LIFE EXPECTANCY IN RELATION TO SOCIETAL DEVELOPMENT LEVEL: SIGNIFICANT DISCORDANT FACTORS

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SUMMARY

Objectives: The aim of this study is to determine the interdependence between life expectancy and numerous social indicators, i.e., to determine the factors that encourage an increase or decrease in life expectancy.

Methods: Pearson coefficients as well as linear and logarithmic trends and correlations between the dependent variable of life expectancy and numerous independent variables were calculated and analysed. The calculations were carried out for all countries in the world for which data is available. Based on the strength of the correlations between life expectancy and numerous indicators, we have tried to determine the reasons for the different values of life expectancy in the various countries.

Results: Important factors for achieving high life expectancy values are economic development and healthcare spending but the spread of "diseases of the modern era", such as obesity or diabetes, have a significant negative impact on life expectancy. Other important limiting factors for life expectancy are large income inequalities, a higher share of private healthcare expenditure in total healthcare expenditure and lower total healthcare expenditure. Less developed societies can significantly increase their life expectancy by providing clean water and safe sanitation and by combating various infectious diseases (especially HIV).

Conclusions: Life expectancy is a meaningful indicator of the state of social development and accurately reflects the general state of a particular society. It has been shown that GDP per capita (PPP) is a key determinant of life expectancy, while other important factors play the role of a further modifier.

Key words: life expectancy, development level, healthcare sector, causes of death, health risks

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INTRODUCTION

The countries with the longest-lived people consistently extended their life expectancy by 3 months on a yearly basis, for the period of 1840 to 2000; though many experts insist that life expectancy is nearing its maximum (1). The life expectancy of a South Korean woman will likely be over 90 by 2030 (57% chance), and they will be shortly followed by French, Spanish, and Japanese women (2). In many countries with low mortality rates, it is expected that life expectancy will increase to 90 by 2050, and 20% of each generation will live to see 100 (3).

The current trend is to look for potential influences on mortality rates within environmental influences, i.e., in social, political, and technological factors (4). Development (GDP per capita) and education levels show a 72.6%–82.6% difference in life expectancy at birth for various EU countries, in the period of 2001 to 2011 (5). Income per capita has a strong positive correlation with life expectancy, due to the ability to obtain higher quality food, access to clean water, sanitation, and higher-quality healthcare (6). A negative correlation between life expectancy and income inequality has been determined in Brazil (7).

The difference in the life expectancy of the richest 1% and the poorest 1% of Americans is 14.6 years for men and 10.1 years for women, and this difference grew in the period of 2001 to 2014 (8). The strongest positive links with life expectancy in the world's less developed countries are literacy and access to safe water (9). The two main contributors to extending life expectancy in less developed countries for the period of 1970 to 2004 were: economic development (GDP per capita) and literacy rate, while type of political regime and nutrition status were significantly less important (10). Income inequality (Gini index) showed a stronger correlation ($r=-0.785$) than development level ($r=0.538$) or education level ($r=0.470$), in analysed Italian regions from 1995 to 2000 (11).

Life expectancy is significantly reflected in how much a society spends on its healthcare system, although the greatest positive effects have been documented in states that are on the lower end of moderately developed, while higher developed

states show diminishing positive effects from healthcare spending over a certain threshold (12). There are various life expectancy predictors, but childhood vaccination, safe hygiene, and generally available health insurance that provides the population with broad access to health services have the greatest influence on increasing life expectancy (13). An analysis of life expectancy growth in Sweden from 1751 onward concluded that development of public health systems and medical interventions with the goal of reducing exposure to infectious diseases and other sources of infection (especially in childhood) made an important contribution to increasing life expectancy (14).

Furthermore, higher education levels, non-manual professions, and higher income levels were shown to have increased the life expectancy of Finnish women by 4–5 years, when the trend of increasing life expectancy was examined for the period of 1971 to 2014 (15). In the most developed regions of Hungary, men live 4.5 years longer and women 2.6 years longer than their fellow citizens in less developed regions (16). Numerous papers have shown the harmful influence of various "habits and diseases of the developed world" (such as alcohol consumption, smoking, obesity, and sedentary lifestyle) on general health and, therefore, also on life expectancy. One prediction states that the average life expectancy of an 18-year-old woman would increase by 3.76 years were all Americans to stop smoking and maintain a normal weight (17).

Life expectancy for Japanese men and women who smoke (starting before their 20th birthday) is shortened by 8 and 10 years, respectively (18). The greatest negative effect on life expectancy among non-Hispanic white people in the USA, for the period 2000–2014, was unintentional poisoning (mainly via drugs and alcohol), as well as suicide and chronic liver disease (19). In Washington D.C., Caucasians had a much greater life expectancy than African-Americans (17.23 years for men and 12.06 years for women in 2016). The three main causes of this difference for men were heart disease (4.14 years), murder (2.36 years), and cancer (2.30 years); and for women the three main causes were heart disease (3.24 years), cancer (2.36 years), and accidental injury (0.85 years) (20). Improved nutrition was one of the most important factors behind reduced mortality rates throughout the 20th century, but it should be mentioned that mortality rates fell more drastically in Western European countries in the 18th and 19th centuries; and increased consumption of animal fats was responsible for an increase in mortality rates caused by "diseases of the wealthy", e.g., cardiovascular disease and various types of cancer (21).

People in England and the USA with 2 or more behavioural risk factors (e.g., consumption of alcohol, smoking, sedentary lifestyle, obesity) can expect their life expectancy to be up to 12 years shorter in relation to people without behavioural risk factors and chronic disease (22). Life expectancy in South Africa increased by 11.3 years, from 49.2 in 2003 to 60.5 in 2011, after anti-retroviral therapy (ART) for HIV and AIDS was introduced in 2004 (23). Social deprivation was shown to have a negative influence on life expectancy in England and Wales (24). The negative influence of serious mental illness on life expectancy is significantly higher than other established risks, such as smoking, diabetes, and obesity (25). The life expectancy of people with personality disorders was found to be much shorter (17.7 years for men and 18.7 years for women) than that of the general population of England and Wales (26).

MATERIALS AND METHODS

Database

The main sources of data for this paper were the World Bank and the World Health Organization (WHO). The WHO documents data only for states, while the World Bank documents data for states and territories with a certain level of autonomy (that are not independent states). We have used data for 2019 because it is the last year before the outbreak of the COVID 19 pandemic. The remaining indicators were used for 2019, apart from data that is rarely or intermittently published. We considered that using data from 2021, the last year in which the World Bank documented life expectancy, could provide partially skewed data due to the COVID-19 pandemic. The extent to which a COVID-19 pandemic can be assumed is shown by the fact that despite numerous wars, revolutions and economic crises as well as the HIV virus, the life expectancy of the world's population rose continuously every year between 1960 and 2019 from 50.89 to 72.98 years without falling once, only to fall for the first time to 72.24 (2020) and 71.33 (2021).

Statistical Analysis

Coefficients and linear and logarithmic trends and correlations between the dependent variable of life expectancy and numerous independent variables were calculated. Correlations were calculated for all of the world's countries for which there was data, and special calculations were made for the 36 least developed countries (less than $4,000 GDP per capita PPP), 117 moderately developed countries ($4,000–$40,000 GDP per capita PPP), and the 39 most developed countries (greater than $40,000 GDP per capita PPP). We used data regarding the strength and size of the healthcare system, education level of the population, level of income inequality, poverty level, mortality rate, and health risks.

For this research, we used only the indicators that had a strong correlation, while excluding those with moderately weak or insignificant correlations. Although income inequality does not stand out as a factor which significantly forms life expectancy, it was used for specific clarification. Due to the visible link between development level (GDP per capita PPP) and life expectancy, their correlation is of central importance. The remaining correlations used additionally explain deviations in life expectancy in relation to development level.

Scatter plots with linear and logarithmic lines of correlation trends are shown. The correlation that was strongest was used. In so far as the scatter had a rounded shape, the coefficient of logarithmic correlation (r log) showed a higher strength than linear correlation (r lin) (Fig. 2). In contrast, in so far as the scatter had a linear shape, the Pearson coefficient of linear correlation showed higher strength (Fig. 5).

The correlation groups that were determined for this research are: total correlation with a coefficient of 1 or −1; strong correlation with a coefficient of 0.800 to 0.999; moderately strong correlation with a coefficient of 0.500 to 0.799; relatively weak correlation with a coefficient of 0.200 to 0.499; insignificant correlation with a coefficient of 0.001 and 0.199; and total lack of correlation with a value of 0.

These maps were created with ArcGIS Desktop 10.7.1 from ESRI. The administrative boundaries as the most important vector

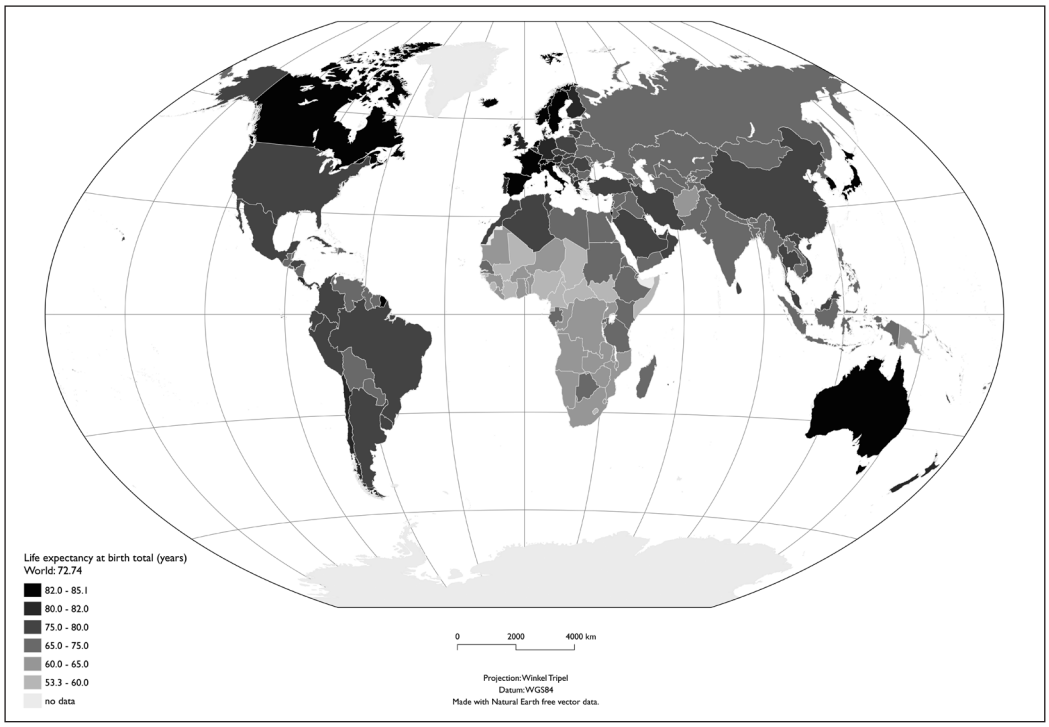

Fig. 1. *Life expectancy in the world in 2019.*

layer were created using data available online from Natural Earth. Due to its public domain licensing and cartographic generalization level, Natural Earth proved to be the optimal data source for maps of this scale. In addition, linking the GIS layers with tabular data sources was quite simple and straightforward due to the structure of the attribute data.

RESULTS

Correlation Between Life Expectancy and Economic Development Level

The states with the longest-lived populations (2019) are Japan (84.4 years), Switzerland (83.7 years), Singapore (83.5 years), Spain (83.5 years), and South Korea (83.2 years) (Fig. 1). These states are also all highly developed (greater than $40,000 GDP per capita PPP). The states with the shortest life expectancy are the Central African Republic (53.3 years), Chad (54.2 years), Lesotho (54.3 years), Nigeria (54.7 years), and Sierra Leone (54.7 years) (Fig. 1). These states are also among the least developed in the world (from $985 to $5,353 GDP per capita PPP).

A strong positive link between life expectancy and level of economic development was determined (Pearson coefficient 0.849) (Fig. 2), but for the 39 most developed states (greater than $40,000 GDP per capita PPP) this positive link was of insignificant strength (r lin 0.164), which suggests that further development past $40,000 GDP per capita PPP does not significantly influence growth of life expectancy. The same correlation for the 36 least developed states (less than $4,000 GDP per capita PPP) was moderately weak (r lin 0.472). Moreover, this correlation was

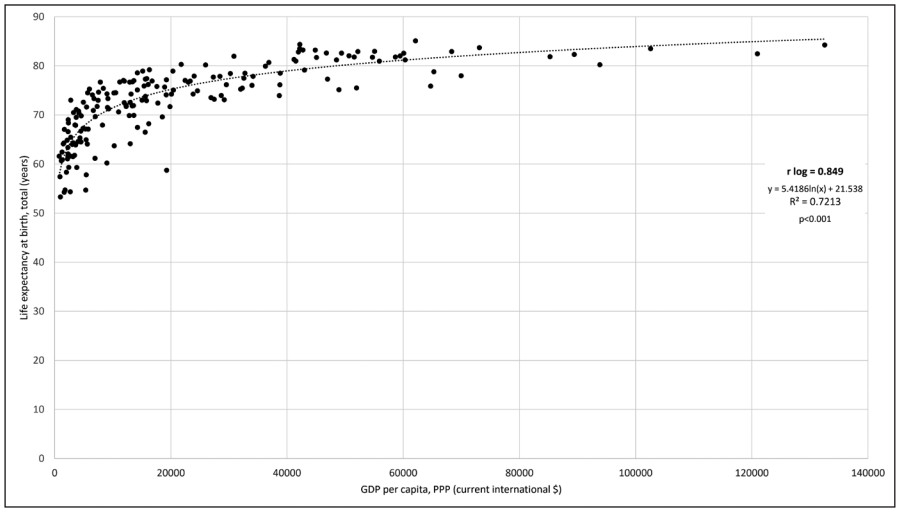

Fig. 2. *Logarithmic correlation of life expectancy and GDP per capita PPP in the world's countries in 2019.*

moderately strong (r log 0.599) in moderately developed states ($4,000–$40,000 GDP per capita PPP). The greatest growth in life expectancy is achieved up to the level of development of around $10,000 GDP per capita PPP (Fig. 2).

Correlation of Life Expectancy and Healthcare System

There are numerous significant deviations within the strong link between development level and life expectancy: the USA is more economically developed ($65,280 GDP per capita PPP) than Japan ($42,197 GDP per capita PPP), but Japanese people live 5.6 years longer than Americans (84.4 years and 78.8 years, respectively). This is a good example of the fact that numerous factors have correlative effects on life expectancy. Life expectancy has a strong positive correlation with total healthcare spending (r log 0.847) (Fig. 3) and government healthcare spending (r log 0.871). The level of private healthcare spending has a moderately strong positive correlation with life expectancy (r log 0.701), but a high share of private spending in total healthcare spending was determined to have moderately weak negative correlation with life expectancy (r lin −0.326).

Surgeons per capita (r log 0.803) and doctors per capita (r log 0.750) have a stronger positive correlation with life expectancy than hospital beds per capita (r log 0.606). The greatest growth in life expectancy comes when a society spends around $800 per capita on the healthcare system, while spending over $2,000 per capita PPP does not result in detectable growth in life expectancy (Fig. 3). A relatively weak positive correlation (r log 0.429) between life expectancy and healthcare spending was determined for the most developed states. Americans spend 136% more than the Japanese and 354% more than the Greeks on their healthcare system but live 5.6 years shorter than the Japanese and 3.2 years shorter than the Greeks.

Correlation of Life Expectancy and Education Level

The strongest positive link between life expectancy and the various indicators related to education level of the population was determined to be with the percentage of the population that had finished secondary school (r lin 0.847) (Fig. 4). The link between life expectancy and higher educational achievement (undergraduate and graduate degrees) was somewhat weaker. In all states with a life expectancy over 80 years, at least 80% of their population had a secondary school education; while no states where less than 40% of the population had a secondary school education had an average life expectancy of over 70 years (Fig. 4).

Correlation between Life Expectancy and Income Inequality

With increasing income inequality (increasing Gini index values), reduction in life expectancy is predicted (r log −0.435) (Fig. 5). Most countries of the world with an average life expectancy over 80 years have low Gini index values: 38 of them have between 25 (Slovenia) and 36 (Italy); while the remaining 3 have higher Gini index values: Israel – 39, Chile – 44, and Costa Rica – 48 (Fig. 5). In the six states with the highest Gini index values (55+), life expectancy is significantly shorter: from 53.3 years in the Central African Republic to 71.7 years in Surinam (Fig. 5). South Africa has the highest Gini index value in the world (63) and an average life expectancy of 64.1 years, which is low in relation to the country's level of economic development ($13,010 GDP per capita, PPP). A relatively weak negative correlation was determined between Gini index value and life expectancy in the least developed (r lin −0.356) and moderately developed (r lin −0.229) states; while in the most developed states, a relatively weak positive correlation was determined (r log 0.236).

Correlation of Life Expectancy and Mortality Rate

A strong negative correlation was determined between life expectancy and several indicators linked to infectious diseases and poor nutrition conditions (r lin −0.878), unsafe water and unsafe sanitation (r log −0.881) (Fig. 6), and accidental poisoning (r lin −0.735). A moderately strong negative correlation was determined between life expectancy and mortality from cardiovascular disease, cancer, and diabetes (r log −0.717) (Fig. 7) as well as from HIV (r log −0.607). The strong distribution of all the afore-mentioned causes of death significantly shortens

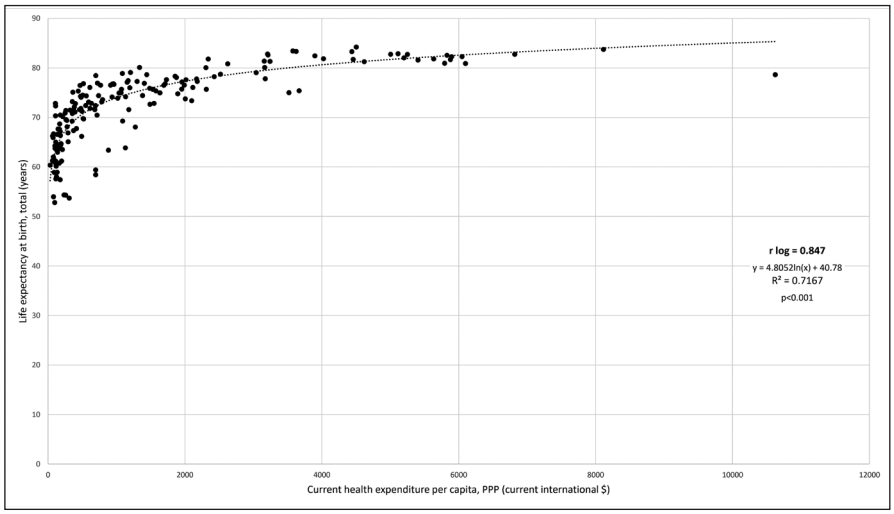

Fig. 3. *Logarithmic correlation of life expectancy and current healthcare expenditure per capita PPP in the world's countries in 2019.*

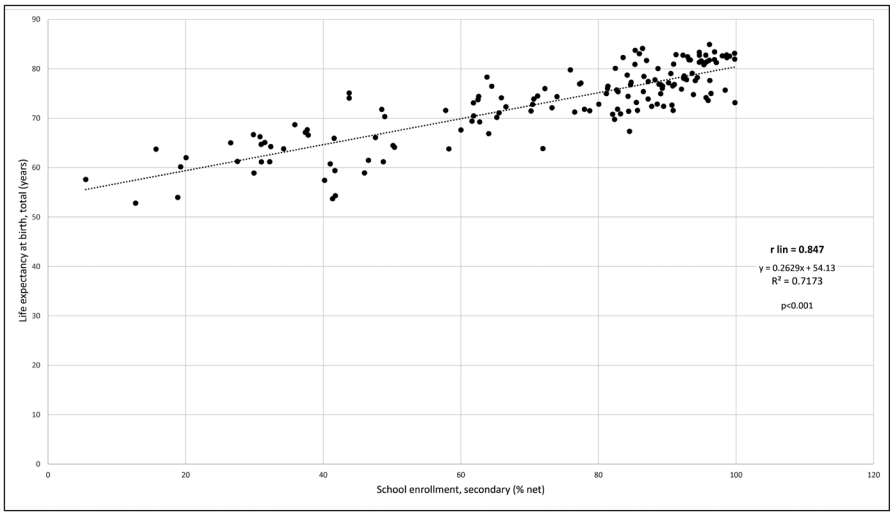

Fig. 4. *Linear correlation of life expectancy and secondary school enrolment in the world's countries in 2018.*

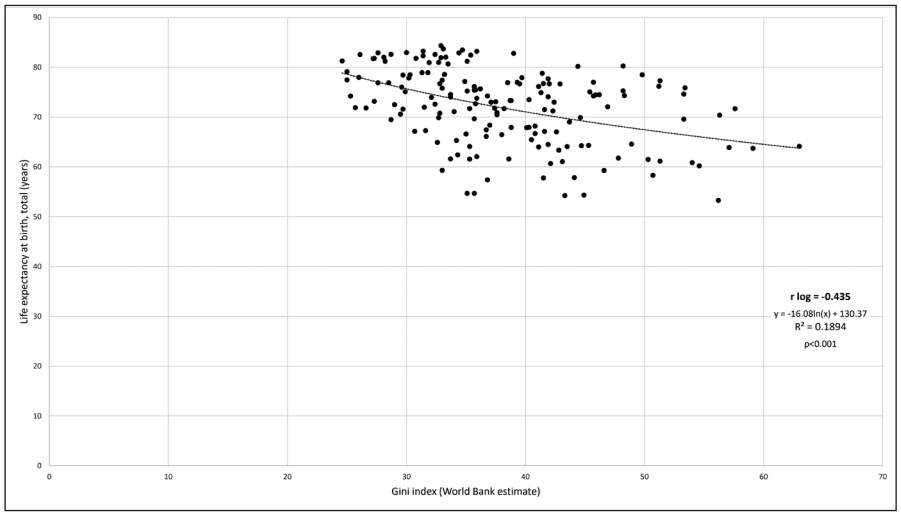

Fig. 5. *Logarithmic correlation of life expectancy and Gini index value in the world's states 2010–2019.*

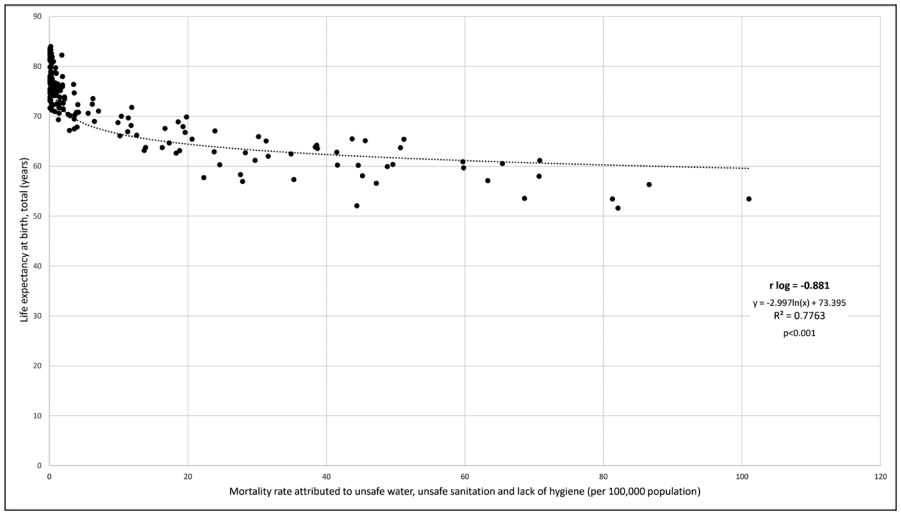

Fig. 6. *Logarithmic correlation of life expectancy and mortality rate attributed to unsafe water, unsafe sanitation, and lack of hygiene in the world's countries in 2016.*

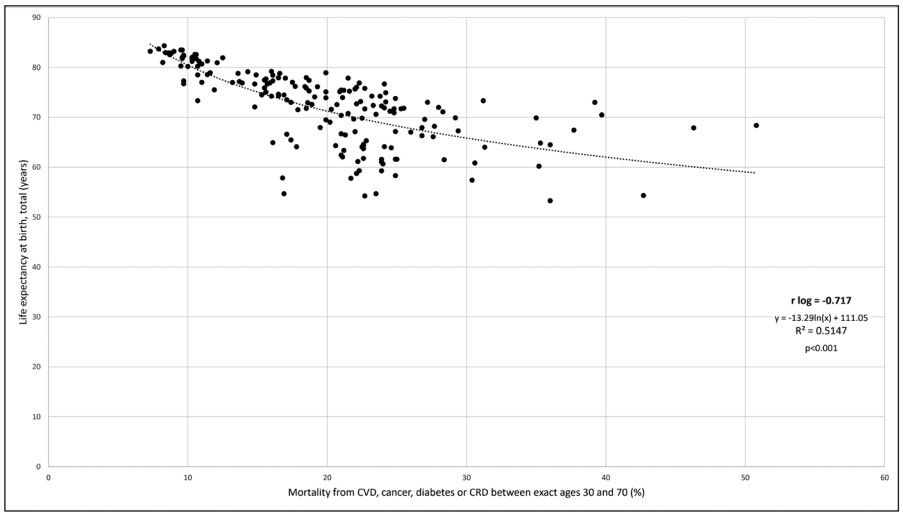

***Fig. 7**. Logarithmic correlation of life expectancy and mortality from cardiovascular disease, cancer, diabetes, or CRD between the ages of 30 and 70 in the world's countries in 2019.*

average life expectancy on the global level. As expected, there are visible differences between the least developed and most developed countries.

For the 36 least developed countries (most of which are found in Africa) (less than $4,000 GDP per capita PPP), the strongest negative link was determined between life expectancy and unsafe water and sanitation (r lin −0.791), and infectious diseases and poor nutrition conditions (r lin −0.716); while among the 39 most developed countries (more than $40,000 GDP per capita PPP), the strongest negative link was confirmed between life expectancy and mortality from cardiovascular disease, cancer, and diabetes (r log −0.875) and widespread diabetes (r lin −0.797). The problem of unsafe water, unsafe sanitation, air pollution, and infectious diseases are primarily found in the underdeveloped world, while cardiovascular disease, cancer, and diabetes are largely found in the developed world.

DISCUSSION

The main aim of this study is to investigate the numerous influences on life expectancy. An important determinant of life expectancy is the economic development of society, measured by GDP per capita (PPP). Large positive and negative deviations in the assumed life expectancy of individual countries depending on their economic development are striking. On the basis of numer-

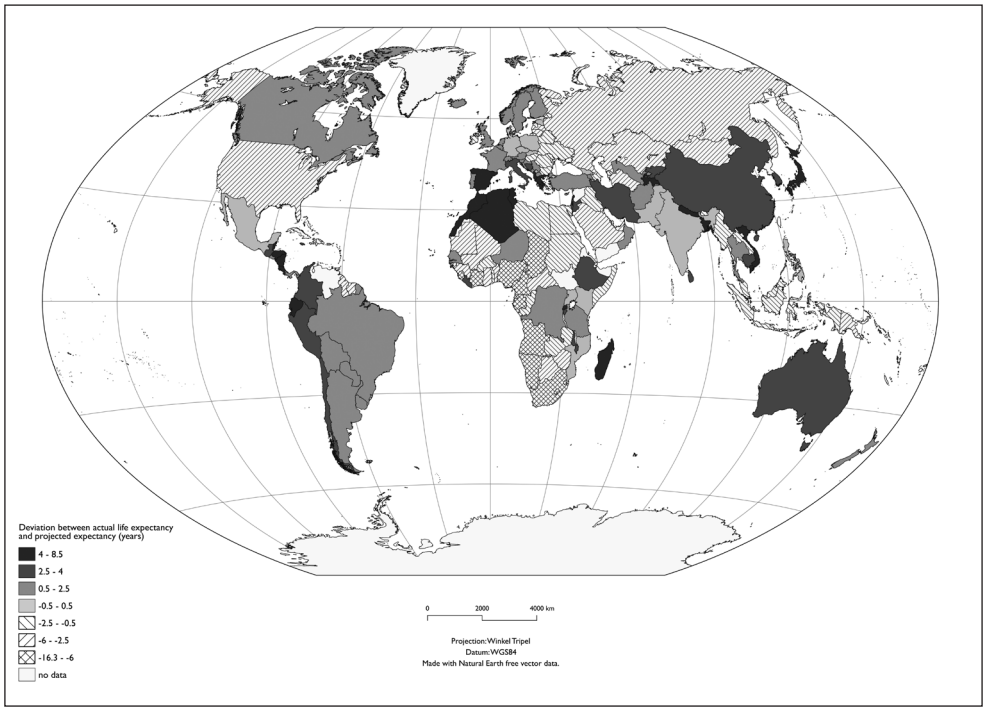

***Fig. 8.** Deviation between actual life expectancy and projected life expectancy based on economic development level (GDP per capita PPP) in the world in 2019.*

ous and varied data, we have attempted to determine or at least partially identify the reasons for the differences in life expectancy at national level. We have paid particular attention to the considerable differences in groups of countries with similar economic development. The consumption of the entire health sector is not particularly accurate for estimating life expectancy, especially in the group of highly developed countries.

The largest negative deviation between actual and projected life expectancy (more than 6 years) based on economic development level was documented in 12 African states (Fig. 8). Two reasons for this particularly stand out: five states (Eswatini, Lesotho, South Africa, Namibia, and Equatorial Guinea) have exceptionally widespread HIV (7.3%–27.4% of the population 15–49 years old is HIV positive), while all 12 states have widespread unsafe water and lack of hygiene (mortality rate of 13.7 to 101.0 per 100,000 population). The life expectancy of HIV-positive individuals aged 20 years from Switzerland will increase by 52.7 years with compulsory education and by 60.0 years with higher education during combination antiretroviral therapy (period 2006–2013), compared to the general population, where the increase is 61.5 and 65.6 years, respectively (27). Despite the dramatic increase of 43.1 years in the life expectancy of HIV-positive individuals treated with combination antiretroviral therapy (period 2006–2013) compared to the period of monotherapy (period 1988–1991), the life expectancy of the general population is still significantly higher by 5.6 to 8.8 years compared to HIV-positive individuals (27). Another important reason for the negative deviation in life expectancy in underdeveloped African countries are numerous diseases caused by poor water quality. The incidence of diarrhoeal diseases attributable to water quality decreased by 13.4 % worldwide between 2005 and 2015 (28). Water related deaths have decreased significantly over the last 50 years, which has contributed to the increase in life expectancy (28).

The states with the largest positive deviations between actual and projected life expectancy based on economic development level (more than 4.0 years) are a mixed group: six underdeveloped states, 17 moderately developed states, and highly developed Japan (+5.1 years) and Spain (+4.2 years) (Fig. 8). The underdeveloped and moderately developed states do not have widespread problems with HIV among the population aged 15–49 (0.1%–0.4%), with the exception of Belize (1.3%) and Rwanda (2.6%), and also have fewer problems with unsafe water and poor hygiene conditions (mortality rate of 0.1 to 30.2 per 100,000 population) in relation to the 12 states that showed negative deviation. It is estimated that in 2016, 1.6 million people died (2.8% of all deaths worldwide) due to inadequate drinking water, sanitation and hygiene behaviour (29). Two states that showed an exceptionally positive deviation had a high percentage of population with secondary education: Albania (86.6%) and Tajikistan (83.2%). Numerous studies show that a more highly educated population lives longer. For example, the difference between the population with primary and tertiary education in Norway in 2009 is 6.4 years higher for men and 4.7 years higher for women (30).

Table 1. *Deviation between actual and projected life expectancy based on economic development level (GDP per capita PPP) in states that have an actual or projected life expectancy of 80+ years for 2019, with a minimum variance of 2.5 years.*

State	Actual life expectancy	Projected life expectancy based on economic development level	Difference between actual and projected life expectancy
Lower actual life expectancy than projected life expectancy of 2.5 years or more			
Brunei Darussalam	75.9	81.6	−5.7
Saudi Arabia	75.1	80.1	−4.9
Kuwait	75.5	80.4	−4.9
United Arab Emirates	78.0	82.0	−4.0
Qatar	80.2	83.6	−3.4
United States	78.8	81.6	−2.8
Luxembourg	82.4	85.0	−2.5
Higher actual life expectancy than projected life expectancy of 2.5 years or more			
France	82.6	80.1	2.5
Australia	82.9	80.4	2.5
Malta	82.6	79.8	2.8
Chile	80.2	76.6	3.6
Israel	82.8	79.2	3.6
Italy	83.2	79.6	3.6
South Korea	83.2	79.3	3.9
Spain	83.5	79.2	4.2
Greece	81.9	77.6	4.4
Costa Rica	80.3	75.7	4.6
Japan	84.4	79.2	5.1

Source: World Bank

There are significant deviations between actual and projected life expectancy based on economic development level in states where the actual and projected life expectancy is 80+ years. There are 11 states with significantly higher actual life expectancy (more than 2.5 years) in relation to projected life expectancy: Japan (+5.1 years), Costa Rica (+4.6 years), Greece (+4.4 years), Spain (+4.2 years), South Korea (+3.9 years), Italy (+3.6 years), Israel (+3.6 years), Chile (+3.6 years), Malta (+2.8 years), Australia (+2.5 years), and France (+2.5 years) (Table 1). Seven states have significantly lower actual life expectancy (more than 2.5 years) in relation to projected life expectancy: Brunei (−5.7 years), Saudi Arabia (−4.9 years), Kuwait (−4.9 years), UAE (−4.0 years), Qatar (−3.4 years), USA (−2.8 years), and Luxembourg (−2.5 years) (Table 1). The German health system (according to number of surgeons, doctors, hospital beds, and spending) is the strongest in Europe, but Germans have a shorter life expectancy than Spaniards or Italians. Expenditure on health care is not the most important determinant of life expectancy, but expenditure on social protection is much more important.

It is remarkable that many of the highest positive deviations are found in Mediterranean states and indicate the possibility that the Mediterranean lifestyle could be an influential factor. Although the USA spends many times more than Japan, Spain, Italy, Israel, and especially Greece, on their healthcare system, the final result – life expectancy – is surprisingly weak. The positive effect of the Mediterranean lifestyle on life expectancy is mainly due to the Mediterranean diet (31). The Mediterranean diet, which includes an above-average consumption of vegetables, legumes, fruit and nuts, cereals, fish, and olive oil, is significantly positively associated with life expectancy and the extension of healthy life expectancy (31). The Mediterranean culture, tradition and lifestyle, characterized by social interaction, short naps, meals in company, and physical activity with others, are associated with a lower incidence of metabolic syndrome and lower mortality from all causes in Spain (32). It should be emphasized that the Mediterranean diet in Spain and Italy has reduced the usual gap in life expectancy between the upper and lower socio-cultural strata of society compared to the countries of Central and Northern Europe, mainly due to the higher lifespan expectancy of the lower socio-economic strata (33). Part of the explanation for the moderately low life expectancy of the population of the USA could be the high percentage of private spending in total healthcare spending (49.6%) in relation to Japan (15.9%), Italy (26.1%), France (26.6%), Costa Rica (27.6%), Spain (29.6%), Australia (30.9%), and Israel (33.6%). The public health sector has a greater positive effect on life expectancy than the private health sector, which could explain the lower value of life expectancy in countries with a high proportion of the private health sector. It should be mentioned that the following countries also have high shares of private spending in total healthcare spending, but this does not seem to be reflected in life expectancy in the same way as in the USA: South Korea (41.5%), Greece (47.9%), and Chile (49.2%). A further reason for this deviation could be higher income inequality in the USA (Gini index value 41.4) than in South Korea (31.4), France (32.4), Japan (32.9), Greece (32.9), Australia (34.4), Spain (34.7), and Italy (35.9). The inequality of national income measured by the Gini index, together with the lower secondary education of women and men, the lower labour productivity and the lower number of old-age pensioners, is an important factor contributing to the inequality of life expectancy. A negative correlation between the Gini index and life expectancy ($p < 0.05$) was found in very unequal Brazil (7). It should be mentioned that the following countries also have high Gini index values, but this does not seem to be reflected in life expectancy in the same way as in the USA: Israel (39.0), Chile (44.4), and Costa Rica (48.2). Certain reasons become more visible when the USA and Japan are directly compared, i.e., when two extremes among highly developed states are compared: Japan's life expectancy is 84.4 years and the USA's is 78.8 years.

The Japanese live 5.1 years longer and Americans 2.8 years shorter than their respective projected life expectancies based on economic development (GDP per capita PPP). The largest difference in respective mortality rates is adult obesity (BMI 30+): 37.3% of American adults are obese, while only 4.4% of Japanese adults are obese. Obesity reduced life expectancy by 7.1 years in 40-year-old female nonsmokers, and by 5.8 years in 40-year-old male nonsmokers from the town of Framingham, Massachusetts (34). Obesity and severe obesity shorten life expectancy by 5.6 to 7.6 years in Australian men and by 8.1 to 10.3 years in Australian women aged 20 to 29 years (35). The high prevalence of obesity contributes significantly to the lower life expectancy in the USA. The US has one of the lowest life expectancies among high-income countries, and it is estimated that obesity is responsible for one-fifth to one-third of this deficit (36). Diabetes is more widespread (among population aged 20 to 79) in the USA (10.8%) than in Japan (5.6%). Diabetes is the cause of a 0.83-year reduction in life expectancy in men aged 30 years and a 0.89-year reduction in life expectancy in women aged 30 years in the USA, which means that diabetes significantly reduces life expectancy in the USA (37). Mortality from CVD, cancer, diabetes, or CRD, among adults aged 30 to 70, is higher in the USA (13.6%) than in Japan (8.3%). More than half of the increase in life expectancy of the population aged 40 to 84 years between 1981 and 2010 is due to a reduction in the mortality rate from cardiovascular diseases, i.e., by 0.5 years for men and 0.8 years for women in societies with a medium to very high Human Developed Index (HDI). The decrease in cancer mortality is the cause of a 20% increase in life expectancy (aged 40 to 84 years), i.e., by 0.8 years for men and 0.5 years for women in societies with a very high HDI and by more than 10% or 0.2 years for men and women in societies with a medium and high HDI (38). Mortality from traffic accidents is over three times higher in the USA (12.4 per 100,000 population) than in Japan (4.1 per 100,000 population). Income inequality is also higher, according to Gini index value, in the USA (41.4) than in Japan (32.9). On the basis of coefficients of linear and logarithmic correlation and significant deviations of individual indicators for Japan and the USA, the main reasons for the USA's shorter life expectancy are widespread obesity and diabetes, as well as higher mortality from CVD, cancer, and diabetes, or CRD. High cholesterol, high blood pressure and obesity are the most important biological risks and the main reasons why mortality is higher in the US than in Japan. While Americans and Japanese exercise equally up to the age of 50, Japanese over 50 exercise significantly more than Americans. It should be noted that Japan has a well-established system of universal health care, while many Americans have been without health insurance for years (39).

CONCLUSIONS

The population of the world is living longer and longer as a result of numerous factors: new medical techniques and therapies, disease prevention, improvements in housing conditions and improved labour conditions. A strong positive link between life expectancy and level of economic development was determined: development level explains 72.1% of life expectancy. An additional correcting factor is the state of the healthcare system, i.e., amount and manner of financing, whereby a very high share of private financing in total healthcare expenditure has a negative effect on life expectancy. Healthcare spending explains 71.7% of life expectancy, while the share of private financing in total healthcare financing explains 10.6% of life expectancy.

Education level has a positive impact on life expectancy, and the strongest link was determined to be the percentage of the population with secondary-level education (explaining 71.7% of life expectancy). When income inequality is too high, it shortens average life expectancy, and this factor must be included in the explanatory algorithm of certain deviations in predicted life expectancy. The Gini index explains 18.9% of life expectancy. The least developed countries of the world could significantly increase their average life expectancy by working to lessen the spread of HIV, and by improving water and general hygiene quality and availability. The main reducers of life expectancy in the most developed societies are increasing obesity and the numerous diseases and causes of death linked therewith, i.e., cancer, cardiovascular disease, diabetes, and CRD, as well as lack of health care availability for low-income members of the population.

Conflicts of Interest

None declared

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