

# Determinants of life expectancy in low and medium human development index countries

## *Determinanty długości życia w krajach o niskim i średnim wskaźniku rozwoju społecznego*

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**Key words:** life expectancy, human development index, determinants.

**Słowa kluczowe:** długość życia, wskaźnik rozwoju społecznego, determinanty.

### Abstract

**Introduction:** Life expectancy is the number of years that people in a given country or population can expect to live. Dramatic gains in life expectancy have been made globally since 2000, but major inequalities persist within and among countries of different human development.

**Aim of the research:** To identify determinants of life expectancy in countries that have low and medium human development index.

**Material and methods:** The study was conducted from January 1, 2018 to April 15, 2018 using the most recent aggregates of health indicator data from the WHO, World Bank, UNDP, and UNICEF databases in 83 countries with low and medium human development. The dependent variable was life expectancy, while the independent variable was socio-economic, health-care related, and morbidity variables. Data was compiled in excel and analysed using SPSS version 21. A linear relationship was drawn between variables and presented in tables.

**Results:** Life expectancy was shorter in the studied countries and varied enormously among countries. A significant relationship between life expectancy and socio-economic, healthcare, and morbidity indicator variables was observed. There was an inverse and significant linear relationship between life expectancy and young age dependency rate, total fertility rate, child mortality rate, and a positive relation with HDI, adult literacy rate, contraceptive prevalence rate, HIV incidence rate, and TB incidence rate.

**Conclusions:** Life expectancy is determined by multiples of socio-economic factors, health and health care system associated factors, disease burden, and their complex interactions. Therefore, policy and programs targeted to improve life expectancy should consider population dynamics, socio-economic influence, and health system factors.

### Streszczenie

**Wprowadzenie:** Oczekiwana długość życia to liczba lat, które według prognoz mogą przeżyć ludzie w danym kraju lub populacji. Spektakularny wzrost tej długości stwierdzany jest na świecie od 2000 r., ale utrzymują się nierówności pod tym względem, głównie w krajach o różnym rozwoju społecznym.

**Cel pracy:** Określenie czynników, które wpływają na oczekiwaną długość życia w krajach o niskim i średnim wskaźniku rozwoju społecznego.

**Materiał i metody:** W badaniu przeprowadzonym od 1 stycznia do 15 kwietnia 2018 r. wykorzystano najnowsze dane o wskaźnikach zdrowotności z baz danych WHO, Banku Światowego, UNDP i UNICEF w 83 krajach o niskim i średnim poziomie rozwoju społecznego. Zmienną zależną była długość życia, a zmienną niezależną – zmienne społeczno-ekonomiczne związane z opieką zdrowotną i zachorowalnością. Dane zostały opracowane w programie Excel i przeanalizowane za pomocą programu SPSS wersja 21. Uzyskane zależności między poszczególnymi zmiennymi przedstawiono w tabelach.

**Wyniki:** W badanych krajach średnia długość życia była krótsza i ogromnie zróżnicowana. Wykazano istotny związek między oczekiwaną długością życia a wskaźnikami społeczno-ekonomicznymi, zdrowotnymi i chorobowymi. Stwierdzono istotną zależność między oczekiwaną długością życia a odsetkiem badanych pod względem wieku, całkowitym współczynnikiem dzietności, wskaźnikiem śmiertelności dzieci oraz pozytywny związek z HDI, poziomem analfabetyzmu u dorosłych, rozpowszechnieniem antykoncepcji, zachorowalnością na HIV i częstością występowania gruźlicy.

**Wnioski:** Oczekiwana długość życia jest determinowana przez szereg czynników społeczno-ekonomicznych związanych z systemem opieki zdrowotnej, obciążeniem chorobowym i ich złożone interakcje. Dlatego też polityka i programy ukierunkowane na poprawę średniej długości życia powinny uwzględniać dynamikę populacji, warunki społeczno-ekonomiczne i czynniki związane z systemem opieki zdrowotnej.

## Introduction

Life expectancy is a summary measure of mortality in a population [1]. It refers to the number of years that people in a given country or population can expect to live, and it is an important synthetic indicator for assessing economic and social development of a country or a region [2]. Life expectancy is frequently analysed in the composition of demographic data for the countries of the world and utilised for the measurement of mortality experiences and comparison of experiences or trends through time and across geographic regions [1].

Dramatic gains in life expectancy have been made globally since 2000, but major inequalities persist within and among countries. As of 2008, the gap in life expectancy between regions classified by the United Nations (UN) as more developed and less developed was as high as 11 years [2]. Similarly, as of 2015, the gap in life expectancy across different human development index countries was also different. The differences are 4 years between very high and low, 7 years between high and low, and 9.3 between medium and low HDI counties. While the difference between very high human development and low human development countries was 20 years [2–4].

Global life expectancy at birth in 2015 was 71.4 years (73.8 years for females and 69.1 years for males), ranging from 60.0 years in the WHO African Region to 76.8 years in the WHO European Region, giving a ratio of 1.3 between the two regions. Women live longer than men throughout the world. The gap in life expectancy between the sexes was 4.5 years in 1990 and had remained almost the same at 2015. By the year 2008, the gap in life expectancy between regions classified by the UN as more developed and less developed was as high as 11 years, which is higher than the current gap in life expectancy between developed and developing countries [4, 5].

Life expectancy increased by 5 years between 2000 and 2015, the fastest increase since the 1960s. Those gains reverse the declines seen during the 1990s, when life expectancy fell in Africa and other developing countries because of the AIDS epidemic, which resulted in a large number of premature deaths, particularly before effective treatment was initiated [4].

Increasing life expectancy is an essential component of health in the developing world (countries with low and medium Human Development Index (HDI)), which is earnestly striving to achieve socio-economic progress through investing significantly in social sectors like health, education, sanitation, environmental management and sustainability, and social safety nets [6]. In developing countries, variations in morbidity and mortality have been associated with a wide variety of measures of socio-economic status including per capita GDP, fertility rate, adult illiteracy rate, per capita calorie intake, health care expenditure, access

to potable drinking water, urban inhabitants, unemployment rate, and the nominal exchange rate [2, 4, 6].

A remarkable improvement in socio-economics and health over the years would have impacted positively on life expectancy [6]. Citizens of wealthier countries have access to modern medicine and medical facilities, the leisure to exercise, and meticulous regulation of sanitation and drinking water. Their life expectancies, therefore, should naturally be higher than those of less developed countries [7]. However, this is not always the case; in some of the countries, although income and health expenditure is increasing, life expectancy is decreasing [8, 9], whereas in most cases economic development determines improvements in the social conditions and increase in the life expectancy [10].

In the other case, increasing life expectancy is due to improvement in the public health care system. This public health care comprises a system of group and individual measures, services, and activities related to preservation and improvement of health, prevention of diseases, early detection of diseases, timely treatment and medical care, and rehabilitation [11]. This is the case in developing countries in which public health intervention is better than clinical care due to increases in the price of medical services [12].

It is difficult to establish a causal relationship between life expectancy and its predictors as a result of the nature of the studies. Many studies assessed determinants of life expectancy in a fragmented scope without acknowledging the impact of broader health and socioeconomic indicators.

## Aim of the research

Therefore, this study aimed to assess factors associated with life expectancy in countries that have low and medium human development index using the most recent health and health-related, social, economic, and developmental indicators.

## Material and methods

### Study design, settings, and population

This study was conducted from January 1, 2018 to April 15, 2018 using aggregates of health indicator data from the WHO, World Bank, UNDP, and UNICEF databases to identify determinants of life expectancy in countries with low and medium human development indices. Regarding the nature of the design, each country is considered as a unit of analysis. Currently the HDI is used as the best measure of development indicator by the World Bank. Accordingly, countries around the globe are divided in to low human development, medium human development, high human development, and very high human development countries based on their level of HDI. Countries that have HDI equal to or above 0.80 are attributed

as having very high human development, countries with HDI of 0.70 to 0.80 are those with high human development index, countries with HDI of 0.55 to 0.70 are those having medium development, and countries below 0.55 are those with low human development. Many countries with HDI below 0.70 are also classified as developing countries based on gross national income (GNI) per capita in the atlas method of 2014. There are 83 countries that have low and medium human development index of below 0.70, and all are included in the study (<http://www.who.int/gho/>).

### Study variables and source of information

The main source of information is the Global Health Observatory (GHO) database of the WHO, which has data for more than 1000 health indicators for 194 member countries and was designed for monitoring of sustainable development goals (SDG) [4, 13]. Additionally, UNICEF [14], UNDP [15], and the World Bank [16, 17] databases were used as data sources for some variables and for verification purposes. The study used the latest available data from 2008 to 2017 of the above databases. Separately available indicators were sorted and compiled based on the selected countries list, identified health, and socio-economic indicators, and secondary analysis was carried out. The outcome variable was life expectancy; while the determinants were health and health-related indicators and socio-economic indicators used by the WHO and other UN affiliate organisations. The relationship between life expectancy and the selected determinants was assessed based on multiple linear regression models.

For the sake of description, determinant factors were classified in to seven categories based on the modification of a classification from sustainable development goal indicators and reviewing other literature, such as: socio-economic and development indicators, maternal health indicators, child health indicators, disease prevention and control indicators, hygiene and environmental health indicators, nutrition indicators, and human and financial resource indicators: tuberculosis incidence, HIV incidence, and anaemia during pregnancy were used. The variables were selected based on the existing evidence from previous studies and the availability of data sources from the reviewed databases.

Operational definition (according to reference [4, 13–17]):

#### 1. Socio-economic and development indicators:

- Life expectancy at birth: number of years a newborn infant could expect to live if prevailing patterns of age-specific mortality rates at the time of birth stay the same throughout the infant's life.
- Human development index (HDI): a composite index measuring average achievement in three basic dimensions of human development – a long and

healthy life, knowledge, and a decent standard of living.

- Gross national income (GNI) per capita: aggregate income of an economy generated by its production and its ownership of factors of production, less the incomes paid for the use of factors of production owned by the rest of the world, converted to international dollars using PPP rates, divided by midyear population.
  - Coefficient of human inequality: average inequality in three basic dimensions of human development.
  - Urban population: de facto population living in areas classified as urban according to the criteria used by each country or area.
  - Young age dependency ratio: ratio of the population aged 0–14 to the population aged 15–64 years, expressed as the number of dependents per 100 people of working age (ages 15–64 years).
  - Total fertility rate: number of children who would be born to a woman if she were to live to the end of her child-bearing years and bear children at each age in accordance with prevailing age-specific fertility rates.
  - Adult literacy rate: percentage of the population aged 15 years and older, who can, with understanding, both read and write a short, simple statement about everyday life.
- #### 2. Maternal health indicators:
- MMR: is the number of deaths among women from any cause related to or aggravated by pregnancy or its management (excluding accidental or incidental causes) during pregnancy, childbirth, or within 42 days of termination of pregnancy, irrespective of the duration or site of the pregnancy, for every 100,000 live births in a given year or period of time.
  - Antenatal care coverage: percentage of women aged 15–49 years, who were attended at least once during pregnancy by a skilled health personnel (doctor, nurse, or midwife).
  - Births attended by skilled health personnel: percentage of births that received care from qualified medical personnel.
  - Contraceptive prevalence: the percentage of women aged 15–49 years, married or in-union, who are currently using, or whose sexual partner is using, at least one method of contraception, regardless of the method used.
- #### 3. Child health indicators:
- Under-five mortality rate: probability of dying between birth and exactly age 5, expressed per 1000 live births.
- #### 4. Disease prevention and control indicators:
- HIV prevalence, adult: Percentage of the population aged 15–49 years that is living with HIV.
- #### 5. Hygiene and environmental health indicators:

- Access to an improved water source: percentage of the population using an improved drinking water source.
  - Access to improved sanitation: percentage of the population with access to facilities that hygienically separate human excreta from human, animal, and insect contact.
6. Nutrition indicators: malnutrition proportion.
  7. Human and financial resource indicators:
    - Density of physicians (per 1000 population): number of medical doctors (physicians), including general and specialist medical practitioners, per 1000 population.
    - Health expenditure (% GDP): level of total expenditure on health (THE) expressed as a percentage of gross domestic product (GDP).

### Statistical analysis

After the data was obtained from different sources, it was compiled with excel, each variable was checked for completeness and consistency. Whenever series of data were obtained, the most recent one was used. Data was cleaned, coded, and exported to SPSS version 21 for Windows, and then exploratory data analysis carried out to check the levels of missing values, presence of influential outliers, normality, linearity, and multicollinearity. The normality of the quantitative variables was checked using the Kolmogorov-Smirnov test, and none had violated the assumption. Multicollinearity was assessed with correlation coefficient in the correlation matrix and variance inflation factor during the regression. MMR and infant mortality ratio were removed from the regression due to their collinearity with child mortality ratio. Crude birth rate was omitted due to its collinearity with total fertility and density of nurses removed due to its collinearity with density of physicians. ITN utilisation, ORS utilisation, exclusive breast feeding rate, and iodised salt coverage were removed due to having more than 15% incomplete data record.

Based on the final compiled data, descriptive analysis and binary linear relationship of both the independent and dependent variables of interest were performed. The results were presented in the form of tables and texts. Finally, by taking variables with a *p*-value of less than or equal to 0.05 a multiple linear regression model was fitted by backward stepwise procedure. All associations and tests were said to be significant at a *p*-value < 0.05.

## Results

### Description of variables

A total of 83 countries (mostly from Africa) with Low and medium human development index of less than 0.70 were included in this study. Of them 42 are low human development countries with an HDI of less than 0.55, and 41 are medium human development

countries with an HDI of 0.55–0.70. The mean HDI for low human development countries is 0.497 and ranges between 0.352 in the Central African Republic to 0.541 in Swaziland, and the mean HDI for medium human development states is 0.631, ranging between 0.550 in Pakistan to 0.699 in Moldova, which is far lower than the HDI of developed states and the global average. Many of the countries in this classification were also classified as low income and lower middle income countries by the World Bank in 2014 (Table 1).

These countries account for 3.5 billion in total population (nearly half of the world population) but their average gross national income is only 4513 (3990), which is far lower than the global average. In addition, the adult literacy rate and the proportion of urban population is lower, while the young age dependency rate, total fertility rate, and coefficient of human inequality are higher. Also, the percentage of public expenditure for health is lower, particularly in low human development countries (Table 1).

Maternal and child health coverage is low, and availability and utilisation of service is poor. On average, 35.5 ± 23% of women were using contraception. Mean ANC utilisation is 78 ± 28%, ranging from 41% in Ethiopia to 99% coverage in Moldova and Oman. There is a wider gap in skilled delivery service utilisation, which ranges from 16% in Ethiopia to 100% coverage in four countries with a mean of 63 ± 29. Twelve per cent of live births were of low birth weight, and 56 children under five years old are dying each year out of 1000 live births. Anaemia is highly prevalent among children and pregnant women in these countries. Among women the reported prevalence of anaemia during pregnancy is between 19% and 64% with a mean prevalence of 38%, and it is between 14% and 86% among children (Table 1).

The incidence of the two most epidemic communicable diseases, HIV and tuberculosis, is higher in these countries. There were 0.17 HIV infections per 1000 population with the range of 0.01–2.36 in 2014. Similarly, there were 195.4 ± 163 TB incident cases per 100,000 population. The incidence is highest in Lesotho (788 per 100,000 population) and lowest in the West Bank and Gaza at only 1 per 100,000 population. Three countries had attained improved water coverage of 100% and two countries have 100% coverage in improved sanitation. There are 0.47 ± 0.7 physicians per 1000 population within the range of 0.1–3, the highest being three physicians per 1000 population in Moldova (Table 1).

### Life expectancy at birth

Globally, life expectancy at birth has increased remarkably over the last decade in most countries. However, still there is huge discrepancy between regions, economic groups, and gender groups. Life expectancy in our case ranged from 49 years in Swazi-



**Table 1.** Description of life expectancy and health and health-related indicators among low and medium HDI countries, 2008–2017

Indicators	Mean (SD)	Range
Life expectancy	64 (6.57)	49–76
Total population	10.9 (2.5–26.8)	0.1–1311
HDI	0.55 (0.09)	0.35–0.70
GNI per capital (atlas method)	4513 (3990)	587–21517
Coefficient of human inequality	25.4 (11)	10.1–44.8
Urban population (%)	42 (17)	12–87
Young age dependency rate	66.4 (17.5)	21–107
Adult literacy rate	68.4 (24.5)	19.1–99.8
Total fertility rate	3.86 (1.36)	1.3–7.6
Contraceptive prevalence rate	35.5 (23)	4–80
ANC	78 (28)	41–99
Skilled delivery	63 (29)	23–100
Anaemia among pregnant women	38 (14)	19–64
Child mortality rate	56.3 (32)	4–157
Measles vaccine coverage	79 (18)	27–99
Low birth weight proportion	12 (5.5)	5–35
Anaemia among children	50 (18)	14–86
Vitamin A supplementation coverage	48.2 (40)	2–99
HIV incidence rate (15–49 years)	0.17 (0.3)	0.01–2.36
TB incidence rate per 100,000 population	207 (176)	1–834
Improved water coverage (%)	75 (21)	40–100
Improved sanitation coverage (%)	47.5 (28)	11–100
Malnutrition proportion	25.3 (15.7)	6.4–57.5
Ratio of physician to 1000 population	0.47 (0.7)	0.1–3
Hospital beds per 1000 population	1.4 (1.6)	0.1–6.3
Health expenditure (% GDP)	6 (2.6)	1.5–13.7

ANC – antenatal care, HDI – human development index.

land to 76 years in Vietnam, with a mean of  $64 \pm 6.57$  years. There is a much greater difference between low human development countries and countries with higher human development. Globally life expectancy is 71.6 years, while it is 79.4, 75.5, 68.6, and 59.3 years in countries that have very high human development, high human development, medium human development, and low human development, respectively. Although the highest share of mortality related to HIV and other communicable disease is in these developing countries, some countries in our list, like Vietnam and Nicaragua, had attained a similar life expectancy to developed countries (Table 1).

### Determinants of life expectancy at birth

From the binary linear regression model, it was observed that a unit increase in HDI, urban population percentage, adult literacy rate, contraceptive prevalence rate, skilled delivery service utilisation percentage, measles vaccine coverage, improved water coverage, improved sanitation coverage, physician density (ratio of physicians to 1000 population), and availability of hospital beds per 1000 population has significantly increased life expectancy. However, a unit increase in coefficient of human inequality, young age dependency rate, total fertility rate, prevalence of anaemia among pregnant mothers, child mortality rate, low birth weight proportion, prevalence of anaemia among children, HIV incidence rate (among 15–49-year-olds), TB incidence rate per 100,000 population, and malnutrition proportion significantly decreased the life expectancy within low and medium human development states (Table 2).

After controlling the effect of confounders within a multiple linear regression HDI, the adult literacy rate, contraceptive prevalence rate, young age dependency rate, total fertility rate, child mortality rate, HIV incidence rate (among 15–49-year-olds), and TB incidence rate per 100,000 population were associated with life expectancy. A unit increase in HDI is associated with a 0.31 (2.98, 38.6)-year increase in life expectancy, a unit increase in adult literacy rate is associated with a 0.38 (0.21, 0.531)-year increase in life expectancy, and a unit increase in contraceptive prevalence rate is associated with a 0.386 (0.036, 0.50)-year increase in life expectancy. Also, a unit increase in young age dependency rate, total fertility rate, child mortality rate, HIV incidence rate (among 15–49 years), and TB incidence rate per 100,000 population were associated with a 0.717-, 0.85-, 0.675-, 0.3-, and 0.176-year decline in life expectancy, respectively (Table 2).

### Discussion

This study aimed to assess the linear relationship between socio economic indicators, health indicators, and disease burden indicators with life expectancy

**Table 2.** Determinants of life expectancy among low and medium HDI countries, 2008–2017

Indicators	Life expectancy				
	Bivariate regression		Multiple variable regression		
	<i>B</i>	<i>P</i> -value	<i>B</i>	95% CI	<i>P</i> -value
Total population	0.087	0.43			
HDI	0.7	< 0.001	0.31	2.98, 38.6	0.024
GNI per capital (atlas method)	0.185	0.093			
Coefficient of human inequality	−0.37	0.001			
Urban population (%)	0.25	0.022			
Young age dependency rate	−0.6	< 0.001	−0.717	−0.45, 0.133	0.001
Adult literacy rate	0.33	0.002	0.38	0.21, 0.531	0.001
Total fertility rate	−0.61	< 0.001	−0.85	−0.975, −2.25	0.001
Contraceptive prevalence rate	0.473	< 0.001	0.386	0.036, 0.20	0.006
ANC	−0.02	0.86			
Skilled delivery	0.3	0.006			
Anaemia among pregnant women	−0.48	< 0.001			
Child mortality rate	−0.82	< 0.001	−0.675	−0.19, −0.9	< 0.001
Measles vaccine coverage	0.314	0.004			
Low birth weight proportion	−0.31	0.016			
Anaemia among children	−0.57	< 0.001			
Vitamin A supplementation coverage	−0.4	< 0.001			
HIV incidence rate (15–49 years)	−0.47	< 0.001	−0.3	−6.7, −1.9	0.001
TB incidence rate per 100,000	−0.3	< 0.001	−0.176	0.014, 0.001	0.023
Improved water coverage (%)	0.282	0.01			
Improved sanitation coverage (%)	0.622	< 0.001			
Malnutrition proportion	−0.31	0.005			
Density of physician to population	0.485	< 0.001			
Hospital beds per 1000 population	0.36	< 0.001			
Health expenditure (% GDP)	0.013	0.91			

ANC – antenatal care, HDI – human development index.

among 83 countries having low and medium human development index. Accordingly, it was shown that the countries have a shorter life expectancy, higher disease burden, and poorer economy. However, a significant improvement in life expectancy was observed in the last few years. Life expectancy in our case ranged from 49 years in Swaziland to 76 years in Vietnam with a mean of  $64 \pm 6.57$  years, and it is largely determined by HDI, adult literacy rate, contraceptive prevalence rate, young age dependency rate, total fertility rate, child mortality rate, HIV incidence rate (among 15–49-year-olds), and TB incidence rate per 100,000 population.

This indicates that the possible influencing factors for prolonging life (living longer) go beyond routinely studied healthcare system-related variables. A wide

variation of life expectancy was observed among different countries having different levels of human development, which urges countries to design comprehensive intervention that acknowledges the potential effect of the aforementioned variables for improving health and prolonging life. The finding was also supported by many other studies [18–21]. The differences in life expectancy between developed and developing countries witness the effect of human development, socio-economic variables, and health-related factors [4, 18, 21].

It has long been known that socio-economic factors are the major determinants of life expectancy in both developing and developed countries [20, 21]. As a composite measure of healthy life, knowledge and standard of living; human development index is commonly used

in current situation. According to our study, HDI is significantly related to increased life expectancy in low and medium human development countries. In line with our findings, other studies supported this [18–21]. This could be due to the fact that countries with higher human development index are those with higher gross national income, a strong health care system, and with a highly educated community. Therefore, the government expenditure for health is likely to be higher, the purchasing capacity of the citizens will be higher, and overall quality of life will be improved, which helps people to live longer.

The other socio-economic variables that determined the life expectancy of the citizens were: young age dependency rate and adult literacy rate. For a unit increase in young age dependency, life expectancy is reduced by 0.717 years. This relationship was also drawn from previous studies [19, 20]. This is because young age populations are the largest population group in developing countries; if they are economically dependent, attainment of healthy living, which is the basis for increased life expectancy, may not be attained [10–13]. On the other hand, the adult literacy rate, which is one source of income, has positively improved life expectancy in the studied countries. Since education is the backbone of every development indicator variable, its contribution to improved life expectancy has been reported from previous studies [20].

Healthcare system-associated variables are the other contributors to life expectancy in this research. In line with a survey conducted by the WHO, total fertility rate and contraceptive prevalence rate were found to be significantly associated with the observed life expectancy in the study area [18, 22]. Thus, total fertility rate is negatively associated with life expectancy. This could be due to the fact that the risk of complications and related maternal and child death is proportional to the number of pregnancies a woman will have. This premature loss in turn with other contributors shortens the life expectancy. Similarly, contraceptive prevalence rate is significantly and positively associated with life expectancy. This finding was also reported in previous studies [18, 20, 22].

The other determinants of life expectancy are classified as the burden of common communicable diseases like HIV/AIDS and tuberculosis. Morbidity levels for relevant conditions in a population significantly influenced life expectancy. HIV incidence rate (among 15–49-year-olds) and tuberculosis incidence rate per 100,000 populations is negatively and significantly related with life expectancy. The pandemicity of these major communicable diseases in developing countries has contributed significantly to premature death and declined the economic system substantially, and in turn contributed to the decline in life expectancy [20–23].

Similarly to the overall effect of child health care, child mortality rates in the countries were highly related to the life expectancy of the country. This is mainly due to the weight of life lost due to premature death among children. Therefore, even though the absolute number of deaths recorded among children is lower, their relative contribution for the lost life will become larger. For this reason, our research showed that child mortality negatively affects the life expectancy within low and medium human development index countries [21].

However, variables like the percentage of health expenditure from GNI, physician density (ratio of physicians to 1000 population), and improved water and sanitation coverage were not significantly related with life expectancy. The difference ascribed to the share of health expenditure was also reported in another study [20, 21].

## Conclusions

Countries that have low and medium human development have a lower life expectancy than the developed states. Even though a remarkable improvement has been observed in the last few decades through comprehensive healthcare improvement and economic development, still the loss of life is higher in developing countries. It is determined by many factors: socio-economic factors (HDI, adult literacy rate, young age dependency rate, and total fertility rate), health care system factors (contraceptive prevalence rate and child mortality rate), disease burden (HIV incidence rate (among 15–49-year-olds) and TB incidence), and their complex interactions. Therefore, policy and programs targeted to improve life expectancy should consider population dynamics, socio-economic influence, and health system factors that pose a major risk on child health, maternal health, and global health in general.

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## Conflict of interest

The authors declare no conflict of interest.

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