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Predicting the role of socio-economic indices for the Human Development Index based on a multivariate regression model

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Abstract

Background Social and economic indicators of countries at the global level can reveal both weak and strong achievements concerning specific countries on a wide range of indices. The purpose of the present study was to investigate the correlations between social and economic indicators and the Human Development Index (HDI), a summary composite measure of a country's average wellbeing.

Methods Secondary analysis was conducted between April and July 2022. Six variables of the HDI (i.e., the Gini Coefficient Index [GCI], Multidimensional Poverty Index [MPI], Research and Development Percentage Index of gross domestic product [R&D], infant mortality rate (IMR), and Gender Development Index [GDI]) were investigated across 189 countries in six continents. Data were analyzed using a multivariate regression model.

Results The average HDI in the countries of the world was equal to 0.72 (SD ± 0.14), with the highest HDI score in Europe (0.87 ± 0.06; $p < .001$). Europe also had the highest R&D (1.34 [SD ± 1.02]; $p < .001$) and GDI indicators (0.98 [SD ± 0.02]; $p < .001$). Africa had the highest infant mortality (41.62 [SD ± 18.93]; $p < .001$) and highest MPI (0.230 [SD ± 0.166]; $p < .001$). America had the highest GCI (44.10 [SD ± 6.27]; $p < .001$). Findings indicated that countries with a higher HDI had better social and economic indicators ($p < .001$). There was a correlation between all selected indices with the HDI. The highest (negative) correlation was observed between IMR and HDI ($r = -0.885$). The multivariate regression model showed IMR and the MPI were significant predictors of HDI and explained 84.7% of variance.

Conclusion The two country indicators of IMR and MPI are good predictors of a country's HDI.

Keywords Human Development Index · Socio-economic indicators · Infant mortality · Multivariate regression model

1 Introduction

One of the most common criteria for measuring development in countries is the Human Development Index (HDI) [1]. The HDI, one of the composite indicators of human potential level and quality of life, is a combination of three dimensions: life expectancy at birth (a key health indicator using the Life Expectancy Index), the number of years of education and the expected number of years of education (using the Education Index), and standard of living (using the Gross National Income Index). Economic benefits are expressed as gross domestic product (GDP) [2]. The HDI is currently widely used as an indicator of the development status of countries [3] and to evaluate the happiness and quality of human life [4]. Before the 1990s, economic performance was considered the main indicator of development

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for countries [5]. However, GDP and economic performance alone are insufficient to compare countries' levels of development due to lack of attention to the quality of development and the fair provision of living opportunities for individuals [6]. Indeed, the increase in economic growth of a country may not necessarily mean improvement in health and education, or fair distribution of economic growth benefits among the population which means there might be some kind of inequity in the use of available facilities [7]. Therefore, the United Nations introduced the HDI in 1990 and declared this index would be both constructive and useful.

Originally, the HDI focused on economic factors but has been optimized many times over the years [8]. Therefore, in addition to paying attention to the economic growth at country level, the HDI includes education and life expectancy to emphasize the expansion of human capacities, capabilities, and livelihood options in society [9]. The human development paradigm emphasizes simultaneous basic issues including human empowerment, how individuals use their abilities to function better in society, and how individuals choose between options they have in all aspects of their lives [10]. The HDI provides a summary composite measure of a country's average achievements in three basic aspects of human development: long and healthy life (with indicator of life expectancy at birth), knowledge (with indicators of expected years of schooling and mean years of schooling), and a decent standard of living (with indicator of gross national income [GNI] per capita). Therefore, the HDI includes both economic criteria and indicators assessing social progress to evaluate the development of a country [11]. Moreover, the HDI is a specific socio-demographic measure at country level including the key indicators of human development [12].

The HDI has been used in different areas: (i) it has helped the World Health Organization (WHO) to develop various strategies to increase life expectancy; (ii) it is a useful index to classify the risk of disease and mortality at international level (e.g. women in countries with low HDI are 2–3 times more at risk of illness and have decreased life expectancy); and (iii) its use is increasingly widespread in the medical literature, where very high HDIs are representative of countries with more resources (e.g., better economies, skilled workforce, etc.) [13]. Overall, the HDI emphasizes countries' contributions to overall human well-being and focuses attention on improvement needs, and is therefore valuable [14]. The HDI is easily calculated, accessible, and is an important indicator of social and economic impact across the world [15]. The novel contributions of the present study include the examination of (i) the HDI by geographical continent, (ii) the role of important socio-economic indicators and their relationship with the HDI, and (iii) which indicators have a predictive role for human development.

However, it may have some limitations. One of the main proposed weaknesses of the HDI is underestimating the inequalities and injustices within a country, which limits its use as one of the most important indicators of human development. Consequently, other social and economic indicators were introduced to fill this gap. Therefore, it has been recommended that the HDI should be complemented with other indicators related to socio-economic cohesion and development strategies [16]. The Gini Coefficient Index, Multidimensional Poverty Index, research and development expenditure, infant mortality rate, and Gender Development Index (GDI) are among these socio-economic indicators which are used worldwide for better configuring countries' socio-economic profiles.

There is now a global consensus that poverty is a multifactorial phenomenon. The most widely used index for poverty globally is the Multidimensional Poverty Index, which has made a significant contribution to the discussion of measuring the dimensions of poverty. However, it suffers from weaknesses such as the inability to capture inequality between the poor and within-household inequalities [17]. Based on the analysis of socio-economic variables such as life expectancy, per capita income, and education, they have been shown to be positively and significantly associated with human development. Therefore, policymakers and stakeholders should focus on programs and policies that provide important and structured insights into improving the Human Development Index [18].

A study by Almasi et al. [19] showed that infant mortality occurs more in developing countries than developed ones. There is also a significant inverse association between the HDI score and the infant mortality rate. Therefore, the average annual percentage change in the HDI score is also associated with the infant mortality rate [19]. Evidence also shows that the HDI score in Iran increased by 12% from 2005 to 2016, and along with it, the infant mortality rate decreased by 52% during the same period [20]. The results of another study showed that the urbanization rate and increased share of government health expenditure in GDP had an inhibiting effect on the infant mortality rate, while inequality in income distribution worsens the health situation and increases the infant death rate. Therefore, the association between the HDI score and infant mortality has been empirically confirmed. Increasing economic growth and, along with it, better access to health services for individuals in the community leads to decreased child mortality [21].

The Multidimensional Poverty Index (MPI) is a very important index. In Africa, an improving score on this index results in improved health for women and children [22]. This index identifies multidimensional poverty and provides an assessment of the current poverty situation of a country or region for policymakers in the direction of planning [23].

1.1 Aims of the present study

The present study aimed to (i) assess the correlation between countries selected social and economic indicators with their HDIs; and (ii) explore the role of countries selected social and economic indicators in predicting the total HDI score.

2 Methods

2.1 Study design

The study comprised secondary analysis of pre-existing datasets available on the United Nations and World Health Organization's website. These datasets are freely available from https://hdr.undp.org/data-center/human-development-index#/indicies/HDI and https://worldpopulationreview.com/country-rankings/how-many-countries-are-there.

2.2 Eligibility criteria and sampling procedure

The only inclusion criteria in the study were the completeness and availability of the data for countries' HDI scores. Based on the data available on the abovementioned websites, HDI scores and information regarding selected social and economic indicators (including GINI Coefficient Index, Multidimensional Poverty Index, research and development expenditure, infant mortality rate, and Gender Development Index [GDI]) were available for 189 countries out of total 206 independent countries (the number of countries recognized by the United Nations). Data were collated from 44 countries in Europe, 43 countries in Asia, 54 countries in Africa, 35 countries in America, and 13 countries in Oceania. Countries with incomplete data regarding selected study variables were excluded. The data regarding the selected indicators in 2022 were collected by two expert researchers from 15 May to 15 June within a period of one month. Where possible, the most up-to-date and latest data in each indicator was examined.

2.3 Measures

The data from six indicators were collected including (i) HDI, (ii) GINI Coefficient Index (GCI), (iii) Multidimensional Poverty Index (MPI), (iv) research and development expenditure (as a percentage GDP [R&D]), (v) infant mortality rate (IMR), and (vi) Gender Development Index (GDI).

- HDI: This composite index measures average achievement in three basic dimensions of human development (i.e., life expectancy, educational knowledge, and standard of living). Scores range from 0 to 1 (which is multiplied by 100 and expressed as a percentage). Higher scores indicate countries' higher position in terms of welfare and health.
- GCI: This index measures the deviation of the distribution of income among individuals or households within a country from a perfectly equal distribution to absolute inequalities in a range of 0 to 100. A score of 0 indicates absolute equality and a score of 100 indicates absolute inequity.
- MPI: This index measures the percentage of the population that is multi-dimensionally poor adjusted by the intensity of deprivation. Scores range from 0 to 1 (also presented as 0%–100%). A score of 0 indicates no deprivation and a score of 1 indicates complete deprivation.
- R & D expenditure: This measures the current and capital expenditures (both public and private) on creative work undertaken systematically to increase knowledge, including knowledge of humanity, culture and society, and the use of knowledge for new applications. Research and development cover basic research, applied research, and experimental development. The score in this index shows the percentage of the country's spending on development and research from the GDP which is represented from 0% to 100%. The higher the percentage, the more the country devotes their budget to development and research.
- GDI: This index measures the ratio of female to male HDI scores. It is a composite index measuring average achievement in the three basic dimensions captured in the Human Development Index—a long and healthy life, knowledge,

and a decent standard of living— adjusted to account for inequalities between males and females. The ratio is calculated as female HDI to male HDI. A score equal to 1 indicates development equality between genders, while scores further from 1 have less development equality between genders. A score equal to 1 indicates equal development between the sexes, while scores below 1 mean more gender development in men and scores above 1 mean more gender development in women.

- IMR: This measures the infant mortality rate infant per 1,000 live births (i.e., the probability of dying between birth and one year expressed per 1,000 live births).

For the HDI, the data of 189 countries were available. For the IMR, the data of 187 countries were available. For the MPI, the data of 109 countries were available. For R&D, the data of 136 countries were available. For GDI, the data of 167 countries were available. Finally, for the GCI, the data of 152 countries were available.

2.4 Statistical analysis

Data were analyzed using SPSS software (version 25). Means and standard deviations (SDs) were used to describe continuous variables. Frequencies and percentages were used to describe categorical variables. Inferential statistics including Pearson's correlation coefficient, independent *t*-test and analyses of variance (ANOVAs) were used. Countries were categorized into two categories of high and low HDI based on the median of HDI for included countries which was 0.74 in a range of 0–1 (a higher HDI score basically means better health and wealth at country level).

To assess the predicting role of selected indicators for HDI, multivariable linear regression models were applied. The assumptions of linear regression model were confirmed (i.e., normal distribution of dependent variables, absence of outliers, variance inflation factor [VIF] < 5, and tolerance < 1 for all variables). In the linear regression, HDI was set as the dependent variable and the selected indicators were independent variables entered to the model using the stepwise approach. A *p*-value of < 0.05 was set as the significance level for all tests. The value of the Durbin-Watson Index in the study was 1.96, which indicates the absence of autocorrelation in the data. Moreover, the value of the VIF was 2.668 and the tolerance was 0.375.

2.5 Ethical consideration

The study protocol was according to the guidelines of the Declaration of Helsinki and approved by Institutional Review Board and the Ethics Committee in Biological Research affiliated to Qazvin University of Medical Sciences (Ethical code: IR.QUMS.REC.1400.339).

3 Results

A total of 189 countries (based on having available and complete data on HDI scores) were included. For the selected variables, the highest data availability was for the IMR with 187 countries and the lowest data availability was for MPI data with 109 countries (Table 1). The average HDI in the countries of the world was 0.72 (SD ± 0.14), and the average IMR in the world was 21.35 (SD ± 19.18). The means and standard deviations of other variables are shown in Table 1.

Table 1 Table of frequencies, means and standard deviations of study variables

Variable	HDI	IMR	MPI	R&D*	GDI*	GCI
Valid N (missing)	189 (0)	187 (2)	109 (80)	136 (53)	167 (22)	152 (37)
Range	0.39–0.95	1.40–84.50	0–0.60	0–5	0.48–1.06	24.20–63
Mean (SD)	0.72 (0.14)	21.35 (19.18)	0.13 (0.15)	0.81 (0.97)	0.93 (0.07)	38.22 (7.81)
Median (IQR)	0.74 (0.23)	14 (26)	0.07 (0.23)	0.50 (0.98)	0.96 (0.08)	36.95 (10.15)

HDI Human Development Index, *IMR* infant mortality rate, *MPI* Multidimensional Poverty Index, *R&D* research and development expenditure, *GDI* Gender Development Index, *GCI* Gini Coefficient Index

*Explanation: The scores of two indicators (GCI and R&D) are in percentages

There were significant correlations between most of the study variables and the HDI (Table 2). The highest (negative) correlation was observed between IMR and HDI ($r = -0.885$). Table 2 shows the correlation of the other variables with each other.

3.1 Inter-continent comparison of study variables

The mean and standard deviation of the study variables HDI, GCI, MPI, GDI, R&D and IMR based on related continents are shown in Table 3. Europe compared to other continents had the highest mean scores on (i) HDI (0.87 [SD = 0.06]; $p < 0.001$, (ii) R&D (1.34 [SD = 1.02]; $p < 0.001$), and (iii) GDI (0.98 [SD = 0.02]; $p < 0.001$). Africa compared to other continents had the highest mean scores on (i) IMR (41.62 [SD = 18.93]; $p < 0.001$) and MPI (0.230 [SD = 0.17]; $p < 0.001$). Finally, America compared to other continents had the highest average score on GCI (44.10 [SD = 6.27]; $p < 0.001$).

3.2 Comparison of study variables in high and low HDI countries

All study variables including HDI, GCI, MPI, GDI, R&D and IMR were significantly in a worse condition in the countries with low HDI scores compared to countries with high HDI scores (Table 4).

3.3 Predictors of HDI

The multivariable linear regression model showed a significant and positive relationship between the HDI and the IMR and the MPI (Table 5). Each unit increase in the IMR score reduced the score of the HDI score by − 0.003. Also, a unit increase in the MPI led to a 0.38% decrease in HDI score. In total, these two socio-economic indicators (IMR and MPI) explained 84.7% of HDI score variance.

4 Discussion

The Human Development Index (HDI) is a composite measure of various factors such as health, education, and living standards. It is used as a key indicator of the overall well-being of a population. However, it is also influenced by other variables such as infant mortality, GINI coefficient, Multidimensional Poverty Index, and the Gender Development Index. Understanding the associations between these variables and the HDI can help policymakers to identify areas for improvement of actions among human populations and prioritize interventions to promote human development. The present study aimed to determine the associations between HDI with selected national social and economic indicators (including GINI, MPI, R&D expenditure, IMR, and GDI). The results indicated a significant correlation between selected indicators and the HDI. The highest (negative) correlation coefficient was between the IMR and HDI. Two of the socio-economic indicators (IMR and MPI) explained 84.7% of variance in HDI score. Based on these results, it can be inferred that IMR and MPI can provide a good description of the economic and social wellbeing of countries and can be used as proxy measures for the HDI.

Table 2 Study variables' inter-item correlation coefficients

Variables	Inter-item Pearson correlation coefficients					
	1	2	3	4	5	6
1. Human Development Index (HDI)	1	−0.885**	−0.871**	−0.588**	0.619**	−0.421**
2. Infant mortality rate (IMR)		1	0.791**	−0.431**	−0.606**	0.410**
3. Multidimensional Poverty Index (MPI)			1	−0.142	−0.519**	0.151
4. Research and development expenditure (R&D)				1	0.222*	−0.350**
5. Gender Development Index (GDI)					1	−0.039
6. GINI Coefficient Index (GCI)						1

**Correlation is significant at the $p < 0.01$ level (two-tailed)

*Correlation significant at the $p < 0.05$ level (two-tailed)

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Table 3 Variance analysis of study variables in different continents in the world

Continents	HDI		IMR		MPI		R&D*		GDI		GCI*	
	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)
Europe	44	0.87 (0.06)	43	4.51 (3.76)	7	0.002 (0.002)	41	1.34 (1.02)	42	0.98 (0.02)	40	31.69 (4.20)
Asia	43	0.73 (0.12)	42	18.14 (13.67)	28	0.083 (0.092)	35	0.84 (1.23)	42	0.91 (0.10)	31	34.99 (4.27)
Africa	54	0.56 (0.11)	54	41.62 (18.93)	48	0.230 (0.166)	33	0.36 (0.24)	49	0.89 (0.06)	49	42.29 (7.82)
America	35	0.76 (0.07)	35	14.13 (8.68)	21	0.037 (0.049)	23	0.47 (0.63)	29	0.97 (0.03)	22	44.10 (6.27)
Oceania	13	0.69 (0.12)	13	22.72 (12.68)	5	0.095 (0.099)	4	0.90 (0.89)	5	0.95 (0.03)	10	41.50 (7.62)
Total	189	0.72 (0.14)	187	21.35 (19.18)	109	0.134 (0.150)	136	0.81 (0.97)	167	0.93 (0.07)	152	38.22 (7.81)
ANOVA statistics	F: 60.68; $p < .001$		F: 52.51; $p < .001$		F: 13.48; $p < .001$		F: 6.49; $p < .001$		F: 13.82; $p < .001$		F: 24.65; $p < .001$	

HDI Human Development Index, *IMR* infant mortality rate, *MPI* Multidimensional Poverty Index, *R&D* research and development expenditure, *GDI* Gender Development Index, *GCI* Gini Coefficient Index

* The scores of two indicators (GCI and R&D) are in percentages

Table 4 Mean (SD) of studied variables in countries with high and low Human Development Index

Variable	Country HDI	N	Mean (SD)	Mean difference [95% CI]	*t*-statistic and *p* value
IMR	Low	95	34.88 (17.93)	27.50 [23.64; 31.36]	14.05 (2), $p < .001$
	High	92	7.30 (5.61)		
MPI	Low	82	0.173 (0.153)	0.155 [0.095; 0.215]	5.16 (80). $p < .001$
	High	27	0.017 (0.049)		
R&D	Low	55	0.28 (0.24)	−0.88 [−1.19; −0.58]	−5.82 (53). $p < .001$
	High	81	1.17 (1.11)		
GDI	Low	83	0.90 (0.08)	−0.07 [−0.09; −0.05]	−7.15 (22). $p < .001$
	High	84	0.97 (0.03)		
GCI	Low	79	40.97 (7.66)	5.71 [3.37; 8.05]	4.82 (37), $p < .001$
	High	73	35.25 (6.87)		

HDI: Human Development Index, IMR: Infant mortality rate, MPI: Multidimensional Poverty Index, R&D: Research and development expenditure, GDI: Gender Development Index, GCI: Gini Coefficient Index

Table 5 Results of multivariable linear regression models presenting predictors of Human Development Index

Predictors	Unstandardized coefficients		Standardized beta coefficients	*t*	*P*
	B (95% CI)	SE			
	HDI				
IMR	−0.003 (−0.004; −0.002)	0.001	−0.494	−8.029	$p < .001$
MPI	−0.383 (−0.481; −0.286)	0.049	−0.480	−7.797	$p < .001$
Model summary	$R = 0.922$; $R^2 = 0.850$; Adjusted $R^2 = 0.847$				

HDI Human Development Index, *IMR* infant mortality rate, *MPI* Multidimensional Poverty Index

Reducing IMR is a key goal of global health initiatives. Several studies have found a strong negative association between infant mortality and HDI score [24]. Infant mortality is clearly one of the most important indicators of the health and well-being of a population. High infant mortality rates can be caused by various factors, including poor access to healthcare, inadequate nutrition, and poor hygiene. In many cases, infant mortality is a reflection of broader patterns of poverty and inequality in a society [25]. Poverty is also another vital factor in human development, and reducing poverty is another key goal of global development plans. One study showed a negative association between poverty and HDI score [26]. MPI is a broader scale of poverty that takes into account multiple dimensions of deprivation, including health, education and standard of living. The MPI provides a more nuanced understanding of poverty because it takes into account multiple factors that contribute to poverty and deprivation [27].

Infant mortality and MPI score are closely related because poverty and deprivation are major contributors to high infant mortality rates. In many cases, poor families may lack access to basic healthcare services, adequate nutrition, and safe living conditions, all of which can lead to poor health outcomes for infants. Consequently, reducing poverty and improving access to basic resources and services are necessary to improve infant health and reduce infant mortality rates [28]. Therefore, the results of other studies are consistent with the results of the present study.

In the present study, social and economic indicators were compared at the continent level. Europe had the highest significant mean scores on the HDI, R&D, and GDI compared to other continents. Africa had the highest significant mean scores on IMR and MPI compared to other continents. America had the highest significant mean score on GCI compared to other continents. At the country level, selected indicators (e.g., GDI and R&D) were significantly lower in the countries with low HDI compared to high HDI countries These results are in line with previous studies reporting that European countries have better social and economic indicators compared to African countries in terms of health status [29, 30]. In a study conducted in Austria, the results showed that individuals with a lower social and economic status suffered more from disease (in general), something that was also observed in during the COVID-19 epidemic [31]. In short, individuals from lower economic and social levels (i.e., lower economic and educational levels and deprived areas) have increased chances of contracting diseases (including COVID-19).

The results of a previous study showed that there was a significant inverse relationship between per capita health expenditure and both human health resource indicators and infant mortality [32]. Therefore, economic growth and health financing policies have a positive effect on reducing infant mortality and, consequently, increasing HDI score

[33]. Therefore, developing and implementing policies to increase vaccination rates, in addition to increasing the number of screening tests, will likely increase the efficiency of countries in promoting the health of individuals in the community and reducing infant mortality and in line with increasing life expectancy [34].

Evidence also indicates that the MPI score is related to traditional monetary poverty measures by capturing acute deprivations such as educational deprivation and expresses the deprivations of a country or a region [35]. Consequently, the MPI is a strong tool for achieving sustainable development goals. At the global level, the MPI is an excellent tool for measuring and monitoring poverty that definitively determines the pace and progress in sustainable development goals [36].

In addition, the results of a study showed that more than 80% of countries have reduced multidimensional poverty. However, progress in sub-Saharan Africa has been very limited [37]. Various analyses show that poverty reduction is mainly related to health decline and health deprivation. The findings of another study [38] showed that to significantly reduce poverty levels, three independent variables should be considered, namely, improving the level of education and literacy, improving health-oriented policies, and increasing GDP. Moreover, operational measures such as health education for mothers, job creation, and reducing unemployment should be included in government policies. In countries with high income and appropriate economic growth, equitable distribution of income and health centers are among the factors that improve the health status of the community [39].

Research has shown that education and improving the level of health knowledge of mothers are significantly associated with infant mortality, and that mothers with lower education have higher infant mortality [40]. Therefore, the results show that inequality plays an important role in determining the health status of different populations in the world and more efforts should be made for programs to combat inequality and promote justice (in relation to equality and non-discrimination) in societies. Government health spending and the consequent increase in life expectancy and reduction in infant mortality positively affect the HDI score and each of its components. Therefore, government health spending can target human development and improve the well-being of citizens by allocating more resources to healthcare [41].

Therefore, based on the evidence presented, governments can reduce mortality and improve the health of the community by educating the community about health education, improving literacy, trying to distribute income more equally across society by helping low-income households, improving knowledge and awareness among mothers of pregnancy care, allocating more resources to healthcare (including equipping health centers with maternal and infant care equipment, hiring more health personnel), making healthcare services more available, and introducing supportive government policies such as distribution of nutritional supplements for pregnant mothers.

In a study by Tjepkema et al. [42], the proportion of socio-economic inequality in mortality was different based on the index of socio-economic status (education, occupation or income), age group, sex, and cause of death. This suggests that education, occupation, and income are each independently associated with mortality and are not simply proxies for each other. Therefore, when assessing socio-economic inequalities in mortality, using different indicators of socio-economic status can provide a more complete picture. Moreover, many studies have indicated that child mortality and the subsets of indicators in the MPI (e.g., health and nutrition) are the most important determinants of human development, and these results were consistent with the findings of the present study.

Although IMR, MPI, R&D, GDI, and GCI scores were all significantly correlated with HDI, only IMR and MPI were strong predictors of HDI in the regression analyses. Other socio-economic indicators can also have a significant impact on infant mortality and the MPI score, with an impact on the sub-sets of MPI, education, and nutrition. Therefore, other socio-economic indicators can indirectly effect on human development at the global level (e.g., educating mothers on health and reducing infant mortality, paying more attention and investing in health in deprived areas and reducing infant mortality). For example, educating mothers and improving the nutrition of pregnant mothers and increasing pregnant mothers' access to health services, and increasing equality in the use of services can affect the reduction of infant mortality. Therefore, other study indicators can indirectly affect HDI score.

4.1 Limitations

The present study has some limitations. First, the data were cross-sectional and extracted from secondary datasets, which at best can only describe associations between variables and not causal relationships. Second, not all the data from all the countries in the world were available. Therefore, only the countries that had data were included in the analysis.

5 Conclusion

The results of the present study showed that the European continent had the highest scores on key wellbeing indices than other continents in the majority of the investigated indicators, and that the African continent had the lowest indices scores on the selected indicators. Also, the results of the study showed that like the HDI, infant mortality and the MPI are good indicators of a country's welfare and health status.

Based on the results of the present study, the IMR and MPI had almost equal power (based on the beta co-efficient scores), and the IMR and MPI appear to provide a good description of the economic and social wellbeing of countries and could be used as proxy measures for the HDI. Each unit increase in the IMR reduced the HDI score by − 0.003. Also, a unit increase in the MPI led to a 0.383% decrease in HDI score. In total, the IMR and MPI predicted almost 85% of the HDI score. Based on these findings, infant mortality and poverty are important measures of human development that provide insight into the well-being of individuals and societies.

Addressing the root causes of poverty and deprivation is necessary to reduce infant mortality and improve the overall health and well-being of communities. Understanding the associations between these variables and the HDI is very important in improving human development outcomes. Essential strategies for developing countries include the following: educating pregnant mothers to improve their health status, preparing and distributing essential supplements (such as iron supplements, folic acid, and vitamin D) to ensure proper nutrition for pregnant women, paying more attention to mothers and children in deprived areas to prevent malnutrition by implementing supportive policies, and increasing access to health services for women in deprived areas. Essential strategies that have been implemented by developed countries include the following: prevention of congenital anomalies with genetic screening to detect a problem, moving towards prenatal and antenatal care for mothers, encouraging increased participation of mothers in regular visits to health centers, screening children to identify potential problems, and encouraging mothers to visit and follow-up on their health status during pregnancy.

Policymakers can use of these strategies to identify areas for improvement and prioritize interventions. It should also be noted that developing countries are different from developed countries due to their poor economic situation and lower level of education. Developed countries with more adequate per capita income and higher level of education have lower infant mortality rates. Therefore, global attention to poverty indicators and higher level of education can help developing countries more. Health problems in developing and developed countries are different, and each of these two types of country must pursue specific strategies tailored to their circumstances.

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Data availability The study comprised secondary analysis of pre-existing datasets available on the United Nations and World Health Organization's website. These datasets are freely available from https://hdr.undp.org/data-center/human-development-index#/indicies/HDI and https://worldpopulationreview.com/country-rankings/how-many-countries-are-there.

Declarations

Competing interests The authors declare no competing interests.

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