ÖAW AUSTRIAN ACADEMY OF SCIENCES

VIENNA INSTITUTE OF DEMOGRAPHY

WORKING PAPERS

02/2024

MORTALITY DIFFERENTIALS BY EDUCATIONAL ATTAINMENT GLOBALLY

MORADHVAJ DHAKAD AND SAMIR KC

Vienna Institute of Demography
Austrian Academy of Sciences
Dominikanerbastei 16 | 1010 Vienna, Austria
vid@oeaw.ac.at | www.oeaw.ac.at/vid

VIENNA INSTITUTE OF DEMOGRAPHY

https://doi.org/10.1553/0x003f4a9d

ABSTRACT

The mortality status across the population is determined by its level of socioeconomic development. Education significantly impacts a population's health and lifespan, with more educated individuals tending to live longer than their less-educated counterparts. However, the impact of education on mortality may differ across countries, and the evidence on mortality by educational attainment is primarily limited to low-mortality countries. Understanding mortality differentials by educational attainment is critical for social and health policy formation, and for comprehending the current and future prospects of the population. The Wittgenstein Centre (WIC) population projections in 2013 (WIC2013) and 2018 (WIC2018) assumed standardised mortality differentials by educational attainment based on evidence from a limited number of countries. The updated WIC global population projections in 2023 (WIC2023) now account for age-sex-specific heterogeneity in mortality and migration by educational attainment. This paper describes the data and methods used to estimate mortality by educational attainment in the base year globally. Finally, we analyse mortality patterns by educational attainment for males and females across countries using multiple data sources.

AUTHORS

Moradhvaj Dhakad, Wittgenstein Centre for Demography and Global Human Capital (IIASA, OeAW, University of Vienna), IIASA and Vienna Institute of Demography/Austrian Academy of Sciences. Email: moradhvaj@iiasa.ac.at.

Samir KC, Wittgenstein Centre for Demography and Global Human Capital (IIASA, OeAW, University of Vienna), IIASA, E-Mail: kc@iiasa.ac.at.

ACKNOWLEDGEMENTS

The authors would like to thank Anne Goujon, Director of the Population and Just Societies Program, and Wolfgang Lutz, Interim Deputy Director General for Science, for their comments and suggestions for improving this study.

1 INTRODUCTION

Achieving a longer life is one of the most cherished goals of the human race and an essential component of development. Therefore, it is a primary concern for social and health policies. In recent decades, mortality rates have declined across countries due to the development of modern healthcare facilities and improved socioeconomic conditions (Brenner, 2005; Mackenbach, 1996). The global period life expectancy at birth (LE0) has increased from 48 and 49 years in 1950-1955 to 70 and 75 years in 2015-2020 for males and females, respectively. In 1950-1955, no country had a LE0 higher than 75 years. In 2015-2020, about 10% and 33% of countries achieved a LE0 higher than 85 years for males and females, respectively. Nevertheless, the improvement in mortality has not been uniform across all countries. In 2015-2020, Japan had the highest LE0, at about 84.3 years (81.2 for males, 87.3 for females), which is significantly higher than the LE0 in many countries, for example, in Nigeria (51.4 for males, 54.3 for females) (United Nations, 2022a). The global development agenda emphasises the urgent need to address health and longevity disparities across countries (Marmot & Bell, 2018).

Understanding the mortality situation by socioeconomic groups can facilitate the formulation of more effective healthcare and social policies to improve overall life expectancy. Many social factors outside healthcare influence health and mortality outcomes on a universal scale (Zimmerman et al., 2015, p. 201). Among them, education is considered an important social determinant of health and mortality (Hayward et al., 2014; Preston & Taubman, 1994). Overall, educational attainment is the primary indicator of development and is widely recognised as a fundamental determinant of health and wellbeing, with profound effects on individuals and societies (Hummer & Chinn, 2011, 2011; Hummer & Lariscy, 2011; Montez & Friedman, 2015). However, due to the lack of data, there is limited evidence on mortality differences by education attainment across countries; thus, this study aims to understand such differences among adults by sex across various countries.

An in-depth meta-analysis revealed that after controlling for socioeconomic status and economic resources, less-educated persons are 67% more likely to die prematurely compared to their more-educated counterparts (Baker et al., 2011). This education gradient in adult morbidity and mortality has been found globally across different levels of socioeconomic development (KC & Lentzner, 2010), at both the individual and the aggregate levels, controlling for other measures of socioeconomic status, such as income and race (Grossman & Kaestner, 1997). In the United States in 1960, an additional year of schooling was causally linked to an increase in life expectancy at age 35 of 1.7 years (Lleras-Muney, 2005). Contrary to expectations, the reduction in mortality risk associated with education has not levelled off among American adults (Montez et al., 2012). Even after accounting for childhood socioeconomic disadvantages and poor health, educational attainment remains at the forefront in explaining health and mortality differentials among elderly US-Americans in the latter part of the 20th century (Montez & Hayward, 2014).

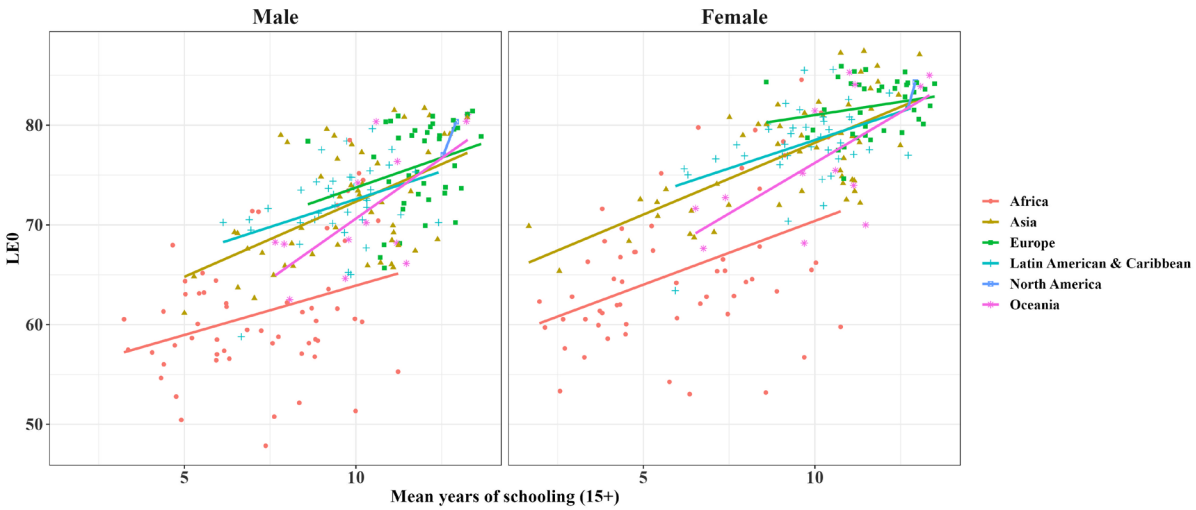
There is evidence to suggest a causal relationship between education and health (Buckles et al., 2016) since there are several pathways through which educational attainment can affect health and mortality. Education enhances human capital by improving knowledge, cognitive function, access to information, problem-solving skills, sense of control, valuable social ties, and resources, which positively influence health and healthcare behaviours throughout life (Mirowsky, 2017). Higher educational attainment increases an individual's chances of obtaining a better job and a higher income. A consistent finding is that better occupational conditions reduce the risk of death, while higher income is associated with better access to healthcare resources, leading to better health outcomes. Higher education is associated with optimal health behaviours, such as quitting smoking, avoiding excessive alcohol intake, and exercising regularly, which result in better health outcomes (Lantz et al., 1998; Ross & Wu, 1995). Education and psychometric intelligence have a positive correlation, which substantially impacts an individual's health. A lower psychometric intelligence is associated with an earlier death (Deary & Der, 2005). It has been demonstrated that education leads to improved cognitive abilities, interpersonal relationships, and greater personal control, all of which contribute to improved health and reduced mortality (House et al., 1988).

Education promotes social relationships in the community and positively impacts individual health. Lack of interpersonal support leads to poor mental and physical health status (Jokela, 2022). The effect of education on health and mortality varies across countries and changes over time (Galama et al., 2018). The differential effect of education on mortality across the countries may be due to contextual factors leading to differences in the pathways through which education affects mortality.

These factors include differences in healthcare conditions, employment status, protection, the quality of education, the time spent in schools, other socioeconomic circumstances, and gender and social discrimination. All contributing to the varied impact of education on mortality. Moreover, the quality of education may have a differential effect on health across countries (Bundy et al., 2017).

Figure 1 demonstrates the positive correlation between LE0 and mean years of schooling among individuals aged 15 years and over (MYS15) in 2015-2020 across countries. Countries with higher MYS15 also exhibit higher LE0 for both males and females. The degree of correlation between MYS15 and LE0 varies across countries, with Oceanian and Asian countries showing a stronger correlation than Europe, Latin America, and the Caribbean regions.

FIGURE 1 LIFE EXPECTANCY AT BIRTH (LE_0) AND MEAN YEARS OF SCHOOLING ACROSS COUNTRIES



Data sources: LE_0 from the United Nations (2022b) and MYS15 from the Wittgenstein Centre for Demography and Global Human Capital (2018).

State of the art

Most studies analyse the association between health and education in higher-income countries, with limited evidence available for lower-income countries due to data scarcity (Galama et al., 2018). Understanding the heterogeneity of mortality by education is crucial for population estimates, projections/forecasts, epidemiology, and healthcare planning. Educational attainment is recognised as one of the most important dimensions for the analysis and projection of the population (Lutz & KC, 2011). Since higher-educated individuals are more likely to live longer compared to less-educated adults, the educational attainment of a population impacts its size and age structure. The previous attempt by Masquelier & Garbero (2016) to estimate adult mortality by education using sibling survival histories relied on the assumption that educational outcomes are correlated within sibships. In their approach, the educational attainment of the respondent serves as a proxy for the educational level of their siblings. However, sibling-based methods for measuring adult mortality have limitations. They often underestimate mortality because mortality tends to cluster within sibling groups. Additionally, the correlation between siblings' educational outcomes diminishes with age (Timæus, 2013).

Gap

How education and the education-mortality gradient evolve in the future will be important for projections. It is, therefore, crucial to analyse mortality statistics by educational attainment to establish a comprehensive global understanding of education differentials in mortality. Very few studies have compared educational differences in life expectancy across countries.

What this paper offers

This paper elucidates the methodology used to estimate mortality rates based on educational attainment levels. These estimates were utilised in the mortality projection for the WIC 2023 global population projections (KC et al., 2024).

2 DATA SOURCES

The data for this study were compiled from various sources and broadly divided into two categories: Demographic Health Surveys (DHS) and other data sources. Other data sources include the European Statistical Office (EUROSTAT), the Organization for Economic Co-operation and Development (OECD), longitudinal surveys conducted in specific countries, and scientific publications.

EUROSTAT provides life expectancy statistics by educational attainment at a single age. We obtained the life expectancy at 15 years of age (LE15) for 19 countries from EUROSTAT. The list of these countries is provided in Table 1. The LE15 was extracted annually from National Statistical Institutes from 2007 to 2017 for males and females and harmonised by three educational attainment groups: up to lower secondary, upper secondary, and post-secondary education. The annual estimates of LE15 by the educational group show fluctuations for some countries. We have therefore used the average LE15 for 2007-2017 to obtain a smooth value. Further, we used OECD data on life expectancy by educational attainment published in Education at a Glance (OECD 2021) and in OECD Working Paper statistics (Murtin et al., 2017). For the United States of America, LE25 by educational attainment is compiled by the National Center for Health Statistics, estimated from the National Health Interview Survey (NHIS) Linked Mortality File. The estimates are based on the individuals' reported education in NHIS years 2000-2004 and their mortality follow-up through 2006 (National Center for Health Statistics, 2015).

TABLE 1 SOURCES FOR LIFE EXPECTANCY AT A GIVEN AGE BY COUNTRY

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, IHDS-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
Italy	2007-2017	15	Eurostat	Turkey	2010-2017	15	Eurostat
United Kingdom	2011	25	OECD	United States of America	2011-12	25	OECD

Further, longitudinal household data were used to estimate LE25 and LE30 for India and Indonesia, respectively. For India, this study draws upon data from the 2004–2005 and 2011–2012 India Human Development Surveys (IHDS) (Desai et al., 2008). The IHDS was the first nationally representative panel survey conducted in India with a sufficiently large sample size to cover rare events like death in early adult ages. Its longitudinal design allows the direct connection of individual deaths to living conditions at the time of the previous survey. The mortality rates were estimated based on the individuals surveyed in IHDS 2004-2005 and by tracking their survival status in IHDS 2011-12.

Similarly, for Indonesia, we used the Indonesian Family Life Survey (IFLS) to estimate life expectancy at age 25 by educational attainment (Strauss et al., 2016). IFLS is an ongoing longitudinal survey in Indonesia. The life expectancy was estimated based on the individuals surveyed in IFLS4 years 2007-2008, and these individuals followed in the IFLS5 years 2014-2015. The life expectancy was calculated using a person-year approach from the survey data (United Nations, 2011).

For some countries, life expectancy is gathered from scientific publications and reports. For Japan, life expectancy by educational attainment at age 65 was collected from a study by Chiu et al. (2016) based on the Nihon University Japanese Longitudinal Study of Aging (NUJLSOA). For the Netherlands, life expectancy between 2001 and 2011 is collected from a study based on the Dutch Labour Force Survey (LFS) linked to the mortality registry. For South Korea, the life expectancy by educational attainment was calculated from the Korean national death registry files and the Korean census data in 2010 (Son et al., 2012). For Russia, life expectancy by educational attainment is taken from estimates of deaths from registration certificates and census records (Shkolnikov, 2006).

For high-mortality countries with limited data on mortality, we used the most recent DHS for 65 countries (see Table 2). DHS is a routine household survey that provides nationally representative data on various indicators, including infant and child mortality, fertility, family planning use, maternal health, child immunisation, malnutrition levels, HIV prevalence, and malaria within populations. Birth history data were used to obtain under-five mortality by sex for the ten years preceding the survey. The women's questionnaire in DHS provides information about the mother's socioeconomic and demographic information, including educational attainment. Using the DHS data, we calculated under-five mortality rates by mothers' education attainment during the ten years preceding the survey (see Table 2). As the definition of education level may vary across countries, leading to potential bias when comparing outcomes, we standardised the results by using the International Standard Classification of Education (ISCED 2011), ensuring comparable results across countries.

TABLE 2 LIST OF DHS COUNTRIES BY SURVEY YEAR USED TO ESTIMATE UNDER-FIVE MORTALITY RATES BY MOTHER'S EDUCATION

Country	Survey year	Country	Survey year
Afghanistan	2015	Kenya	2014
Angola	2015-2016	Lesotho	2014
Azerbaijan	2006	Liberia	2019-2020
Bangladesh	2017-2016	Madagascar	2008-2009
Benin	2017-2018	Malawi	2015-2016
Bolivia	2008	Maldives	2016-2017
Brazil	1996	Mali	2018
Burkina Faso	2010	Morocco	2003-2004
Burundi	2016-2017	Mozambique	2011
Central African Republic	1994-1995	Myanmar	2015-2016
Cambodia	2014	Namibia	2013
Cameroon	2018-2019	Nepal	2016
Chad	2014-2015	Nicaragua	2001
Colombia	2015-2016	Niger	2012
Comoros	2012	Nigeria	2018
Congo	2011-2012	Pakistan	2017-2018
Cote d'Ivoire	2011-2012	Peru	2012
Dominican Republic	2013	Philippines	2017
DR Congo	2013-2014	Rwanda	2014-2015
Egypt	2014	Sao Tome and Principe	2008
Eswatini	2006-2007	Senegal	2017
Ethiopia	2011	Sierra Leone	2019
Gabon	2012	South Africa	2016
Gambia	2020	Tajikistan	2017
Ghana	2014	Tanzania	2015-2016
Guatemala	2014-2015	Timor-Leste	2016
Guinea	2018	Togo	2013-2014
Guyana	2009	Turkey	2013
Haiti	2016-2017	Uganda	2016
Honduras	2011-2012	Yemen	1991
India	2015-2016	Zambia	2017-2018
Indonesia	2017	Zimbabwe	2015
Jordan	2017-2018		

3 METHODS

To estimate life expectancy at adult ages (at age 25, and 30), we first estimated the age-specific mortality rates (ASMR) based on the number of deaths among usual residents of households between two surveys, following the methodology described in the United Nations (UN) technical paper on mortality estimates from major sample surveys (United Nations, 2011).

Age-specific mortality rates are calculated using the following formula:

$${}_5m_x = \frac{nDx^i}{nPx^i} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where

nDx^i= Number of deaths from age x to x+n between two surveys, i represents the educational attainment of the population group

nPx^i= Person years lived in x to x+n between two surveys, i donates the educational attainment of the population group.

Using age-specific mortality rates, life tables were computed using the Chiang method to derive the life expectancy in adult ages (Chiang 1972).

3.1 SURVIVAL ANALYSIS

The survival analysis was used to estimate the under-five mortality from DHS birth history data, which is time-to-event data. The survival duration of children before reaching their fifth birthday is reported in months, with the death of children before their fifth birthday considered an event of interest. The survival status of the children under five who were still alive at the time of the interview might not be known and are censored cases in the data. The Cox-proportional hazard model, which is widely used in survival analysis (Cox & Oakes, 2018; Dhakad & KC, 2023) has the advantage that it can account for the censored problem in time-to-event data. The Cox-proportional hazard model was employed to estimate the probability of death by mothers' educational attainment by the sex of the child.

From DHS data, we obtained mortality rates for the under-five age group, and mortality rates for the remaining age group are estimated based on the assumption of the relationship between under-five mortality and adult age mortality in a given country. Life expectancy at age 15 (LE15) was estimated using the Under-Five Mortality Rate (U5MR). To estimate the LE15 corresponding to the U5MR, we used the UN sex-specific annual (January 1 to December 31) single-age lifetable estimates for 2000-2019 and 2025-2099 (medium variant) for each country (United Nations, 2022b). We develop an interpolation method using the UN sex-specific annual single-age lifetable estimates. 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 excluded medium variant life tables from 2020-2024 to avoid the impact of COVID-19. First, we identified the life tables that have 5m0 close to DHS estimates.

3.2 COMPUTE LIFE TABLE

The main steps to derive life tables are outlined below:

1. For a given U5MR (5m0 by 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 U5MR (known data points) in WPP2022.
2. We then compute the log transformation of the 5m0 of the corresponding lifetables between time t and t+1.

3. Next, we interpolate the log-transformed 5m0 (log(5m0)) between the two sets (t and t+1) to obtain a lifetable corresponding to the given 5m0. For life table calculations using 5m0, 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 (1m0) using the sex and country-specific UN series (estimates and the medium variant) of 1m0 and a0 between two points (t and t+1).

4 RESULTS

Figure 2 depicts the remaining life expectancy at given ages for 40 countries. The remaining life expectancy is shown at age 15 for 19 countries, at age 25 for 15 countries, at age 30 for four countries, at age 40 for one country, and at age 65 for one country. The age for the given life expectancy is mentioned in parentheses with the country's name on the y-axis. The life expectancy at age 15 is given for three educational groups: lower-secondary, upper-secondary and post-secondary. The figure indicates a significant difference in the remaining life expectancies at age 15 by educational attainment. Adults with higher levels of education have a longer life expectancy than their counterparts with lower levels. Noteworthy is that the educational differences in life expectancy vary across the countries. The life expectancy gap between the lowest and highest educational groups is observed to be higher in central and eastern European countries. Males with a post-secondary education were expected to live 15 years longer after age 15 in Estonia and Slovakia, followed by 11 years in Poland and Hungary, compared to males with lower secondary education. Whereas Turkey, Portugal, Canada, and Malta exhibit the lesser gap in male remaining life expectancy between the lowest and highest educational groups. Adults aged 15+ with post-secondary education live on average four years longer compared to those with lower secondary education.

The remaining life expectancy at age 15 for women with post-secondary education was 8 years higher in Estonia, 7 and 6 years higher in Slovakia and Bulgaria, respectively, compared to those with lower secondary education. In some countries (Greece, Serbia and Portugal), the difference is minimal.

Further, this figure shows the remaining years of life expectancy at age 25 for 15 countries. The life expectancy at age 25 by education is not uniformly available for all countries. Out of 15 countries, in 13 countries, life expectancy is given by the three educational groups: lower-secondary, upper-secondary, and post-secondary. For India and the Netherlands, the life expectancy is given for different educational groups: some primary, primary, and post-secondary education in India, and primary, lower secondary, and post-secondary education in the Netherlands. The difference in remaining life expectancy for men is substantial between post-secondary and lower secondary in Czechia (13.7 years), Latvia (11.5 years), Chile (10.9 years), and Belgium (10.5). It is less in Canada (4.0), the United Kingdom (4.5 years), Mexico (4.8) and New Zealand (4.9 years). For women, the differences are lower, but more reported in Latvia (8.3 years), Belgium (7.8 years), Chile (7.6 years), and Czechia (6.2 years), and less in the Netherlands (2.2 years), Mexico (2.7 years), France (2.6 years).

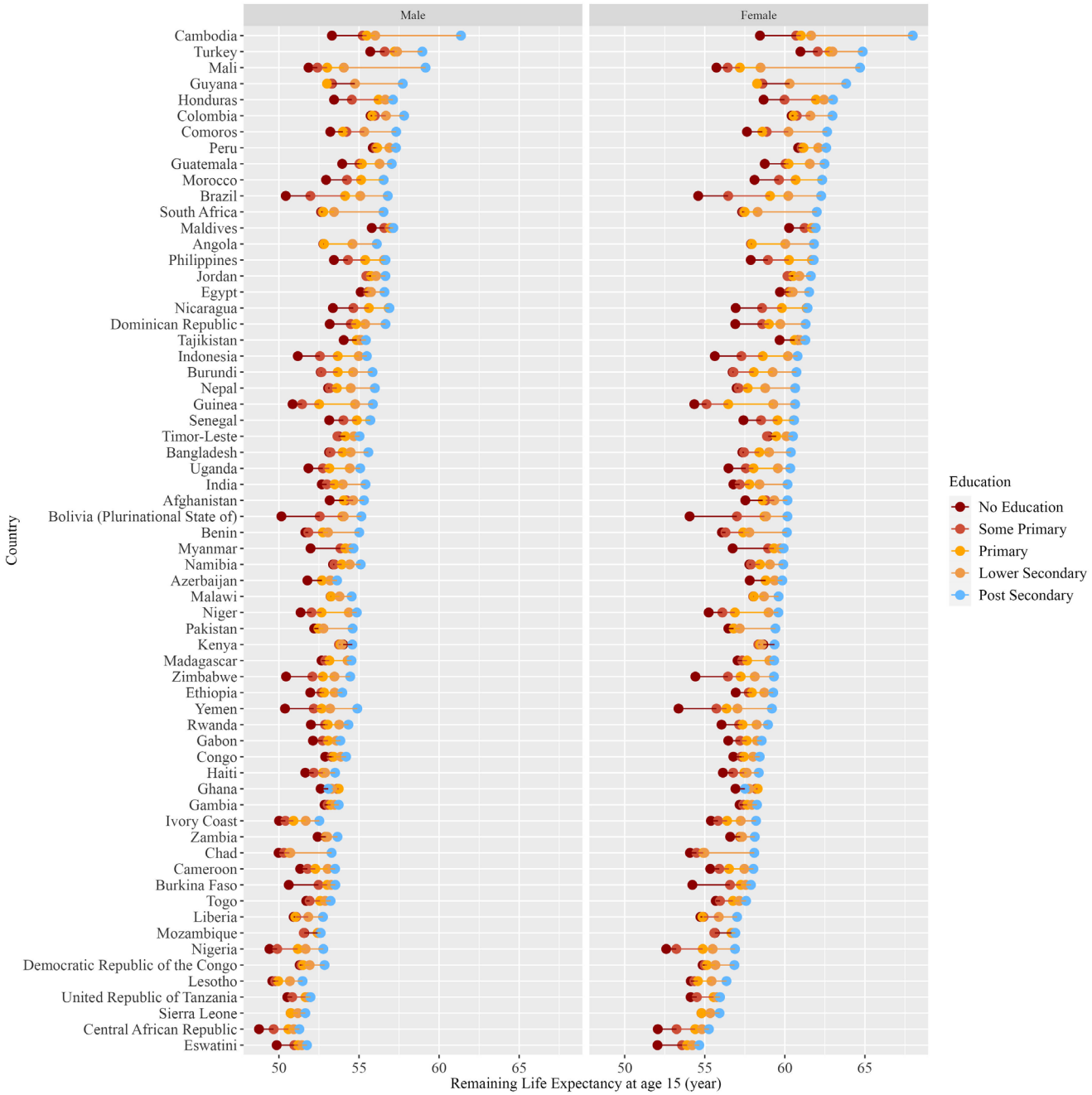
FIGURE 2 ESTIMATED REMAINING LIFE EXPECTANCY BY EDUCATIONAL ATTAINMENT AT A GIVEN AGE BY COUNTRY FOR MALE-FEMALE, ESTIMATED FROM NON-DHS DATA.

The gender differences in the education gap across countries shown in Figure 2 suggest that education impacts mortality differently for men and women. Overall, men have greater differences in life expectancy based on their educational background. The impact of education on male and female life expectancy varies across countries. For example, the gap between males and females (between low and high levels of education) is 8 years larger in Slovakia and Poland, while it is less than two years in Turkey, Sweden, Norway, and Denmark. In general, the gap is less important in American and Asian countries than in European countries.

Figure 3 shows the estimated life expectancy at age 15 for males and females by educational attainment estimated for DHS countries. The figure illustrates the considerable differences in LE15 across countries. Overall, the remaining life expectancy increases with higher levels of education, and the education difference is in LE15 as well. The difference in remaining life expectancy between male individuals with a post-secondary education and those with no education is substantial in Cambodia

(8.05 years), Mali (7.3 years), Brazil (6.4 years) and Guinea (5 years). In Ghana, Kenya, Gambia, Sierra Leone, and Jordan, the difference is less than one year. Unlike the findings for non-DHS countries, we found higher educational differences in life expectancy at age 15 for females than males. However, the difference was smaller. Out of 65 countries, only six countries had educational differences higher by more than a year for females compared to males. This indicates that the impact of educational attainment on life expectancy at age 15 does not differ largely between men and women in DHS, which is mostly in low- and middle-income countries.

FIGURE 3 ESTIMATED REMAINING LIFE EXPECTANCY BY EDUCATIONAL ATTAINMENT AT AGE 15 BY SEX FOR DHS COUNTRIES



5 DISCUSSION AND CONCLUSION

This study provides estimates of life expectancy in the adult age group by educational attainment and compares them across different countries. Our findings indicate that educational attainment is significantly associated with variations in adults' life expectancy, with higher levels of education correlating with longer life spans. However, the magnitude of educational differences in life expectancy varies across countries, indicating that education has a differential impact on mortality. Notably, the life expectancy gap between the lowest and highest educational groups is more pronounced in central and eastern European countries, while it is smaller in low- and middle-income countries, as estimated from DHS data. Furthermore, these educational differences in life expectancy also vary by gender, with non-DHS countries reporting larger educational disparities in life expectancy for males than for females.

Education is an important social resource and a form of human capital that facilitates the acquisition of other resources (Mirowsky, 2017; Mirowsky & Ross, 2005). The mechanisms through which education influences health are multifaceted and interconnected. Educational attainment impacts mortality through a variety of pathways, including economic stability, social support, psychological well-being, interpersonal relationships, and health-related behaviours. Numerous intermediate factors can modulate the strength of the relationship between educational attainment and mortality, underscoring the complexity of this association.

Education affects mortality through its impact on employment prospects, providing better opportunities for employment. Generally, less educated adults are more likely to face unemployment, which is a significant predictor of mortality risks. Several studies have documented this relationship. For instance, Leclerc et al. (2006) examined mortality differentials in the French population between 1968-1974 and 1990-1996 by occupational attainment, finding that the relative risk of death for the unemployed was higher and had increased significantly by 1990-1996. Similarly, in New Zealand, Blakely et al. (2003) found that unemployed adults experienced higher suicide rates even after accounting for other socioeconomic factors.

Social welfare and healthcare policies can shape the degree of association between educational attainment and mortality. For example, in Austria, despite rising unemployment rates during the 1980s and 1990s, educational gaps in mortality were not significantly affected due to the high quality and better coverage of insurance and social welfare policies (Fuchs et al., 2003; Klotz & Doblhammer, 2008). In contrast, in New Zealand, rising social inequality in mortality during the 1980s led to changes in social policy, including the implementation of healthcare charges (Fawcett et al., 2005). Similarly, Józan and Forster (1991) argued that changing healthcare systems since 1990 may have contributed to widening health disparities in Eastern Europe.

In this study, we found substantial educational differentials in mortality in Estonia, where a rapid educational and economic transition took place between 1990 and 2000. During this period, the population with low levels of education was relatively small and likely quite selective, possibly facing a higher risk of unemployment (Vodopivec, 2002). Additionally, poverty, social disruption, and wealth inequality in 2000 further contributed to widening the educational gap in mortality (Leinsalu et al., 2003).

Moreover, the differential effect of educational attainment on adult mortality might have resulted in variations in the quality of education across the countries (Sansani, 2011). The quality of education (years of schooling or test scores) differs across the countries (Pradhan et al., 2018). Education quality is associated with improved economic progress and cognitive ability (Jamison et al., 2007; Knight & Sabot, 1990). The increased quality of education is associated with a greater decline in adult and under-five mortality (Jamison et al., 2007; Pradhan et al., 2018).

This study found that life expectancy and educational attainment are positively correlated for both men and women, although the strength of this association varies by sex. Men exhibit larger education-related differences in mortality than women in European countries and the USA, indicating a more substantial impact of education on male mortality. Women often report worse health than men but tend to live longer (Crimmins et al., 2019). Several explanations for these differences have been proposed and tested, including variations in biological risks, reporting biases, acquired risks, socioeconomic status, and access to healthcare. Men experience higher mortality rates due to epidemiological factors and risky behaviours such as illegal drug consumption, heavy drinking, smoking, fast driving, promiscuous sexual activity, and conflict (Rogers et al., 2010). External

constraints on women regarding risky behaviour are more significant, leading to less involvement in such behaviours (Bird & Rieker, 2008; Epstein, 2007; Sen, 1997). For instance, women have historically smoked less than men due to externally imposed norms (Bird & Rieker, 2008; Pampel, 2002).

Education is likely more important for reducing risky behaviours, and individuals with higher education are less likely to engage in such behaviours (Kino et al., 2018; Mirowsky & Ross, 2005). Higher education levels correlate with reduced transmission risk of HIV/AIDS among adults by enhancing treatment and prevention measures (Baird et al., 2012; Behrman, 2015). A prospective cohort study of Dutch adults aged 15-74 years found that, when adjusting for physical inactivity and smoking, excess mortality among the lowest education group fell by 30% compared to the highest education group (van Oort et al., 2004). In Austria, the lowest educated individuals had higher daily smoking rates, prevalence of obesity, and leisure time inactivity in 2006-2007 (Klotz & Doblhammer, 2008). The recent stagnation in life expectancy in the US has been attributed to rising midlife mortality from suicide, drug overdose, and liver cirrhosis (Case & Deaton, 2015; Sasson, 2016; Woolf et al., 2018). Men tend to engage in more destructive behaviours benefit more from education's mitigating effects on mortality. Consequently, higher education's impact on men's mortality is more significant than on women's due to its substantial effect on reducing behaviour-related risk factors. Though, the educational differences in mortality by gender are not found differ largely for the DHS countries.

Limitations

The life expectancy at adult ages for DHS countries is estimated using under-five mortality estimates. The limitations of these estimates are that they are based on the assumption that the level of under-five mortality is associated with adult-age mortality (Wilmoth et al., 2012). The low-middle countries have limited data on adult mortality due to the poor vital registration system, and these countries have more reliable child mortality data. In these countries, child mortality estimates are used to infer mortality for other age groups (Clark, 2019). There are associations between under-five mortality and adult-age mortality; populations with low childhood mortality also tend to have lower adult mortality (Crimmins & Finch, 2006). The early life conditions and exposure to mortality in early life also contribute to adult mortality. Another limitation of this study is the assumption that parental education impacts their child's educational attainment into adulthood. It is documented that parental education significantly affects their children's educational attainment and academic performance during adulthood (Dubow et al., 2009; Li & Qiu, 2018). Additionally, children born to more educated parents also reported lower mortality in the adult ages (Elsenburg et al., 2022).

REFERENCES

Baird, S. J., Garfein, R. S., McIntosh, C. T., & Özler, B. (2012). Effect of a cash transfer programme for schooling on prevalence of HIV and herpes simplex type 2 in Malawi: A cluster randomised trial. *The Lancet*, *379*(9823), 1320–1329.

Baker, D. P., Leon, J., Smith Greenaway, E. G., Collins, J., & Movit, M. (2011). The education effect on population health: A reassessment. *Population and Development Review*, *37*(2), 307–332.

Behrman, J. A. (2015). The effect of increased primary schooling on adult women's HIV status in Malawi and Uganda: Universal Primary Education as a natural experiment. *Social Science & Medicine*, *127*, 108–115.

Bird, C. E., & Rieker, P. P. (2008). *Gender and health*. Citeseer.

Blakely, T. A., Collings, S. C., & Atkinson, J. (2003). Unemployment and suicide. Evidence for a causal association? *Journal of Epidemiology & Community Health*, *57*(8), 594–600.

Boys, R. J., Forster, D. P., & Józan, P. (1991). Mortality from causes amenable and non-amenable to medical care: The experience of Eastern Europe. *British Medical Journal*, *303*(6807), 879–883.

Brenner, M. H. (2005). Commentary: Economic growth is the basis of mortality rate decline in the 20th century—Experience of the United States 1901–2000. *International Journal of Epidemiology*, *34*(6), 1214–1221.

Buckles, K., Hagemann, A., Malamud, O., Morrill, M., & Wozniak, A. (2016). The effect of college education on mortality. *Journal of Health Economics*, *50*, 99–114. https://doi.org/10.1016/j.jhealeco.2016.08.002

Bundy, D. A. P., de Silva, N., Horton, S., Jamison, D. T., & Patton, G. C. (Eds.). (2017). *Disease Control Priorities, Third Edition (Volume 8): Child and Adolescent Health and Development*. The World Bank. https://doi.org/10.1596/978-1-4648-0423-6

Case, A., & Deaton, A. (2015). Rising morbidity and mortality in midlife among white non-Hispanic Americans in the 21st century. *Proceedings of the National Academy of Sciences*, *112*(49), 15078–15083. https://doi.org/10.1073/pnas.1518393112

Chiu, C.-T., Hayward, M., & Saito, Y. (2016). A comparison of educational differences on physical health, mortality, and healthy life expectancy in Japan and the United States. *Journal of Aging and Health*, *28*(7), 1256–1278.

Clark, S. J. (2019). A general age-specific mortality model with an example indexed by child mortality or both child and adult mortality. *Demography*, *56*(3), 1131–1159.

Cox, D. R., & Oakes, D. (2018). *Analysis of survival data*. Chapman and Hall/CRC.

Crimmins, E. M., & Finch, C. E. (2006). Infection, inflammation, height, and longevity. *Proceedings of the National* Academy *of Sciences*, *103*(2), 498–503.

Crimmins, E. M., Shim, H., Zhang, Y. S., & Kim, J. K. (2019). Differences between men and women in mortality and the health dimensions of the morbidity process. *Clinical Chemistry*, *65(1), 135–145*.

Deary, I. J., & Der, G. (2005). Reaction time explains IQ's association with death. *Psychological Science*, *16*(1), 64–69.

Desai, S., Dubey, A., Joshi, B., Sen, M., Shariff, A., & Vanneman, R. (2008). India human development survey. *College Park, Maryland: University of Maryland*.

Dhakad, M., & KC, S. (2023). Differential impact of maternal education on under-five mortality in rural and urban India. *Health & Place*, *80*, 102987.

Dubow, E. F., Boxer, P., & Huesmann, L. R. (2009). Long-term effects of parents' education on children's educational and occupational success: Mediation by family interactions, child aggression, and teenage aspirations. *Merrill-Palmer Quarterly (Wayne State University. Press)*, *55*(3), 224.

Elsenburg, L. K., Rieckmann, A., Nguyen, T.-L., Bengtsson, J., Andersen, A.-M. N., Taylor-Robinson, D., Lange, T., & Rod, N. H. (2022). Mediation of the parental education gradient in early adult mortality by childhood adversity: A population-based cohort study of more than 1 million children. *The Lancet Public Health*, *7*(2), e146–e155.

Epstein, C. F. (2007). Great divides: The cultural, cognitive, and social bases of the global subordination of women. *American Sociological Review*, *72*(1), 1–22.

Fawcett, J., Blakely, T., & Kunst, A. (2005). Are mortality differences and trends by education any better or worse in New Zealand? A comparison study with Norway, Denmark and Finland, 1980-1990s. *European Journal of Epidemiology*, *20*(8), 683–691. https://doi.org/10.1007/s10654-005-7923-y

Fuchs, M., Schmied, G., & Oberzaucher, N. (2003). Quantitative und qualitative Erfassung und Analyse der nicht-krankenversicherten Personen in Österreich. *Wien: Bundesministerium Für Gesundheit Und Frauen*.

Galama, T. J., Lleras-Muney, A., & Van Kippersluis, H. (2018). The effect of education on health and mortality: A review of experimental and quasi-experimental evidence.

Grossman, M., & Kaestner, R. (1997). Effects of education on health. In J. R. Behrman & N. Stacey (Eds.), *The Social Benefits of Education* (pp. 69–123). University of Michigan Press.

Hayward, M. D., Hummer, R. A., & Sasson, I. (2014). Trends and group differences in the association between educational attainment and U.S. adult mortality: Implications for understanding education's causal influence. *Social Science & Medicine*. https://doi.org/10.1016/j.socscimed.2014.11.024

House, J. S., Landis, K. R., & Umberson, D. (1988). Social relationships and health. *Science*, *241*(4865), 540–545.

Hummer, R. A., & Chinn, J. J. (2011). Race/Ethnicity and Us Adult Mortality: Progress, Prospects, and New Analyses1. *Du Bois Review: Social Science Research on Race*, *8*(1), 5–24.

Hummer, R. A., & Lariscy, J. T. (2011). Educational attainment and adult mortality. In *International Handbook of Adult Mortality: Vol. Vol. 2* (p. pp.241-261). Springer Netherlands.

Jamison, E. A., Jamison, D. T., & Hanushek, E. A. (2007). The effects of education quality on income growth and mortality decline. *Economics of Education Review*, *26*(6), 771–788.

Jokela, M. (2022). Why is cognitive ability associated with psychological distress and wellbeing? Exploring psychological, biological, and social mechanisms. *Personality and Individual Differences*, *192*, 111592.

KC, S., & Lentzner, H. (2010). The effect of education on adult mortality and disability: A global perspective. *Vienna Yearbook of Population Research*, *8*, 201–235. https://doi.org/10.1553/populationyearbook2010s201

K.C., S., Dhakad, M., Potančoková, M. , Adhikari, S., Yildiz, D. , Mamolo, M., Sobotka, T., Zeman, K., et al. (2024). Updating the Shared Socioeconomic Pathways (SSPs) Global Population and Human Capital Projections. IIASA Working Paper. Laxenburg, Austria: WP-24-003

Kino, S., Bernabé, E., & Sabbah, W. (2018). The role of healthcare and education systems in co-occurrence of health risk behaviours in 27 European countries. *The European Journal of Public Health*, *28*(1), 186–192.

Klotz, J., & Doblhammer, G. (2008). Trends in educational mortality differentials in Austria between 1981/82 and 2001/2002: A study based on a linkage of census data and death certificates. *Demographic Research*, *19*, 1759–1780.

Knight, J. B., & Sabot, R. H. (1990). Education, productivity, and inequality: The East African natural experiment. World Bank.

Lantz, P. M., House, J. S., Lepkowski, J. M., Williams, D. R., Mero, R. P., & Chen, J. (1998). Socioeconomic factors, health behaviors, and mortality: Results from a nationally representative prospective study of US adults. *JAMA*, *279*(21), 1703–1708. https://doi.org/10.1001/jama.279.21.1703

Leclerc, A., Chastang, J.-F., Menvielle, G., & Luce, D. (2006). Socioeconomic inequalities in premature mortality in France: Have they widened in recent decades? *Social Science & Medicine*, *62*(8), 2035–2045.

Leinsalu, M., Vågerö, D., & Kunst, A. E. (2003). Estonia 1989–2000: Enormous increase in mortality differences by education. *International Journal of Epidemiology*, *32*(6), 1081–1087. https://doi.org/10.1093/ije/dyg192

Li, Z., & Qiu, Z. (2018). How does family background affect children's educational achievement? Evidence from Contemporary China. *The Journal of Chinese Sociology*, *5*(1), 1–21.

Lleras-Muney, A. (2005). The relationship between education and adult mortality in the United States. *The Review of Economic Studies*, *72*(1), 189–221. https://doi.org/10.1111/0034-6527.00329

Lutz, W., & KC, S. (2011). Global human capital: Integrating education and population. *Science*, *333*(6042), 587–592. https://doi.org/10.1126/science.1206964

Mackenbach, J. (1996). The contribution of medical care to mortality decline: McKeown revisited. *Journal of Clinical Epidemiology*, *49*(11), 1207–1213.

Marmot, M., & Bell, R. (2018). The sustainable development goals and health equity. *Epidemiology*, *29*(1), 5–7.

Masquelier, B., & Garbero, A. (2016). Educational differentials in adult mortality in low-and middle-income countries. *Quetelet Journal*, *4*(1), 7–28.

Mirowsky, J. (2017). Education, social status, and health. Routledge.

Mirowsky, J., & Ross, C. E. (2005). Education, cumulative advantage, and health. *Ageing International*, *30*(1), 27–62. https://doi.org/10.1007/BF02681006

Montez, J. K., & Friedman, E. M. (2015). Educational attainment and adult health: Under what conditions is the association causal? *Social Science & Medicine*, *127*, 1–7. https://doi.org/10.1016/j.socscimed.2014.12.029

Montez, J. K., & Hayward, M. D. (2014). Cumulative Childhood Adversity, Educational Attainment, and Active Life Expectancy Among U.S. Adults. *Demography*, *51*(2), 413–435. https://doi.org/10.1007/s13524-013-0261-x

Montez, J. K., Hummer, R. A., & Hayward, M. D. (2012). Educational Attainment and Adult Mortality in the United States: A Systematic Analysis of Functional Form. *Demography*, *49*(1), 315–336. https://doi.org/10.1007/s13524-011-0082-8

Murtin, F., Mackenbach, J., Jasilionis, D., & d'Ercole, M. M. (2017). Inequalities in longevity by education in OECD countries: Insights from new OECD estimates.

National Center for Health Statistics. (2015). Office of Analysis and Epidemiology. The National Health Interview Survey (1986–2004) linked mortality files, mortality follow-up through 2006: Matching methodology. 2009. *Hyattsville, Maryland:(Available at the Following Address: Http://Www. Cdc. Gov/Nchs/Data/Datalinkage/Matching_methodology_nhis_final. Pdf)[Google Scholar]*.

Pampel, F. C. (2002). Cigarette use and the narrowing sex differential in mortality. *Population and Development Review*, *28*(1), 77–104.

Pradhan, E., Suzuki, E. M., Martínez, S., Schäferhoff, M., & Jamison, D. T. (2018). The effects of education quantity and quality on child and adult mortality: Their magnitude and their value.

Preston, S. H., & Taubman, P. (1994). Socioeconomic differences in adult mortality and health status. *Demography of Aging*, *1*, 279–318.

Rogers, R. G., Everett, B. G., Zajacova, A., & Hummer, R. A. (2010). Educational Degrees and Adult Mortality Risk in the United States. *Biodemography and Social Biology*, *56*(1), 80–99. https://doi.org/10.1080/19485561003727372

Ross, C. E., & Wu, C. (1995). The links between education and health. *American Sociological Review*, 719–745.

Sansani, S. (2011). The effects of school quality on long-term health. *Economics of Education Review*, *30(6)*, 1320–1333.

Sasson, I. (2016). Trends in Life Expectancy and Lifespan Variation by Educational Attainment: United States, 1990–2010. *Demography*, *53*(2), 269–293. https://doi.org/10.1007/s13524-015-0453-7

Sen, A. K. (1997). Human capital and human capability. *World Development*, *25*(12), 1959–1961.

Shkolnikov, V. M. (2006). The changing relationship between education and life expectancy in central and eastern Europe in the 1990s. *Journal of Epidemiology & Community Health*, *60*(10), 875–881. https://doi.org/10.1136/jech.2005.044719

Son, M., Cho, Y., Oh, J., Kawachi, I., Yi, J., & Kwon, S. (2012). Social inequalities in life expectancy and mortality during the transition period of economic crisis (1993–2010) in Korea. *International Journal for Equity in Health*, *11*(1), 1–8.

Strauss, J., Witoelar, F., & Sikoki, B. (2016). *The fifth wave of the Indonesia family life survey: Overview and field report* (Vol. 1). Rand Santa Monica, CA, USA.

Timæus, I. M. (2013). Estimation of adult mortality from sibling histories. *Tools for D*, 310.

United Nations. (2011). Mortality estimates from major sample surveys: Towards the design of a database for the monitoring of mortality levels and trends. Department of Economic and Social Affairs.

United Nations. (2022a). *World Population Prospects 2022: Summary of Results* (p. UN DESA/POP/2022/TR/NO. 3). Department of Economic and Social Affairs, Population Division.

United Nations. (2022b). *World Population Prospects: The 2022 Revision*. Department of Economic and Social Affairs, Population Division. http://esa.un.org/unpd/wpp/

van Oort, F. V., van Lenthe, F. J., & Mackenbach, J. P. (2004). Cooccurrence of lifestyle risk factors and the explanation of education inequalities in mortality: Results from the GLOBE study. *Preventive Medicine*, *39*(6), 1126–1134.

Vodopivec, M. (2002). Worker reallocation during Estonia's transition to market. *International Journal of Manpower*, *23*(1), 77–97.

Wilmoth, J., Zureick, S., Canudas-Romo, V., Inoue, M., & Sawyer, C. (2012). A flexible two-dimensional mortality model for use in indirect estimation. *Population Studies*, *66*(1), 1–28.

Wittgenstein Centre for Demography and Global Human Capital. (2018). *Wittgenstein Centre Data Explorer Version 2.0 (Beta)*. http://www.wittgensteincentre.org/dataexplorer

Woolf, S. H., Chapman, D. A., Buchanich, J. M., Bobby, K. J., Zimmerman, E. B., & Blackburn, S. M. (2018). Changes in midlife death rates across racial and ethnic groups in the United States: Systematic analysis of vital statistics. *BMJ*, *362*, k3096. https://doi.org/10.1136/bmj.k3096

Zimmerman, E. B., Woolf, S. H., & Haley, A. (2015). Understanding the relationship between education and health: A review of the evidence and an examination of community perspectives. *Population Health: Behavioral and Social Science Insights. Rockville (MD): Agency for Health-Care Research and Quality*, *22*(1), 347–384.

APPENDIX

TABLE 3: UNDER-FIVE MORTALITY RATES BY MOTHERS EDUCATION ATTAINMENT FOR MALE-FEMALE FROM DHS SURVEYS.

Country (survey year)	Male					Female				
	No education	Some primary	Primary	Lower Secondary	Upper secondary	No education	Some primary	Primary	Lower Secondary	Upper secondary
Afghanistan (2015)	55.7	42.2	44.0	37.3	30.6	48.7	36.8	38.4	32.5	26.7
Angola (2015.5)	61.6	61.3	61.0	37.8	23.9	45.1	44.8	44.6	27.6	17.4
Azerbaijan (2006)	78.1	62.9	62.8	55.3	49.4	45.9	36.9	36.8	32.3	28.9
Bangladesh (2017.5)	56.2	55.0	44.9	39.1	28.2	50.6	49.5	40.3	35.1	25.3
Benin (2017.5)	80.4	77.1	62.0	57.3	33.4	65.0	62.3	50.0	46.2	26.9
Bolivia (2008)	110.2	65.1	45.1	44.1	32.1	92.1	54.2	37.5	36.7	26.7
Brazil (1996)	104.4	74.8	43.1	32.8	19.2	84.4	60.3	34.6	26.3	15.4
Burkina Faso (2010)	100.5	66.3	58.0	54.4	50.8	89.6	59.0	51.6	48.4	45.2
Burundi (2016.5)	64.1	63.4	48.8	37.4	26.0	57.2	56.5	43.5	33.3	23.2
Cambodia (2014)	53.7	31.4	29.1	24.7	4.0	40.0	23.2	21.6	18.3	3.0
Cameroon (2018.5)	86.4	78.0	69.6	57.5	51.0	74.2	67.0	59.7	49.3	43.7
Central African Republic (1994.5)	142.6	120.9	100.9	94.1	87.4	123.4	104.5	87.1	81.2	75.3
Chad (2014.5)	114.0	106.8	99.6	98.4	54.0	91.8	85.9	80.0	79.1	43.2
Colombia (2015.5)	27.0	24.9	26.2	19.9	13.7	25.0	23.1	24.2	18.5	12.7
Comoros (2012)	55.2	42.1	44.7	30.5	16.2	47.6	36.3	38.6	26.3	13.9
Congo (2011.5)	59.8	54.0	52.3	46.3	42.3	56.7	51.2	49.6	43.9	40.1
Côte d'Ivoire (2011.5)	113.4	104.8	94.5	80.0	65.5	73.6	68.0	61.2	51.7	42.2
Democratic Republic of the Congo (2013.5)	87.0	85.0	83.0	75.7	60.4	80.6	78.7	76.9	70.1	55.9
Dominican Republic (2007)	55.7	39.0	35.4	30.0	20.1	55.3	38.7	35.2	29.7	20.0
Egypt (2014)	32.6	28.4	27.6	26.8	20.5	29.9	26.1	25.3	24.6	18.9
Eswatini (2006.5)	116.7	93.4	88.9	84.5	78.6	123.7	99.1	94.4	89.7	83.5
Ethiopia (2008)	74.9	63.5	60.9	51.4	45.2	55.0	46.5	44.6	37.6	33.0
Gabon (2012)	72.1	62.3	57.2	49.9	46.7	60.3	52.0	47.8	41.6	39.0
Gambia (2020)	60.4	57.6	54.8	51.4	48.0	52.4	49.9	47.5	44.5	41.6
Ghana (2014)	64.2	49.2	48.0	54.0	56.9	55.2	42.3	41.2	46.3	48.9
Guatemala (2014.5)	45.3	33.3	31.8	22.7	17.7	37.3	27.5	26.2	18.7	14.6
Guinea (2018)	95.6	84.2	65.7	36.0	25.8	87.9	77.3	60.3	33.0	23.7
Guyana (2005)	53.8	54.3	58.2	36.1	14.1	38.7	38.9	41.6	25.8	10.0
Haiti (2016.5)	80.5	71.2	61.9	60.0	51.0	64.2	56.8	49.3	47.8	40.6
Honduras (2005.5)	51.9	38.2	23.1	20.2	17.3	38.0	27.9	16.8	14.7	12.6
India (2015.5)	63.1	58.3	51.4	44.9	29.7	56.6	52.4	46.1	40.2	26.6
Indonesia (2012)	89.2	64.9	48.8	33.8	29.0	70.5	51.2	38.4	26.5	22.8
Jordan (2012)	27.8	29.3	26.8	24.3	20.2	25.3	26.7	24.4	22.1	18.3
Kenya (2014)	44.6	47.8	46.6	45.4	37.9	38.1	40.9	39.8	38.8	32.4

Country (survey year)	Male					Female				
	No education	Some primary	Primary	Lower Secondary	Upper secondary	No education	Some primary	Primary	Lower Secondary	Upper secondary
Kyrgyzstan (2012)	0.0	0.0	7.5	17.2	22.1	0.0	0.0	7.6	17.4	22.3
Lesotho (2009.5)	122.8	118.6	114.5	99.0	83.6	91.0	87.9	84.7	73.2	61.6
Liberia (2006.5)	94.2	91.3	92.3	77.1	61.9	82.5	79.9	80.8	67.4	54.1
Madagascar (2008.5)	63.3	59.7	56.0	41.2	38.5	53.8	50.7	47.5	34.9	32.6
Malawi (2015.5)	54.8	54.6	54.5	47.4	38.3	43.8	43.6	43.5	37.8	30.5
Maldives (2016.5)	26.4	20.6	18.3	17.7	17.2	26.0	20.3	18.0	17.5	16.9
Mali (2018)	76.8	67.4	58.0	44.0	8.7	69.2	60.7	52.2	39.6	7.8
Morocco (2003.5)	59.0	41.7	32.3	20.9	20.9	43.1	30.3	23.5	15.2	15.1
Mozambique (2011)	81.7	82.2	67.2	65.7	64.2	70.5	70.9	57.9	56.6	55.3
Myanmar (2015.5)	74.6	46.7	42.8	39.0	37.1	57.1	35.6	32.6	29.7	28.3
Namibia (2013)	52.7	51.6	45.6	39.7	32.5	46.1	45.1	39.9	34.7	28.4
Nepal (2011)	57.1	55.7	49.6	39.0	24.8	54.4	53.1	47.2	37.1	23.6
Nicaragua (2001)	52.9	37.2	27.9	18.9	18.6	55.0	38.8	29.0	19.7	19.3
Niger (2012)	85.9	73.6	63.3	40.3	35.0	75.5	64.7	55.6	35.4	30.6
Nigeria (2018)	126.9	115.9	89.2	80.2	61.6	114.7	104.7	80.5	72.3	55.5
Pakistan (2017.5)	70.7	66.4	66.2	61.5	37.7	60.2	56.5	56.3	52.3	32.0
Peru (2012)	25.9	24.4	23.7	18.6	16.2	22.5	21.3	20.7	16.2	14.1
Philippines (2017)	52.0	41.0	29.9	20.7	20.1	45.3	35.7	26.0	18.0	17.5
Republic of Moldova (2005)	0.0	8.2	12.2	9.3	6.5	0.0	9.7	14.5	11.1	7.7
Rwanda (2010.5)	74.3	60.0	57.5	47.7	40.6	65.3	52.7	50.5	41.8	35.7
Sao Tome and Principe (2008)	109.5	60.6	55.0	101.9	125.3	45.7	24.9	22.5	42.7	52.8
Senegal (2017)	56.1	44.3	35.0	27.3	27.1	49.9	39.3	31.0	24.2	24.0
Sierra Leone (2019)	98.0	98.0	97.9	89.2	80.4	81.6	81.5	81.5	74.2	66.8
South Africa (2016)	63.7	62.7	61.7	51.9	20.9	50.7	49.9	49.1	41.3	16.6
Tajikistan (2017)	44.1	33.2	35.0	32.3	29.5	30.1	22.6	23.8	21.9	20.1
Timor-Leste (2016)	48.2	49.1	42.9	36.8	33.3	35.5	36.2	31.6	27.1	24.5
Togo (2013.5)	79.4	75.6	64.8	59.9	54.9	69.8	66.4	56.9	52.6	48.2
Turkey (2013)	27.2	20.4	16.7	15.9	9.3	21.7	16.3	13.3	12.7	7.4
Uganda (2016)	77.0	62.0	56.0	39.7	32.9	60.1	48.4	43.7	30.9	25.5
United Republic of Tanzania (2004.5)	102.3	96.1	80.3	77.5	74.7	91.2	85.6	71.5	69.0	66.5
Yemen (1991)	105.4	71.2	63.3	55.4	34.6	102.6	69.3	61.5	53.8	33.7
Zambia (2013.5)	67.3	59.6	58.8	58.0	49.0	58.9	52.1	51.4	50.8	42.9
Zimbabwe (2015)	104.0	72.6	62.1	51.6	39.4	86.9	60.5	51.7	42.9	32.7

Wittgenstein Centre

FOR DEMOGRAPHY AND
GLOBAL HUMAN CAPITAL

IIASA ÖAW universität wien

The Wittgenstein Centre is a collaboration among the Austrian Academy of Sciences (ÖAW), the International Institute for Applied Systems Analysis (IIASA) and the University of Vienna.

www.wittgensteincentre.org