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Working paper

Updating the Shared Socioeconomic Pathways (SSPs) Global Population and Human Capital Projections

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Abstract

The first set of population projections following the Shared Socioeconomic Pathways (SSPs) was developed in 2013. These projections have found widespread use within the environmental and climate change community, among others. In 2018, an SSPs update was generated but not integrated into the SSP database. In 2021, the SSP community requested an update of the human core of the SSPs, which is detailed in this report. This updated version is based on 2020 as the reference year, with adjustments to certain short-term assumptions extending to 2030. Consequently, the assumptions' trend component is grounded in recent observed changes. The modeling approaches for fertility, mortality, and educational attainment have been revised. Notably, there are updates to education-specific fertility rates with new estimates. Education-specific mortality has been made specific to countries and regions. Additionally, this version introduces explicit education-specific migration differentials. The paper presents a comparison between the methodology used for developing the global population and education projections under the five SSPs and the previous method. Furthermore, a brief analysis is conducted on the primary results regarding population size and composition, with comparisons made to earlier projections and other organizations, including the United Nations Population Division.

Acknowledgments

We extend our grateful thanks to the many individuals who have supported the work behind the projections in this version, as well as in the previous ones, and their documentation.

1. Introduction

This paper documents the changes implemented to update the population and human capital projection component of the Shared Socioeconomic Pathways (SSPs) regarding data and modeling approach. The first major update has to do with changing the base-year. The updated projections, referred to as WIC2023 (Wittgenstein Center population projections version 3.0), encompass 200 countries, reflecting the most recent 2020 baseline information published by the United Nations (UN) as of July 2022 (WPP2022) (United Nations 2022a, 2022b).

The updated data are available in the Wittgenstein Centre Data Explorer at this link https://dataexplorer.wittgensteincentre.org/wcde-v3/ (beta version) and in Zenodo (v.13).

The base-year of the initial set of SSPs (KC and Lutz 2014), referred to as WIC2013 (version 1.0), was 2010 and used demographic data up to 2012, primarily from the UN 2010 assessment (WPP2010) (United Nations 2011), and data on educational attainment from 2000 census rounds (Bauer et al. 2012) and available surveys. These population projections, with a base year 2010 and five scenarios (SSP 1-5), were shared in the SSP database[1] and widely used by the SSP community and beyond[2].

In 2018, the first update of the SSPs (KC et al. 2018) was produced with a change in the base year to 2015 (WIC2018) using data from the UN 2017 assessment (WPP2017) (United Nations 2017) and more recent education data, particularly from the 2010 census rounds. However, the 2018 update was not incorporated into the SSP database without a general SSP update plan. In 2021, the SSP community requested an update on the human core of the SSPs.

The WIC2023 update is the most comprehensive since 2013, extending beyond updating the base year to 2020. Short-term assumptions (up to 2030) have been occasionally updated, while assumptions for 2050 and 2100 remain largely unchanged since they were based on comprehensive analyses and expert input. However, the trend component of the assumptions has been modified based on recent observations. Modeling methodology, fertility, migration, and education have also been modified. Education-specific fertility levels have been updated with new estimates, and education differentials in mortality are now country- and region-specific rather than being normalized to a single level by gender. Also, education-specific migration rates are implemented in the projection model for the first time. In addition to a detailed overview of the modifications in the production of WIC2023 (Section 2), this report includes the main results for the world and world regions, focusing on selected countries, in Section 3, followed by a discussion and conclusion section.

[1] https://tntcat.iiasa.ac.at/SspDb

[2] For instance, KC and Lutz (2014) was cited over 1200 times according to Google Scholar (on October 3, 2022).

2. Data and Methods

2.1. Base year population by age, sex and educational attainment

WIC2013 projected educational attainment trajectories for 171 countries (Bauer et al. 2012). The base-year populations by age and sex for 2020 for the 200 countries[3] are sourced from the WPP2022 by the UN, which represents the population as of January 1[4].

We apply an education distribution to the WPP2022 population by age and sex, considering six levels of educational attainment: no education - E1, some primary - E2, completed primary - E3, completed lower secondary - E4, upper secondary - E5, and post-secondary - E6. Completed primary corresponds to completed level ISCED 1 according to the International Standard Classification of Education (ISCED), completed lower secondary corresponds to completed ISCED 2 level, completed upper secondary to completed ISCED 3 level and the post-secondary level to any higher level (ISCED 4 or higher), and includes university as well as non-university higher education. We only consider formal education. More details on the translation of ISCED levels and the education categories used in the projection can be found in KC et al. (2018). The main differences are summarized in Table 1 below.

We rely on data obtained from censuses and surveys, such as the Demographic and Health surveys, for 185 countries (Table 2). The coverage is an increase of 14 countries, listed in Table 2, compared to WIC2013. In the WIC2023 update, we have revised the education structure for 28[5] countries compared to WIC2018, mainly updating with more recent censuses and surveys. For the 15 countries and territories listed in Table 2 (column 'Countries with missing education data'), we have not been able to obtain an education distribution. We estimate it by proxy, using data from neighboring countries with similar education systems or regional distributions. Details regarding the sources of the educational distribution data can be found in Appendix Table Ae1. The map in Figure 1 summarizes the data sources used.

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[3] The 200 countries are those with a population exceeding 80,000 inhabitants in 2020, excluding smaller countries and territories, e.g., 195. In WIC2013, countries/territories with at least 100,000 were included. The Channel Islands were excluded from the UN database in WPP2022.
[4] WPP2022 reference time has shifted from the 1st of July to the 1st of January. Hence, we changed the reference time in this update.
[5] Belize, Myanmar, Central African Republic, Chile, Cuba, State of Palestine, Guatemala, Guinea, Iran (Islamic Republic of), Israel, Lao People's Democratic Republic, Malaysia, Maldives, Mexico, Morocco, Mozambique, Pakistan, Peru, Philippines, Saudi Arabia, Senegal, Sierra Leone, Suriname, Tajikistan, Uganda, and Egypt; we excluded the data for Papua New Guinea and Uzbekistan due to bad quality.

Table 1: Translation of ISCED classification into WIC categories of educational attainment (different versions)

ISCED 2011	ISCED 1997	WIC 2013	WIC 2018 & 2023
01 Early childhood educational development	—	No education	No education (E1)
02 Pre-primary education	0 Pre-primary education		
1 Primary education	1 Primary education	Incomplete & completed primary	Incomplete (E2) & completed primary (E3)
2 Lower secondary education	2 Lower secondary education	Lower secondary	Lower secondary (E4)
3 Upper secondary education	3 Upper secondary education	Upper secondary	Upper secondary (E5)
4 Post-secondary non-tertiary	4 Post-secondary non-tertiary	Post-secondary	Short cycle (E6)*
5 Short-cycle tertiary	5B First stage tertiary		
6 Bachelor's or equivalent	5A		Bachelor (E6)*
7 Master's or equivalent	5A		Master + (E6)*
8 Doctoral or equivalent	6 Second stage tertiary		

* In WIC2018, we disaggregated for a subset of countries the post-secondary education category in several groups (short cycle, bachelor and master and over). In WIC2023, we only project the broad E6 category (post-secondary).

Table 2: Country coverage of the WIC 2023 dataset by UN regions

UN region	All countries	Countries covered	Countries covered (%)	Population covered (%)	Countries with missing education data	New countries added as compared to WIC2013 dataset
Europe*	39	39	100	100	-	-
Asia	51	49	96.1	99.3	Brunei, Uzbekistan	Afghanistan, North Korea, Oman, Sri Lanka, Taiwan, Yemen
Africa	57	50	87.7	98.6	Djibouti, Eritrea, Libya, Mauritania, Mayotte, Seychelles, Western Sahara	Angola, Botswana
Northern America	2	2	100	100	-	-
Latin America	38	34	89.5	99.9	Antigua and Barbuda, Barbados, Grenada, US Virgin Islands	Curaçao
Oceania	13	11	84.6	79.6	Guam, Papua New Guinea	Fiji, Guam, Kiribati, Micronesia, Solomon Islands
World	***200***	***185***	***92.5***	***99.2***		

Note: * Excludes Kosovo

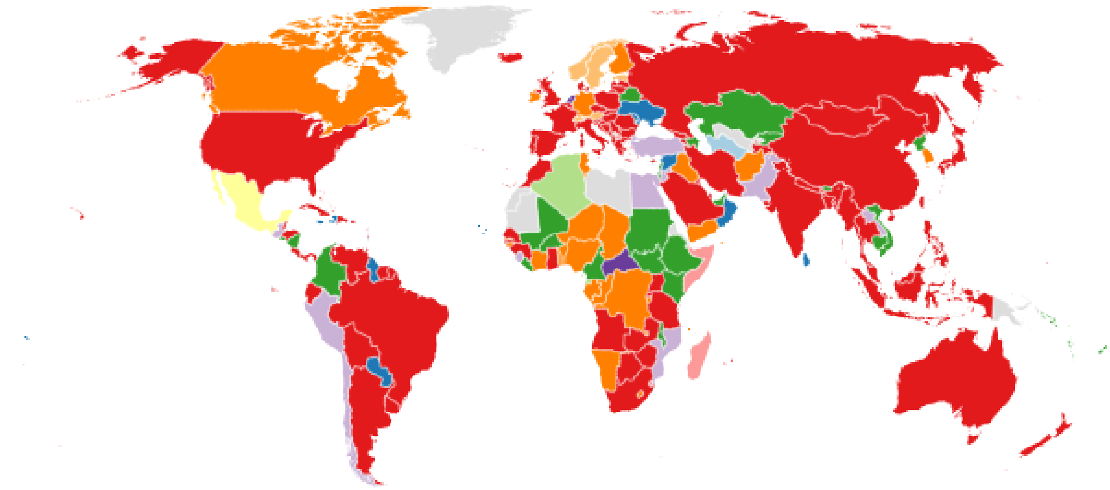

Figure 1: Types of data sources used in the WIC2023 dataset on populations by age, sex and education in 185 countries

Except for Mexico, the empirical education data come from source years different from 2020 (see Figure 1), necessitating an initial projection (nowcasting) to align them with the 2020 timeframe. We achieved this by extrapolating the educational attainment progression ratios (EAPRs) until 2020 for each of the five transitions, employing linear fitting of the logits of EAPRs (see section 2.2). It is important to note that our analysis only considers education among the population aged 15 and over. Starting at the first projection step (2020-2025), we also collect data on births categorized by the mother's education, primarily to apply maternal education-specific mortality differentials.

2.2. Education Scenarios

The recent data allow us to validate the educational expansion assumptions against new evidence and, if needed, rebase and adjust these assumptions to be reflected in the future education trajectories of the projected populations. The divergence can go in either direction, with some countries, for example, China, showing faster educational trends than anticipated in WIC2013, while others, especially among the least developed countries, witnessing stalls in educational attainment and slower progressions. In WIC2013, we defined one main scenario, the global education trend (GET), and three alternative education scenarios (Barakat and Durham 2014): constant enrollment number (CEN), constant enrollment rate scenario (CER), and the fast track (FT) scenario assuming universal rapid education progression, regardless of the existing trend.

In the WIC2018 update, education scenarios for the future were updated using the data from the 2010 census round and the most up-to-date surveys. The CER and GET scenarios were adjusted only to reflect the baseline data update. However, the FT scenario was replaced by a new Sustainable Development Goal (SDG) scenario. While the fast-track education scenario sets all countries onto the educational transition trajectory of South Korea and Singapore (as these countries experienced the most rapid educational expansion globally), the SDG scenario incorporates SDG targets for educational attainment. In many instances, it is more ambitious than the FT scenario in the short term. In the WIC2023 version, we largely adopt the approach taken in the WIC2018 update, with some adjustments, as detailed below. For the 26 countries with updated education structures, we calculate the future education trajectories for all scenarios to be consistent with the 2018 update. The scenarios are explained below:

The Global Education Trend (GET) scenario represents a moderate path for educational development, assuming an average trend based on the historical experience of all countries. Educational assumptions are integrated into SSP2 (see Table 3 in section 2.6). In our model, educational transitions occur progressively between ages 15-19 and 30-34, with no transitions to higher education after that. The sequence includes transitions to incomplete (e12) and completed primary education (e23) until age 15-19 (ultimate age group), lower secondary (e34) until age 20-24, upper secondary (e45) until age 25-29, and post-secondary (e56) until age 30-34. Cohort-specific EAPR scenarios are projected for each educational attainment in these age groups. EAPRs at younger age groups are derived from the ratio of age-specific attainment (in 2020) to the corresponding cohort's eventual attainment. This process generates one ratio for lower secondary at age 15-19, two for upper secondary at age 15-19 and 20-24, and three for post-secondary at age 20-24, 25-29, and 30-34. The same age-specific ratios are assumed for the projection period[6].

The Constant Enrolment Rate **(CER)** assumes that the EAPRs calculated at each level and for each country are set to be constant for the whole projection period (for ultimate age groups for each education) at the level estimated for 2020. It applies the same age-specific ratios for all age groups between 15-19 and 30-34. For many countries, this implies some progress as the younger generations are generally more educated than the older generations. This education scenario is implemented in SSP3 (see Table 3).

The Sustainable Development Goal (SDG) scenario, initially developed for the WIC2018 projections, represents a significant departure from the WIC2013 version, where it replaces the fast-track (FT) education scenario (see above). The SDG scenario assumes the achievement of SDG 4, targeting high-quality universal primary and secondary education by 2030. This goal is highly ambitious and unrealistic for countries with very low education levels. Moreover, by promoting progression to secondary education, the SDG scenario influences advancement to higher education as well. This results in rapid increases in the proportion of young cohorts with

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[6] Which still leads to changes in the ultimate cohort proportions by education.

post-secondary education for most countries, as the number of people with completed secondary education grows rapidly, along with EAPR to post-secondary. The post-secondary target is set at 90% for all countries (refer to Figure 2), to be achieved relatively, e.g., for Niger, passing 80% around the middle of the century. In this case, a less-developed country such as Niger surpasses a developed country Germany swiftly, as shown in Figure 2.

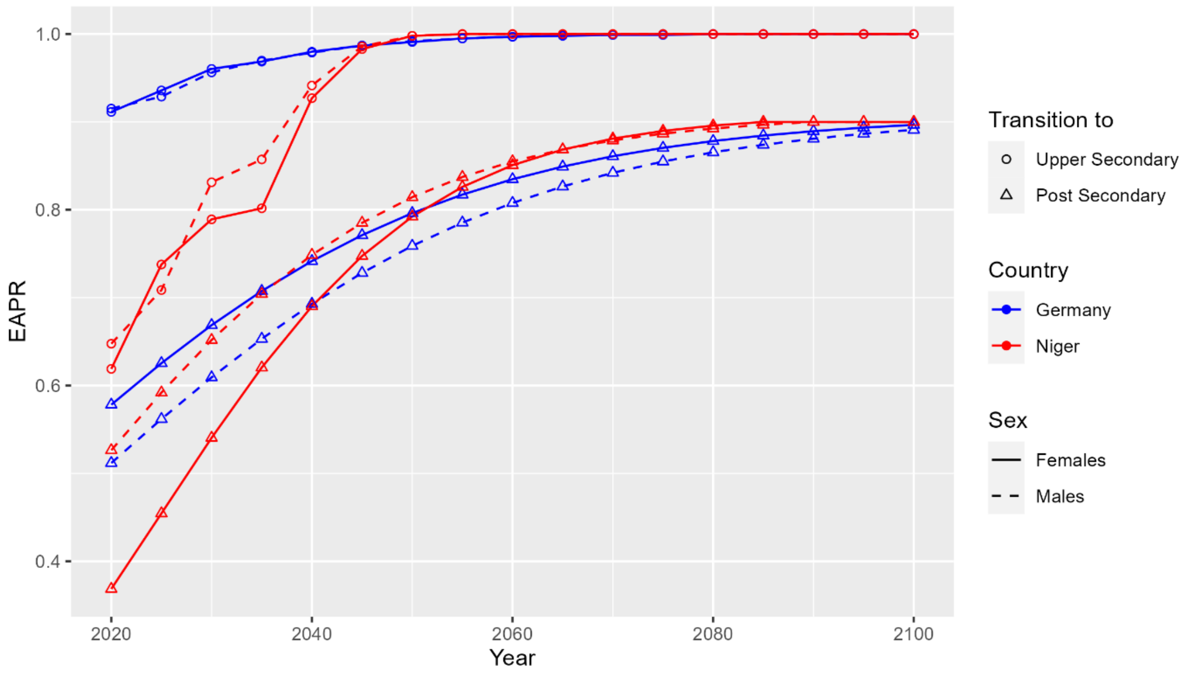

Figure 2: Educational Attainment Progression Ratios (EAPRs) to upper- and post-secondary by age 30-34 in Niger and Germany, SDG scenario

Figure 3 gives an example of how the EAPRs change across the projection period, depending on the scenarios in the case of two countries: Nepal and Sweden.

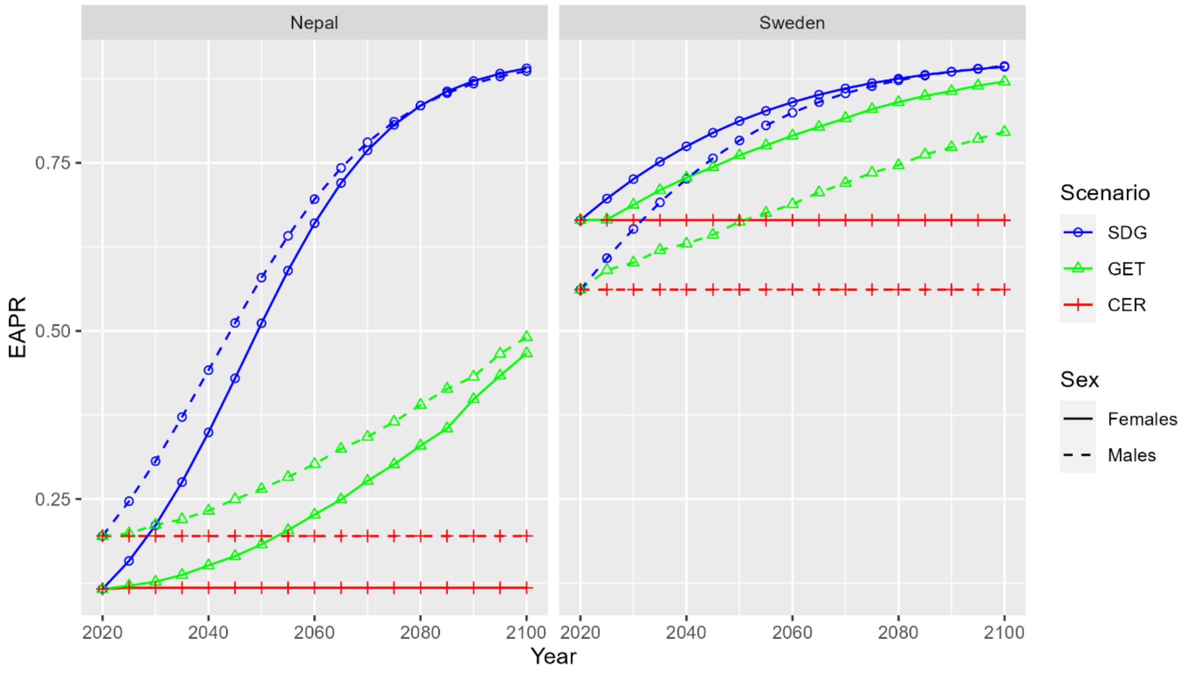

Figure 3: EAPR to post-secondary education by age 30-34 for Nepal and Sweden, CER, GET, and SDG education scenarios, 2020-2100

For the SSPs, we define two unique scenarios based on the assumptions of the education scenarios above mentioned:

The SDG-GET scenario is based on assumptions calculated as the average of the GET and SDG EAPRs. This education scenario is implemented in SSP1 and SSP5 (see Table 3). As a result of mixing the assumptions, this scenario allows for fast educational development without reaching to the extreme of imagining that all countries would be able to achieve SDG4. In 2023, the United Nations estimated that without further actions being implemented, only one out of every six countries will attain SDG4, ensuring universal access to quality education by 2030[7].

The CER-10% -GET scenario is implemented in SSP4 (see Table 3), reflecting increasing inequality within a country, and the existence of a dual society composed of an elite of highly educated individuals and a large segment of the population with lower secondary and below. It is calculated as a combination of GET for the transitions to upper-secondary and post-secondary education and CER-10% for the transitions to other levels.

[7] See https://sdgs.un.org/goals/goal4#progress_and_info [26/11/2023]

Educational Attainment Progression Ratios

We start with 185 countries in WIC2018, all having available educational attainment data. In this round, we find 26 countries with new data. For these countries, we generate education scenarios for the future. For the remaining 159 countries, we continue using the scenarios developed in WIC2018. However, for countries (122) with empirical data available in years not ending in 0 or 5, we notice errors in the syntax code when the data was (back-) projected to the nearest year ending in 0 or 5. We correct it in this round for the concerned countries while keeping the rate of change in the scenarios of WIC2018. For both sets of countries, generating a new set of scenarios for 26 country updates and correcting the WIC2018 scenarios for 122 countries, we convert the proportions to the educational attainment progression ratio (EAPR). We use the logit of the EAPRs in the modeling process. This process results in the educational attainment distribution for our projection's base year 2020. The steps are the following for each empirical country-sex educational attainment distribution:

1. We extend the given EAPRs (five in total - e12, e23, e34, e45, and e56, see section 2.2) to the hypothetical age 160+[8] by extrapolating the logits of EAPRs from the last known 5 age groups (as cohorts) using the logit regression model:

   logit(EAPR) = A + B*cohort
2. We generate an education-specific logit regression model for the scenarios using the empirical data from the ultimate age to the following six age groups.
3. For each country, we first align the existing scenario from WIC2018 to match the predicted values from the logit regression model. This results in temporal shifts. A final model is set by fitting the empirical logits and the shifted WIC2018 scenarios. Whenever the temporal shift is backward, the final model is extrapolated to cover the scenario's projection period (until 2115, 15 extra years needed to cover the cohort aged 15-19 in 2100). In a few cases, the alignment is not possible. We use the logit regression model to extrapolate and generate the scenarios.
4. We revise assumptions for calculating education transitions in ages below the ultimate age. Earlier models project proportions for each cohort when they reach age 30-34. Moreover, it assumes that the proportion that makes transitions in ages below the ultimate age converges for all countries in the short run: all transitions to low-sec (E4) happen by age 20-24 with 40% by 15-19; to upper-sec (E5) by 25-29 with 40% by 20-24. Furthermore, finally, for E6, all transitions are complete by 30-34, with 70% by 25-29. These assumptions indicate a quick global convergence in the timing of education attainment and could be unrealistic for specific future scenarios (such as GET). Therefore, in the current version, we assume that the transition timing at different ages will remain the same as the youngest birth cohort of 1995-2000, aged 15-19 in 2015. We acknowledge that this will maintain the late education completion in many developing countries.

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[8] This does not mean that we extend the life expectancy to this age but that we create transitions for hypothetical age groups based on trend extrapolation.

2.3. Mortality

The comparison of WIC2013 mortality estimates using the WPP2010 baseline with the present estimates of WPP2022 reveals substantial changes in mortality levels and patterns over the last decade. Overall, life expectancy at birth (LE0) increased more during 2015-2019 than was projected in WIC2013. We projected a LE0 of 68.4 years for men and 73.0 years for women, while the UN WPP2022 estimates a value of 69.8 and 74.9 years (averaged over the years 2015 to 2019). It is particularly the case in African countries (see Figure 4). It is noteworthy that the mortality situation has improved in many countries with high prevalence of HIV/AIDS, with antiretroviral treatment enhancing survival and preventing mother-to-child transmission of HIV (Gona et al. 2020; Tanser et al. 2013). In 2010, there were 48 designated as HIV/AIDS countries, which was reduced to 21[9] by 2022. Similarly, the number of high-mortality[10] countries decreased from 67 to 52. Child mortality declined in higher mortality countries due to improvements in women's educations, the standard of living, and public health interventions such as antenatal and postnatal care, immunization, skilled birth attendance (Kipp et al. 2016; Wang et al. 2014).

Some countries experienced a dramatic increase in female LE0 between 2015 and 2020, higher than what was projected by the WIC2013. For instance, WPP2022 estimates that the LE0 in Botswana for males would be 14 years higher in 2015-2019 than WIC projected in 2013. In Afghanistan, Eswatini, Zambia, and South Africa LE0 is ten years higher for males than earlier projected. For females, LE0 was observed to be eight years more in Zambia, DR Congo, and Afghanistan in 2015-2019 than was anticipated in WIC2013 for the same period. On the other hand, some countries have exhibited slower progress in LE0 than expected in WIC2013 in recent years, especially in Latin America, the Caribbean, and Europe. Several factors contributed to this, such as rising obesity and diabetes levels, and a slowdown in improvements in chronic diseases (Raleigh 2019; Murphy and Grundy 2022). In some countries, mortality has increased recently, resulting in a decline in LE0 in 2015-2019. In the United States Virgin Islands, LE0 was observed to be ten years lower and seven years lower in 2015-2019 for males and females, respectively, than predicted by WIC2013. Similarly, Brunei Darussalam experienced a seven-year lesser gain in LE0 for both males and females. In the Syrian Arab Republic, the civil war resulted in thirteen years less LE0 for men and seven years less for women than anticipated in WIC2013 for 2015-2019.

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[9] The 21 countries that are still considered HIV/AIDS countries in 2020 (WPP2022) are Kenya, Malawi, Mozambique, Rwanda, Uganda, Tanzania, Zambia, Zimbabwe, Cameroon, Central African Republic, Congo, Equatorial Guinea, Gabon, Botswana, Eswatini, Lesotho, Namibia, South Africa, Côte d'Ivoire, Guinea-Bissau, Liberia. The 27 countries that are no longer on the list are Angola, Bahamas, Belize, Benin, Burkina Faso, Burundi, Chad, China, DR Congo, Djibouti, Eritrea, Ethiopia, Gambia, Ghana, Guinea, Guyana, Haiti, India, Jamaica, Mali, Nigeria, Russia, Sierra Leone, Suriname, Thailand, Togo, USA.

[10] High- and low-mortality countries are defined based on the under-five mortality threshold—those with over 40 deaths per 1000 children before age five belong to the high-mortality group, and those with less than 40 belong to the low-mortality group.

*Figure 4: Difference in LE0 between WIC2013 assumptions & WPP2022 estimates for 2015-2020**

*The WPP2022 LE0 refers to the period 1 January 2015 to 31 December 2019 (reference: R package *'wpp2022'*, and the WIC2013 LE0 refers to the period 1 July 2015 to 30 June 2020.

In WIC2023, we linearly interpolate the LE0 for each sex between the UN estimates for 2015-2019 (WPP2022) and the original WIC2013 assumptions for 2095-2100, following the medium mortality scenario. This ensures the update aligns with the assumed and agreed-upon long-term mortality level based on extensive consultations with experts and meta-experts (Lutz, Butz, and KC 2014) for high- and low-mortality countries.

2.3.1. Life Table Generation

To derive a lifetable corresponding to a given life expectancy at exact age x (LEx), we develop an interpolation method using the UN sex-specific annual (January 1 to December 31) and single age lifetable estimates (2000-2019) and medium variant (2025-2099) for each country (United Nations, 2022b). UN life expectancies prior to 2000 are excluded to avoid fluctuations in LEx, especially in Sub-Saharan Africa, Eastern Europe, and some Southeast Asian countries such as Cambodia and Vietnam. Moreover, we exclude medium variant life tables from 2020-2024 to avoid the impact of COVID-19 – some countries experienced a loss of 2-3 years in LE0 – which is projected to be short-term in the WPP2022 until 2023 (see section 2.3.2). The main steps to derive life tables are outlined below:

1. For a given LEx (sex- and country-specific), we find its nearest equivalent between time t and t+1 in the corresponding annual trend and projection of the UN LEx *(known data points)* in WPP2022.

2. We then compute the log transformation of the age-specific mortality rates (mx) of the corresponding lifetables between time t and t+1.
3. Next, we interpolate the log-transformed mx (log(mx)) between the two sets (t and t+1) to obtain a lifetable corresponding to the given LEx. For life table calculations using mx, a series of ax (the mean person-years lived by those who died during age x) is needed. While the UN assumes an ax value of 0.5 year for ages above 0, the value is much smaller for infants whose mortality is higher within the first days after birth. Therefore, we also interpolate for the a0 corresponding to a given infant mortality rate (m0) using the sex and country-specific UN series (estimates and the medium variant) of m0 and a0 between two points (t and t+1).
4. If an estimated LEx is larger than the maximum LEx available in WPP2022 (for 2099) in the known data points, we adjust the log(mx) for 2099 proportionally, to obtain the log(mx) for the estimated LEx.

2.3.2. Impact of COVID-19

The COVID-19 pandemic disrupted the improvement in mortality rates, resulting in decreased life expectancy at birth globally. Figure 5 compares life expectancy at birth in 2020-2024 with (WPP2022) and without the pandemic (hypothetical, interpolated). The impact of the pandemic on life expectancy differs across countries, both for males and females. We account for the negative effect of COVID-19 on the progression of LE0 gains between 2020 and 2023. Non-COVID survival ratios are first calculated by linearly interpolating LE0 for 2020-2024 using the UN Medium Variant LE0 estimates for 2010-2015 and 2025-2029. We then generate non-COVID life tables using each country's UN sex-specific life tables, as explained above (see section 2.3.1). Here, we follow the WP2022 assumption (United Nations, 2022b), which assumes full recovery of the pre-COVID-19 path for the LE0 trajectory by 2023. Due to the negative health impact of expected "long-COVID," future mortality rates might still have the COVID-19 signature. However, with no concrete evidence, we continue with the UN assumptions. We calculate the relative ratio of the UN survival ratio with and without COVID (see Section 2.3.1). The relative ratios are then used to adjust the survival ratios for 2020-2025. With this correction, in our medium-mortality variant, COVID-19 results in about 20 million excess deaths between 2020 and 2025, higher than the WHO estimates of 15 million (Msemburi et al. 2023), due to different methodologies.

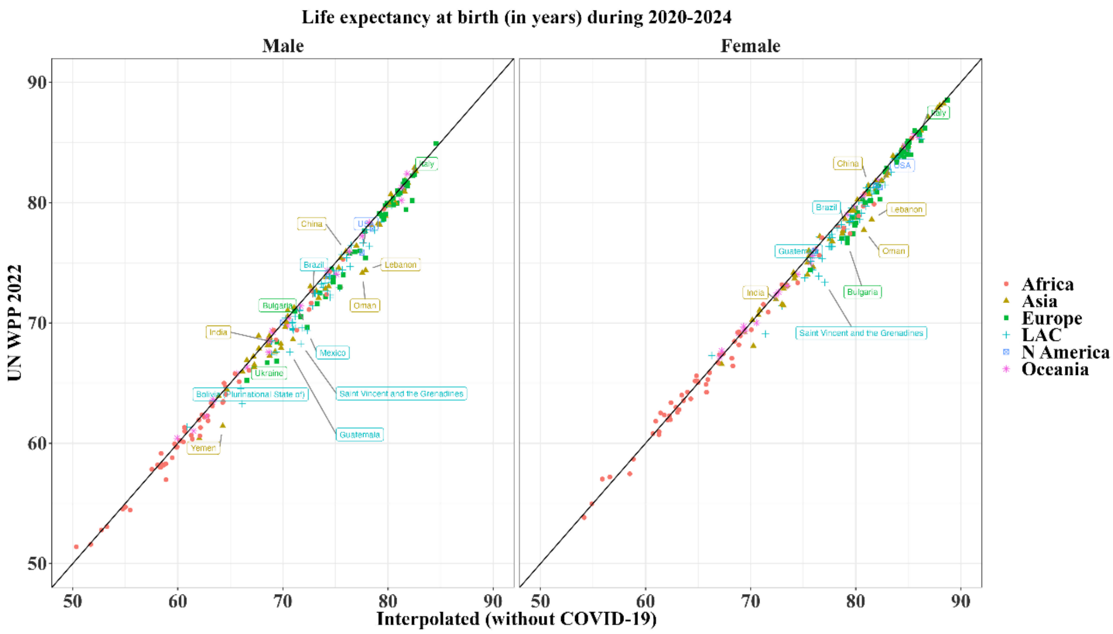


Figure 5: Life expectancy at birth (LE0) for the period 2020-2024 comparing UNWP2022 and interpolated between 2015-2019 and 2025-2029 (without COVID-19)*

*The WPP2022 LE0 refers to the period 1 January 2015 to 31 December 2019 (reference: R package *'wpp2022').*

2.3.3. Education Differentials in Mortality

The final step in updating mortality assumptions involves the education differentials in mortality rates and LE0. In the previous WIC2013 and WIC2018, we used standardized differentials in mortality based on available evidence from a limited number of countries. For WIC2023, we collect more available data from various sources, broadly categorized into Demographic and Health Surveys (DHS) and other data sources (mainly Eurostat, longitudinal surveys, and scientific publications).

We calculate education-specific adult LEx using these available data sources. Alternatively, for 40 countries (see Table Am1), education-specific adult-age LEx are available. We generate lifetables for a given adult age-specific LEx (preferably at age 15), as explained in section 2.3.1. Moreover, for missing under-five mortality (U5M) differentials in these countries, we extrapolate the adult differentials to children using the UN life tables (see section 2.3.1).

Further, using recent DHS data, we estimate the U5M rates by mother's educational level for 65 countries (see Table Am2). The details for the under-five mortality estimation using DHS data are provided in (Dhakad and KC 2024). It is assumed that children under the age of 15 have similar educational differences in mortality to those observed among children under the age of five. Using the mortality estimates below age 5, we generate the full life table following a similar approach for a given LEx (as explained in section 2.3.1), compute the life expectancy at age 15 ($LE15_{edu}$), and use it as the adult mortality differential.

Altogether, we now have estimated education-specific mortality data for 100 countries. For the remaining 100 countries, we use proxy (single or aggregate of countries) mortality differentials from the known 100 countries. The proxy country selection is based on two criteria: geographical proximity and LE0 level. We use the average education differentials for countries in the Eurostat database for low-mortality countries (N=29) and the average of the DHS countries for high-mortality countries (N=3). The education-specific LEx are shown in Figure 6 for low-mortality countries and in Figure 7 for countries using DHS data (mostly high-mortality countries).

Figure 6: Estimated life expectancy at a given age (in parenthesis) by level of educational attainment, low-mortality countries, and latest available periods (for details, see Appendix Table Am1 and Am3)

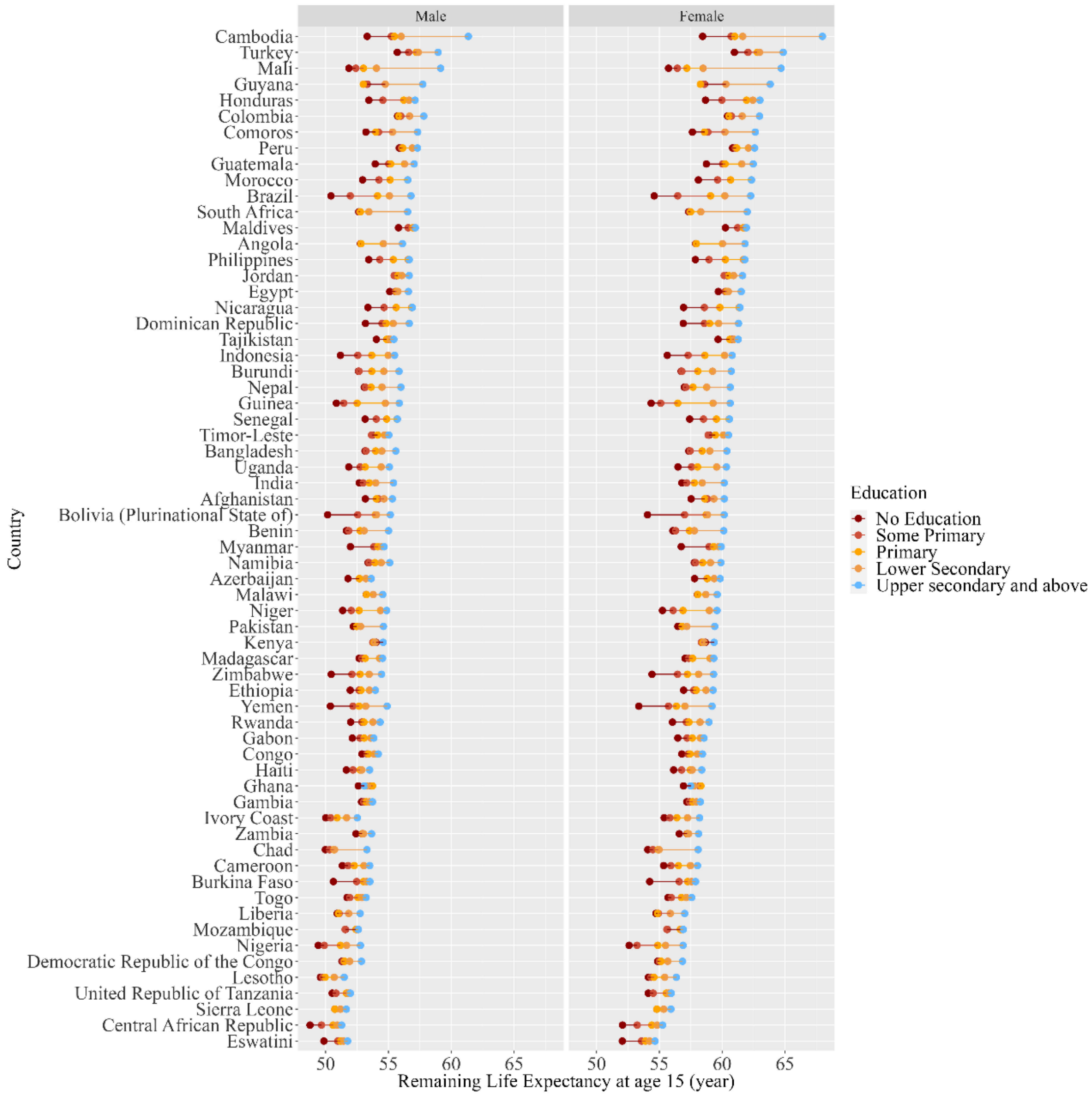


Figure 7: Estimated life expectancy at age 15 by level of educational attainment, countries with DHS data (for details see Appendix Table Am2 and Am3)

Note: Post-secondary includes upper-secondary

2.3.4. Mortality Differentials Scenario

We keep the relative mortality differentials constant for the entire projection period, similar to the assumptions made in WIC2013 and WIC2018. The implication of this assumption within the population is less variation in the population when levels of educational attainment improve.

We use education distribution and mortality differentials for the population aged 15 and over by sex. For the under-15 age group, we use the sex-specific life expectancy extrapolated from adult mortality in non-DHS countries. In the DHS countries, mortality differentials based on maternal education are used for children under the age of 15. We then run an optimization procedure to generate lifetables to match the age-specific deaths between the overall lifetable and the education-specific ones.

2.3.5. High- and Low-Mortality Scenario

These scenarios do not change between the WIC2023 and the WIC2013/2018 versions. The high-mortality variant is generated by reducing the gain in LE0 per decade by one year for both sexes from the LE0 medium scenario assumptions. In contrast, countries would gain one extra year per decade in the low-mortality scenario compared to the LEO medium scenario assumptions. We set a maximum limit for LE0 at 105 years, particularly relevant for low-mortality countries such as Japan. Life tables are generated for low- and high-mortality scenarios following the steps taken above for the medium scenario. The high-mortality scenario is implemented in SSP3 (all countries) and SSP4 (only for high-fertility countries), the low-mortality scenario in SSP1 and SSP5, and the medium scenario in SSP2 (all countries) and SSP4 (only for low-fertility countries) (see Table 4).

2.4. Fertility

The WIC2023 update also includes a revision of the fertility scenarios, starting with the base-year data. When we compare the total fertility rate (TFR) as projected by WIC2013 for 2015-2020 and the actual TFRs estimated by the UN (WPP2022) in Figure 8, it is clear that in most countries, the TFR for 2015-2020 did not decline as projected in WIC2013 (see data points above the diagonal line), especially in medium- and high-fertility countries, e.g., in sub-Saharan Africa (Chad, Central African Republic), and Central Asia (Uzbekistan, Kyrgyzstan). The stalls in fertility decline or less rapid fertility decrease than expected happened for multiple reasons that have mainly to do with stalled or slow socioeconomic development (Bongaarts 2020).

On the other end of the spectrum, fertility levels in many countries such as Timor-Leste, Puerto Rico, Jamaica, and South Korea have declined more rapidly than anticipated. This was the case especially in low-fertility countries. South Korea's total fertility rate (TFR) has fallen to an extreme low level of 0.78 children per woman in 2022 . In East Asia, the persistent gender inequalities, as well as the challenges associated with educating children, combining work and family life in the context of long and inflexible work hours, and securing housing in the major cities where the majority of the region's population resides have negative impact on fertility (Jones 2019).

We update the fertility trajectories to reflect recent trends as explained below. Also, the education differentials are updated for countries where recent DHS data are available. Here we describe the method to derive the fertility assumptions for the WIC2023. The basic methodology is described in KC et al. (2014).

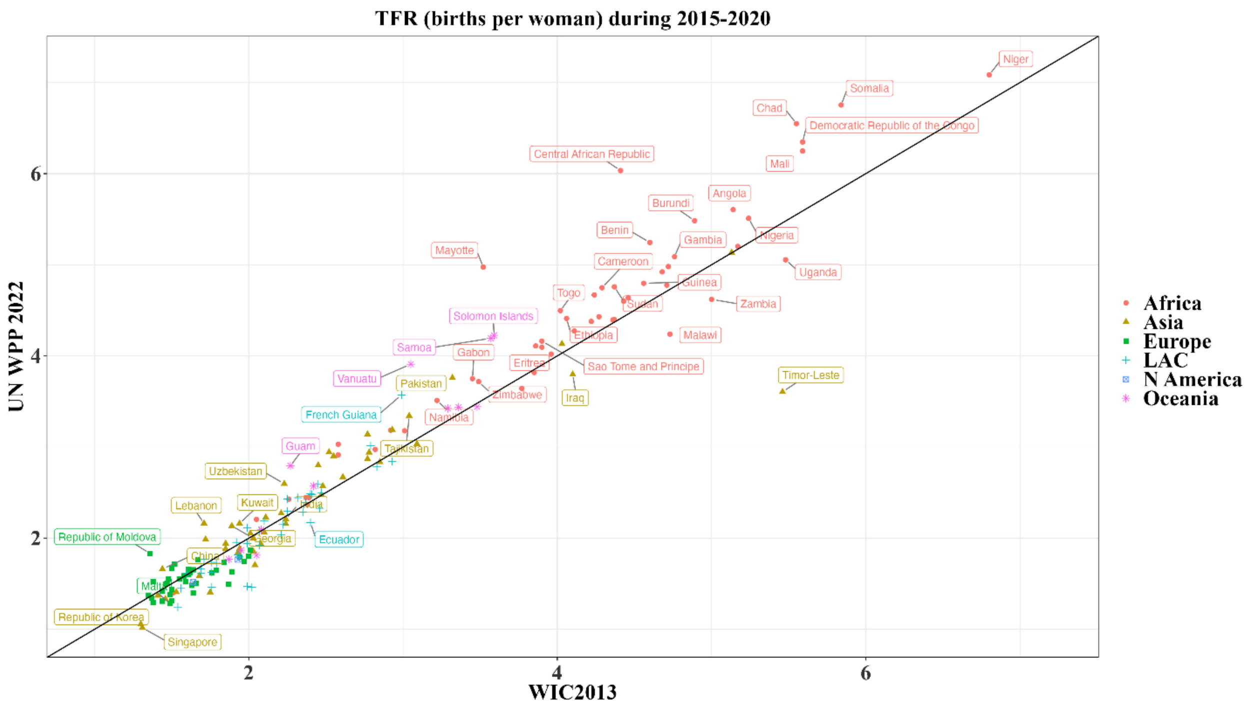


Figure 8. Total Fertility Rates for 2015-2020, projected in WIC2013 and estimated in WPP2022, all countries

2.4.1. High and Low Fertility Countries

To translate broader narratives into bundles of specific demographic assumptions, the countries are divided into two groups depending on their TFR and human development index (HDI) as assessed in 2005-2010. Low-fertility countries (63) are defined as countries with a) TFR<2.1 and HDI>=0.65; or b) 2.1<=TFR>2.5 and HDI>= 0.67 or unknown HDI, and; c) Israel (TFR>=2.5 & HDI>0.85). The remaining are considered high-fertility countries (137).[11]

2.4.2. Total Fertility Rates

For this round, we move forward the jump-off period for fertility projection from 2005-2010 in WIC2013 to 2015-2020. Some countries classified as high-fertility countries in WIC2013 would now fall in the low-fertility category according to the WPP 2022 and other available data. This is especially the case of many Latin American countries and countries from South-East Asia. However, we decided to keep our earlier categorization because of the complexities of updating the assumptions that were generated in WIC2013. For most countries, we do

[11] see Appendix Table Af1.

not use the 2030 TFR assumptions as designed in WIC2013 but use instead the 2050 and 2100 assumptions as points for the trendline. Only in a few selected low-fertility countries (explained below in section 2.4.3), we also kept the 2030 data point (as well as the 2050 and 2100) ones.

2.4.3. Baseline TFR Update

High-fertility countries

We use WPP2022's TFR for high-fertility countries in 2015-2019, with a few exceptions, i.e., Argentina, Brazil, Costa Rica, Chile, and Uruguay. For these countries, we interpolate the TFRs between the data from 2015 (using WPP2022) and 2020 (using the United Nations Demographic Yearbook 2020 (United Nations 2021)) to obtain the baseline values, which were thought to be more realistic according to fertility experts.

Low-fertility countries

We collect and estimate the TFRs around 2020 from various sources for low-fertility countries. Often, these levels differ significantly from the baseline data we used in WIC2013 (see Appendix Table Af2). A few country-specific notes are listed below:

- In Romania, different official datasets on population by age and sex and fertility rates were published in parallel by the national statistical institutes. We used a TFR of 1.76 published for 2019 in Table 2.13 in the Romanian Statistical Yearbook 2021. This value is also reported in Eurostat statistics.
- For Belarus, only data for 2019 was available.
- For four countries (Cyprus, Greece, Montenegro, Serbia), we use Eurostat-published value for 2019.
- For three countries (Albania, North Korea, and New Caledonia), we use UN WPP2022 for 2015–2019.
- For Russia, we use data from the Russian Fertility and Mortality Database[12].
- For Iran, we calculate the TFR from age-specific fertility rates (ASFRs) published in UN Demographic Yearbook 2020, Table 10, for 2019 (1.67 children).
- For China, we use the value 1.3 for 2020 based on various sources compiled by Cuiling Zhang, China Population and Development Research Centre, Beijing. TFR is further estimated to decline to 1.1 in 2022 and then increase to 1.2 in 2030 and to 1.4 in 2050, according to fertility experts at the Wittgenstein Centre.
- For Bosnia and Herzegovina, and North Macedonia, we use the deficient data to estimate the base-year TFR at a level of 1.5 children.

[12] Available here: http://demogr.nes.ru/index.php/en/demogr_indicat/data_description [8/1/2024]

- For Puerto Rico, we use a TFR value of 0.92 in 2020 based on US birth data publication (Osterman et al. 2021).

For low-fertility countries, the fertility level for the period 2015-2020 is estimated based on a set of simple rules:

- For most countries, this is calculated as an average of 2015 (as used in WIC2018) and 2020 values (estimated from different sources, see also above).
- For three countries (Albania, North Korea, and New Caledonia), we used the UN WPP2022 values for both 2015 and 2020.
- Bosnia and Herzegovina: estimated at 1.5 (based on WIC expert estimation).
- Moldova: estimated at 1.83 (average TFR values from NSO for 2015–2019).
- Romania: estimated at 1.70 (average TFR values from NSO for 2015–2019).
- Iran: estimated at 1.96 (average from values for 2015–2019 from the Iranian Demographic Yearbook 1399).

2.4.4. TFR for 2030 and 2050 Assumptions

In the low-fertility countries, we project the TFR using linear interpolation between the baseline TFRs from 2015-2020 or 2020 or 2022 (in the case of China) to 2030 (for 33 countries) and to 2050 (for all 63 countries) and the TFRs provided by experts (WIC2013 and WIC2018). There is only one change in the 2030 estimate – for China, where we newly estimate the level at 1.2 based on recent evidence as explained above.
In the 30 low fertility countries, for which we do not use the previous set of 2030 values, interpolate the TFR values between 2020 and 2050. These countries are located in Northern, Western and Southern Europe, East Asia, USA, Canada, Australia and New Zealand. They experienced a faster decline in fertility levels than previously projected in WIC 2018, which lead us to modify the pathway to 2050, using the following criteria:

- The observed 2020 TFR is lower by 0.20 or more than the projected TFR for 2030 in WIC2018;
- Or the projected TFR for 2030 in WIC2018 is at 1.8 or higher, whereas the currently observed TFR in 2020 is below 1.8.

For high-fertility countries, the projection method described in KC et al. (2014) is implemented, skipping the 2030 values, and using the 2050 values that were based on the opinions of experts and meta experts. Beyond 2050, we follow the method outlined in KC et al. (2014) for both low- and high-fertility countries, with the TFR converging slowly to 1.75 either by decreasing (for countries having not reached a TFR of 1.6 before 2100) or by increasing (for countries having reached a TFR of 1.6 or below before 2100) until 2200. Finally, because of the lack of data availability, the impact of COVID is only considered for low-fertility countries. We assume that TFR would be stalled in low fertility countries from 2015-2020 to 2020-2025 due to COVID uncertainty and that COVID would have no further impact after 2025.

2.4.5. Age Specific Fertility Rates (ASFRs)

For a given TFR trajectory, we generate ASFRs using the UN WPP2022 Medium variant annual ASFRs for each country. We follow these steps:

- For each country, for the TFR value for the first period, 2020-2024 ($tfr_{2020\text{-}2024}$), we identify the matching UN annual TFR (year 2000-2021 in estimates and 2022-2099 in the Medium Variant) and record the time interval (t, $t+1$), such that $tfr_t < tfr_{2020\text{-}2024} < tfr_{t+1}$;
- We extract the $asfr_t$ and $asfr_{t+1}$ from the UN's annual ASFRs.
- We then linearly interpolate for the value of the $tfr_{2020\text{-}2024}$ using $asfr_t$ and $asfr_{t+1}$, resulting in $asfr_{2020\text{-}2024}$
- For the next period, we repeat the steps but within an upper limit as the next ten years (t to $t+10$), restricting a larger jump in the ASFR pattern and ensuring the progressive assumption in the UN's ASFR to an increase in the age at childbearing (see Figure 9 for Kenya).

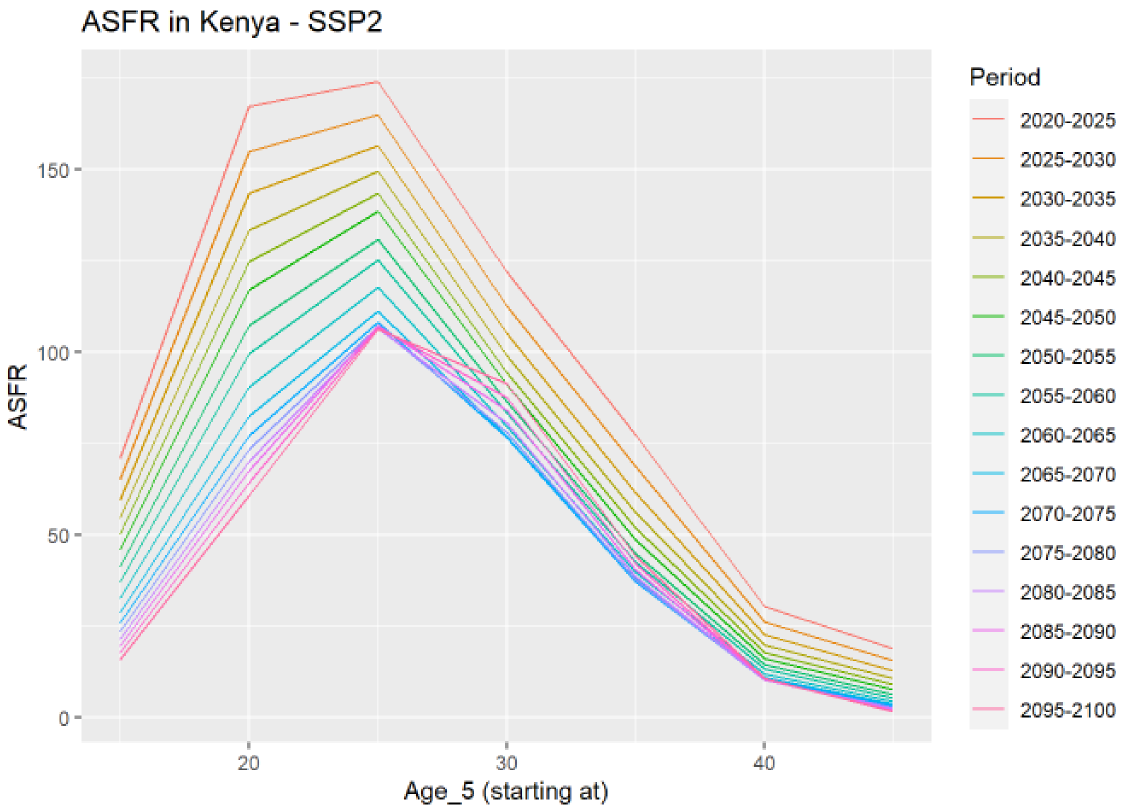


Figure 9: Projected ASFRs (per 1,000 women) for the Medium TFR scenario in Kenya, 2020-2100

2.4.6. Education Differentials in Fertility

We estimate the education differentials in fertility from the latest available data sources in line with the previous WIC projections (WIC2013, WIC2018). The differentials for the first period (2020-2024) are presented in Appendix Table Af3. We keep the educational differentials that were computed in WIC2013 for some and updated in 2018 for most countries. For 51 countries, we are able to update them using the latest DHS data. In most countries, the educational differentials in TFR do not change significantly (see Figure 10) comparing with WIC2018). However, the relative ratios are higher than previously estimated in Haiti, Chad, Liberia, DR Congo, and Mozambique. The most significant increase in relative ratios is seen in Haiti, where the ratio between upper secondary and post-secondary education is twice as high, and other education levels also display 1.9 times higher relative ratios compared to post-secondary education. Conversely, some countries have significantly lower relative ratios. For example, in Ethiopia, the relative ratios between education specific TFRs decrease by 30-45% in individual education categories, in relation to post-secondary education compared to the previous estimate.

When projecting the education-based differences in TFR, we assume that once the TFR reaches 1.8 births per woman, the education differentials would converge to specific TFR ratios relative to post-secondary education. We assume a convergence ratio of 1.42 for those up to primary completion, and 1.35 and 1.14 for lower and upper secondary, respectively – the rationale is explained in (Basten, Sobotka, and Zeman 2014). For countries where the maximum differential lower than 1.42 in the base year, the relative ratios are maintained at those lower levels throughout the projection period with a minimum of 1.05 (for some Nordic countries, that do not display an education differential in fertility, we introduce a minimal differential as explained in KC et al. (2014)).

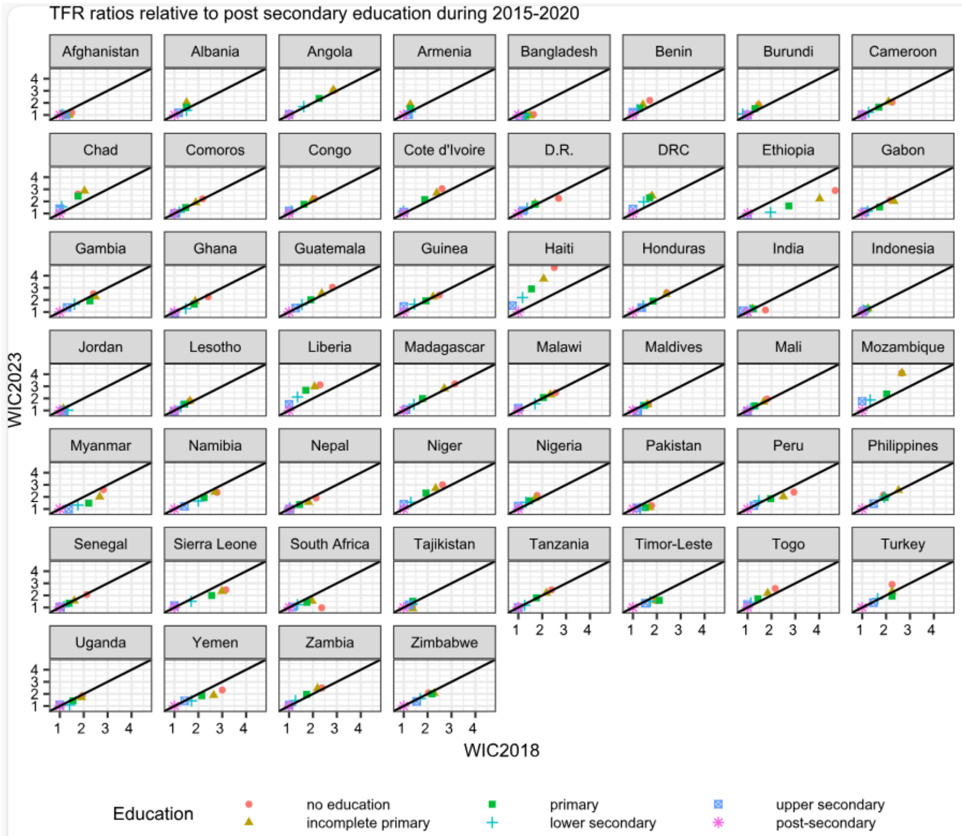


Figure 10: Relative ratios of education-specific TFRs to a TFR of women with a post-secondary education in WIC2018 and WIC2023 projection (latest available), 51 countries with updated TFR differentials

Note: DR= Dominican Republic, DRC= Democratic Republic of the Congo

For fertility scenario that is used in SSP2, we combine the above-described medium assumptions for ASFR and education differentials in TFR to generate education-specific ASFRs by minimizing the sum of the squared difference in age-specific births between age-sex and age-sex-education calculations at each time step of the projection.

2.4.7. High and Low Fertility Scenario

In addition, we define high and low fertility scenario relative to the medium fertility assumptions. The high (low) pathway assumes that education-specific TFRs are 20% higher (lower) than the medium up to 2040, with the difference subsequently increasing to 25% by 2060 and remaining at that level until 2100. The low fertility assumptions are used in SSP1 and SSP5 for high-fertility countries, and in SSP4 for low-fertility countries. The high fertility assumptions are used for SSP3, and SSP4 in the case of high-fertility countries. We also develop an additional low-fertility scenario (Low10) which is 10% lower than medium after 2040 and 12.5% after 2060. This scenario is used in SSP1 and SSP5 for low-fertility countries as it is more consistent with the general narrative of these two scenarios that imagine better economic conditions in countries that already have low fertility (see Table 3).

2.5. Migration

International migration is volatile, difficult to predict, and certain events (such as the Syrian civil war, the COVID crisis, and the invasion of Ukraine by Russia) impact the flows between countries. However, some features are more stable, e.g., on average, certain countries are known to attract migrants or others to send migrants. In 2020, (Abel and Cohen 2019) estimated bilateral international migration flows for 200 countries and in 2022, Abel and Cohen updated the estimates using the latest population stock data of the ("International Migrant Stock 2020" 2020) and further disaggregated them by sex. In the WIC2023 and for the first time we explicitly include the international migration flows by age, sex, and educational attainment (using IPUMS[13] data). The methodology and the results are provided in Yildiz and Abel (2024). To arrive at immigration and emigration rates by age, sex, and educational attainment for the base period (2015-2020), first, age, sex, education distribution of immigration and emigration rates calculated by two random forest models; and then, these rates are used to disaggregate the average migration rate for the 1990-2020 period for each country. The main steps are as follows:

Step 1: Age, sex, and education distribution of immigration and emigration rates

- A random forest model is used to predict the proportions of immigration flows by age for males and females using IPUMS data for 183 countries.
- A second random forest model is used to disaggregate the age and sex distribution of population over 15 years further by educational attainment using IPUMS data for 183 countries.
- Rogers-Castro migration age schedules (for immigration rates) are used to smooth the age distribution of immigration flows by age group and education for both sexes.
- Emigration flows for each country and sex by Abel and Cohen (2022) are disaggregated by age and educational attainment according to the age and education distribution of all international migration flow in the same period except the immigration flow to that particular country.
- Immigration and emigration rates by age, sex and education are calculated by dividing the flows by the population by age, sex and educational attainment of each country.

Step 2: Average immigration and emigration rates by country

- Country specific immigration and emigration rates are calculated by dividing the average 1990-2020 immigration and emigration flows by Abel and Cohen (2022), respectively, by the rest of the world and the country's population in 2020 after removing the outlier flows.
- Outliers are identified as the flows for which the difference between the mean flow of the country (for 1990-2020) and the flow for the specific five-year period were above or below 1.5 standard deviation.

[13] https://www.ipums.org/

Step 3: Adjustments

- Average immigration and emigration rates for each country are disaggregated by age, sex and education to reflect the age, sex and education distribution of the rates estimated using two random forest models in the first step.
- A final correction for the sex-specific under-15 years rates is done by averaging the sex-specific rates to ensure no sex differential migration rates among children.

For the projections, we first design the medium migration scenario, that is used in SSP1, SSP2 and SSP4 (see Table 3:

- We first assume that, for each country, the age-, sex-, and education-specific migration flow rate would remain the same as estimated for 2015-2020 until 2060 and then converge to net-zero total flows for each education group by 2095-2099. This step incorporates the effect of the compositional change in education.
- We adjust all flows to match the flows corresponding to the overall rate for the country, similar to WIC2013 assumptions.
- As a final step, we adjust the age, sex, and education-specific global immigration numbers to be equal to the emigration numbers.

The low migration scenario, as utilized in SSP3, assumes migration rates will be half of those in the medium migration scenario from 2020-2025. Conversely, the high migration scenario (utilized in SSP5) assumes that migration rates will be twice as high as those in the medium scenario.

We add two migration scenarios that are applied to SSP2 which has a medium migration component in its basic version: one with zero migration and one with double net- migration. These scenarios are important to show the impact of migration on the population numbers and structures.

2.6. The SSPs

Table 3 shows the demographic and human capital scenarios for the five SSPs. The SSPs are part of an ongoing global effort, associated with the Intergovernmental Panel on Climate Change (IPCC), to depict various future trends regarding socioeconomic challenges for climate change mitigation and adaptation (O'Neill et al. 2017). In contrast to prior IPCC scenarios that focused solely on total population size and GDP, the SSPs offer a more comprehensive view of demographic and social trends. These scenarios, elaborated on in KC and Lutz (2017) and KC et al. (2018), encompass factors such as age, gender, education levels, forming the 'human core' of the SSPs, which also incorporate other dimensions like energy and economic variables (Riahi et al. 2017).

Table 3 shows how the assumptions described in Sections 2.2 to 2.5 are assembled within the SSPs. The Middle-of-the-Road/Continuation SSP2 scenario combines medium fertility, mortality, and migration assumptions with the Global Education Trend (GET) scenario. In SSP1 (Sustainability/ Rapid Social Development) the rapid education expansion scenario (SDG-GET education scenario) is combined with rapid fertility and mortality decline. SSP3 (Fragmentation/Stalled Development) combines stalled school enrolment rates (CER education scenario) with slow fertility and mortality decline. SSP5 (Conventional Development) is a variant of SSP1 but with high migration, and SSP4 (Inequality) combines a mix of demographic variants and a distinct within-country unequal educational attainment (CER-10%GET). In the SSP4 educational scenario, the SSP3 education transitions (CER) are decreased by 10% for levels up to lower secondary education, keeping the SSP2 (GET) education transitions for upper and post-secondary education.

In WIC2013 and WIC2018, a distinction was made between high-fertility, low-fertility and rich-OECD countries. This is partly removed in WIC2023 by merging rich-OECD countries with low-fertility countries, resulting in two country groupings (see Section 2.4.1). This is done to avoid artificial differences in future demographic trajectories between the two groups. Appendix Tables Ar1a and Ar1b show the changes in the composition of the scenarios that were implemented between WIC2013 and WIC2018 (Table Ar1a) and between WIC2018 and WIC2023 (Table Ar1b).

Table 3: SSP combined assumptions for fertility, mortality, migration and education

		SSP 1		**SSP 2[a]**	**SSP 3**	**SSP 4**		**SSP 5**	
Country Grouping									
		HiFert	*LoFert*			*HiFert*	*LoFert*	*HiFert*	*LoFert*
Population									
	Fertility	Low	Low10	Med	High	High	Low	Low	Low10
	Mortality	Low		Med	High	High	Med	Low	
	Migration	Med		Med	Low	Med		High	
Education		High (SDG-GET)		Med (GET)	Low (CER)	CER-10%/GET		High (SDG-GET)	

Note: HiFert = high-fertility countries, LoFert = low-fertility countries; [a] The SSP2 scenario has two more variants with double and zero net migration.

2.7. Ukraine Correction

We correct some of the flows of the migration assumptions to take into account the refugee movements in 46 countries due to the invasion of Ukraine by Russia, following the assumptions and results of the work by (Ueffing et al. 2023). The main assumptions and steps are summarized below:

- We assume nine million Ukrainian refugees (by age and sex, mostly children, elderly and women) left Ukraine immediately after the war. However, fifty percent of refugees would return (4.5 million) after the war ends by 2025. This is the first wave of refugees.
- More people (more men than women) leave the country for family reunion, we assume 1.17 million by 2025. This is the second wave of refugees.
- Out of the remaining refugees (5.67 million, first and second waves) by 2025, 75% would eventually return by 2050.
- We maintain the refugee population separately for each country (46 countries) until 2050, after which we combine the remaining refugees and their children with the host population.
- We apply Ukraine's fertility, mortality, and education progression to the refugee population.
- We assume no educational differential for the refugee movement, mainly due to unavailable data (although qualitative surveys have shown the selectivity of Ukrainian refugees (Kohlenberger, Rengs, and Buber-Ennser 2022).

2.8. Regional and Global Aggregation

Excluding countries with populations smaller than 80 thousand, alongside a few larger ones (e.g. Kosovo), leads to the world population being smaller by 2.94 million in 2020 than estimated by the UN (United Nations 2022b). The 200 countries in our sample cover 99.962% of the world population. Hence, the regional total and, consequently, the global total need to be corrected. Here, we define a simple rule using the total population size in 2020 from the UN's estimate. We calculate the ratio of the total population in the UN-defined world regions (22 in total) to the aggregated total population of countries within the region included in our projection. A value of one indicated no missing population data. In nine world regions, some population is missing (see Table 4). We apply the correction factors for all population, births, and deaths figures (total or otherwise) for the projection period. The following table shows the correction factors for nine world regions.

Table 4: Adjustment factors for nine UN regions*

UN World Regions	Adjustment factor
South America	1.000009
Western Africa	1.000013
Northern America	1.000337
Western Europe	1.000388
Northern Europe	1.002908
Caribbean	1.009058
Southern Europe	1.012059
Polynesia	1.145825
Micronesia	1.305544

*Ratio of population of the UN region and aggregate of countries in the projection within the region.

3. Results

We present selected results from our projection and how they compare to earlier results (WIC2013 and WIC2018), and other global population projection exercises.

3.1. Global and Major World Regions

Figure 11 compares the medium scenario (SSP2) in WIC2023 with the earlier versions (WIC2013 and WIC2018) and with the medium variant of the projections by the United Nations (2022), of the Institute for Health Metrics and Evaluation (IHME) (2020) and the US Census Bureau (2021). In the WIC2023's SSP2, the world would peak in 2080 at 10.13 billion and slowly decline after that to reach 9.88 billion in 2100. WIC2018 had its peak happening in 2070 at 9.7 billion, with the world population at the end of the century at 9.3 billion. WIC2013 again projected lower population growth, peaking at 9.4 billion in 2070 and declining to 8.9 billion by 2100.

There are two main reasons behind the increasing projected population in the WIC projections. Firstly, the larger starting population, which can be seen by comparing the projected population in 2015 by WIC2013 and the actual population estimated by the UNWPP2017 (7.25 vs 7.38: 130 million higher), and the same in 2020, when the estimated population in 2020 was 200 million more than projected in WIC2013 (but only 30 million more than projected in WIC2018). While the difference at the global level is quite small in relation to the total population (a 2% difference between WIC2013 and WIC2023 in 2020), it is more substantial in Africa where the population in 2020 is 6% higher than projected in WIC2013 (1.344 vs 1.268 billion), 5% in Oceania (44 vs

42 million), and 2% in Asia (4.678 vs 4.557 billion). For other regions (Europe, Latin America, and Northern America), the difference lies between -0.1% and +0.3%.

Table 5: Base-year population in WIC2013, WIC2018, and WIC2023 and projected subsequent years, 2010-2015

	2010	2015		2020	
Base year	Estimated	Estimated	Projected	Estimated	Projected
WIC2013 based on WPP2010	6.87		7.25		7.61
WIC2018 based on WPP2017	6.97	7.38			7.78
WIC2023 based on WPP2022*	6.94	7.38		7.81	

Note: WPP2010 and WPP2017 give the population on June 1st, while WPP2022 gives the population on January 1st.

Secondly, and related to the change in the base-year, there are certain changes in the pathways leading to the projected population until 2100. The fastest growing region would be Africa, whose population would not peak in this century, and would continue growing until 2100, reaching considerably higher level than projected in WIC2013 (3.55 compared to 2.62 billion in 2100, hence a 35% difference). This is the result of a further expected decline in mortality, especially among children, that has become evident in the last years, combined with a slower fertility transition in many African countries. The other substantial difference at the regional level, with less bearing on the global population size is the projected population of Northern America which is 14% smaller in 2100 in WIC2023 compared to WIC2013 (450 vs 524 million). The main reason is a deceleration of the gain in life expectancy as well as a decline in net migration. In other regions (Asia, Europe, Latin America, and Oceania), the difference in 2100 is less important.

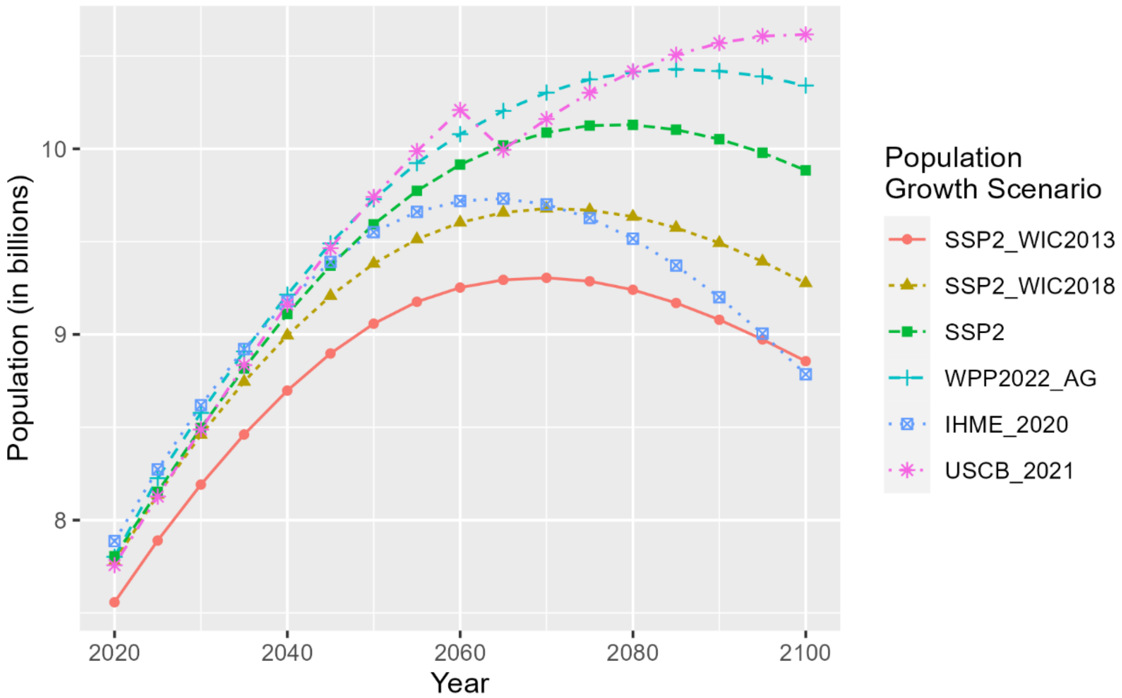


Figure 11: Comparison of world population projections – medium scenario – by WIC (WIC2013, WIC2018, WIC2023), United Nations (WPP2022), the US Census Bureau (USCB, 2021), and IHME (2020)

Table 6: Projection of total population for the world and regions, 2020, 2050 and 2100 (under the medium scenario), according to WIC2013 and WIC2023

Population (in Millions)	2020 WIC2023	2020 WIC2013	2050 WIC2023	2050 WIC2013	2100 WIC2023	2100 WIC2013
World	7805	7639	9594	9174	9885	8991
Africa	1344	1268	2429	2019	3550	2622
Asia	4648	4557	5219	5135	4483	4368
Europe	747	748	725	755	671	703
Latin America	650	651	744	758	669	684
Northern America	373	372	419	447	450	521
Oceania	44	42	56	57	62	67

The WIC2023 population according to the SSP2 scenario is lower than the UN's Medium WPP2022 projection. Both scenarios lead to similar results until 2060. However, while the WIC2023 population peaks in 2080 at 10.1 billion, the WPP2022 population keeps growing until 2086 (10.4. billion). In 2100, the WP2022 population is 470 million larger than the WIC2023 one: 10.355 vs. 9.885 billion. The IHME population peaks earlier in the 2060s at 9.7 billion and rapidly declines to reach 8.8 billion in 2100, at a level similar to WIC2013. The US Census Bureau has projected the population until 2060 for all countries, after which the projections do not include the USA. Its projection is almost identical to that of the UN's WPP2022 until 2050 but increases faster after that to reach 10.7 billion in 2100 – without the US.

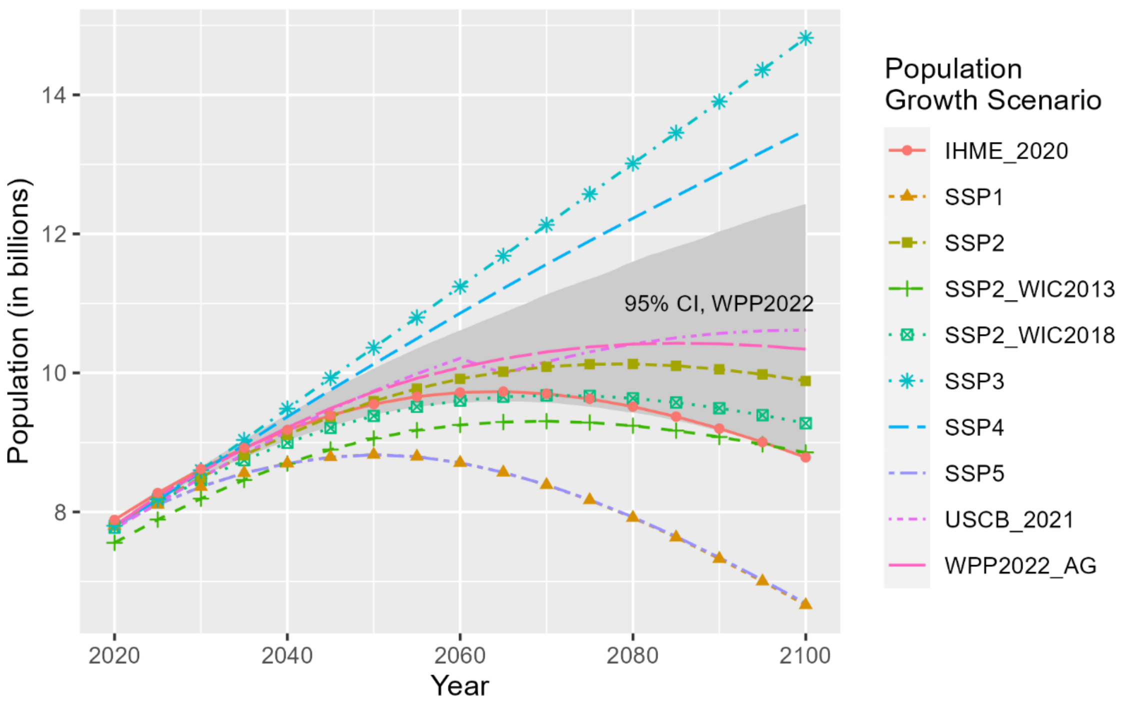


Figure 12: Comparison of world population projections – several scenarios – by WIC (WIC2013, WIC2018, WIC2023 – SSP1-5), United Nations (WPP2022 – Medium variant and 95% CI), the US Census Bureau (USCB - 2021), and IHME (2020 – reference scenario)

The SSPs provide a large range of demographic future, with the SSP3 scenario (Fragmentation/Stalled Development) leading to the fastest population growth unabated and 14.5 billion people on the planet in 2100. SSP4 (inequality) resembles SSP3 in terms of unabated population growth but attaining a population of 13.3 billion – 1 billion lower. At the other extreme, the SSP1 scenario (Sustainability/ Rapid Social Development) peaks in the middle of the century, in 2050 (below 8.5 billion) and declines further to 7.4 billion by the end of the century. SSP5 (Conventional Development) is almost identical to SSP1. Figure 12 shows only SSP2 is within the UN's 95% CI range, and SSP1,3-5 are outside.

Table 7: Decomposition of the change in world population, SSP2_WIC2023 (Numbers in '000)

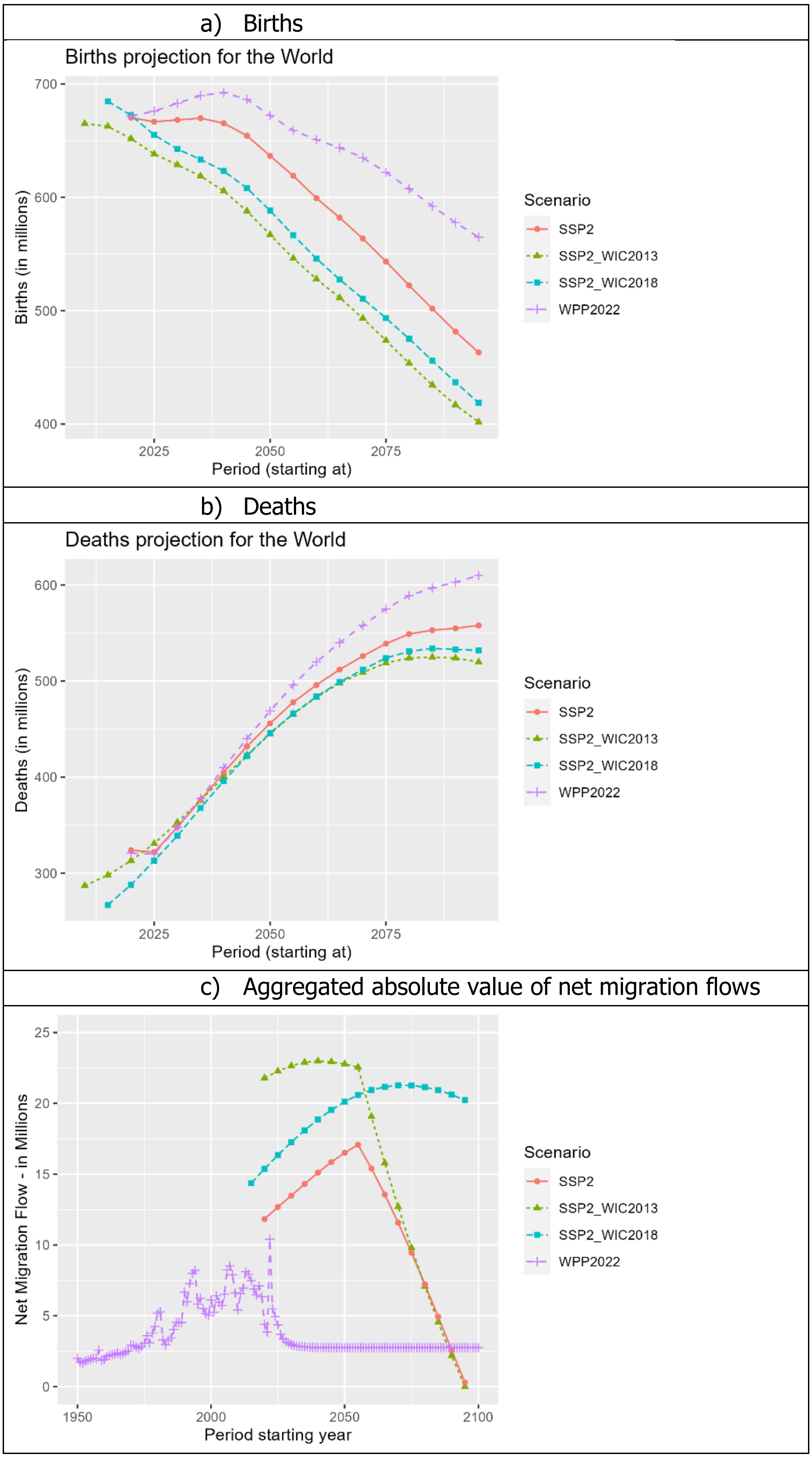
Period	*Initial Population*	*Births*	*Deaths*	*Population Change*	*Migration Flow*
2020-2025	7802025	670293	323629	346664	38454
2025-2030	8148689	666710	321840	344871	40162
2030-2035	8493559	668330	348024	320305	41881
2035-2040	8813865	669823	376350	293474	43479
2040-2045	9107338	665432	404876	260556	44946
2045-2050	9367895	654437	431799	222638	46269
2050-2055	9590533	636630	456181	180449	47464
2055-2060	9770982	619092	477924	141168	48431
2060-2065	9912150	599301	496391	102911	49210
2065-2070	10015061	582130	512113	70016	49806
2070-2075	10085077	563672	526166	37506	50239
2075-2080	10122583	543420	539196	4225	50511
2080-2085	10126808	522310	548514	-26205	50631
2085-2090	10100603	501880	552982	-51103	50615
2090-2095	10049501	481588	554839	-73251	50481
2095-2100	9976250	463204	557694	-94490	50229

Note: World aggregated using 200 countries only

Table 7 shows that the world population peak according to the SSP2 scenario would occur in 2080 when there would be more deaths than births -- Appendix Table Ar2 shows the information for major world regions. With the exception of the decline in the number of deaths due to the end of the impact of the COVID-19 pandemic, there is a continuous increase in the number of deaths until 2100. The number of births slightly increases/stagnates until 2035-2040 and then starts a clear descent to 463 million by the end of the century, in 2095-2099. The international migration flows would continue to increase as long as the population size increases. After 2060, the migration flows stabilize (see Section 2.5).

Figure 12 compares the evolution of births, deaths and net migration according to SSP2 in the three different versions (WIC2013, WIC2018 and WIC2023) and according to the United Nations medium variant. For births and deaths, the patterns are similar between the WIC and UN latest updates, although at different level. This is not the case for net migration for which the UN WPP2022 envisages constant levels for each country throughout the projection period while WIC2023 assumes that the migration rate (by age, sex, and education) would remain the same as estimated for 2015-2020 until 2060 and then converge to net-zero total flows by 2095-2100.

Figure 13: Total births and deaths (in million) from 2010-2015 to 2095-2100 according to several scenarios



Note: WPP2022 produces annual net migration flows, whereas the SSPs are 5-yearly flows. World aggregated using 200 countries only

The share of population aged 25+ by level of education would not vary much in WIC2023 compared to WIC2013 (and 2018), this is also true for the base-year where in 2010, 17% of the population aged 25+ had not received any education in WIC2013, compared to 14% in 2020 according to WIC2023. On the other hand, the share of population with a post-secondary education increased from 14% in 2010 to 18% in 2020. By the middle of the century, the majority of the population would have an upper-secondary or more (64%) according to the SSP2 scenario (see Table 8), and 29% a post-secondary education. Africa would still be the least educated world region, with 30% of the 25+ population having not completed a primary education (13% at the world level) but diminishing from 48% in 2020 (21% at the world level). According to the global education trend scenario, North America would have the highest share of population with a post-secondary education (53%), followed by Europe and Oceania (45%), while Asia would have 29% and Latin America 28% of its population in this education category. This scenario would lead to the diffusion of education by the end of the century with more than 90% of the 25+ population having an upper-secondary education or more in all regions, except Africa whose proportion would be at 73%. Table 9 shows that the gender gap is declining in the global trend scenario as more women attain higher levels of education, which leads to a reversal of the gender gap in certain regions at the post-secondary level, i.e. in Europe and Oceania, in 2050, and in most regions except Africa by 2100. The stark contrast existing between the younger (25-29) and the older (60-64) age groups in terms of education is declining over the century. The decline is particularly strong in Asia where the difference in mean years of schooling (MYS) is of 3.3 years in 2020 and reduces to 0.9 years in 2100.

Table 8: Share of population aged 25 years and over by levels of educational attainment (in %) and mean years of schooling (MYS) (in years), 2020, 2050 and 2100, world and major world regions, by age, sex and education according to the Global Education Trend scenario

Region	Time	E1	E2	E3	E4	E5	E6	E4+ 20-39	MYS 25+	MYS 25-29	MYS 60-64
					Both sexes						
World	2020	14	7	14	20	26	18	73	8.5	9.9	7.7
World	2050	8	5	9	14	35	29	86	10.5	11.8	9.6
World	2100	2	3	3	6	38	48	95	12.7	13.4	12.5
Africa	2020	34	14	15	12	17	9	47	6.1	7.6	4.3
Africa	2050	16	14	13	12	29	17	69	8.8	10.3	7.2
Africa	2100	4	7	6	10	42	31	90	11.8	12.7	11.4
Asia	2020	16	6	16	24	22	15	75	8	10	6.7
Asia	2050	8	3	9	17	34	29	92	10.5	12.5	9.4
Asia	2100	1	1	2	4	37	54	98	13.3	14.1	13.2
Europe	2020	1	1	7	16	46	30	97	11.3	12.6	11.1
Europe	2050	0	0	2	9	43	45	99	12.5	13.2	12.4
Europe	2100	0	0	1	2	30	67	99	13.5	13.6	13.4
Latin America and the Caribbean	2020	7	12	20	16	27	17	77	8.5	10.2	7.4
Latin America and the Caribbean	2050	3	6	11	14	38	28	92	10.5	11.8	9.9
Latin America and the Caribbean	2100	0	2	2	6	43	47	99	12.3	12.8	12.3
Northern America	2020	1	1	3	6	47	42	98	12.4	12.7	12.3
Northern America	2050	1	0	2	4	41	53	99	12.8	13.1	12.7
Northern America	2100	0	0	0	1	29	69	100	13.3	13.4	13.4
Oceania	2020	3	4	10	7	40	35	85	11.8	12.3	11.5
Oceania	2050	2	5	4	6	37	45	90	12.6	12.9	12.5
Oceania	2100	1	4	1	2	32	60	96	13.7	13.9	13.4
					Men						
World	2020	12	7	15	20	27	19	75	8.8	10.1	7.9
World	2050	6	5	9	15	36	30	87	10.7	11.9	9.9
World	2100	1	3	3	6	39	48	96	12.8	13.4	12.6
Africa	2020	27	14	16	13	20	11	51	6.9	8.1	5.4
Africa	2050	13	14	12	12	31	19	72	9.2	10.6	7.8
Africa	2100	3	7	5	9	42	34	92	12.2	13	11.7
Asia	2020	13	7	17	24	23	16	77	8.3	10.2	6.9
Asia	2050	6	4	9	17	35	29	93	10.7	12.5	9.7
Asia	2100	1	1	2	5	38	53	99	13.3	14	13.2
Europe	2020	1	1	6	15	48	30	97	11.5	12.5	11.3
Europe	2050	0	0	2	9	45	43	99	12.5	13	12.3
Europe	2100	0	0	1	2	35	62	99	13.4	13.5	13.3

Region	Time	E1	E2	E3	E4	E5	E6	E4+ 20-39	MYS 25+	MYS 25-29	MYS 60-64
Latin America and the Caribbean	2020	6	12	19	17	28	18	78	8.8	10.2	7.6
Latin America and the Caribbean	2050	2	5	11	14	39	28	91	10.6	11.6	10.1
Latin America and the Caribbean	2100	0	2	3	7	45	44	98	12.2	12.6	12.1
Northern America	2020	1	1	3	6	46	44	98	12.5	12.8	12.4
Northern America	2050	0	0	1	4	39	55	99	12.9	13.1	12.8
Northern America	2100	0	0	0	1	30	68	100	13.3	13.4	13.3
Oceania	2020	3	4	10	7	43	33	85	11.8	12.2	11.5
Oceania	2050	2	6	4	6	40	43	89	12.6	12.7	12.5
Oceania	2100	1	5	1	2	35	57	95	13.5	13.7	13.3
Women											
World	2020	17	7	14	20	26	17	71	8.2	9.7	7.5
World	2050	9	5	9	14	34	29	84	10.2	11.7	9.3
World	2100	2	3	3	6	38	48	94	12.6	13.3	12.4
Africa	2020	40	13	14	10	15	8	43	5.4	7.1	3.4
Africa	2050	18	14	13	12	28	15	67	8.3	9.9	6.6
Africa	2100	4	8	7	11	43	28	89	11.5	12.5	11.1
Asia	2020	19	6	15	24	22	15	73	7.7	9.8	6.5
Asia	2050	10	3	9	17	33	29	91	10.3	12.4	9.1
Asia	2100	2	1	2	3	36	55	98	13.2	14.1	13.2
Europe	2020	1	1	7	16	45	29	98	11.2	12.7	11
Europe	2050	0	1	2	8	42	46	99	12.5	13.3	12.4
Europe	2100	0	0	1	1	26	71	100	13.5	13.8	13.6
Latin America and the Caribbean	2020	8	13	20	16	26	17	76	8.3	10.1	7.2
Latin America and the Caribbean	2050	3	6	12	14	37	28	93	10.4	11.9	9.7
Latin America and the Caribbean	2100	0	2	2	5	41	49	99	12.4	13	12.5
Northern America	2020	1	1	3	7	48	40	97	12.3	12.6	12.2
Northern America	2050	1	0	2	5	43	50	99	12.7	13.1	12.6
Northern America	2100	0	0	0	1	29	70	100	13.4	13.4	13.4
Oceania	2020	4	4	10	7	37	38	85	11.7	12.4	11.4
Oceania	2050	2	5	4	6	35	48	91	12.7	13.1	12.5
Oceania	2100	1	4	1	2	29	64	96	13.8	14	13.6

Note: E1 = no education, E2 = some primary, E3 = primary, E4 = lower secondary, and E5 = upper secondary; MYS = Mean Years of Schooling.

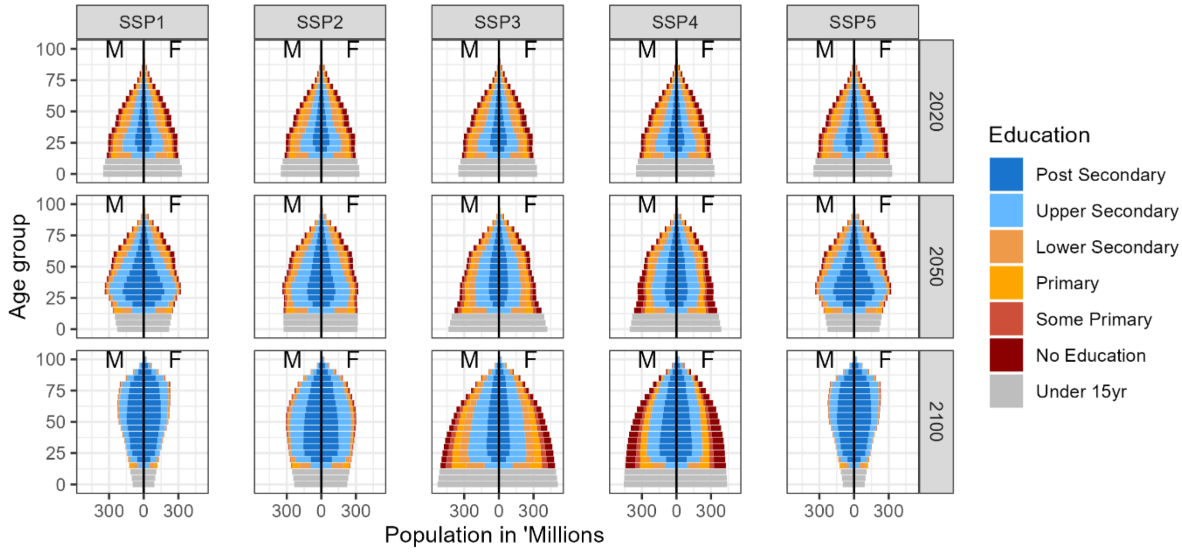


Figure 14: Population pyramids by education, SSP1-5, 2020, 2050 and 2100

The different SSPs entail different outcomes in terms of educational composition of the population (see Figure 14 and 15). According to SSP1 and SSP5, the world in 2100 is less populated and composed in a large majority of post-secondary educated individuals, across all ages and sexes. Conversely, SSP3 and to a lesser extent SSP4 lead to a larger populated world with lower levels of education. However, according to these scenarios, the progress of the past that have increased the share of population with an upper-secondary and post-secondary education stalls but does not reverse and still under this scenario, more than half of the population would have at least an upper-secondary education or more. There would be more women than men among the 'no education' and 'some primary' categories. SSP2 as the middle of the road scenario leads to a highly educated society by 2100, with large segments of the population having either acquired an upper-secondary or post-secondary education.

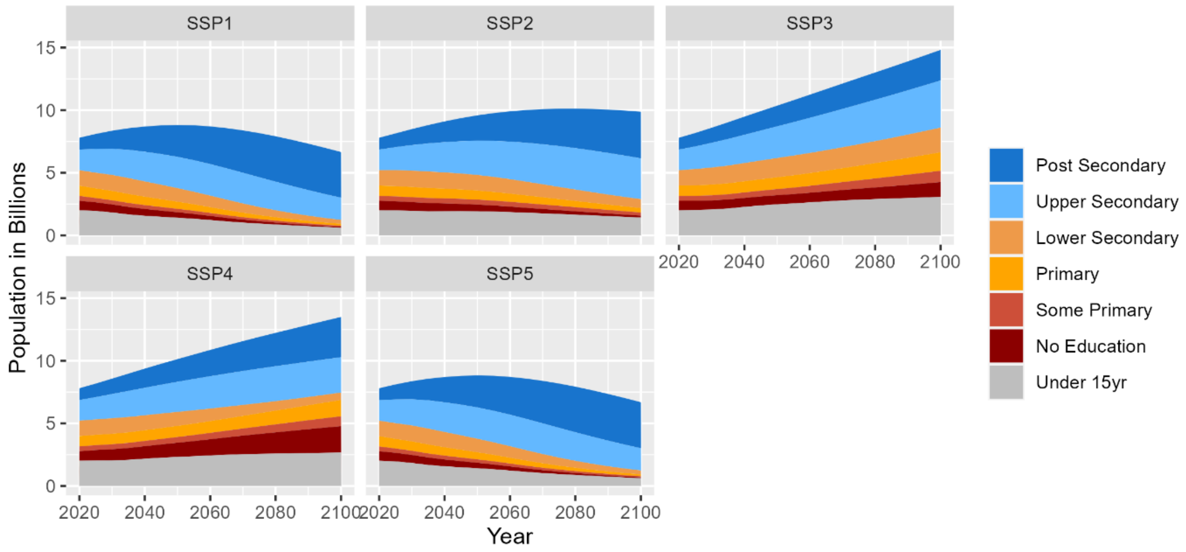


Figure 15: Total population by education (in billion), SSP1-5, 2020-2100

3.2. Largest Countries

In this section, we describe projected population trends and differences between WIC2013 and WIC2023 projections for 15 most populous countries that account for 65% of the world population in 2020 (see Table 9). Overall the difference is rather small in the 2020 base-year (between the projected in WIC2013 and the estimated in WIC2023, corresponding to the UN WPP2022), at 2.4% (117 million people). The 2020 estimates diverge more extensively for three main countries, Egypt (12%), Ethiopia (12%) and Pakistan (9%), where particularly fertility has declined more slowly than expected, leading to a larger population in 2020 than expected in the earlier projection round. For instance, in Egypt, in the aftermath of the "Arab Spring" protests, total fertility increased from 3.0 in 2008 to 3.5 children in 2014. Mexico is the only large country where the population estimated in 2020 is lower than the projected population in WIC2013; however, the difference is minimal (-1%). In 2050, the differences in the projection become larger for the three above-mentioned countries as a result of the divergence in the base year population and its multiplying effect, and even more so in 2100 when Pakistan's population would reach 491 million in WIC2023 (compared to 314 million previously), hence a 57% difference. The difference between the two projections is also around 50% for Egypt and Ethiopia.

The population of Brazil and India would peak at lower levels than in the previous version according to SSP2 scenario (see Table 9). The population of India in 2100 would be as large as the 2020 one (1392 million in 2100 vs 1390 in 2020 according to WIC2023). In other large countries such as Nigeria and Indonesia (and to a lesser extent in the Philippines), population growth is expected to be more important over the course of the century than previously projected. In Nigeria, the population would be multiplied by 3.4 between 2020 and 2100 (it was

2.9 in WIC2013) leading to a population almost at 700 million in 2100 (compared to 580 in WIC2013). For Bangladesh, China, Japan, Mexico, and Russia, the population in 2100 would be moderately larger in WIC2023 than in WIC2013 (<9%), mostly due to higher life expectancies and lower number of deaths in WIC2023.

Table 9: Population of the 15 largest countries in 2020 (in million) and difference between WIC2013 and WIC2023 (in %), SSP2 scenario

	2020			2050			2100		
Countries	WIC 2013	WIC 2023	Diff. (%)	WIC 2013	WIC 2023	Diff. (%)	WIC 2013	WIC 2023	Diff. (%)
Bangladesh	165	166	0.8	191	199	4.5	162	171	6
Brazil	211	213	0.7	233	228	-2.1	189	182	-3.6
China	1379	1424	3.3	1255	1306	4	754	800	6.1
Egypt	95	107	12.1	126	163	29	134	201	50.1
Ethiopia	103	116	12.1	159	209	31.1	190	283	48.7
India	1385	1390	0.3	1715	1620	-5.5	1569	1392	-11.3
Indonesia	261	271	3.6	285	311	8.8	225	273	21.4
Japan	125	126	0.8	107	106	-1.4	75	75	0.4
Mexico	127	126	-1	152	149	-1.8	145	146	0.5
Nigeria	202	206	2.1	371	401	8.1	576	697	20.9
Pakistan	207	225	9	286	370	29.4	314	491	56.5
Philippines	108	111	2.7	141	154	9.1	147	163	11.3
Russia	142	146	2.6	132	139	5	115	125	8.7
USA	334	335	0.4	400	377	-5.8	466	406	-12.9
Total 15 countries	**4844**	**4960**	**2.4**	**5555**	**5733**	**3.2**	**5061**	**5405**	**6.8**

4. Discussion and Conclusion

This report covers a comprehensive update of the Wittgenstein Centre population projection scenarios, produced in 2023 (WIC2023). It is a minor update in the sense that it does not change most of the assumptions about the future that were initiated in WIC2013 and WIC2018. The most important refinements introduced in WIC2023 cover education differentials in mortality and migration. The base-year data has been updated as well with the most recent estimates by the United Nations. Overall, and most interestingly, the more rapid decline in child mortality than expected and the slower demographic transition in many low-income countries, particularly in sub-Saharan Africa would lead to higher population growth and larger absolute population in 2100 than expected in the previous versions. This presents important challenges due to its impact on society, the environment and resource availability.

It is important to reflect on the next round of population projections in the framework of the SSPs, which should go beyond a simple update. Firstly, we need to reflect upon the assumptions for the future that are at present derived from a mixed method using the results of a survey conducted in 2010-2011 with the participation of experts in demography and a trend analysis based on the 2010 data (see Lutz et al. 2014). In 2010, the socio-economic and environmental conditions were not too different than now but there was definitely less emphasis on the potential impact of environmental and climate change on demographic parameters. Furthermore, several major shocks with global impact happened since the initial set of WIC2013 scenarios were produced, including the COVID-19 pandemic, the civil war in Syria and the ensuing migration wave, the invasion of Ukraine by Russia and an acceleration of global climate change. In 2023, the European Commission Joint Research Centre, The United Nations Population Division and IIASA initiated a survey among demographers (in the same vein as the 2010-2011 survey but addressing some of these new major concerns). The results were published in Icardi et al. (2023). The survey shows that the experts have different views on the future than what the present projections (of the United Nations and WIC2023) assume. For instance, the experts think that the fertility transition in high-fertility countries would be slower than assumed at present in the projections and that on the contrary, in low-fertility countries, there is a high probability that fertility rates would remain at very low level and not rebound as assumed in the projections. The next update should take into consideration the insight provided by the survey. As well, as environmental changes can significantly impact human populations, implementing complex and multi-dimensional feedback loops would render the population projections more relevant, for instance following cross-tabulating the representative concentration pathways (RCPs – future greenhouse gas concentrations in the atmosphere) with the SSPs.

The WIC2023 population projection data are available in Zenodo and in the Wittgenstein Centre Human Capital Data Explorer.

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Appendix

Education

Appendix Table Ae1: Sources of data on educational attainment

N	Region	Country	Year	Data type	Source
1	Africa	Algeria	2002	survey	papfam
2	Africa	Angola	2014	census	nso
3	Africa	Benin	2011	survey	dhs
4	Africa	Botswana	2011	census	ipums
5	Africa	Burkina Faso	2006	census	nso
6	Africa	Burundi	2010	survey	dhs
7	Africa	Cabo Verde	2000	census	nso
8	Africa	Cameroon	2005	census	ipums
9	Africa	Central African Republic	2019	survey	unicef
10	Africa	Chad	2014	survey	dhs
11	Africa	Comoros	2012	survey	dhs
12	Africa	Congo	2011	survey	dhs
13	Africa	Cote d'Ivoire	2011	survey	dhs
14	Africa	DR Congo	2013	survey	dhs
15	Africa	Djibouti	NA	NA	NA
16	Africa	Egypt	2017	census	ipums
17	Africa	Equatorial Guinea	2000	survey	unicef
18	Africa	Eritrea	NA	NA	NA
19	Africa	Eswatini	2006	survey	dhs
20	Africa	Ethiopia	2007	census	ipums
21	Africa	Gabon	2012	survey	dhs
22	Africa	Gambia	2013	survey	dhs
23	Africa	Ghana	2010	census	nso
24	Africa	Guinea	2014	census	ipums
25	Africa	Guinea-Bissau	2014	survey	unicef
26	Africa	Kenya	2009	census	ipums
27	Africa	Lesotho	2014	survey	dhs
28	Africa	Liberia	2008	census	nso
29	Africa	Libya	NA	NA	NA
30	Africa	Madagascar	2008	survey	dhs
31	Africa	Malawi	2008	census	ipums
32	Africa	Mali	2009	census	ipums
33	Africa	Mauritania	NA	NA	NA
34	Africa	Mauritius	2011	census	nso
35	Africa	Mayotte	NA	NA	NA
36	Africa	Morocco	2014	census	ipums
37	Africa	Mozambique	2017	census	nso
38	Africa	Namibia	2013	survey	dhs
39	Africa	Niger	2012	survey	dhs

N	Region	Country	Year	Data type	Source
40	Africa	Nigeria	2013	survey	dhs
41	Africa	Reunion	2008	census	nso
42	Africa	Rwanda	2012	census	nso
43	Africa	Sao Tome and Principe	2009	survey	dhs
44	Africa	Senegal	2013	census	ipums
45	Africa	Seychelles	NA	NA	NA
46	Africa	Sierra Leone	2019	census	ipums
47	Africa	Somalia	2006	survey	unicef
48	Africa	South Africa	2011	census	nso
49	Africa	South Sudan	2008	census	ipums
50	Africa	Sudan	2008	census	ipums
51	Africa	Togo	2013	survey	dhs
52	Africa	Tunisia	2010	survey	nso
53	Africa	Uganda	2014	census	ipums
54	Africa	United Republic of Tanzania	2012	census	ipums
55	Africa	Western Sahara	NA	NA	NA
56	Africa	Zambia	2010	census	nso
57	Africa	Zimbabwe	2012	census	nso
58	Asia	Afghanistan	2011	survey	nso
59	Asia	Armenia	2011	census	nso
60	Asia	Azerbaijan	2009	census	nso
61	Asia	Bahrain	2010	census	nso
62	Asia	Bangladesh	2011	census	nso
63	Asia	Bhutan	2005	census	nso
64	Asia	Brunei Darussalam	NA	NA	NA
65	Asia	Cambodia	2008	census	ipums
66	Asia	China	2010	census	nso
67	Asia	China, Hong Kong SAR	2011	census	nso
68	Asia	China, Macao SAR	2011	census	nso
69	Asia	China, Taiwan Province of China	2010	census	nso
70	Asia	Cyprus	2011	census	eurostat
71	Asia	Dem. People's Rep. of Korea	2008	census	un
72	Asia	Georgia	2014	census	nso
73	Asia	India	2011	census	nso
74	Asia	Indonesia	2010	census	nso
75	Asia	Iran	2011	census	ipums
76	Asia	Iraq	2011	survey	mics
77	Asia	Israel	2008	census	ipums
78	Asia	Japan	2010	census	nso
79	Asia	Jordan	2015	census	nso
80	Asia	Kazakhstan	2009	census	nso
81	Asia	Kuwait	2010	census	nso

N	Region	Country	Year	Data type	Source
82	Asia	Kyrgyzstan	2009	census	ipums
83	Asia	Lao People's Dem. Republic	2015	census	report
84	Asia	Lebanon	2007	census	nso
85	Asia	Malaysia	2010	census	nso
86	Asia	Maldives	2006	census	nso
87	Asia	Mongolia	2010	census	nso
88	Asia	Myanmar	2014	census	unfpa
89	Asia	Nepal	2011	census	nso
90	Asia	Oman	2003	census	unsd
91	Asia	Pakistan	2017	census	ipums
92	Asia	Philippines	2010	census	ipums
93	Asia	Qatar	2010	census	nso
94	Asia	Republic of Korea	2010	survey	nso
95	Asia	Saudi Arabia	2010	census	nso
96	Asia	Singapore	2010	census	nso
97	Asia	Sri Lanka	2001	census	unsd
98	Asia	State of Palestine	2017	census	ipums
99	Asia	Syrian Arab Republic	2004	census	nso
100	Asia	Tajikistan	2010	census	unsd
101	Asia	Thailand	2010	census	nso
102	Asia	Timor-Leste	2010	census	nso
103	Asia	Turkey	2015	census	nso
104	Asia	Turkmenistan	1995	census	uis
105	Asia	United Arab Emirates	2005	census	nso
106	Asia	Uzbekistan	NA	NA	NA
107	Asia	Viet Nam	2009	census	ipums
108	Asia	Yemen	2013	survey	nso
109	Europe	Albania	2011	census	nso
110	Europe	Austria	2013	register	nso
111	Europe	Belarus	2009	census	nso
112	Europe	Belgium	2011	census	nso
113	Europe	Bosnia and Herzegovina	2013	census	nso
114	Europe	Bulgaria	2011	census	nso
115	Europe	Croatia	2011	census	nso
116	Europe	Czechia	2011	census	nso
117	Europe	Denmark	2011	census	nso
118	Europe	Estonia	2012	register	nso
119	Europe	Finland	2012	survey	eurostat
120	Europe	France	2011	census	ipums
121	Europe	Germany	2014	survey	nso
122	Europe	Greece	2011	census	nso
123	Europe	Hungary	2011	census	nso
124	Europe	Iceland	2011	census	nso

N	Region	Country	Year	Data type	Source
125	Europe	Ireland	2014	survey	eurostat
126	Europe	Italy	2011	census	nso
127	Europe	Latvia	2011	census	nso
128	Europe	Lithuania	2011	census	nso
129	Europe	Luxembourg	2011	census	nso
130	Europe	Malta	2011	census	eurostat
131	Europe	Montenegro	2011	census	nso
132	Europe	Netherlands	2015	survey	eurostat
133	Europe	North Macedonia	2008	survey	nso
134	Europe	Norway	2014	register	nso
135	Europe	Poland	2011	census	nso
136	Europe	Portugal	2011	census	nso
137	Europe	Republic of Moldova	2004	census	nso
138	Europe	Romania	2011	census	nso
139	Europe	Russian Federation	2010	census	nso
140	Europe	Serbia	2011	census	unsd
141	Europe	Slovakia	2011	census	nso
142	Europe	Slovenia	2014	census	nso
143	Europe	Spain	2011	census	nso
144	Europe	Sweden	2014	register	nso
145	Europe	Switzerland	2014	register	nso
146	Europe	Ukraine	2001	census	nso
147	Europe	United Kingdom	2011	census	eurostat
148	Latin America	Antigua and Barbuda	NA	NA	NA
149	Latin America	Argentina	2010	census	ipums
150	Latin America	Aruba	2010	census	nso
151	Latin America	Bahamas	2010	census	unsd
152	Latin America	Barbados	NA	NA	NA
153	Latin America	Belize	2010	census	nso
154	Latin America	Bolivia	2012	census	celade
155	Latin America	Brazil	2010	census	nso
156	Latin America	Chile	2017	census	celade
157	Latin America	Colombia	2005	census	celade
158	Latin America	Costa Rica	2011	census	celade
159	Latin America	Cuba	2012	census	ipums
160	Latin America	Curacao	2011	census	nso
161	Latin America	Dominican Republic	2010	census	celade
162	Latin America	Ecuador	2010	census	celade
163	Latin America	El Salvador	2007	census	celade
164	Latin America	French Guiana	2008	census	nso
165	Latin America	Grenada	NA	NA	NA
166	Latin America	Guadeloupe	2008	census	nso
167	Latin America	Guatemala	2018	census	celade
168	Latin America	Guyana	2002	census	nso
169	Latin America	Haiti	2003	census	ipums

N	Region	Country	Year	Data type	Source
170	Latin America	Honduras	2013	census	celade
171	Latin America	Jamaica	2001	census	caricom
172	Latin America	Martinique	2008	census	nso
173	Latin America	Mexico	2020	census	nso
174	Latin America	Nicaragua	2005	census	celade
175	Latin America	Panama	2010	census	celade
176	Latin America	Paraguay	2002	census	celade
177	Latin America	Peru	2017	census	ipums
178	Latin America	Puerto Rico	2010	census	ipums
179	Latin America	Saint Lucia	2010	census	celade
180	Latin America	St. Vincent and the Grenadines	2001	census	caricom
181	Latin America	Suriname	2012	census	ipums
182	Latin America	Trinidad and Tobago	2011	census	unsd
183	Latin America	United States Virgin Islands	NA	NA	NA
184	Latin America	Uruguay	2011	census	ipums
185	Latin America	Venezuela	2011	census	celade
186	Northern America	Canada	2011	survey	nso
187	Northern America	United States of America	2010	census	ipums
188	Oceania	Australia	2011	census	nso
189	Oceania	Fiji	2007	census	ipums
190	Oceania	French Polynesia	2007	census	nso
191	Oceania	Guam	NA	NA	NA
192	Oceania	Kiribati	2010	census	nso
193	Oceania	Micronesia (Fed. States of)	2010	census	nso
194	Oceania	New Caledonia	2009	census	nso
195	Oceania	New Zealand	2013	census	nso
196	Oceania	Papua New Guinea	NA	NA	NA
197	Oceania	Samoa	2001	census	nso
198	Oceania	Solomon Islands	2009	census	nso
199	Oceania	Tonga	2006	census	nso
200	Oceania	Vanuatu	2009	census	nso

Mortality

Table Am1: 10 Availability of adult mortality differentials at a given age, different data sources*

Country	Year	Age	Source	Country	Year	Age	Source
Australia	2011	25	OECD	Japan	2002	65	NUJLSOA data
Austria	2012	25	OECD	Latvia	2011-2012	25	OECD
Belgium	2012	25	OECD	Malta	2007-2011	15	Eurostat
Bulgaria	2007-2017	15	Eurostat	Mexico	2010	25	OECD
Canada	2011	25	OECD, 2021	Netherlands	2001-2011	25	LFS linked to mortality registry
Chile	2004	25	OECD	New Zealand	2001-2006	25	OECD
Croatia	2007-2017	15	Eurostat	North Macedonia	2007-2016	15	Eurostat
Czechia	2010-2014	25	OECD	Norway	2007-2017	15	Eurostat
Denmark	2007-2016	15	Eurostat	Poland	2008-2017	15	Eurostat
Estonia	2007-2016	15	Eurostat	Portugal	2010-2017	15	Eurostat
Finland	2007-2017	15	Eurostat	Republic of Korea	2010	40	Census and death file, Statistics Korea
France	2012	25	OECD, 2021	Romania	2007-2017	15	Eurostat
Greece	2013-2017	15	Eurostat	Russian Federation	1998	30	Census and death records
Hungary	2007-2017	15	Eurostat	Serbia	2014-2017	15	Eurostat
Iceland (age 30)	2017	30	OECD, 2021	Slovakia	2011-2017	15	Eurostat
India	2005-2012	25	IHDS-2005, 2012	Slovenia	2007-2017	15	Eurostat
Indonesia	2007-08 - 2014-15	30	IFLS-2007-08, IFLS-2014-15	Spain (age 30)	2017	30	INE, OECD
Israel (age 30)	2008-2012	25	OECD, 2021	Sweden	2007-2017	15	Eurostat

Country	Year	Age	Source	Country	Year	Age	Source
Italy	2007-2017	15	Eurostat	Turkey	2010-2017	15	Eurostat
United Kingdom	2011	25	OECD	United States of America	2011-12	25	OECD

Table11 Am2: Availability of U5M rates by mother's education from DHS, by survey year

Country	Year of the survey (mid)	Country	Year of the survey (mid)
Bangladesh	2017.5	Guinea	2018
Bolivia	2008	Jordan	2017.5
Burkina Faso	2010	Kyrgyzstan	2012
Cameroon	2018.5	Mali	2018
CAR	1994.5	Mozambique	2011
Colombia	2015.5	Nepal	2016
Cote d'Ivoire	2011.5	Nicaragua	2001
Dominican Republic	2013	Philippines	2017
Egypt	2014	South Africa	2016
Ghana	2014	Togo	2013.5
Guatemala	2014.5	Kazakhstan	1999
Haiti	2016.5	Uzbekistan	1996
India	2015.5	Congo	2011.5
Indonesia	2017	Ethiopia	2011
Kenya	2014	Guyana	2009
Madagascar	2008.5	Lesotho	2014
Morocco	2003.5	Moldova	2005
Namibia	2013	Nigeria	2018
Niger	2012	Albania	2017
Pakistan	2017.5	Angola	2015.5
Peru	2012	Burundi	2016.5
Rwanda	2014.5	Gambia	2020
Senegal	2017	Liberia	2019.5
Tanzania	2015.5	Malawi	2015.5
Turkey	2013	Maldives	2016.5
Uganda	2016	Myanmar	2015.5
Yemen	1991	Sierra Leone	2019
Zambia	2017.5	Tajikistan	2017
Zimbabwe	2015	Timor-Leste	2016
Brazil	1996	Azerbaijan	2006

Country	Year of the survey (mid)	Country	Year of the survey (mid)
Armenia	2015.5	Honduras	2011.5
Benin	2017.5	Sao Tome and Principe	2008
Cambodia	2014	Eswatini	2006.5
Chad	2014.5	DR Congo	2013.5
Comoros	2012	Afghanistan	2015
Gabon	2012		

Table12 Am3: Education Differential in remaining life expectancy at a given age used in the projection along with proxy country or regions for countries with no data (data source Table Am1 and Am2)

Country	Proxy	Sex	Age	E0	E1	E2	E3	E4	E5
Afghanistan	-	f	15	0	1.28	1.09	1.81	NA	2.63
Albania	Croatia	f	15	NA	NA	NA	0	0	1.53
Algeria	Egypt	f	15	0	0.55	0.67	0.8	NA	1.82
Angola	-	f	15	0	0.02	0.05	2.13	NA	3.92
Antigua and Barbuda	Dominican Republic	f	15	0	1.68	2.1	2.81	NA	4.39
Armenia	Jordan	f	15	0	-0.22	0.14	0.53	NA	1.24
Aruba	Dominican Republic	f	15	0	1.68	2.1	2.81	NA	4.39
Azerbaijan	-	f	15	0	0.99	1	1.56	NA	2.04
Bahamas	Dominican Republic	f	15	0	1.68	2.1	2.81	NA	4.39
Bahrain	Jordan	f	15	0	-0.22	0.14	0.53	NA	1.24
Bangladesh	-	f	15	0	0.1	1.06	1.66	NA	3.03
Barbados	Dominican Republic	f	15	0	1.68	2.1	2.81	NA	4.39
Belarus	Romania	f	15	NA	NA	NA	0	2.48	2.48
Belize	Guatemala	f	15	0	1.3	1.49	2.81	NA	3.73
Benin	-	f	15	0	0.22	1.33	1.71	NA	4.05
Bhutan	India	f	15	0	0.39	1	1.63	NA	3.38
Bolivia (Plurinational State of)	-	f	15	0	2.95	4.68	4.77	NA	6.11
Bosnia and Herzegovina	Croatia	f	15	NA	NA	NA	0	0	1.53
Botswana	South Africa	f	15	0	0.08	0.16	0.97	NA	4.66
Brunei Darussalam	Philippines	f	15	0	1.08	2.39	3.82	NA	3.93
Bulgaria	-	f	15	NA	NA	NA	0	5.1	5.94
Burkina Faso	-	f	15	0	2.35	3.03	3.34	NA	3.66
Burundi	-	f	15	0	0.06	1.32	2.5	NA	3.99
Cabo Verde	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Cambodia	-	f	15	0	2.26	2.56	3.19	NA	9.54
Cameroon	-	f	15	0	0.57	1.18	2.13	NA	2.7
Central African Republic	-	f	15	0	1.17	2.33	2.75	NA	3.19
Chad	-	f	15	0	0.41	0.83	0.9	NA	4.01
China	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Colombia	-	f	15	0	0.32	0.12	1.17	NA	2.55
Comoros	-	f	15	0	1.23	0.96	2.59	NA	5.01

Country	Proxy	Sex	Age	E0	E1	E2	E3	E4	E5
Congo	-	f	15	0	0.51	0.66	1.24	NA	1.65
Costa Rica	Guatemala	f	15	0	1.3	1.49	2.81	NA	3.73
Cote d'Ivoire	-	f	15	0	0.44	1.01	1.86	NA	2.82
Croatia	-	f	15	NA	NA	NA	0	0	1.53
Cuba	Dominican Republic	f	15	0	1.68	2.1	2.81	NA	4.39
Curacao	Dominican Republic	f	15	0	1.68	2.1	2.81	NA	4.39
Cyprus	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Dem. People's Republic of Korea	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
DR Congo	-	f	15	0	0.14	0.27	0.8	NA	1.98
Denmark	-	f	15	NA	NA	NA	0	2.88	4.01
Djibouti	Ethiopia	f	15	0	0.81	1.01	1.78	NA	2.34
Dominican Republic	-	f	15	0	1.68	2.1	2.81	NA	4.39
Egypt	-	f	15	0	0.55	0.67	0.8	NA	1.82
El Salvador	Guatemala	f	15	0	1.3	1.49	2.81	NA	3.73
Equatorial Guinea	DR Congo	f	15	0	0.14	0.27	0.8	NA	1.98
Eritrea	Ethiopia	f	15	0	0.81	1.01	1.78	NA	2.34
Estonia	-	f	15	NA	NA	NA	0	5.08	8.32
Eswatini	-	f	15	0	1.54	1.85	2.17	NA	2.61
Ethiopia	-	f	15	0	0.81	1.01	1.78	NA	2.34
Fiji	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Finland	-	f	15	NA	NA	NA	0	2.68	3.91
Gabon	-	f	15	0	0.74	1.16	1.79	NA	2.09
Gambia	-	f	15	0	0.23	0.47	0.77	NA	1.08
Georgia	Jordan	f	15	0	-0.22	0.14	0.53	NA	1.24
Germany	Slovenia	f	15	NA	NA	NA	0	2.75	3.8
Ghana	-	f	15	0	1.28	1.39	0.85	NA	0.59
Greece	-	f	15	NA	NA	NA	0	0.5	0.5
Grenada	Dominican Republic	f	15	0	1.68	2.1	2.81	NA	4.39
Guadeloupe	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Guatemala	-	f	15	0	1.3	1.49	2.81	NA	3.73
Guinea	-	f	15	0	0.76	2.12	4.93	NA	6.29
Guinea-Bissau	Cote d'Ivoire	f	15	0	0.44	1.01	1.86	NA	2.82
Guyana	-	f	15	0	-0.03	-0.33	1.71	NA	5.23
Haiti	-	f	15	0	0.64	1.33	1.49	NA	2.24
Honduras	-	f	15	0	1.31	3.27	3.77	NA	4.33
Hungary	-	f	15	NA	NA	NA	0	4.35	4.43
India	-	f	15	0	0.39	1	1.63	NA	3.38
Indonesia	-	f	15	0	1.66	2.99	4.56	NA	5.16
Iran (Islamic Republic of)	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Iraq	Jordan	f	15	0	-0.22	0.14	0.53	NA	1.24
Ireland	Sweden	f	15	NA	NA	NA	0	1.91	3.25
Italy	-	f	15	NA	NA	NA	0	2.15	2.15
Jamaica	Dominican Republic	f	15	0	1.68	2.1	2.81	NA	4.39
Jordan	-	f	15	0	-0.22	0.14	0.53	NA	1.24
Kazakhstan	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16

Country	Proxy	Sex	Age	E0	E1	E2	E3	E4	E5
Kenya	Ethiopia	f	15	0	0.81	1.01	1.78	NA	2.34
Kiribati	average DHS	f	15	0	0.83	1.39	2.12	NA	3.25
Kuwait	Jordan	f	15	0	-0.22	0.14	0.53	NA	1.24
Kyrgyzstan	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Lao People's Democratic Republic	Myanmar	f	15	0	2.21	2.59	2.98	NA	3.18
Lebanon	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Lesotho	-	f	15	0	0.22	0.44	1.29	NA	2.23
Liberia	-	f	15	0	0.19	0.12	1.14	NA	2.29
Libya	Egypt	f	15	0	0.55	0.67	0.8	NA	1.82
Lithuania	Finland	f	15	NA	NA	NA	0	2.68	3.91
Luxembourg	Portugal	f	15	NA	NA	NA	0	0.06	1.49
Madagascar	-	f	15	0	0.29	0.6	1.99	NA	2.28
Malawi	-	f	15	0	0.02	0.03	0.66	NA	1.57
Malaysia	Philippines	f	15	0	1.08	2.39	3.82	NA	3.93
Maldives	-	f	15	0	0.97	1.42	1.54	NA	1.66
Mali	-	f	15	0	0.7	1.46	2.76	NA	8.97
Malta	-	f	15	NA	NA	NA	0	0.68	1.8
Martinique	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Mauritania	Liberia	f	15	0	0.19	0.12	1.14	NA	2.29
Mauritius	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Mayotte	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Micronesia (Fed. States of)	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Mongolia	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Montenegro	Croatia	f	15	NA	NA	NA	0	0	1.53
Morocco	-	f	15	0	1.53	2.57	4.22	NA	4.23
Mozambique	-	f	15	0	-0.04	1.04	1.16	NA	1.28
Myanmar	-	f	15	0	2.21	2.59	2.98	NA	3.18
Namibia	-	f	15	0	0.1	0.66	1.28	NA	2.12
Nepal	-	f	15	0	0.12	0.69	1.78	NA	3.65
Nicaragua	-	f	15	0	1.65	2.88	4.43	NA	4.49
Niger	-	f	15	0	0.85	1.64	3.74	NA	4.35
Nigeria	-	f	15	0	0.63	2.28	2.9	NA	4.29
North Macedonia	-	f	15	NA	NA	NA	0	1.28	3.55
Norway	-	f	15	NA	NA	NA	0	2.41	3.55
Oman	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Pakistan	-	f	15	0	0.32	0.34	0.71	NA	2.93
Papua New Guinea	average DHS	f	15	0	0.83	1.39	2.12	NA	3.25
Paraguay	Guyana	f	15	0	-0.03	-0.33	1.71	NA	5.23
Peru	-	f	15	0	0.22	0.33	1.25	NA	1.75
Philippines	-	f	15	0	1.08	2.39	3.82	NA	3.93
Poland	-	f	15	NA	NA	NA	0	2.35	4.38
Portugal	-	f	15	NA	NA	NA	0	0.06	1.49
Puerto Rico	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Qatar	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Republic of Moldova	Romania	f	15	NA	NA	NA	0	2.48	2.48

Country	Proxy	Sex	Age	E0	E1	E2	E3	E4	E5
Reunion	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Romania	-	f	15	NA	NA	NA	0	2.48	2.48
Rwanda	-	f	15	0	1.1	1.31	2.19	NA	2.9
Saint Lucia	Dominican Republic	f	15	0	1.68	2.1	2.81	NA	4.39
Saint Vincent and the Grenadines	Dominican Republic	f	15	0	1.68	2.1	2.81	NA	4.39
Samoa	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Sao Tome and Principe	Egypt	f	15	0	0.55	0.67	0.8	NA	1.82
Saudi Arabia	Jordan	f	15	0	-0.22	0.14	0.53	NA	1.24
Senegal	-	f	15	0	1.1	2.13	3.14	NA	3.16
Serbia	-	f	15	NA	NA	NA	0	0	1.09
Seychelles	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Sierra Leone	-	f	15	0	0	0	0.55	NA	1.13
Singapore	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Slovakia	-	f	15	NA	NA	NA	0	5.14	6.77
Slovenia	-	f	15	NA	NA	NA	0	2.75	3.8
Solomon Islands	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Somalia	Burundi	f	15	0	0.06	1.32	2.5	NA	3.99
South Africa	-	f	15	0	0.08	0.16	0.97	NA	4.66
South Sudan	Burundi	f	15	0	0.06	1.32	2.5	NA	3.99
Sri Lanka	Maldives	f	15	0	0.97	1.42	1.54	NA	1.66
State of Palestine	Jordan	f	15	0	-0.22	0.14	0.53	NA	1.24
Sudan	Gabon	f	15	0	0.74	1.16	1.79	NA	2.09
Suriname	Peru	f	15	0	0.22	0.33	1.25	NA	1.75
Sweden	-	f	15	NA	NA	NA	0	1.91	3.25
Syrian Arab Republic	Jordan	f	15	0	-0.22	0.14	0.53	NA	1.24
Tajikistan	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Thailand	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Timor-Leste	-	f	15	0	-0.08	0.5	1.14	NA	1.54
Togo	-	f	15	0	0.27	1.07	1.47	NA	1.89
Tonga	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Trinidad and Tobago	Dominican Republic	f	15	0	1.68	2.1	2.81	NA	4.39
Tunisia	Morocco	f	15	0	1.53	2.57	4.22	NA	4.23
Turkey	-	f	15	NA	NA	NA	0	1.58	2.33
Turkmenistan	average DHS	f	15	0	0.83	1.39	2.12	NA	3.25
Uganda	-	f	15	0	1.08	1.56	3.08	NA	3.86
Ukraine	Bulgaria	f	15	NA	NA	NA	0	5.1	5.94
United Arab Emirates	Turkey	f	15	NA	NA	NA	0	1.58	2.33
United Republic of Tanzania	-	f	15	0	0.39	1.44	1.63	NA	1.83
United States Virgin Islands	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Uzbekistan	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Vanuatu	average EUROSTAT	f	15	NA	NA	NA	0	2.28	3.16
Venezuela (Bolivarian Republic of)	Peru	f	15	0	0.22	0.33	1.25	NA	1.75
Viet Nam	Philippines	f	15	0	1.08	2.39	3.82	NA	3.93
Western Sahara	Egypt	f	15	0	0.55	0.67	0.8	NA	1.82

Country	Proxy	Sex	Age	E0	E1	E2	E3	E4	E5
Yemen	-	f	15	0	2.37	3	3.68	NA	5.83
Zambia	-	f	15	0	0.61	0.68	0.75	NA	1.54
Zimbabwe	-	f	15	0	2.03	2.83	3.71	NA	4.9
Argentina	Chile	f	25	NA	NA	NA	0	4.89	7.57
Australia	-	f	25	NA	NA	NA	0	2.24	3.66
Austria	-	f	25	NA	NA	NA	0	1.71	3.05
Belgium	-	f	25	NA	NA	NA	0	4.33	7.79
Brazil	Chile	f	25	NA	NA	NA	0	4.89	7.57
Canada	-	f	25	NA	NA	NA	0	1.34	2.87
Chile	-	f	25	NA	NA	NA	0	4.89	7.57
Czechia	-	f	25	NA	NA	NA	0	0.64	6.19
Ecuador	Chile	f	25	NA	NA	NA	0	4.89	7.57
France	-	f	25	NA	NA	NA	0	2.23	2.65
French Guiana	Chile	f	25	NA	NA	NA	0	4.89	7.57
French Polynesia	New Zealand	f	25	NA	NA	NA	0	3.05	4.47
Guam	New Zealand	f	25	NA	NA	NA	0	3.05	4.47
Israel	-	f	25	NA	NA	NA	0	2.9	3.88
Latvia	-	f	25	NA	NA	NA	0	5.14	8.34
Mexico	-	f	25	NA	NA	NA	0	2.47	2.67
Netherlands	-	f	25	NA	NA	-3.44	0	NA	2.05
New Caledonia	New Zealand	f	25	NA	NA	NA	0	3.05	4.47
New Zealand	-	f	25	NA	NA	NA	0	3.05	4.47
Panama	Chile	f	25	NA	NA	NA	0	4.89	7.57
Switzerland	France	f	25	NA	NA	NA	0	2.23	2.65
United Kingdom	-	f	25	NA	NA	NA	0	3.29	4.12
United States of America	-	f	25	NA	NA	NA	0	2.23	4.02
Uruguay	Chile	f	25	NA	NA	NA	0	4.89	7.57
Iceland	-	f	30	NA	NA	NA	0	2	3
Russian Federation	-	f	30	NA	NA	NA	0	4.69	10.21
Spain	-	f	30	NA	NA	NA	0	1	2
Republic of Korea	-	f	40	NA	NA	NA	0	1.63	4.6
China, Hong Kong SAR	Japan	f	65	NA	NA	NA	0	1.4	3.8
China, Macao SAR	Japan	f	65	NA	NA	NA	0	1.4	3.8
China, Taiwan Province of China	Japan	f	65	NA	NA	NA	0	1.4	3.8
Japan	-	f	65	NA	NA	NA	0	1.4	3.8
Afghanistan	-	m	15	0	1.04	0.88	1.47	NA	2.14
Albania	Croatia	m	15	NA	NA	NA	0	1.25	5.55
Algeria	Egypt	m	15	0	0.45	0.55	0.65	NA	1.48
Angola	-	m	15	0	0.02	0.04	1.82	NA	3.34
Antigua and Barbuda	Dominican Republic	m	15	0	1.32	1.65	2.21	NA	3.49
Armenia	Jordan	m	15	0	-0.18	0.12	0.43	NA	1.02
Aruba	Dominican Republic	m	15	0	1.32	1.65	2.21	NA	3.49
Azerbaijan	-	m	15	0	0.91	0.92	1.42	NA	1.85
Bahamas	Dominican Republic	m	15	0	1.32	1.65	2.21	NA	3.49
Bahrain	Jordan	m	15	0	-0.18	0.12	0.43	NA	1.02

Country	Proxy	Sex	Age	E0	E1	E2	E3	E4	E5
Bangladesh	-	m	15	0	0.08	0.85	1.34	NA	2.45
Barbados	Dominican Republic	m	15	0	1.32	1.65	2.21	NA	3.49
Belarus	Romania	m	15	NA	NA	NA	0	5.91	7.75
Belize	Guatemala	m	15	0	1.07	1.23	2.33	NA	3.1
Benin	-	m	15	0	0.18	1.1	1.41	NA	3.36
Bhutan	India	m	15	0	0.31	0.8	1.31	NA	2.73
Bolivia (Plurinational State of)	-	m	15	0	2.4	3.81	3.89	NA	4.99
Bosnia and Herzegovina	Croatia	m	15	NA	NA	NA	0	1.25	5.55
Botswana	South Africa	m	15	0	0.06	0.13	0.81	NA	3.89
Brunei Darussalam	Philippines	m	15	0	0.88	1.95	3.13	NA	3.22
Bulgaria	-	m	15	NA	NA	NA	0	7.81	10.88
Burkina Faso	-	m	15	0	1.86	2.4	2.65	NA	2.91
Burundi	-	m	15	0	0.05	1.06	2.02	NA	3.23
Cabo Verde	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Cambodia	-	m	15	0	1.92	2.17	2.7	NA	8.05
Cameroon	-	m	15	0	0.46	0.95	1.72	NA	2.18
Central African Republic	-	m	15	0	0.91	1.84	2.17	NA	2.52
Chad	-	m	15	0	0.33	0.68	0.74	NA	3.31
China	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Colombia	-	m	15	0	0.26	0.1	0.96	NA	2.09
Comoros	-	m	15	0	1	0.78	2.12	NA	4.11
Congo	-	m	15	0	0.4	0.52	0.98	NA	1.3
Costa Rica	Guatemala	m	15	0	1.07	1.23	2.33	NA	3.1
Cote d'Ivoire	-	m	15	0	0.4	0.9	1.66	NA	2.51
Croatia	-	m	15	NA	NA	NA	0	1.25	5.55
Cuba	Dominican Republic	m	15	0	1.32	1.65	2.21	NA	3.49
Curacao	Dominican Republic	m	15	0	1.32	1.65	2.21	NA	3.49
Cyprus	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Dem. People's Republic of Korea	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
DR Congo	-	m	15	0	0.1	0.21	0.62	NA	1.55
Denmark	-	m	15	NA	NA	NA	0	3.67	5.99
Djibouti	Ethiopia	m	15	0	0.69	0.86	1.52	NA	2
Dominican Republic	-	m	15	0	1.32	1.65	2.21	NA	3.49
Egypt	-	m	15	0	0.45	0.55	0.65	NA	1.48
El Salvador	Guatemala	m	15	0	1.07	1.23	2.33	NA	3.1
Equatorial Guinea	DR Congo	m	15	0	0.1	0.21	0.62	NA	1.55
Eritrea	Ethiopia	m	15	0	0.69	0.86	1.52	NA	2
Estonia	-	m	15	NA	NA	NA	0	9.95	15.24
Eswatini	-	m	15	0	1.11	1.33	1.57	NA	1.89
Ethiopia	-	m	15	0	0.69	0.86	1.52	NA	2
Fiji	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Finland	-	m	15	NA	NA	NA	0	3.18	6.49
Gabon	-	m	15	0	0.61	0.94	1.47	NA	1.71
Gambia	-	m	15	0	0.19	0.38	0.63	NA	0.88
Georgia	Jordan	m	15	0	-0.18	0.12	0.43	NA	1.02

Country	Proxy	Sex	Age	E0	E1	E2	E3	E4	E5
Germany	Slovenia	m	15	NA	NA	NA	0	5.45	8.65
Ghana	-	m	15	0	1.04	1.13	0.69	NA	0.48
Greece	-	m	15	NA	NA	NA	0	0.92	4.34
Grenada	Dominican Republic	m	15	0	1.32	1.65	2.21	NA	3.49
Guadeloupe	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Guatemala	-	m	15	0	1.07	1.23	2.33	NA	3.1
Guinea	-	m	15	0	0.59	1.66	3.91	NA	5.01
Guinea-Bissau	Cote d'Ivoire	m	15	0	0.4	0.9	1.66	NA	2.51
Guyana	-	m	15	0	-0.04	-0.31	1.44	NA	4.43
Haiti	-	m	15	0	0.53	1.11	1.23	NA	1.86
Honduras	-	m	15	0	1.11	2.78	3.2	NA	3.68
Hungary	-	m	15	NA	NA	NA	0	7.49	11.9
India	-	m	15	0	0.31	0.8	1.31	NA	2.73
Indonesia	-	m	15	0	1.38	2.49	3.81	NA	4.31
Iran (Islamic Republic of)	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Iraq	Jordan	m	15	0	-0.18	0.12	0.43	NA	1.02
Ireland	Sweden	m	15	NA	NA	NA	0	2.65	4.69
Italy	-	m	15	NA	NA	NA	0	4.05	4.36
Jamaica	Dominican Republic	m	15	0	1.32	1.65	2.21	NA	3.49
Jordan	-	m	15	0	-0.18	0.12	0.43	NA	1.02
Kazakhstan	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Kenya	Ethiopia	m	15	0	0.69	0.86	1.52	NA	2
Kiribati	average DHS	m	15	0	0.68	1.14	1.73	NA	2.66
Kuwait	Jordan	m	15	0	-0.18	0.12	0.43	NA	1.02
Kyrgyzstan	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Lao People's Democratic Republic	Myanmar	m	15	0	1.87	2.18	2.51	NA	2.68
Lebanon	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Lesotho	-	m	15	0	0.18	0.37	1.1	NA	1.89
Liberia	-	m	15	0	0.15	0.1	0.91	NA	1.83
Libya	Egypt	m	15	0	0.45	0.55	0.65	NA	1.48
Lithuania	Finland	m	15	NA	NA	NA	0	3.18	6.49
Luxembourg	Portugal	m	15	NA	NA	NA	0	0.96	3.84
Madagascar	-	m	15	0	0.24	0.49	1.63	NA	1.87
Malawi	-	m	15	0	0.01	0.03	0.55	NA	1.31
Malaysia	Philippines	m	15	0	0.88	1.95	3.13	NA	3.22
Maldives	-	m	15	0	0.78	1.15	1.25	NA	1.35
Mali	-	m	15	0	0.56	1.16	2.2	NA	7.31
Malta	-	m	15	NA	NA	NA	0	2.2	3.88
Martinique	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Mauritania	Liberia	m	15	0	0.15	0.1	0.91	NA	1.83
Mauritius	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Mayotte	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Micronesia (Fed. States of)	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Mongolia	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Montenegro	Croatia	m	15	NA	NA	NA	0	1.25	5.55

Country	Proxy	Sex	Age	E0	E1	E2	E3	E4	E5
Morocco	-	m	15	0	1.3	2.19	3.59	NA	3.6
Mozambique	-	m	15	0	-0.03	0.84	0.93	NA	1.03
Myanmar	-	m	15	0	1.87	2.18	2.51	NA	2.68
Namibia	-	m	15	0	0.08	0.54	1.04	NA	1.72
Nepal	-	m	15	0	0.1	0.54	1.41	NA	2.92
Nicaragua	-	m	15	0	1.28	2.25	3.48	NA	3.53
Niger	-	m	15	0	0.68	1.31	3.01	NA	3.51
Nigeria	-	m	15	0	0.48	1.77	2.25	NA	3.36
North Macedonia	-	m	15	NA	NA	NA	0	3.26	6.38
Norway	-	m	15	NA	NA	NA	0	3.62	5.52
Oman	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Pakistan	-	m	15	0	0.26	0.27	0.58	NA	2.4
Papua New Guinea	average DHS	m	15	0	0.68	1.14	1.73	NA	2.66
Paraguay	Guyana	m	15	0	-0.04	-0.31	1.44	NA	4.43
Peru	-	m	15	0	0.18	0.27	1.03	NA	1.45
Philippines	-	m	15	0	0.88	1.95	3.13	NA	3.22
Poland	-	m	15	NA	NA	NA	0	5.77	12.04
Portugal	-	m	15	NA	NA	NA	0	0.96	3.84
Puerto Rico	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Qatar	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Republic of Moldova	Romania	m	15	NA	NA	NA	0	5.91	7.75
Reunion	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Romania	-	m	15	NA	NA	NA	0	5.91	7.75
Rwanda	-	m	15	0	0.89	1.05	1.77	NA	2.34
Saint Lucia	Dominican Republic	m	15	0	1.32	1.65	2.21	NA	3.49
Saint Vincent and the Grenadines	Dominican Republic	m	15	0	1.32	1.65	2.21	NA	3.49
Samoa	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Sao Tome and Principe	Egypt	m	15	0	0.45	0.55	0.65	NA	1.48
Saudi Arabia	Jordan	m	15	0	-0.18	0.12	0.43	NA	1.02
Senegal	-	m	15	0	0.89	1.72	2.55	NA	2.57
Serbia	-	m	15	NA	NA	NA	0	0.6	5.58
Seychelles	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Sierra Leone	-	m	15	0	0	0	0.45	NA	0.91
Singapore	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Slovakia	-	m	15	NA	NA	NA	0	10.79	14.97
Slovenia	-	m	15	NA	NA	NA	0	5.45	8.65
Solomon Islands	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Somalia	Burundi	m	15	0	0.05	1.06	2.02	NA	3.23
South Africa	-	m	15	0	0.06	0.13	0.81	NA	3.89
South Sudan	Burundi	m	15	0	0.05	1.06	2.02	NA	3.23
Sri Lanka	Maldives	m	15	0	0.78	1.15	1.25	NA	1.35
State of Palestine	Jordan	m	15	0	-0.18	0.12	0.43	NA	1.02
Sudan	Gabon	m	15	0	0.61	0.94	1.47	NA	1.71
Suriname	Peru	m	15	0	0.18	0.27	1.03	NA	1.45
Sweden	-	m	15	NA	NA	NA	0	2.65	4.69

Country	Proxy	Sex	Age	E0	E1	E2	E3	E4	E5
Syrian Arab Republic	Jordan	m	15	0	-0.18	0.12	0.43	NA	1.02
Tajikistan	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Thailand	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Timor-Leste	-	m	15	0	-0.07	0.42	0.97	NA	1.31
Togo	-	m	15	0	0.21	0.86	1.18	NA	1.52
Tonga	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Trinidad and Tobago	Dominican Republic	m	15	0	1.32	1.65	2.21	NA	3.49
Tunisia	Morocco	m	15	0	1.3	2.19	3.59	NA	3.6
Turkey	-	m	15	NA	NA	NA	0	1.83	3.68
Turkmenistan	average DHS	m	15	0	0.68	1.14	1.73	NA	2.66
Uganda	-	m	15	0	0.9	1.31	2.58	NA	3.23
Ukraine	Bulgaria	m	15	NA	NA	NA	0	7.81	10.88
United Arab Emirates	Turkey	m	15	NA	NA	NA	0	1.83	3.68
United Republic of Tanzania	-	m	15	0	0.3	1.13	1.29	NA	1.45
United States Virgin Islands	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Uzbekistan	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Vanuatu	average EUROSTAT	m	15	NA	NA	NA	0	4.28	5.23
Venezuela (Bolivarian Republic of)	Peru	m	15	0	0.18	0.27	1.03	NA	1.45
Viet Nam	Philippines	m	15	0	0.88	1.95	3.13	NA	3.22
Western Sahara	Egypt	m	15	0	0.45	0.55	0.65	NA	1.48
Yemen	-	m	15	0	1.8	2.29	2.82	NA	4.52
Zambia	-	m	15	0	0.49	0.55	0.6	NA	1.24
Zimbabwe	-	m	15	0	1.65	2.3	3.02	NA	4.01
Argentina	Chile	m	25	NA	NA	NA	0	4.03	10.92
Australia	-	m	25	NA	NA	NA	0	3.3	6.6
Austria	-	m	25	NA	NA	NA	0	2.63	6.43
Belgium	-	m	25	NA	NA	NA	0	4.63	10.59
Brazil	Chile	m	25	NA	NA	NA	0	4.03	10.92
Canada	-	m	25	NA	NA	NA	0	1.3	4.08
Chile	-	m	25	NA	NA	NA	0	4.03	10.92
Czechia	-	m	25	NA	NA	NA	0	7.34	13.72
Ecuador	Chile	m	25	NA	NA	NA	0	4.03	10.92
France	-	m	25	NA	NA	NA	0	3.65	6.76
French Guiana	Chile	m	25	NA	NA	NA	0	4.03	10.92
French Polynesia	New Zealand	m	25	NA	NA	NA	0	3.17	4.88
Guam	New Zealand	m	25	NA	NA	NA	0	3.17	4.88
Israel	-	m	25	NA	NA	NA	0	3.27	5.52
Latvia	-	m	25	NA	NA	NA	0	4.88	11.54
Mexico	-	m	25	NA	NA	NA	0	0.94	4.8
Netherlands	-	m	25	NA	NA	-3.25	0	NA	2.96
New Caledonia	New Zealand	m	25	NA	NA	NA	0	3.17	4.88
New Zealand	-	m	25	NA	NA	NA	0	3.17	4.88
Panama	Chile	m	25	NA	NA	NA	0	4.03	10.92
Switzerland	France	m	25	NA	NA	NA	0	3.65	6.76
United Kingdom	-	m	25	NA	NA	NA	0	2.38	4.57

Country	Proxy	Sex	Age	E0	E1	E2	E3	E4	E5
United States of America	-	m	25	NA	NA	NA	0	3.09	7.25
Uruguay	Chile	m	25	NA	NA	NA	0	4.03	10.92
Iceland	-	m	30	NA	NA	NA	0	3	5
Russian Federation	-	m	30	NA	NA	NA	0	3.81	13.08
Spain	-	m	30	NA	NA	NA	0	2	4
Republic of Korea	-	m	40	NA	NA	NA	0	2.13	5.9
China, Hong Kong SAR	Japan	m	65	NA	NA	NA	0	0.3	4
China, Macao SAR	Japan	m	65	NA	NA	NA	0	0.3	4
China, Taiwan Province of China	Japan	m	65	NA	NA	NA	0	0.3	4
Japan	-	m	65	NA	NA	NA	0	0.3	4

Note: NA indicates education attainment aggregated to the higher educational level.

Fertility

Appendix Table Af1: High and Low fertility countries

High-Fertility Countries	Low-Fertility Countries
Afghanistan	Albania
Algeria	American Samoa
Angola	Andorra
Antigua and Barbuda	Azerbaijan
Argentina	Australia
Bahamas	Austria
Bahrain	Armenia
Bangladesh	Belgium
Barbados	Bermuda
Bhutan	Bosnia and Herzegovina
Bolivia	British Virgin Islands
Botswana	Bulgaria
Brazil	Belarus
Belize	Canada
Solomon Islands	Cayman Islands
Brunei Darussalam	China
Myanmar	China, Taiwan Province of China
Burundi	Cook Islands
Cambodia	Croatia
Cameroon	Cyprus
Cabo Verde	Czechia
Central African Republic	Denmark
Sri Lanka	Dominica
Chad	Estonia
Chile	Faroe Islands
Colombia	Falkland Islands (Malvinas)

High-Fertility Countries	Low-Fertility Countries
Comoros	Finland
Mayotte	France
Congo	French Polynesia
DR Congo	Georgia
Costa Rica	Germany
Cuba	Gibraltar
Benin	Greece
Dominican Republic	Greenland
Ecuador	Guadeloupe
El Salvador	Holy See
Equatorial Guinea	China, Hong Kong SAR
Ethiopia	Hungary
Eritrea	Iceland
Fiji	Iran (Islamic Republic of)
French Guiana	Ireland
Djibouti	Israel
Gabon	Italy
Gambia	Japan
State of Palestine	Dem. People's Republic of Korea
Ghana	Republic of Korea
Kiribati	Latvia
Grenada	Liechtenstein
Guam	Lithuania
Guatemala	Luxembourg
Guinea	China, Macao SAR
Guyana	Malta
Haiti	Martinique
Honduras	Monaco
India	Republic of Moldova
Indonesia	Montenegro
Iraq	Montserrat
Cote d'Ivoire	Nauru
Jamaica	Netherlands
Kazakhstan	New Caledonia
Jordan	New Zealand
Kenya	Niue
Kuwait	Norway
Kyrgyzstan	Northern Mariana Islands
Lao People's Democratic Republic	Marshall Islands
Lebanon	Palau
Lesotho	Poland
Liberia	Portugal
Libya	Reunion
Madagascar	Romania
Malawi	Russian Federation

High-Fertility Countries	Low-Fertility Countries
Malaysia	Saint Helena
Maldives	Saint Kitts and Nevis
Mali	Anguilla
Mauritania	Saint Pierre and Miquelon
Mauritius	San Marino
Mexico	Serbia
Mongolia	Singapore
Morocco	Slovakia
Mozambique	Slovenia
Oman	Spain
Namibia	Sweden
Nepal	Switzerland
Curacao	Tokelau
Aruba	Turkey
Vanuatu	Turks and Caicos Islands
Nicaragua	Tuvalu
Niger	Ukraine
Nigeria	North Macedonia
Micronesia (Fed. States of)	United Kingdom
Pakistan	Channel Islands
Panama	Isle of Man
Papua New Guinea	United States of America
Paraguay	Wallis and Futuna Islands
Peru	
Philippines	
Guinea-Bissau	
Timor-Leste	
Puerto Rico	
Qatar	
Rwanda	
Saint Lucia	
Saint Vincent and the Grenadines	
Sao Tome and Principe	
Saudi Arabia	
Senegal	
Seychelles	
Sierra Leone	
Viet Nam	
Somalia	
South Africa	
Zimbabwe	
South Sudan	
Western Sahara	
Suriname	
Eswatini	

High-Fertility Countries	Low-Fertility Countries
Syrian Arab Republic Tajikistan Thailand Togo Tonga Trinidad and Tobago United Arab Emirates Tunisia Turkmenistan Uganda Egypt United Republic of Tanzania United States Virgin Islands Burkina Faso Uruguay Uzbekistan Venezuela (Bolivarian Republic of) Samoa Yemen Zambia	

Table Af2: Sources of fertility estimates for the base-year (2020) (countries for which WPP2022 is not used)

Country	TFR 2017.5	TFR 2020	Source 2020	Notes and references
Albania	1.62	1.62	WPP2015-2020	Albanian Stat Office, INSTAT, puts the TFR in 2020 at 1.34, but we keep the higher UN WPP value of 1.62 - http://www.instat.gov.al/en/statistical-literacy/the-population-of-albania/
Armenia	1.65	1.66	NSO2020	Armenian demographic yearbook
Australia	1.7	1.58	NSO2020	https://www.abs.gov.au/statistics/people/population/births-australia/2020
Austria	1.46	1.44	NSO2020	
Azerbaijan	1.82	1.68	NSO2020	https://www.stat.gov.az/source/demography/
Belarus	1.55	1.38	NSO2019	
Belgium	1.62	1.55	NSO2020	
Bosnia and Herzegovina	1.5	1.5	WIC estimate	The official NSO TFR in 2020 is lower, at 1.185, but likely distorted downwards. Therefore, we use WIC estimate=1.5
Bulgaria	1.54	1.56	NSO2020	
Canada	1.5	1.4	NSO2020	https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310041801
Channel Islands	1.5	1.5	WPP2015-2020	
China	1.5	1.3	WIC estimate	

Country	TFR 2017.5	TFR 2020	Source 2020	Notes and references
Croatia	1.44	1.48	NSO2020	
Cyprus	1.33	1.33	EUROSTAT2019	
Czechia	1.64	1.71	NSO2020	
Denmark	1.69	1.68	NSO2020	
Estonia	1.58	1.58	NSO2020	
Finland	1.51	1.37	NSO2020	
France	1.88	1.79	NSO2020	
French Polynesia	1.88	1.7	NSO2020	https://www.ispf.pf/bases/Repertoires/Etatcivil/Fecondite.aspx
Georgia	1.97	1.97	NSO2020	https://www.geostat.ge/en/single-categories/95/statistical-yearbook
Germany	1.52	1.53	NSO2020	
Greece	1.33	1.34	EUROSTAT2019	
Guadeloupe	2.25	2.33	NSO2020	
Hong Kong	1.03	0.87	NSO2020	https://www.censtatd.gov.hk/en/scode160.html
Hungary	1.5	1.56	NSO2020	
Iceland	1.76	1.72	NSO2020	
Iran	1.96	1.67	UN2020	UN Demographic Yearbook 2020, Table 10 (value from 2019 ASFRs)
Ireland	1.77	1.63	NSO2020	
Israel	3	2.9	NSO2020	https://www.cbs.gov.il/en/publications/Pages/2021/Population-Statistical-Abstract-of-Israel-2021-No.72.aspx
Italy	1.29	1.24	NSO2020	
Japan	1.4	1.34	NSO2020	http://www.stat.go.jp/english/data/handbook/pdf/2021all.pdf#page=1
Korea North	1.91	1.91	WPP2015-2020	
Korea South	1.04	0.84	NSO2020	
Latvia	1.62	1.55	NSO2020	
Lithuania	1.59	1.48	NSO2020	
Luxembourg	1.42	1.37	NSO2020	
Macao	1.04	0.89	NSO2020	https://www.dsec.gov.mo/en-US/Statistic?id=101
North Macedonia	1.5	1.5	WIC estimate	
Malta	1.29	1.13	NSO2020	
Martinique	1.93	1.93	NSO2020	
Moldova	1.83	1.77	NSO2020	https://statbank.statistica.md/PxWeb/pxweb/en/20%20Populatia%20si%20procesele%20demografice/20%20Populatia%20si%20procesele%20demografice POPrec POP030/POP032300rcl.px/table/tableViewLayout1/?rxid=b2ff27d7-0b96-43c9-934b-42e1a2a9a774
Montenegro	1.75	1.77	EUROSTAT2019	
Netherlands	1.6	1.55	NSO2020	
New Caledonia	1.97	1.97	WPP2015-2020	

Country	TFR 2017.5	TFR 2020	Source 2020	Notes and references
New Zealand	1.8	1.61	NSO2020	https://www.stats.govt.nz/topics/population
Norway	1.6	1.48	NSO2020	
Poland	1.35	1.38	NSO2020	
Portugal	1.35	1.4	NSO2020	
Réunion	2.33	2.41	NSO2020	
Romania	1.7	1.76	NSO2019	Statistical Yearbook 2019, Table 2.13 https://insse.ro/cms/files/Anuar%20arhive/serii%20de%20date/2019/anuarul_statistic_al_romaniei_2019.pdf
Russian Federation	1.64	1.5	RFMD2020	Russian Fertility and Mortality Database http://demogr.nes.ru/en/demogr_indicat/
Serbia	1.49	1.52	EUROSTAT2019	
Singapore	1.17	1.1	NSO2020	https://www.singstat.gov.sg/publications/population/population-trends
Slovakia	1.5	1.59	NSO2020	
Slovenia	1.58	1.6	NSO2020	
Spain	1.26	1.19	NSO2020	
Sweden	1.75	1.66	NSO2020	
Switzerland	1.5	1.46	NSO2020	
Taiwan	1.08	0.99	NSO2020	https://eng.stat.gov.tw/public/data/dgbas03/bs2/yearbook_eng/y005.pdf
Turkey	1.95	1.76	NSO2020	https://data.tuik.gov.tr/Bulten/Index?p=Birth-Statistics-2020-37229
Ukraine	1.36	1.22	NSO2020	http://database.ukrcensus.gov.ua/MULT/Dialog/view.asp?ma=000_0303&ti=Total+birth+and+death+rates+of+population&path=../Quicktables/POPULATION/03/01/&lang=2&multilang=en
United Kingdom	1.68	1.56	NSO2020	https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/vitalstatisticspopulationandhealthreferencetables/current
United States	1.74	1.64	NSO2020	https://www.cdc.gov/nchs/data/vsrr/vsrr012-508.pdf
Puerto Rico	1.114	0.922	NSO2020	https://www.cdc.gov/nchs/data/nvsr/nvsr70/nvsr70-17.pdf

Note: For the remaining countries we use TFR from WPP2022 as a baseline TFR

Appendix Table Af3: Education specific TFR, 2020-2025, all countries, SSP2

	No Education	Incomplete Primary	Primary	Lower Secondary	Upper Secondary	Post-Secondary
Afghanistan	4.5	4.1	4.3	4.1	3.9	3.8
Albania	2.2	2.4	2.1	1.8	1.6	1.3
Algeria	3.7	3.7	3.7	3.0	2.5	2.2
Angola	5.9	6.0	4.8	3.6	2.4	2.2
Antigua & Barbuda	1.7	1.7	1.6	1.4	1.3	1.1
Argentina	2.4	2.4	2.4	1.9	1.4	1.2
Armenia	2.4	2.6	2.2	1.9	1.6	1.5
Aruba	1.9	1.9	1.8	1.7	1.5	1.3
Australia	1.8	1.8	1.8	1.8	1.6	1.5
Austria	1.7	1.7	1.7	1.7	1.4	1.3
Azerbaijan	1.8	1.8	1.8	1.8	1.7	1.4
Bahamas	2.0	2.0	2.0	1.6	1.4	1.1
Bahrain	3.7	2.4	2.2	1.5	1.6	1.6
Bangladesh	2.0	1.9	1.8	1.9	1.7	1.8
Barbados	2.1	2.1	2.1	1.6	1.4	1.1
Belarus	1.7	1.7	1.7	1.7	1.3	1.1
Belgium	1.8	1.8	1.8	1.8	1.5	1.4
Belize	3.1	2.8	2.5	1.9	1.7	1.7
Benin	5.7	4.9	4.2	3.9	3.3	2.7
Bhutan	1.7	1.7	1.6	1.5	1.3	1.1
Bolivia	4.2	4.0	3.4	2.8	2.2	1.7
Bosnia & Herzegovina	1.8	1.8	1.8	1.8	1.5	1.3
Botswana	4.2	3.7	3.1	2.8	2.4	2.0
Brazil	2.0	2.0	2.0	1.6	1.2	1.0
Brunei	2.2	2.2	2.2	1.8	1.5	1.4
Bulgaria	1.8	1.8	1.8	1.8	1.5	1.2
Burkina Faso	5.1	4.1	3.4	2.5	2.7	2.6
Burundi	5.3	5.2	4.5	3.5	3.1	3.0
Côte d'Ivoire	5.1	4.6	3.8	2.3	2.1	1.9
Cambodia	2.5	2.4	2.2	2.0	1.8	1.5
Cameroon	5.5	5.6	4.6	3.5	2.9	2.8
Canada	1.6	1.6	1.6	1.6	1.3	1.3
Cape Verde	2.6	2.3	2.0	1.8	1.6	1.3
Central African Rep.	5.8	5.9	5.4	3.6	3.0	2.6
Chad	6.1	6.7	5.8	3.9	3.4	2.5
Chile	2.2	2.2	2.2	1.7	1.3	1.1
China	2.0	2.0	1.9	1.6	1.2	1.0
Colombia	2.3	2.3	2.3	1.8	1.4	1.2
Comoros	5.3	4.7	3.9	3.1	2.8	2.6
Congo	5.1	4.9	4.2	3.0	3.0	2.5
DR Congo	6.7	6.8	6.4	5.5	3.9	2.9
Costa Rica	2.0	2.0	2.0	1.6	1.2	1.0
Croatia	1.8	1.8	1.8	1.8	1.5	1.3

	No Education	Incomplete Primary	Primary	Lower Secondary	Upper Secondary	Post-Secondary
Cuba	2.5	2.5	2.5	2.0	1.5	1.3
Curaçao	1.9	1.9	1.9	1.9	1.3	1.1
Cyprus	1.6	1.6	1.6	1.6	1.4	1.2
Czechia	2.0	2.0	2.0	2.0	1.7	1.5
Denmark	1.7	1.7	1.7	1.7	1.6	1.6
Djibouti	2.9	2.8	2.5	2.0	1.6	1.3
Dominican Republic	3.1	2.7	2.6	2.3	1.9	1.6
Ecuador	3.0	2.7	2.4	2.1	1.7	1.4
Egypt	3.1	3.0	2.9	2.9	2.9	2.5
El Salvador	2.4	2.2	2.0	1.7	1.4	1.3
Equatorial Guinea	5.2	4.9	4.2	3.4	2.7	2.3
Eritrea	4.2	4.0	3.4	2.8	2.1	1.8
Estonia	1.8	1.8	1.8	1.8	1.6	1.4
Eswatini	3.4	3.1	2.9	2.5	2.1	1.7
Ethiopia	4.8	3.9	3.0	2.3	1.6	1.9
Fiji	3.2	3.1	2.9	2.6	2.3	1.9
Finland	1.3	1.3	1.3	1.3	1.3	1.3
France	2.1	2.1	2.1	2.1	1.8	1.6
French Guiana	5.2	4.4	3.7	3.0	2.6	2.1
French Polynesia	2.1	2.1	2.1	2.0	1.7	1.5
Gabon	4.4	4.2	3.5	2.9	2.6	2.3
Gambia	5.0	4.6	4.1	3.6	3.0	2.4
Georgia	2.1	2.1	2.1	2.1	1.9	1.6
Germany	1.8	1.8	1.8	1.8	1.5	1.4
Ghana	5.1	4.4	3.9	3.2	2.3	2.5
Greece	1.6	1.6	1.6	1.6	1.4	1.2
Grenada	2.4	2.3	2.2	2.0	1.8	1.5
Guadeloupe	3.1	3.0	2.7	2.4	2.2	1.9
Guam	3.4	3.3	3.1	2.8	2.5	2.1
Guatemala	3.5	3.0	2.5	2.2	1.8	1.4
Guinea	4.6	4.4	3.9	3.3	2.9	2.1
Guinea-Bissau	4.3	4.1	3.6	3.0	2.3	2.0
Guyana	4.4	3.4	2.7	2.7	2.0	1.4
Haiti	4.0	3.3	2.7	2.2	1.6	1.2
Honduras	3.0	2.9	2.4	2.0	1.8	1.3
Hong Kong SAR China	1.0	1.0	1.0	1.0	0.9	0.8
Hungary	1.8	1.8	1.8	1.8	1.6	1.4
Iceland	1.7	1.7	1.7	1.7	1.7	1.7
India	2.4	2.1	2.1	2.0	1.7	1.5
Indonesia	2.1	2.2	2.2	2.1	1.9	1.8
Iran	2.4	2.4	2.4	1.9	1.5	1.1
Iraq	3.8	3.7	3.6	3.1	2.6	2.2
Ireland	1.9	1.9	1.9	1.9	1.7	1.5
Israel	3.9	3.9	3.9	3.2	2.8	2.6
Italy	1.5	1.5	1.5	1.5	1.2	1.1

	No Education	Incomplete Primary	Primary	Lower Secondary	Upper Secondary	Post-Secondary
Jamaica	2.0	2.0	2.0	1.6	1.2	1.0
Japan	1.4	1.4	1.4	1.4	1.4	1.2
Jordan	2.5	2.9	2.8	2.7	2.5	2.5
Kazakhstan	3.4	3.4	3.4	3.3	3.0	2.5
Kenya	4.6	3.7	3.5	3.0	2.4	2.1
Kiribati	4.2	4.1	3.7	3.1	2.7	2.1
Kuwait	2.5	2.5	2.5	2.1	1.6	1.2
Kyrgyzstan	2.8	2.8	2.8	3.0	3.0	2.1
Laos	2.8	2.7	2.6	2.2	1.7	1.6
Latvia	1.8	1.8	1.8	1.8	1.6	1.4
Lebanon	3.0	3.0	3.0	2.4	1.9	1.4
Lesotho	3.6	3.6	3.2	2.8	2.1	2.1
Liberia	4.4	4.3	3.9	3.2	2.4	1.7
Libya	3.6	3.0	2.6	2.3	1.9	1.9
Lithuania	1.7	1.7	1.7	1.7	1.5	1.3
Luxembourg	1.6	1.6	1.6	1.6	1.4	1.3
Macao SAR China	1.0	1.0	1.0	1.0	0.9	0.8
Madagascar	4.7	4.2	3.2	2.6	1.9	1.8
Malawi	4.8	4.5	4.2	3.4	2.6	2.3
Malaysia	2.2	2.1	2.0	1.8	1.6	1.4
Maldives	2.0	2.0	1.9	1.7	1.4	1.3
Mali	6.3	5.6	4.7	4.0	3.3	3.4
Malta	1.3	1.3	1.3	1.3	1.1	1.0
Martinique	2.5	2.4	2.3	2.1	1.9	1.6
Mauritania	4.7	4.5	3.8	3.1	2.4	2.0
Mauritius	1.6	1.6	1.6	1.6	1.3	1.1
Mayotte	7.3	7.0	6.3	5.4	4.6	3.5
Mexico	2.6	2.6	2.6	2.1	1.6	1.3
Micronesia	3.9	3.5	3.0	2.7	2.3	1.8
Moldova	2.0	2.0	2.0	2.0	1.6	1.4
Mongolia	4.0	3.8	3.6	3.2	2.8	2.3
Montenegro	2.2	2.2	2.2	2.2	1.7	1.5
Morocco	3.0	2.5	2.3	2.1	1.7	1.6
Mozambique	5.1	5.1	3.2	2.6	2.4	1.5
Myanmar (Burma)	3.0	2.5	2.0	1.8	1.4	1.4
Namibia	4.2	4.2	3.5	3.1	2.3	1.9
Nepal	2.7	2.3	2.1	1.8	1.6	1.5
Netherlands	1.8	1.8	1.8	1.8	1.5	1.4
New Caledonia	2.3	2.3	2.3	2.3	2.0	1.8
New Zealand	1.9	1.9	1.9	1.9	1.6	1.5
Nicaragua	3.5	2.8	2.3	1.9	1.8	1.4
Niger	7.0	6.4	5.5	3.8	3.4	2.5
Nigeria	6.3	5.7	5.1	4.8	3.9	3.2
North Korea	2.3	2.3	2.3	2.3	1.9	1.7
North Macedonia	1.8	1.8	1.8	1.8	1.4	1.2

	No Education	Incomplete Primary	Primary	Lower Secondary	Upper Secondary	Post-Secondary
Norway	1.5	1.5	1.5	1.5	1.4	1.4
Oman	4.7	4.1	3.4	3.0	2.6	2.1
Pakistan	3.6	3.3	3.3	3.1	3.1	2.8
Palestinian Territories	4.2	4.5	4.3	3.8	3.3	2.9
Panama	3.5	3.3	2.8	2.4	2.0	1.6
Papua New Guinea	4.1	3.7	3.1	2.7	2.3	1.8
Paraguay	3.1	3.3	2.7	2.4	1.9	1.9
Peru	3.2	2.8	2.7	2.4	1.9	1.6
Philippines	3.6	4.0	3.3	3.3	2.5	1.9
Poland	1.6	1.6	1.6	1.6	1.4	1.2
Portugal	1.6	1.6	1.6	1.6	1.4	1.2
Puerto Rico	1.4	1.4	1.4	1.1	0.9	0.7
Qatar	2.0	2.0	2.0	1.6	1.3	1.0
Réunion	3.4	3.3	3.0	2.6	2.4	2.0
Romania	2.0	2.0	2.0	2.0	1.7	1.4
Russia	1.8	1.8	1.8	1.8	1.4	1.2
Rwanda	4.1	3.8	3.5	2.8	2.4	2.2
São Tomé & Principe	4.1	4.3	3.9	3.0	2.6	2.5
Samoa	6.4	5.7	4.8	4.1	3.5	2.6
Saudi Arabia	3.7	3.2	2.8	2.5	2.2	1.8
Senegal	4.9	3.9	3.5	2.9	2.7	2.6
Serbia	1.8	1.8	1.8	1.8	1.5	1.3
Seychelles	3.0	2.9	2.7	2.5	2.2	1.8
Sierra Leone	4.6	4.4	3.9	3.1	2.5	2.2
Singapore	1.3	1.3	1.3	1.3	1.2	1.0
Slovakia	1.8	1.8	1.8	1.8	1.6	1.4
Slovenia	1.9	1.9	1.9	1.9	1.6	1.4
Solomon Islands	5.4	4.8	4.0	3.3	2.8	2.1
Somalia	6.7	6.2	5.4	4.4	3.6	3.2
South Africa	2.8	2.8	2.6	2.3	2.0	1.8
South Korea	1.0	1.0	1.0	1.0	0.9	0.8
South Sudan	4.6	4.3	3.8	3.2	2.6	2.3
Spain	1.4	1.4	1.4	1.4	1.2	1.0
Sri Lanka	2.4	2.4	2.3	2.1	1.8	1.6
St. Lucia	2.5	2.1	1.8	1.4	1.2	1.0
St. Vincent & Grenadines	3.2	2.8	2.3	1.9	1.6	1.3
Sudan	4.9	4.6	4.6	4.4	3.6	2.9
Suriname	4.2	3.5	2.9	2.3	2.0	1.6
Sweden	1.6	1.6	1.6	1.6	1.6	1.6
Switzerland	1.7	1.7	1.7	1.7	1.4	1.3
Syria	3.1	3.0	2.8	2.5	2.2	1.8
Taiwan	1.2	1.2	1.2	1.2	1.0	0.9
Tajikistan	3.0	2.5	3.7	3.2	3.0	2.5
Tanzania	6.0	5.4	4.5	3.2	2.6	2.6
Thailand	1.5	1.5	1.5	1.5	1.3	1.2

	No Education	Incomplete Primary	Primary	Lower Secondary	Upper Secondary	Post-Secondary
Timor-Leste	3.4	3.4	3.4	3.3	2.8	2.3
Togo	5.1	4.5	3.7	3.1	2.7	2.2
Tonga	5.0	4.5	3.8	3.3	2.8	2.2
Trinidad & Tobago	2.6	2.6	2.6	2.0	1.5	1.3
Tunisia	2.9	2.9	2.9	2.4	1.8	1.4
Turkey	3.1	2.6	2.3	2.1	1.7	1.3
Turkmenistan	3.2	3.2	3.2	3.2	2.8	2.4
U.S. Virgin Islands	2.5	2.5	2.3	2.1	1.9	1.6
Uganda	5.3	5.0	4.4	3.6	3.4	3.0
Ukraine	1.3	1.3	1.3	1.3	1.2	1.0
United Arab Emirates	2.0	2.0	2.0	1.6	1.3	1.0
United Kingdom	1.8	1.8	1.8	1.8	1.5	1.4
United States	2.0	2.0	2.0	2.0	1.6	1.4
Uruguay	1.8	1.8	1.8	1.5	1.1	0.9
Uzbekistan	3.2	3.2	3.2	3.2	2.8	2.4
Vanuatu	4.3	4.1	3.7	3.2	2.8	2.2
Venezuela	3.6	3.3	2.8	2.4	2.0	1.6
Vietnam	2.4	1.9	2.0	1.8	1.7	1.5
Western Sahara	2.5	2.2	1.9	1.7	1.5	1.2
Yemen	4.0	3.4	3.4	2.8	2.6	2.0
Zambia	5.3	5.2	4.4	3.4	2.6	2.4
Zimbabwe	4.0	4.0	3.9	3.3	2.8	2.1

SSPs and Projection results

Appendix Table Ar1a: Changes in scenario composition between WIC2013 and WIC2018 (changes in yellow marked cells)

	SSP 1			SSP 2			SSP 3			SSP 4			SSP 5		
	Country Groupings														
SSP Element	**HiFert**	**LoFert**	**Rich-OECD**	**HiFert**	**LoFert**	**Rich-OECD**	**HiFert**	**LoFert**	**Rich-OECD**	**HiFert**	**LoFert**	**Rich-OECD**	**HiFert**	**LoFert**	**Rich-OECD**
Demographics															
Population															
Fertility	*Low*	*~~LOW~~ Low10*	*~~Medium~~ Low*	*Medium*	*Medium*	*Medium*	*High*	*High*	*~~LOW~~ High*	*High*	*Low*	*Low*	*Low*	*~~Low~~ Low10*	*~~High~~ Low*
Mortality	*Low*	*Low*	*Low*	*Medium*	*Medium*	*Medium*	*High*	*High*	*High*	*High*	*Medium*	*Medium*	*Low*	*Low*	*Low*
Migration	*Medium*	*Medium*	*Medium*	*Medium*	*Medium*	*Medium*	*Low*	*Low*	*Low*	*Medium*	*Medium*	*Medium*	*High*	*High*	*High*
Education	*High (FT-GET)*	*High (FT-GET)*	*High (FT-GET)*	*Medium (GET)*	*Medium (GET)*	*Medium (GET)*	*Low (CER)*	*Low (CER)*	*Low (CER)*	*CER-10%/GET*	*CER-10%/GET*	*~~CER/CER-20%~~ CER-10%/GET*	*High (FT-GET)*	*High (FT-GET)*	*High (FT-GET)*

Appendix Table Ar1b: Changes in scenario composition between WIC2018 and WIC2023 (changes in yellow marked cells)

	SSP 1		SSP 2ª	SSP 3	SSP 4		SSP 5	
	Country Grouping							
	HiFert	*LoFert*			*HiFert*	*LoFert*	*HiFert*	*LoFert*
Population								
Fertility	Low	Low10	Med	High	High	Low	Low	Low10
Mortality	Low		Med	High	High	Med	Low	
Migration	Med		Med	Low	Med		High	
Education	High (SDG-GET)		Med (GET)	Low (CER)	CER-10%/GET		High (SDG-GET)	

Note: Rich-OECD countries were moved to the Low-fertility countries group.

Appendix Table Ar2: Decomposition of the change in population by major world regions, SSP2_WIC2023

Population Projection of Africa : SSP2

Numbers in '000

Time	*Population*	*Births*	*Deaths*	*Emigration*	*Immigration*	*Natural Change*	*Total Change*
2020	1,344,064	228,899	59,380	6,486	4,218	169,518	167,251
2025	1,511,315	241,171	61,503	7,227	4,416	179,668	176,856
2030	1,688,171	252,969	66,625	7,991	4,607	186,344	182,960
2035	1,871,132	262,772	72,052	8,768	4,778	190,720	186,729
2040	2,057,861	269,579	77,797	9,541	4,921	191,782	187,162
2045	2,245,023	273,080	83,897	10,288	5,043	189,184	183,939
2050	2,428,961	272,141	90,357	10,993	5,156	181,784	175,947
2055	2,604,908	269,749	97,297	11,642	5,250	172,453	166,060
2060	2,770,968	264,099	104,675	11,801	5,730	159,424	153,353
2065	2,924,321	257,484	112,486	11,841	6,249	144,998	139,406
2070	3,063,728	249,606	120,596	11,767	6,803	129,010	124,046
2075	3,187,774	240,408	128,933	11,582	7,383	111,475	107,277
2080	3,295,051	230,677	137,499	11,294	7,979	93,177	89,862
2085	3,384,912	221,126	146,275	10,918	8,584	74,851	72,517
2090	3,457,429	211,281	155,123	10,468	9,192	56,157	54,880
2095	3,512,309	201,929	163,934	9,958	9,792	37,996	37,830

Population Projection of Asia : SSP2

Numbers in '000

Time	*Population*	*Births*	*Deaths*	*Emigration*	*Immigration*	*Natural Change*	*Total Change*
2020	4,647,858	335,682	177,653	16,267	12,186	158,029	153,948
2025	4,801,955	322,612	179,972	17,133	12,742	142,640	138,248
2030	4,940,162	313,985	197,561	17,910	13,301	116,424	111,814
2035	5,051,949	306,543	216,310	18,596	13,818	90,233	85,454
2040	5,137,389	296,022	234,793	19,191	14,284	61,229	56,321
2045	5,193,704	282,425	251,836	19,692	14,702	30,589	25,599
2050	5,219,303	269,298	266,908	20,095	15,084	2,390	−2,621
2055	5,216,681	257,490	279,770	20,389	15,401	−22,280	−27,268
2060	5,189,413	245,553	289,706	20,271	15,953	−44,153	−48,471
2065	5,140,942	236,143	296,724	20,068	16,434	−60,581	−64,214
2070	5,076,728	226,521	301,987	19,801	16,846	−75,466	−78,420
2075	4,998,308	216,945	306,153	19,484	17,186	−89,209	−91,507
2080	4,906,801	207,752	307,163	19,132	17,456	−99,411	−101,087
2085	4,805,714	199,487	303,915	18,757	17,663	−104,428	−105,522
2090	4,700,192	191,541	298,598	18,370	17,815	−107,058	−107,612
2095	4,592,579	184,650	294,164	17,968	17,912	−109,514	−109,569

Population Projection of Europe : SSP2

Numbers in '000

Time	*Population*	*Births*	*Deaths*	*Emigration*	*Immigration*	*Natural Change*	*Total Change*
2020	744,396	33,942	44,182	8,133	11,872	−10,241	−6,501
2025	737,602	32,135	39,885	7,991	12,383	−7,750	−3,358
2030	734,326	31,809	40,421	7,951	12,903	−8,612	−3,660
2035	730,719	32,574	41,245	7,895	13,389	−8,672	−3,178
2040	727,569	33,621	42,126	7,836	13,847	−8,505	−2,494
2045	725,086	34,366	42,798	7,782	14,269	−8,432	−1,945
2050	723,142	33,019	43,134	7,762	14,648	−10,115	−3,229
2055	719,914	31,634	43,197	7,707	14,950	−11,563	−4,319
2060	715,595	30,897	42,909	8,118	14,749	−12,012	−5,381
2065	710,214	30,855	42,345	8,556	14,460	−11,490	−5,586
2070	704,627	31,086	41,516	9,018	14,096	−10,430	−5,352
2075	699,275	31,070	40,457	9,496	13,667	−9,387	−5,216
2080	694,059	30,498	39,117	9,980	13,185	−8,619	−5,414
2085	688,645	29,492	37,560	10,459	12,660	−8,068	−5,868
2090	682,778	28,449	36,126	10,925	12,100	−7,677	−6,503
2095	676,275	27,647	35,288	11,368	11,510	−7,641	−7,500

Population Projection of Latin America and the Caribbean : SSP2

Numbers in '000

Time	*Population*	*Births*	*Deaths*	*Emigration*	*Immigration*	*Natural Change*	*Total Change*
2020	649,127	48,276	24,291	4,051	2,275	23,986	22,209
2025	671,336	46,765	22,643	4,208	2,380	24,121	22,294
2030	693,630	44,961	24,377	4,345	2,487	20,585	18,726
2035	712,356	42,856	26,333	4,459	2,584	16,522	14,648
2040	727,004	40,755	28,399	4,547	2,672	12,357	10,481
2045	737,485	38,727	30,427	4,610	2,751	8,300	6,441
2050	743,926	37,053	32,296	4,648	2,823	4,757	2,931
2055	746,857	35,467	33,993	4,666	2,882	1,474	−309
2060	746,548	33,935	35,565	4,556	3,038	−1,629	−3,148
2065	743,400	32,615	37,058	4,438	3,175	−4,443	−5,706
2070	737,695	31,331	38,351	4,313	3,295	−7,021	−8,038
2075	729,656	30,034	39,415	4,183	3,398	−9,381	−10,166
2080	719,491	28,876	39,979	4,050	3,484	−11,103	−11,669
2085	707,822	27,844	40,202	3,917	3,555	−12,357	−12,720
2090	695,102	26,882	40,017	3,785	3,611	−13,134	−13,308
2095	681,794	25,920	39,513	3,655	3,656	−13,592	−13,592

Population Projection of Northern America : SSP2							
Numbers in '000							
Time	*Population*	*Births*	*Deaths*	*Emigration*	*Immigration*	*Natural Change*	*Total Change*
2020	373,146	20,140	16,691	2,899	6,816	3,449	7,366
2025	380,655	20,670	16,280	2,962	7,109	4,390	8,537
2030	389,152	21,275	17,343	3,022	7,406	3,932	8,316
2035	397,442	21,738	18,549	3,079	7,689	3,190	7,799
2040	405,228	22,086	19,737	3,132	7,960	2,350	7,177
2045	412,400	22,443	20,667	3,182	8,203	1,776	6,797
2050	419,196	21,816	21,177	3,233	8,418	638	5,823
2055	425,019	21,545	21,245	3,280	8,587	300	5,607
2060	430,626	21,695	21,012	3,664	8,395	683	5,414
2065	436,040	21,954	20,879	4,054	8,165	1,075	5,187
2070	441,227	22,075	20,991	4,441	7,903	1,085	4,546
2075	445,773	21,943	21,400	4,820	7,611	543	3,334
2080	449,107	21,551	21,798	5,185	7,296	−247	1,864
2085	450,971	21,059	21,973	5,534	6,961	−914	513
2090	451,485	20,657	21,862	5,865	6,611	−1,205	−459
2095	451,026	20,362	21,666	6,178	6,249	−1,304	−1,233

Population Projection of Oceania : SSP2							
Numbers in '000							
Time	*Population*	*Births*	*Deaths*	*Emigration*	*Immigration*	*Natural Change*	*Total Change*
2020	43,438	3,350	1,432	618	1,088	1,918	2,388
2025	45,826	3,357	1,556	641	1,132	1,802	2,293
2030	48,119	3,330	1,697	662	1,178	1,633	2,148
2035	50,267	3,341	1,860	681	1,221	1,481	2,021
2040	52,288	3,369	2,025	699	1,263	1,344	1,909
2045	54,197	3,397	2,175	716	1,301	1,222	1,808
2050	56,004	3,303	2,308	732	1,335	995	1,598
2055	57,602	3,207	2,423	747	1,361	784	1,398
2060	59,001	3,121	2,523	800	1,345	598	1,143
2065	60,144	3,079	2,622	850	1,323	457	929
2070	61,073	3,053	2,725	900	1,296	327	724
2075	61,797	3,021	2,838	946	1,265	183	502
2080	62,300	2,956	2,958	990	1,231	−2	239
2085	62,538	2,872	3,058	1,030	1,193	−186	−23
2090	62,515	2,778	3,113	1,067	1,152	−334	−249
2095	62,266	2,695	3,130	1,101	1,110	−434	−426

Validation Process

We generate seven SSP scenarios and validate the results by checking the projection assumptions (input) and results (output) in a graphical manner, looking at age-, education-, sex-specific figures. We list below an example of some indicators that we explore in different graphs that were checked (figures Av1-3). Some discontinuities were found and corrected. Most happen in education categories that become smaller as education increases. Also, migration patterns had to be corrected in a few cases when they were affecting the population structure, especially in terms of age in small population.

- TFR (lines, compared to WIC2013, WIC2018, WPP2022)
- ASFR (lines)
- Education differentials in TFR and ASFR (lines)
- LE0 by sex (lines)
- Survival rates by sex (lines)
- Education differentials in mortality [barplot: base-period value]
- Migration flow rates (barplot: total and by sex)
- Migration flow rates by age, sex, and education (lines)
- Net migration flow by country (total, both sexes, men and women, by education)
- Education attainment progression ratio (lines)
- Population [line: by scenarios wic1/2 and wpp2022]
- Population by age (pyramids, 2020, 2050, 2100)
- MYS15+ by sex

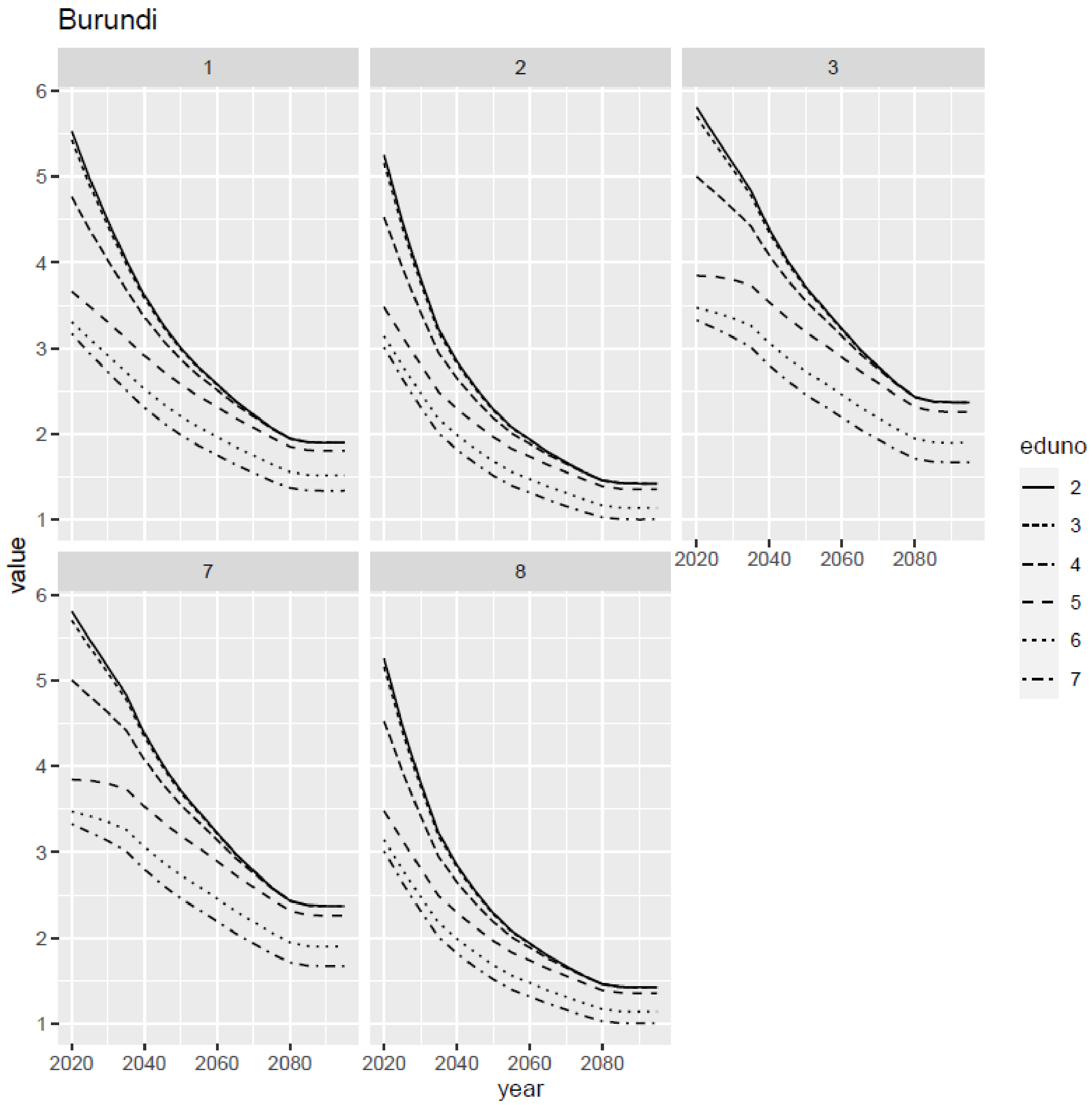

Figure Av1: Education-specific TFR (education 2 to 7 here means E1 top E6), Burundi, 2020-2100, SSP2

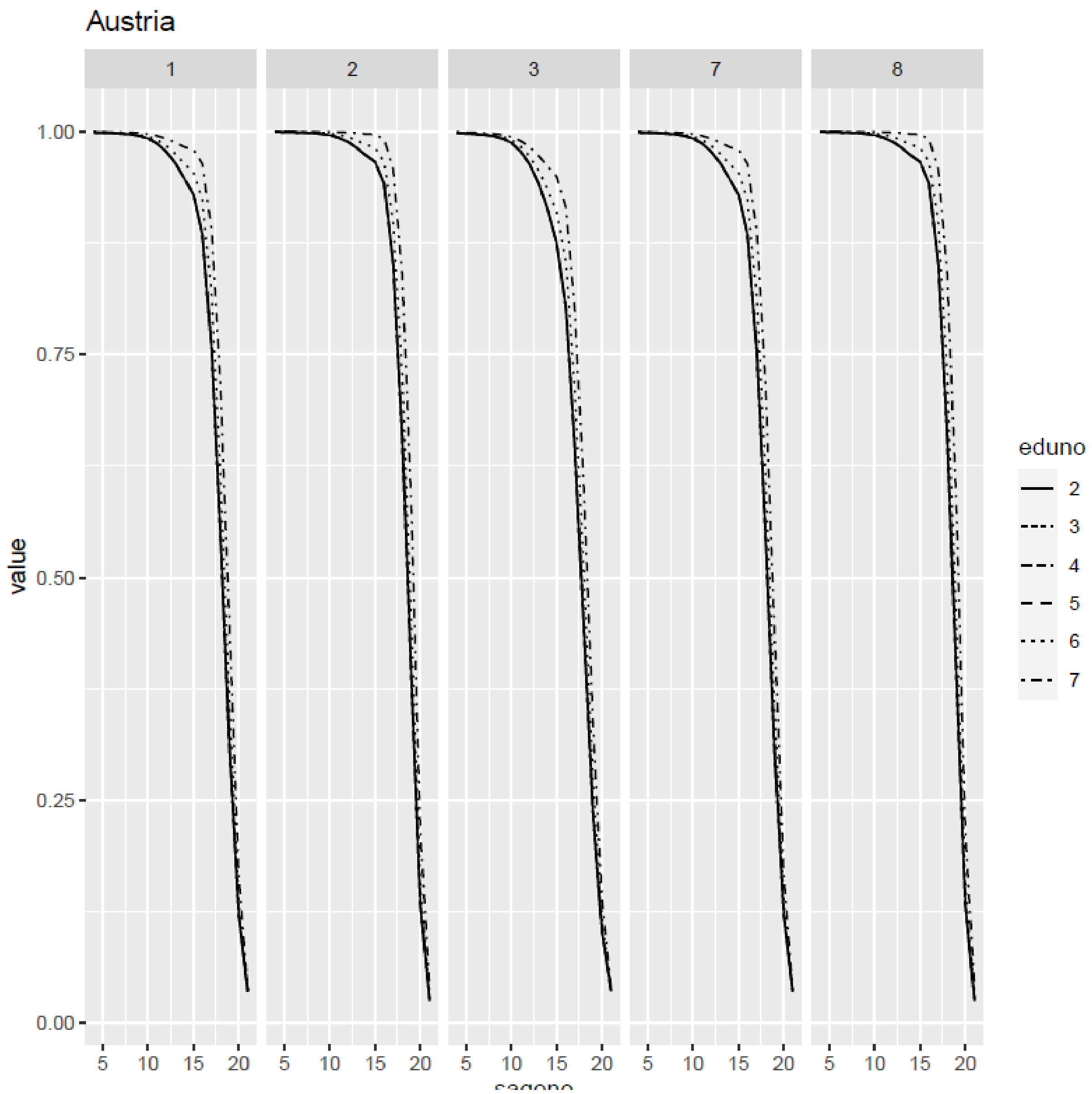

Figure Av2: Education- and age-specific survival ratios for men, Austria (education 2 to 7 here means E1 top E6)

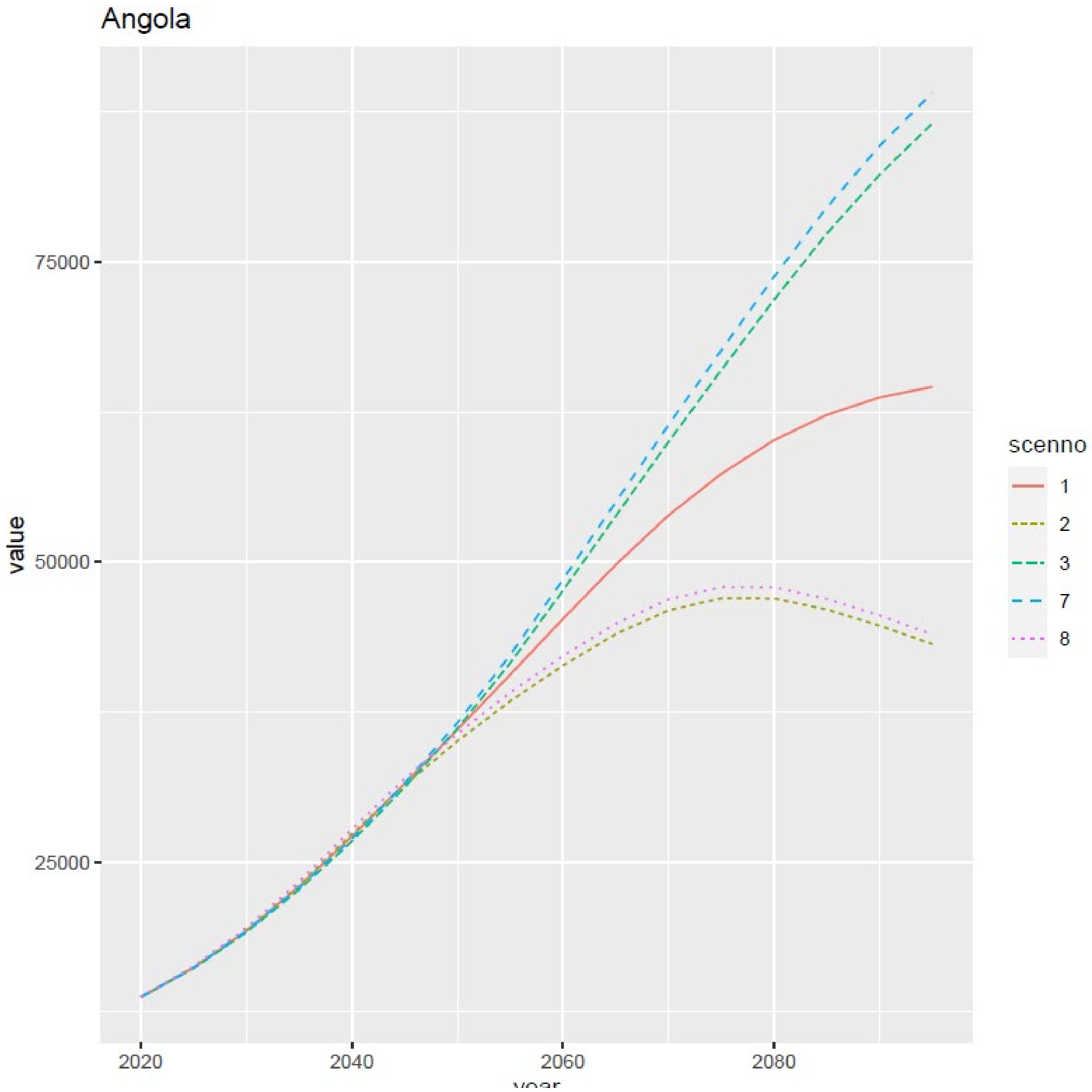

Figure Av3: Total population in different scenario (scenno refers to the five SSPs), Angola, 2020-2100