *Ecology & Society* : Education and Differential Vulnerability to Natural Disasters

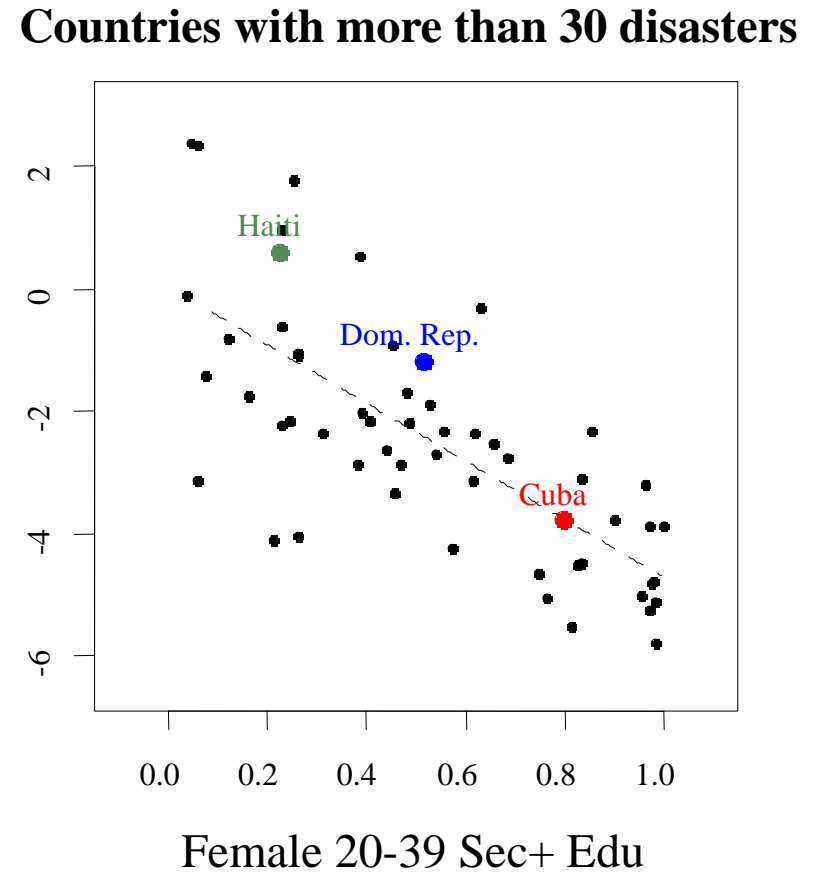
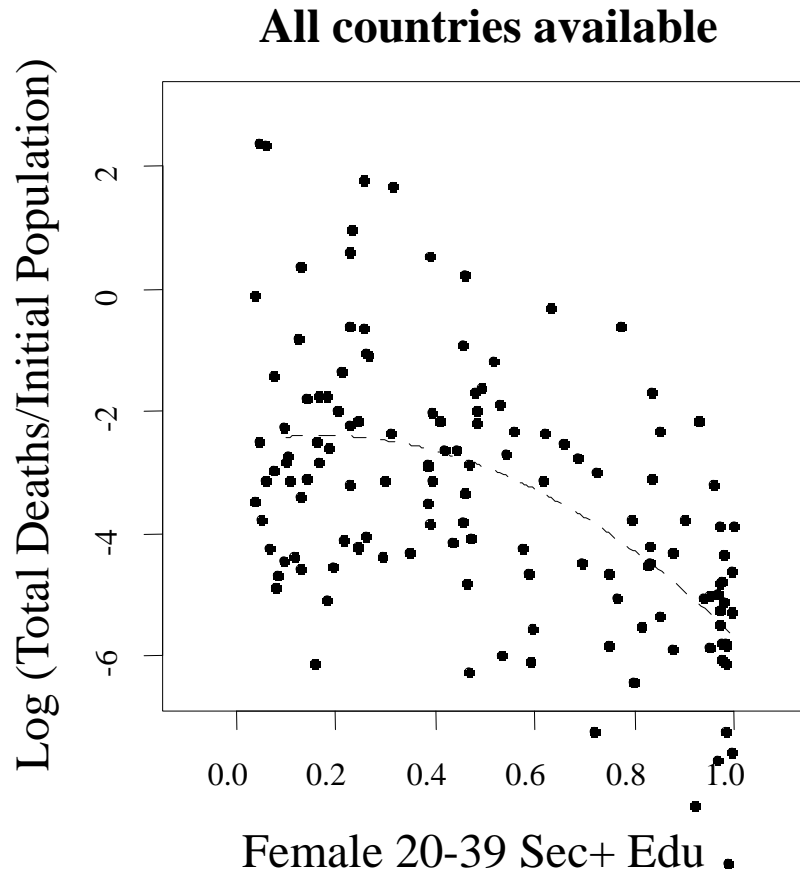


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1. Various types of outcomes investigated



Education and Deaths from Natural Disaster



Source: Total number of deaths (1980 – 2010) is from the Emergency Events Database (EM-DAT) at the Centre for Research on the Epidemiology of Disasters (CRED).

ENVIRONMENT AND DEVELOPMENT

Universal education is key to enhanced climate adaptation

Fund more educators rather than just engineers

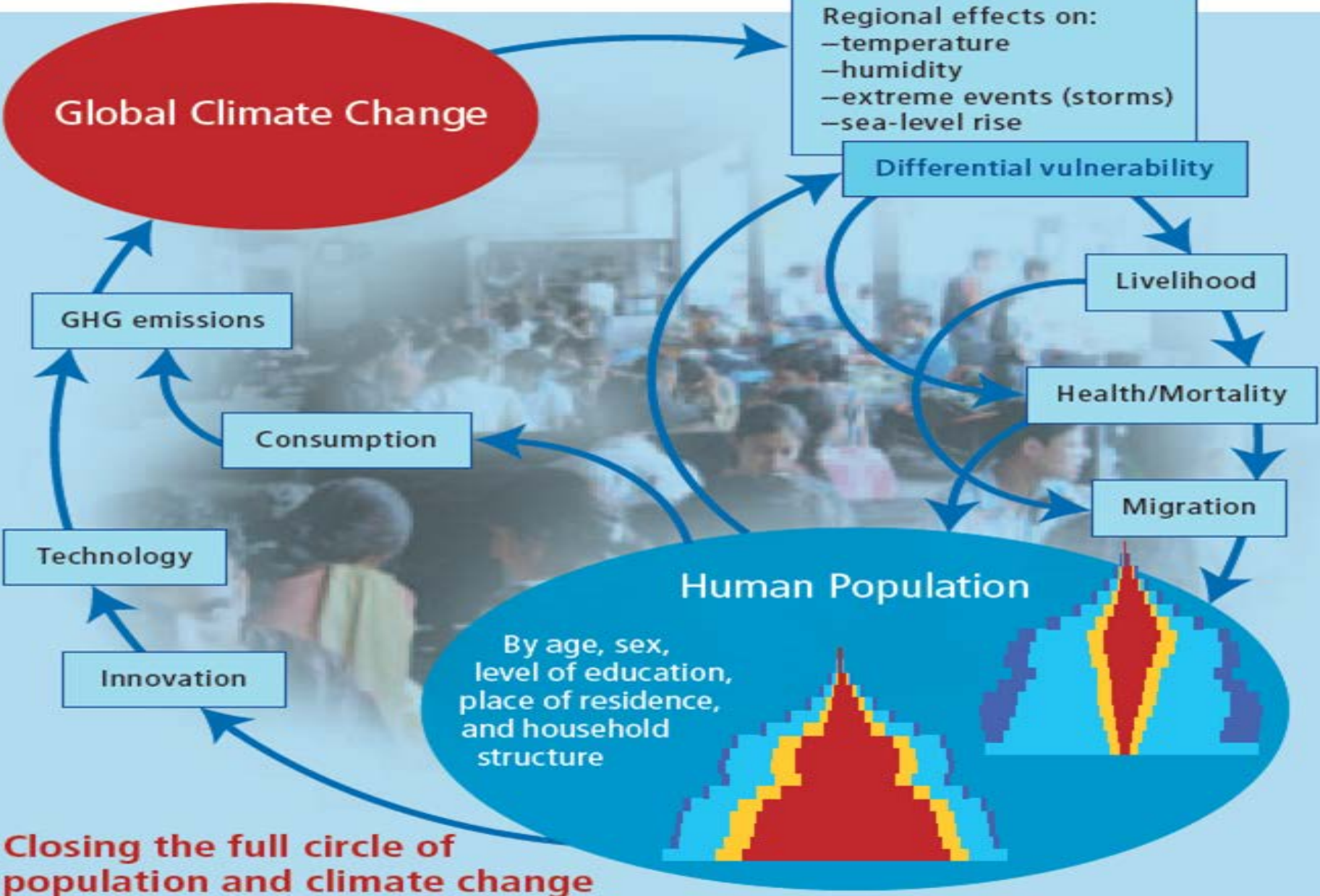
By Wolfgang Lutz, Raya Muttarak,
Erich Striessnig*

Over the coming years, enormous amounts of money will likely be spent on adaptation to climate change. The international community recently made pledges of up to \$100 billion per year by 2020 for the Green Climate Fund. Judging from such climate finance to date, funding for large proj-

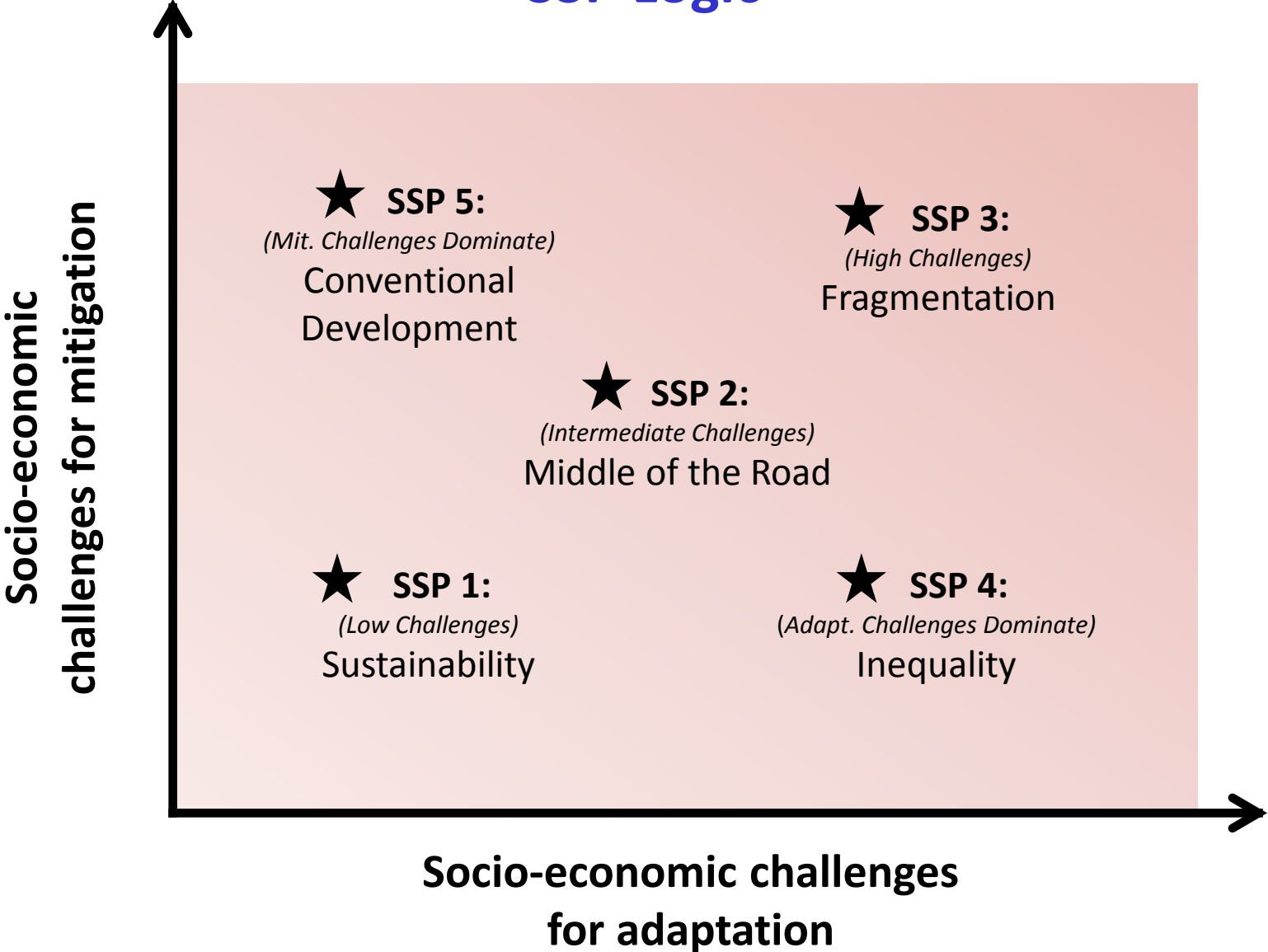
the best available information on the number of disasters and reported fatalities from around the world (5).

EDUCATE FEMALES, REDUCE FATALITIES. Because the literature on disaster vulnerability has conventionally emphasized economic growth while disregarding education, our statistical analysis focuses on the relative assessment of these two factors as measured by Gross Domestic Product (GDP)

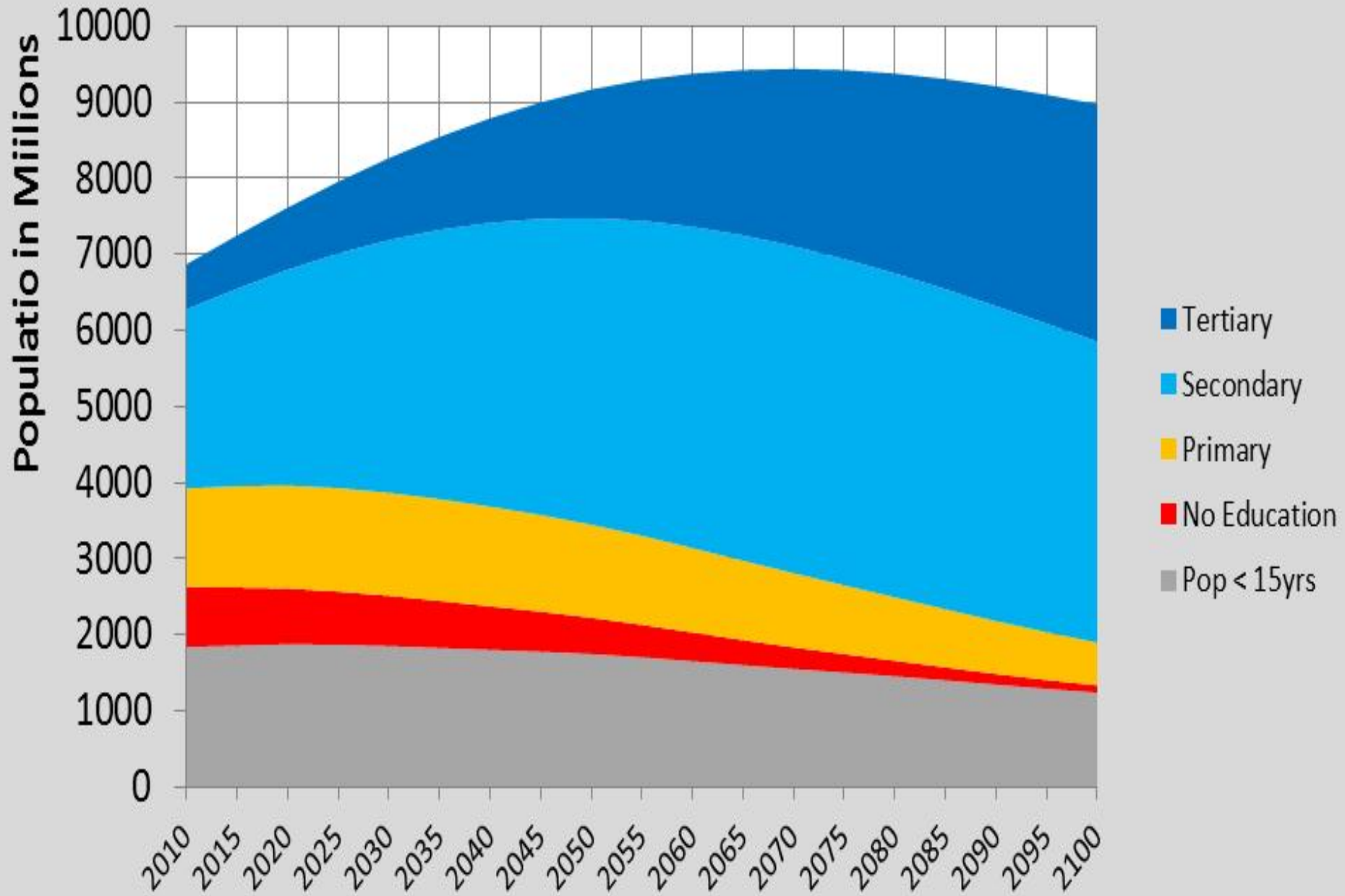
Forecasting Societies' Adaptive Capacities to Climate Change



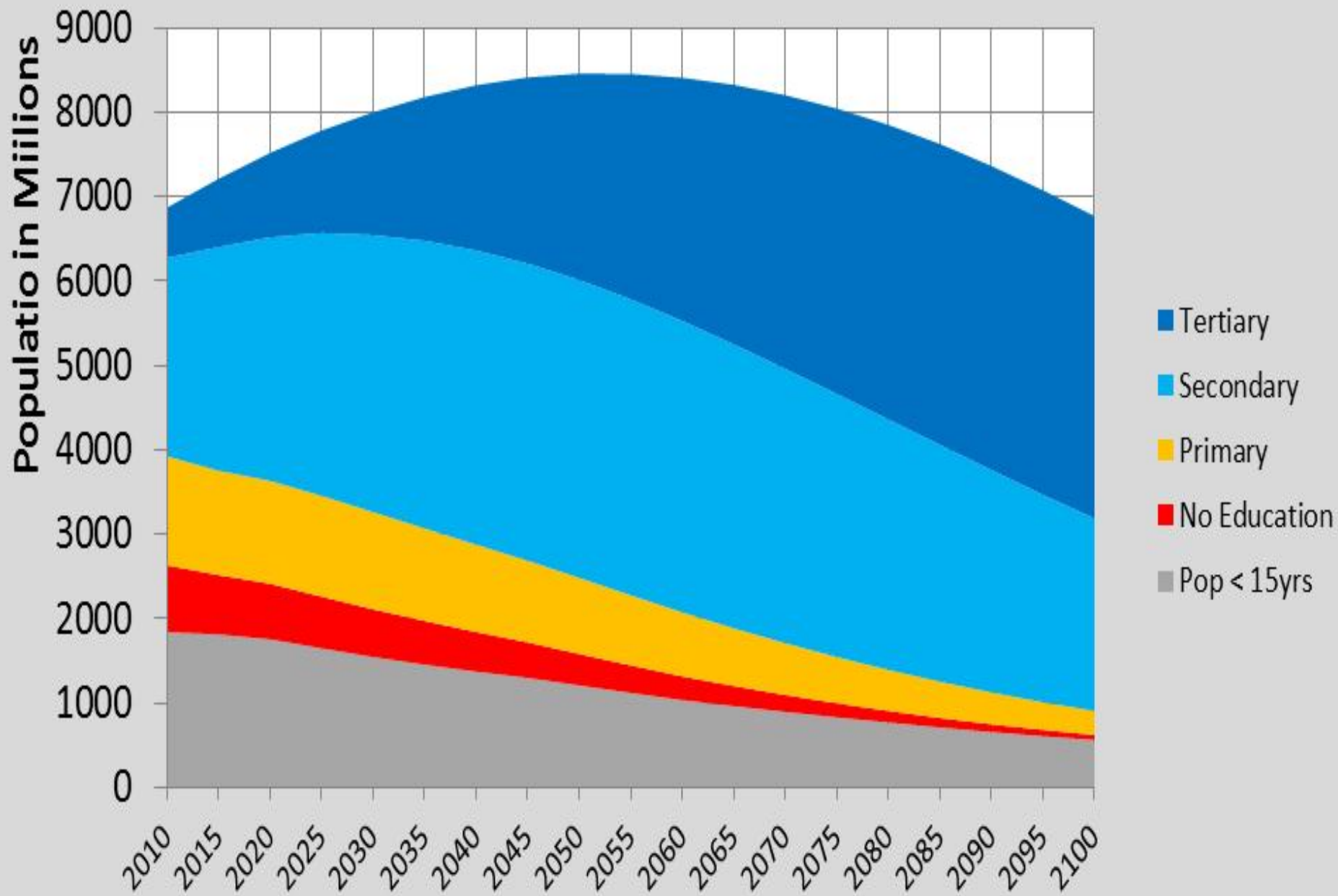
SSP Logic



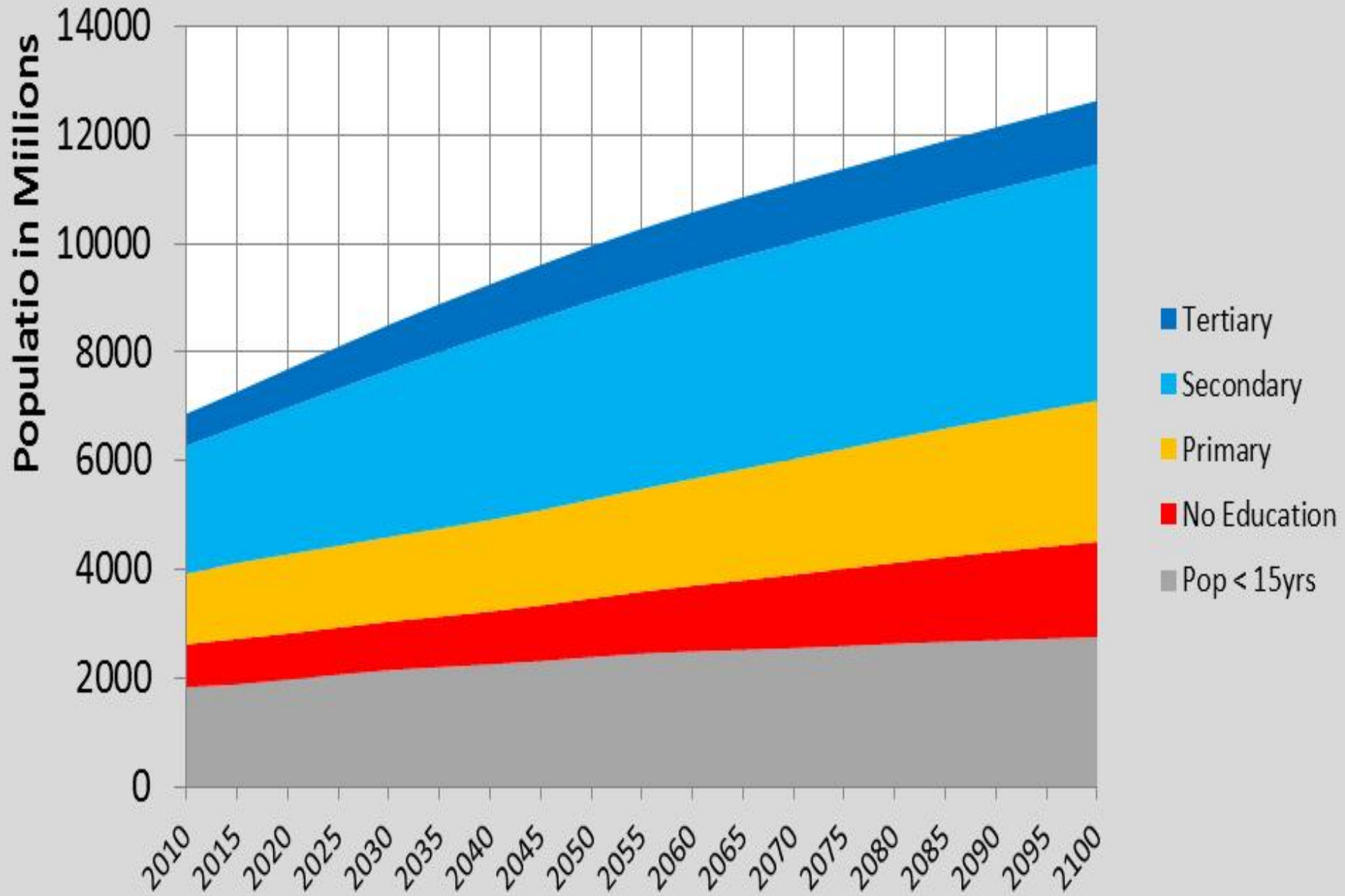
World SSP2



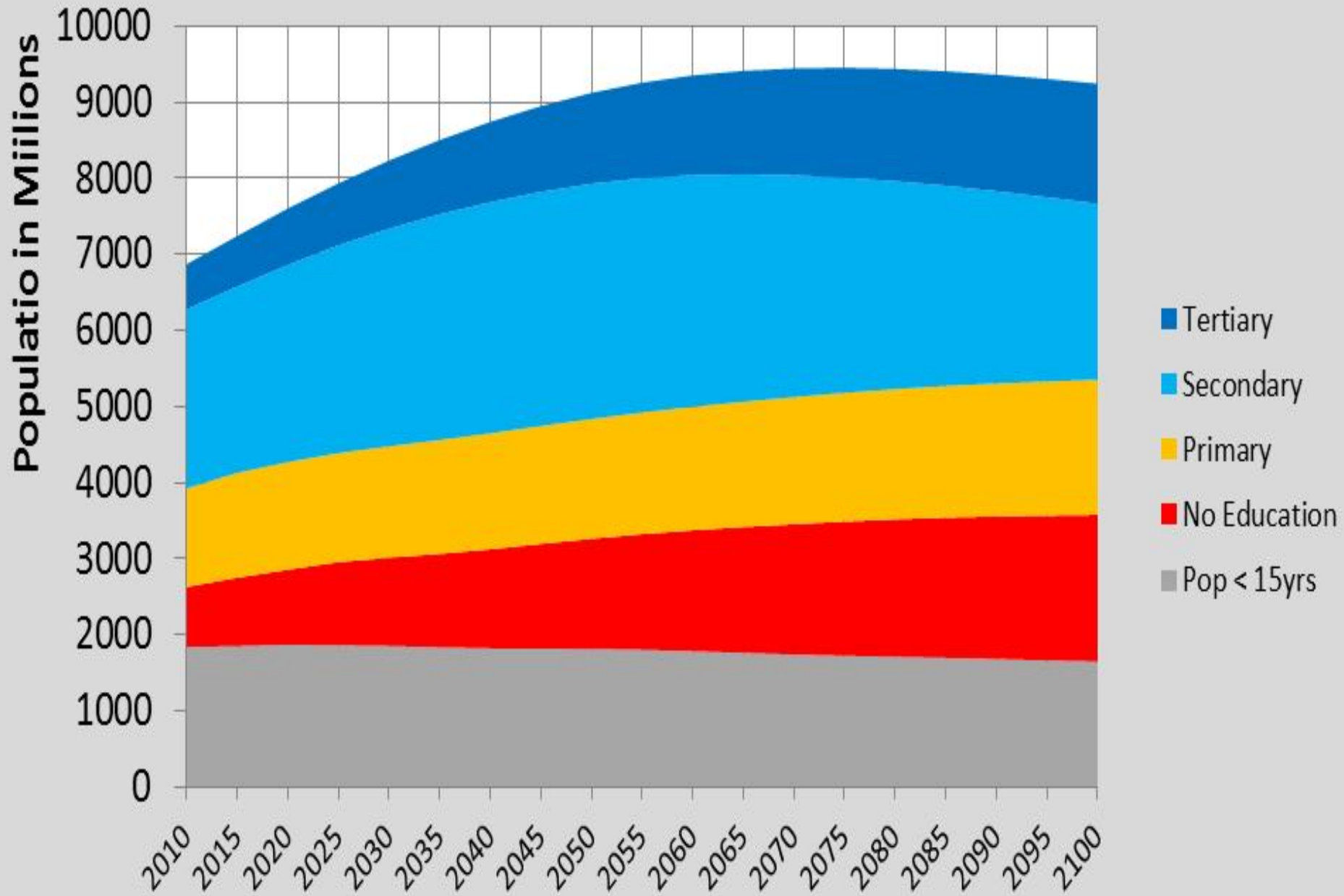
World SSP1



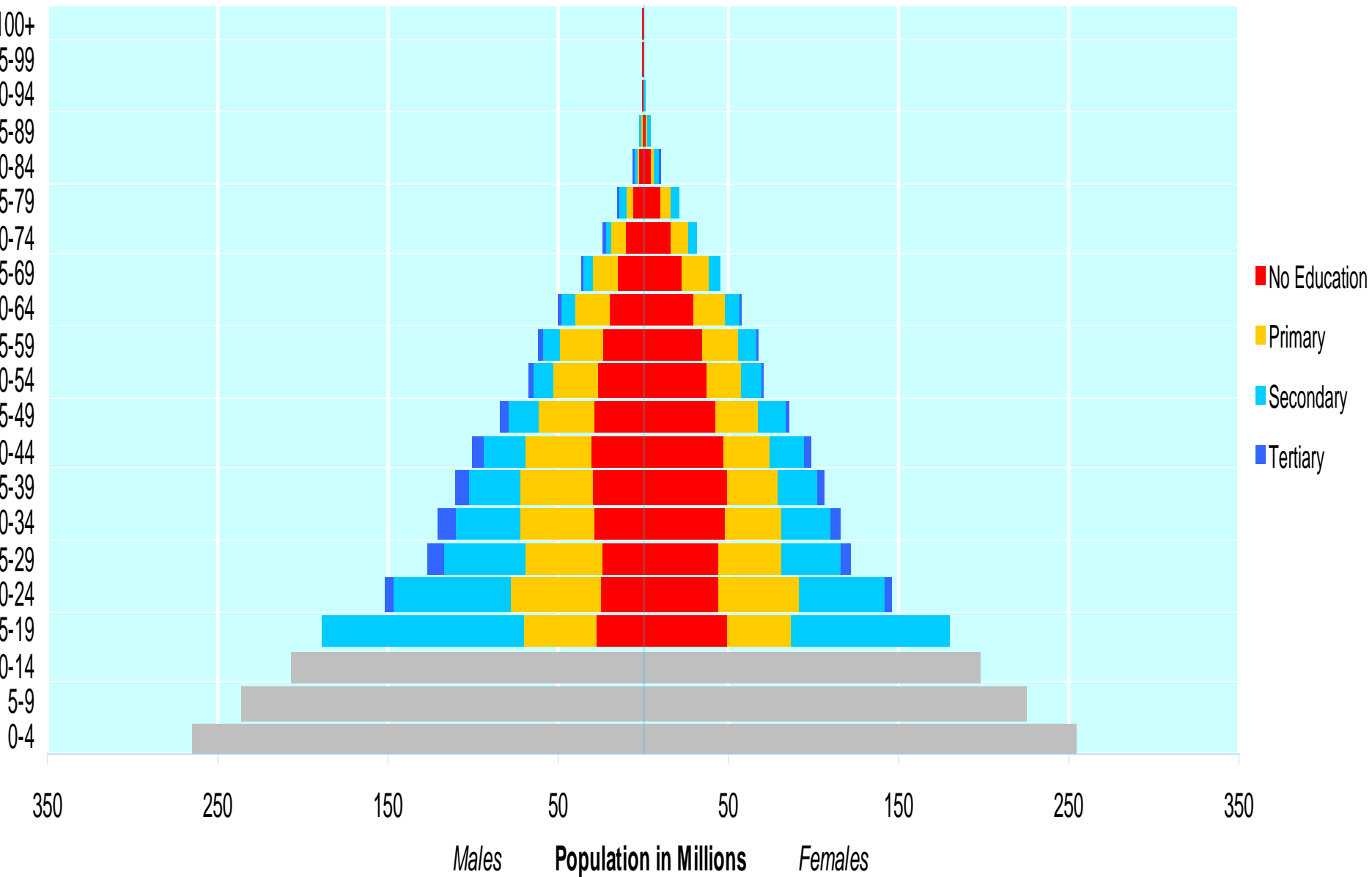
World SSP3



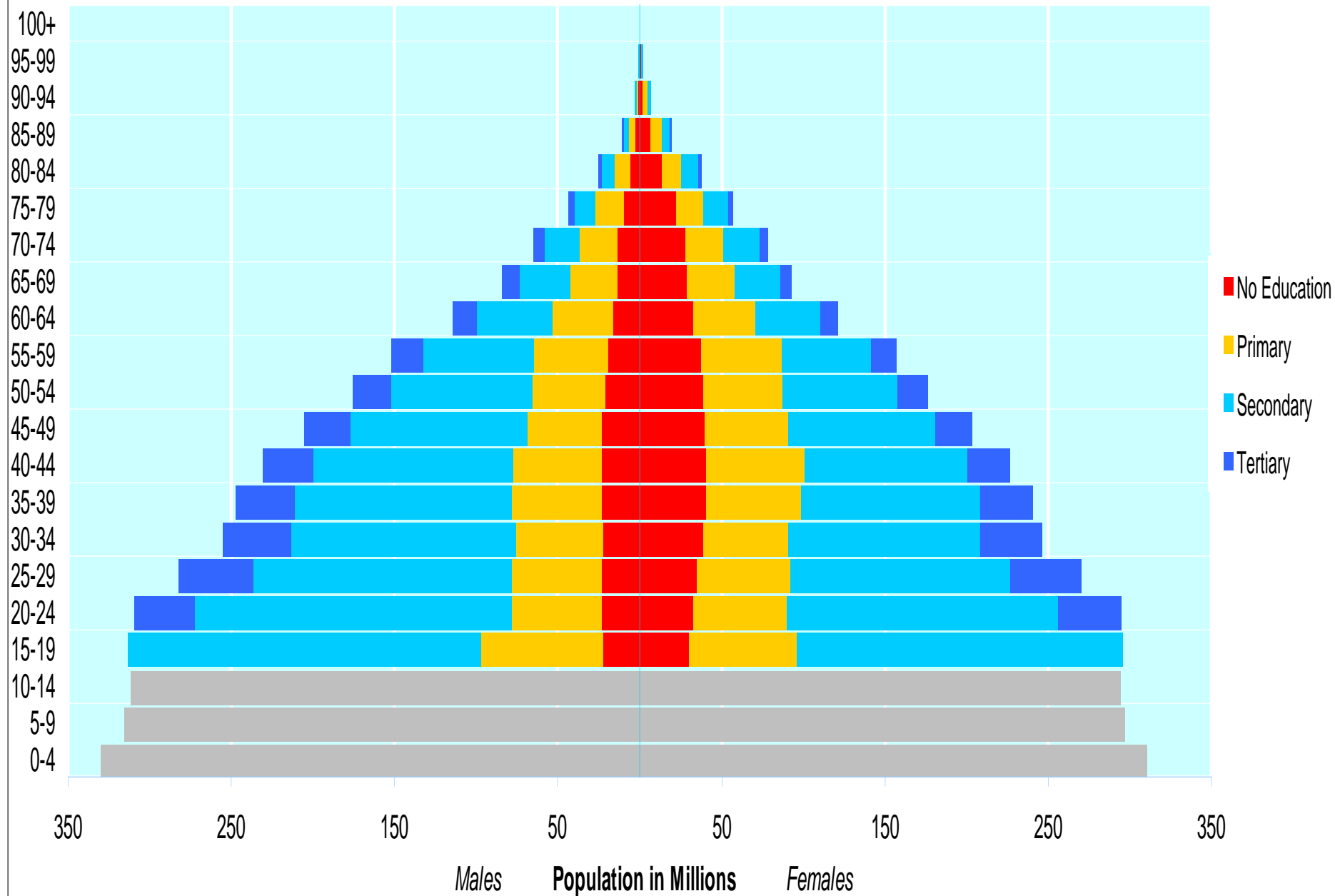
World SSP4



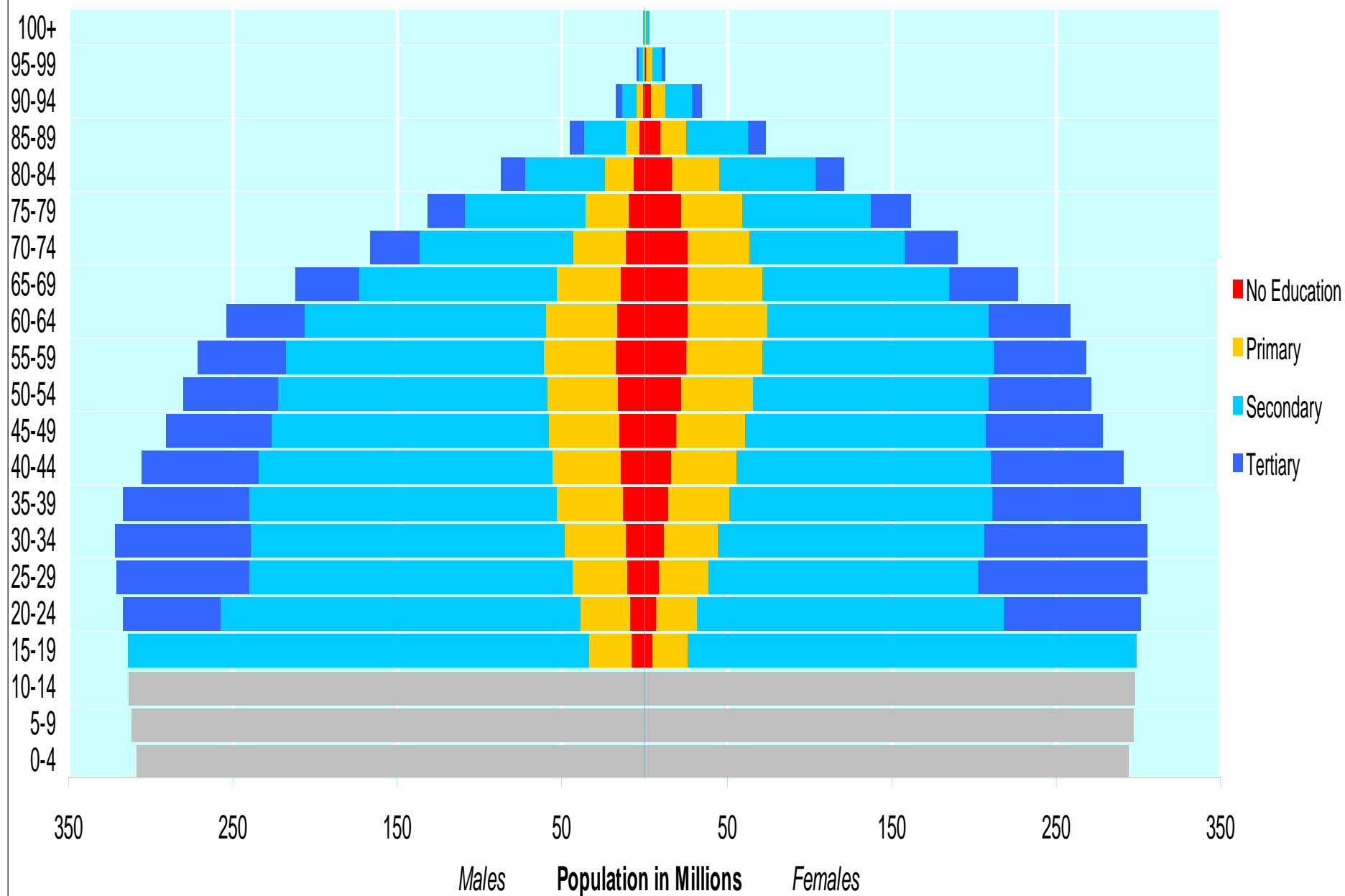
World - Population by Age, Sex and Educational Attainment in 1970



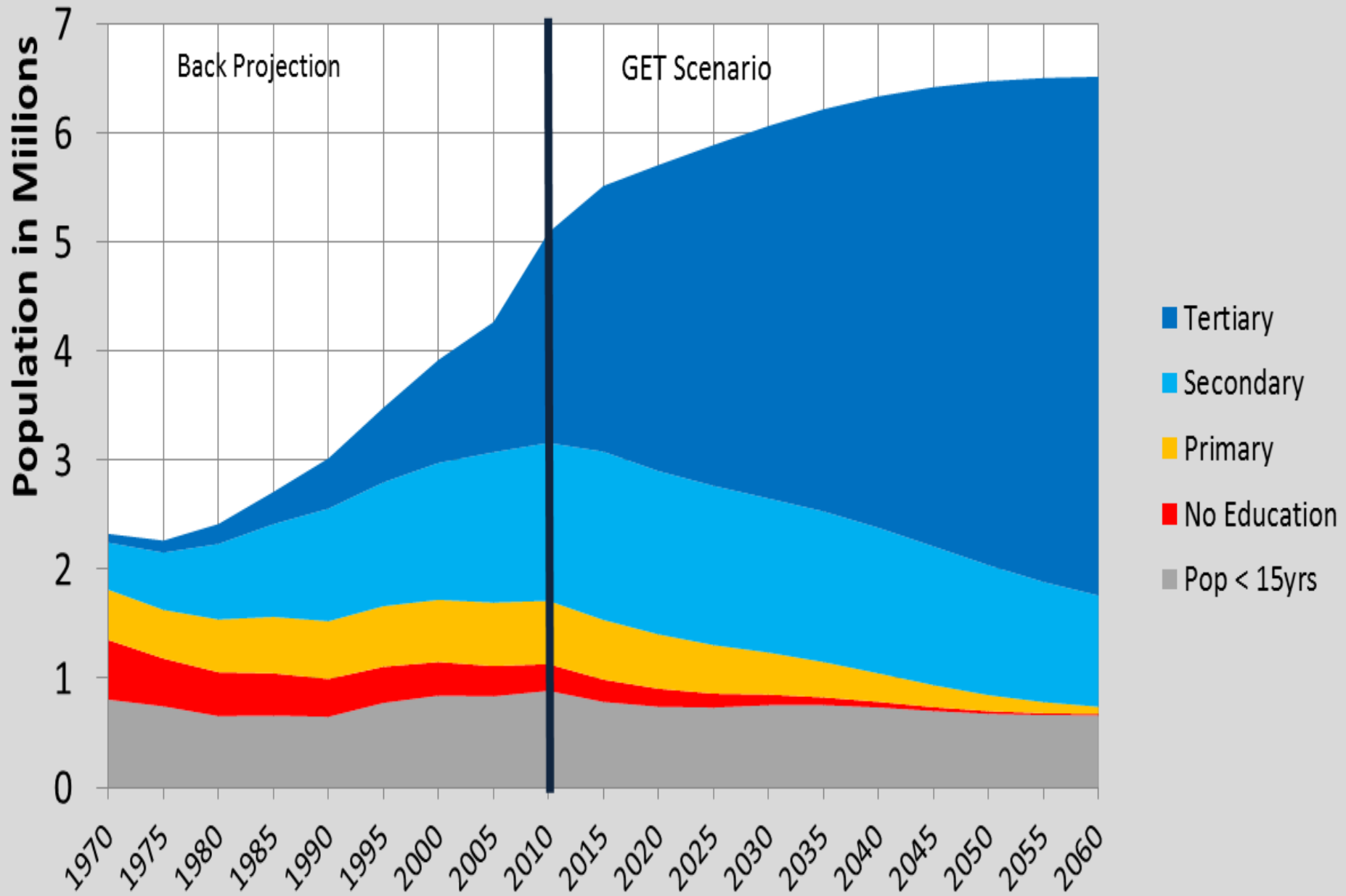
World - Population by Age, Sex and Educational Attainment in 2010 - Global Education Trend - Scenario



World - Population by Age, Sex and Educational Attainment in 2050 - Global Education Trend - Scenario



Singapore - 1970-2060



NUSS PROFESSORSHIP LECTURE

by Professor Wolfgang Lutz, winner of Wittgenstein Prize 2010

SINGAPORE: POPULATION AND HUMAN CAPITAL

Human capital played a historical role as the basis for economic growth and health of the population in Singapore. Find out how Singapore has fared as compared to other countries with respect to future challenges of population growth and ageing.

FREE ADMISSION – LIMITED SEATS AVAILABLE

Date: 18 February 2013, Monday
Time: 7pm to 9pm (Registration begins at 6.30pm)
Venue: Kent Ridge Guild House
Della & Seng Gee Guild Hall
Dress Code: Smart Casual

- *Registration is required and closes on 8 February 2013*
- *Light refreshments will be served*
- *A no-show fee of \$10 applies*

