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Original Article

Sustainable Development Goals and Health in Islamic Countries

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Abstract

Background: We aimed to reveal the relationship between the Sustainable Development Goals (SDGs) and health indicators in Organization Islamic Countries (OIC).

Methods: The panel data method was used in the analyses, health indicators as independent variables belonging to 16 Islamic countries with regular data from 2008-2021, and the SDG score as the dependent variable was considered.

Results: A one-unit increase in maternal mortality reduced the SDG score by 0.0047 units, a one-unit increase in neonatal mortality reduced the SDG score by 0.27 units, besides these results no significant relationships were found between U5mort, NCD mort, TB, VAC variables, and SDG score ($P>0.05$). Granger causality analysis results showed different causal relationships and variance decomposition results show that the long-term explanatory effect of health indicators on the SDG score by approximately 23%.

Conclusion: According to the empirical evidence obtained from the research, improvements in health indicators especially focused on mother and child health positively affect the SDG score in the countries examined.

Keywords: Sustainable development goals; Health indicators, Mortality; Islamic countries

Introduction

A universally accepted definition of sustainable development is vital to effective SDG policies. While this concept may differ across countries and cultures, it must take into account future sustainability. The 1987 World Commission on Environment and Development defines SDG as meeting present needs without compromising the ability of future generations to meet their own needs (1). Meeting needs across generations is complicated by unequal resource distribution and subjective needs related to living standards. For example, in Somalia, access to clean water and basic food is essential, while 72 million Americans today are obese (2). This raises the problem of sustainability of resources as population increases and production-consumption relationships change. For example, agriculture significantly increases the carbon footprint (3). Economic developments over the past 150 years, particularly since the Industrial Revolution, have significantly accelerated greenhouse gas emissions, leading to unprecedented temperature increases (4). Climate change and frequent natural disasters pose a global threat, requiring a shift from hu-

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man-centered thinking to an ecosystem-based approach where all life forms are interconnected. Sustainability efforts initiated by the United Nations in the 1970s have evolved into the Millennium Development Goals and later the 17 SDGs with 169 targets (5,6).

These goals aim to promote human rights, education, gender equality, poverty reduction and sustainability in economic, social and environmental dimensions. Progress on the SDGs is monitored annually through reports that include data, trends and scores to assess the achievement of these goals over time (7). Income, education, and health are crucial factors shaping human capital, which drives development. South Korea, known for its economic success, highlights the impact of education, industrialization, and technology (8). Education enhances workforce skills and productivity, while health improves educational outcomes and economic contributions (9). Good health was reported to have positive effects on growth and productivity (10). For example, each additional year of life expectancy a country gains through health improvements could generate a 4% increase in GDP (11). Healthy social structures support productivity across generations. SDG Goal 3 focuses on health and well-being, including child mortality, maternal mortality, and non-communicable diseases. In 2021, the Goal 3 score is over 80 in (High Income Countries) HIC and UMIC (Upper-Middle Income Countries), and below 42 in (Low Income Countries) LIC-LMIC. Efforts to achieve the SDGs positively impact health and reduce mortality rates (12,13).

Research on OIC countries often focuses on socioeconomic structures but neglects the impact of health on economic development. Existing literature generally emphasizes women's and children's health in low-income countries. In Nigeria, maternal factors affect neonatal deaths, while prenatal care helps reduce them (14). Improving newborn health benefits development in Kenya, Nepal, Honduras, and Ethiopia (15). In Burundi, wealth, education, and urban living improve survival for women and newborns (16). In this study to reveal the relationship between the SDG and health indicators in OIC countries, selected due to their shared socio-economic and cultural factors impacting health policies. These countries face structural challenges in achieving SDG 3, including healthcare access disparities and economic constraints. Extending this research to OIC countries could offer valuable insights into how health factors intersect with economic development across different cultural and economic contexts. This shift in focus may lead to more comprehensive strategies for promoting sustainable development in these nations. Accordingly, this study aimed to explore the relationship between sustainable development and health indicators in OIC countries, with the main hypothesis being:

H_1: Health indicators and SDG are related in OIC.

In the literature focus on projections, scenarios and relational evaluations regarding the SDG and health (17-19). This research aimed to contribute to the existing literature by providing empirical evidence and quantitative analysis of the relationship between mortality and SDG. Econometric methods can offer insights into the causal relationships and dynamics between these variables that cannot be fully captured by other types of analysis. This methodological contribution can improve understanding of how health outcomes intersect with broader SDG and thus inform policy decisions and interventions aimed at improving public health in OIC.

Methods

This research evaluated the relationship between health indicators and SDG in the OIC, focusing on 16 of the 57 members of OIC with consistent health data for SDG3: Good Health and Well-being from 2008 to 2021. Focusing on OIC countries allows for a comparative assessment of the SDGs within a common socio-cultural and economic context. These countries were Afghanistan, Burkina Faso, Ghana, Iran, Iraq, Kazakhstan, Kyrgyzstan, Lebanon, Mali, Nigeria, Pakistan, Sierra Leone, Tajikistan, Tunisia, Türkiye, Uganda. Given the study's focus on countries within a specific year range, the panel data analysis was used in the analyses, which combines cross-sectional and time series data (20). The model's significance was assessed using the least squares method, along with Granger causality, cointegration, and variance decomposition analyses. All statistical analyses were conducted using Eviews 10, with detailed variable explanations provided in Table 1.

Table 1: Definition of Variables

Variables	Definition	Unit	Abbreviation
SDG Index Score	The SDG Index Score, and all goal and indicator scores, retroactively calculated across time using time series data that was carried forward in years with missing data in period t	Score Point	SDGScore
Maternal Mortality	Maternal mortality rate in period t	per 100,000 live births	Matmort
Neonatal Mortality	Neonatal mortality rate in period t	per 1,000 live births	Neonat
Under 5 years Mortality	Mortality rate, under-5 in period t	per 1,000 live births	U5Mort
Non Communicable Diseases Mortality	Age-standardized death rate due to cardiovascular disease, cancer, diabetes, or chronic respiratory disease in period t	% in adults aged 30–70 yr	NCDmort
Traffic Deaths	Traffic deaths in period t	per 100,000 population	Trafficmort
Incidence of tuberculosis	The estimated rate of new and relapse cases of tuberculosis each year, expressed per 100,000 people in period t	per 100,000 population	TB
Surviving infants who received 2 WHO-recommended vaccines	Surviving infants who received 2 WHO-recommended vaccines [3rd dose of DTP and 1st dose of measles] in period t	%	VAC

Ethics approval and consent to participate

The study was designed retrospectively with using secondary data so ethical approval was not required. All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Results

Descriptive Analysis

According to the descriptive information of the variables in to the analysis;

- SDG score mean was 60.07±9.11 (min:37.29, max:75.10)
- Maternal mortality mean was 277.18±319.56 (min:12.55, max:1135.0)
- Neonatal mortality mean was 23.01±13.19 (min:4.63, max:51.06)
- U5mortality mean was 57.53±44.05 (min:8.24, max:175.66)
- NCD mortality mean was 23.64±5.69 (min:14.80, max:39.41)
- Traffic mortality mean was 21.01±6.65 (min:6.20, max:33.40)
- TB mean was 119.40±93.41 (min:9.70, max:318.00)
- VAC mean was 82.74±14.68 (min:42.00, max:99.0)

The representation of the variables according to countries and year ranges was given in Fig. 1. Negative correlation showed between the SDG score and the mortality in OIC.

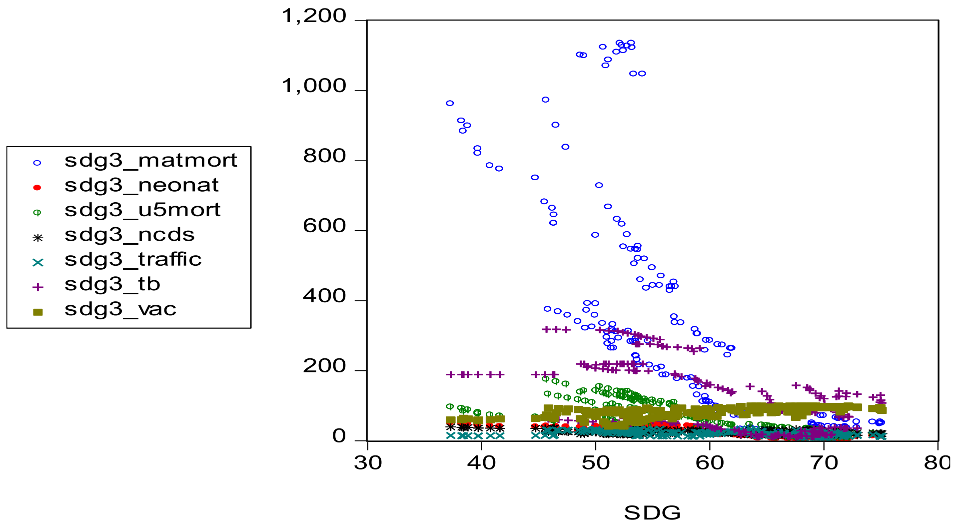

Fig. 1: SDG scores and Health Indicators,16 Countries,2008-2021.
Source: Prepared by the authors.

Econometric Model

The econometric model to be estimated from this equation was established as follows:

$$\begin{aligned} SDGScore_{it} = \beta_0 &+ \beta_1 Matmort_{it} \\ &+ \beta_2 Neonat_{it} \\ &+ \beta_3 U5Mort_{it} \\ &+ \beta_4 NCDmort_{it} \\ &+ \beta_5 Trafficmort_{it} \\ &+ \beta_6 TB_{it} + \beta_7 VAC_{it} + u_{it} \end{aligned}$$

In the model in the equation; the "β_0" coefficient constant expresses the SDG score that occur independently of the explanatory variables. While "β_1" for Matmort, "β_2" for Neonat, "β_3" for U5Mort, "β_4" for NCDmort, "β_5" for Trafficmortt, "β_6" for TB, "β_7" for represents the parameters to be estimated for VAC, "u" represents the error term; "i" denotes the cross-sectional dimension of the panel data, and "t" denotes the time dimension. "SDG score" was taken as the dependent variable.

Least Squares Test

The Least Squares Test (LS) method is one of the methods used to measure the significance of an econometric model (21). In the analysis, the random-effect model gave more consistent results compared to the Hausman test (*P*=0.5883). The econometric model was analyzed under random effects and it was determined that the power of the independent variables to explain the dependent variables was consistent but there was no multicollinearity problem and cross-sectional dependence but the autocorrelation problem was continued. Therefore, the new model was estimated under the AR (1) model. In this model, there was no multicollinearity problem, cross-sectional dependence, and autocorrelation found. These tests confirmed the significance of the econometric model established in the research. According to the least squares analysis results in Table 2, a one-unit increase in maternal mortality reduced the SDG score by 0.0047 units, a one-unit increase in neonatal mortality reduced the SDG score by 0.27 units besides these results R^2 and adjusted R^2 value explained the power of the model was good. On the other hand, no significant relationships were found between U5mort, NCDmort, Trafficmort, TB, VAC variables, and SDG score in the regression analysis (*P*>0.05).

Table 2: Least sqare test results

Dependent Variable	Independent Variables	Coefficient	Prob.
SDG score	Matmort	-0.004761	0.0721***
	Neonat	-0.277776	0.0384**
	U5Mort	-0.020051	0.4637
	NCDmort	0.011317	0.9171
	Trafficmort	-0.010398	0.7721
	TB	-0.003466	0.7189
	VAC	0007796	0.4393
	AR(1)	1.002583	0.0000*

Hausman Tests:0.5883;Breusch-Pagan LM:0.1500;Pesaran scaled LM:0.2988;Peseran CD Test:0.2179;DW:2.241311;Skewness:0.603778;Kurtosis:7.337943;VIF:1.041752-6.850711; R^2:0.99; Adjusted R^2:0.99; *,**,***significance at %1,%5,%10 level.

Cointegration and Granger Casuality Tests

Granger causality analysis is a method that evaluates the contribution of the lagged values of the other variable (sample X_t variable) in explaining the current value of one of the variables (sample Y_t variable) (22). It is frequently applied in panel data analysis to determine the direction of the relationship between variables. The most important assumption of this analysis was to ensure the stationarity of the variables. Unit root tests are a widely used method for testing stationarity. Generally, variables are stationary if their mean and variance do not change over time. The most commonly used unit root tests in the literature are Augmented Dickey–Fuller test (ADF), Phillips–Perron test (PP), Im-Pesaran-Shin (IPS) tests, Levin-Lin-Chu (LLC) tests (20,22-24). For this reason, unit root tests were applied to the variables in order to determine the stationarity status of the variables subject to the research and the variables became stationary at different levels when their level values and first differences were taken. The variables were considered at the I(1) level in the Causality and Co-Integration analyses. After this stage, the lag lengths of the variables were evaluated at 1st and 5th lag. In causality tests performed at the 1st lag length, there was a heteroscedasticity problem and serial correlation, so the analyses were continued using the 5th lag length. After evaluating that all of the variables were stationary at the I(1) level by the unit root test, the lag length of the model was determined in the VAR model, and the long-term relationships were investigated by Johansen Fisher cointegration analysis between the variables. According to the results of Johansen's cointegration tests; the trace test statistic of the H_0 hypothesis (r=0), there was no cointegration between SDG score and the variables, was found to be 254.29 since this value was greater than the critical value of 159.53 at the 1% significance level, the null hypothesis was rejected. Trace test indicated 8 cointegrating eqn(s) at the 0.05 level (Table 3-A).

In the Granger casualty analysis, the lag length of the model was determined as 5th lag length in VAR model and the results was given in Table 3-B. The results unidirectional Granger-type causality was determined i)from SDG score towards U5 mortality ii)from Neonat mortality towards SDG score iii)from Neonat mortality towards NCD mortality iv)from U5Mortality towards Neonat v)from NCD mortality towards U5Mortality vi)from NCD mortality towards VAC vii)from TB towards VAC viii)from TB towards Neonat ix)from TB towards Trafficmortality x)from VAC towards Trafficmortality. Besides these results, bidirectional Granger-type causality was determined i)between Matmort and U5mortality ii)between NCD mortality and TB.

Table 3: Cointegration and Granger Casuality tests results

A: Cointegration Test				
	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.
None*	0.493631	254.2965	159.5297	0.0000
At most1*	0.336290	178.0818	125.6154	0.0000
At most2*	0.322495	132.1719	95.75366	0.0000
At most3*	0.224804	88.56596	69.81889	0.0008
At most4*	0.192789	60.04640	47.85613	0.0024
At most5*	0.161308	36.05931	29.79707	0.0083
At most6*	0.090523	16.35718	15.49471	0.0370
At most7*	0.049874	5.729985	3.841466	0.0167
Trace test indicates 8 cointegrating eqns at the 0.05 level; *Denotes rejection of the hypothesis at the 0.05 level; Roots of Characteristic Polynomial:Between 0.905574-0.195822				

B. Granger Casuality Tests					
Hipotesis	Probability	Result	Hipotesis	Probability	Result
SDGScore≠>Matmort	0.1605	Accepted	Trafficmort≠>SDGScore	0.9470	Accepted
SDGScore≠>Neonat	0.2450	Accepted	Trafficmort≠>Matmort	0.9594	Accepted
SDGScore≠>U5Mort	0.0201**	Rejected	Trafficmort≠>Neonat	0.9770	Accepted
SDGScore≠>NCDmort	0.4203	Accepted	Trafficmort≠>U5Mort	0.4636	Accepted
SDGScore≠>Trafficmort	0.4336	Accepted	Trafficmort≠>NCDmort	0.3536	Accepted
SDGScore≠>TB	0.2156	Accepted	Trafficmort≠>TB	0.5985	Accepted
SDGScore≠>VAC	0.9354	Accepted	Trafficmort≠>VAC	0.7058	Accepted
Matmort≠>SDGScore	0.8339	Accepted	TB≠>SDGScore	0.9957	Accepted
Matmort≠>Neonat	0.7948	Accepted	TB≠>Matmort	0.4021	Accepted
Matmort≠>U5Mort	0.0518**	Rejected	TB≠>Neonat	0.0269**	Rejected
Matmort≠>NCDmort	0.1883	Accepted	TB≠>U5mort	0.7552	Accepted
Matmort ≠>Trafficmort	0.1861	Accepted	TB≠>NCDmort	0.0755***	Rejected
Matmort≠>TB	0.7015	Accepted	TB≠>Trafficmort	0.0031**	Rejected
Matmort≠>VAC	0.4211	Accepted	TB≠>VAC	0.0547***	Rejected
Neonat≠>SDGScore	0.0225**	Rejected	VAC≠>SDGScore	0.3185	Accepted
Neonat≠>Matmort	0.1284	Accepted	VAC≠>Matmort	0.5676	Accepted
Neonat≠>U5Mort	0.1054	Accepted	VAC≠>Neonat	0.9609	Accepted
Neonat≠>NCDmort	0.0050*	Rejected	VAC≠>U5Mort	0.5273	Accepted
Neonat≠>Trafficmort	0.6743	Accepted	VAC≠>NCDmort	0.1215	Accepted
Neonat≠>TB	0.5728	Accepted	VAC≠>Trafficmort	0.0015*	Rejected
Neonat≠>VAC	0.2146	Accepted	VAC≠>TB	0.8393	Accepted
NCDmort ≠>SDGScore	0.6928	Accepted	U5Mort≠>SDGScore	0.3475	Accepted
NCDmort ≠>Matmort	0.8509	Accepted	U5Mort≠>Matmort	0.0171**	Rejected
NCDmort≠>Neonat	0.2775	Accepted	U5Mort≠>Neonat	0.0017*	Rejected
NCDmort≠>U5Mort	0.0527**	Rejected	U5Mort≠>NCDmort	0.2636	Accepted
NCDmort≠>Trafficmort	0.5405	Accepted	U5Mort≠>Trafficmort	0.8247	Accepted
NCDmort≠>TB	0.0001*	Rejected	U5Mort≠>TB	0.5738	Accepted
NCDmort≠>VAC	0.0908	Rejected	U5Mort≠>VAC	0.7027	Accepted
Roots of Characteristic Polynomial:0.905574-0.195822;Serial Correlation LM Tests:0.2864;Residual Heteroskedasticity Tests:0.0482; JB: 0.0168; *,**,*** significance at %1,%5,%10 level respectively.					

Source: Prepared by the author.

As a result of the causality analysis made after the determination of long-term relationships, variance decomposition was performed in the research model in order to show how much the health indicators were explained the SDG score. Variance decomposition investigates the percentage of change in a variable attributable to itself and the percentage attributable to other variables (25). SDG score variable was determined by its own shocks in the short run under the 100.000 monte carlo simulation. According to this test results at the end of the 10th period, 77.95% of the SDG score variable was explained by itself, 0.89% by Matmortality, 1.73% by Neonatmortality, 4.13 % by U5Mortality, 1.96% by NCDmortality, 0.97% by Trafficmortality, 6.57% by TB variable, and 5.76% by VAC variable (Table 4).

Table 4: Variance decomposition analysis results of SDGScore and Health Indicators*

	SDGScore	Matmort	Neonat	U5Mort	NCD Mort	Trafficmort	TB	VAC
1	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	96.50	0.01	0.19	2.36	0.18	0.35	0.16	0.22
3	92.69	0.44	0.69	3.35	0.30	0.44	1.67	0.38
4	87.52	0.50	0.66	3.65	1.38	0.50	1.68	4.06
5	86.33	0.97	0.64	3.53	1.47	0.66	2.39	3.99
6	83.20	0.92	0.67	3.42	1.41	0.73	3.85	5.77
7	82.17	0.91	0.67	3.50	1.40	0.84	4.82	5.66
8	81.76	0.90	0.75	3.76	1.46	0.90	7.79	5.63
9	79.28	0.87	1.58	3.71	1.45	0.87	6.55	5.65
10	77.95	0.89	1.73	4.13	1.96	0.97	6.57	5.76

*Estimated under 100.000 monte carlo simulation.

Discussion

Countries around the world improved their incomes with the Industrial Revolution, and over time, with the understanding of the importance of the human factor in economic growth, they built a productive population structure by making the human capital structure more qualified through public investments such as education and health. A productive population structure has also accelerated the path to development by ensuring the formation of a sustainable economic structure in these countries (8). Income distribution, gender equality, education, health and environment etc., criteria provide important information about the development levels of countries. However, serious differences have emerged over time between countries and development levels. The main reason behind this situation is the ability of countries to use their resources and their success in transforming these skills into productivity over time (26). While developed countries display good performance in terms of the criteria that determine development, this shows that development-related problems continue in underdeveloped countries. Therefore, evaluations based on the criteria that determine development also provide important information to countries about the criteria by which they can improve.

In this research, the relationship between health indicators and development was investigated specifically in OIC. The population of these countries is around 550 million in 2021(It was calculated from OECD database by the authors). In other words, the countries covered in the research constitute approximately 7% of the world's population and increased by approximately 58% in 21 years. When the SDG score was classified according to income groups, the score was 70 and above in high-income and upper middle-income countries, while it remained 60 and below in low-income countries. In the SDG score OIC have a value (62.5 points) well below the developed country groups; in these countries, only around 15% improvement in the SDG score has been achieved in 21 years. Again, the improvement in health indicators in these countries was around

36% (It was calculated from sdgs.un.org database by the authors).

The regression analyzes results of this study revealed that maternal and newborn deaths have negative effects on development (SDG). Therefore, according to the empirical evidence obtained from this research, the increase in mortality decreased the SDG score in OIC. For example, the relationship between country income and child mortality, child deaths are lower in HIC than in LIC, so the effect of country income is reduced mortality rates. In other words, rich countries have longer and higher quality life expectancies and lower mortality rates (27). Maternal–child health should be associated with the emerging issues of long-term development, human capital, and economic growth (28). The continuity of generations is fundamentally shaped by the health of mothers and babies. However, it's important to recognize that women, due to their biological roles, are also the key to ensuring the continuity of generations. Well-educated and healthy women are crucial for the formation of healthy future generations. Developed countries tend to have strong maternal and infant health outcomes, reflecting their investment in this area. Intergenerational continuity depends heavily on the health of mothers and babies. Healthy mothers are more likely to experience healthy pregnancies and give birth to healthy babies, who will grow into the next generation of adults (29). Healthy adults contribute to the continuity of society, particularly from the perspective of human capital. Furthermore, the issue of women's invisibility in economic activities, as highlighted in the literature (30), results in mothers being deprived of economic and social security, which adversely affects children's health and impedes the achievement of health, poverty reduction, and gender equality goals. Additionally, emerging studies in the literature have highlighted the negative impact of diseases such as traffic-related deaths, chronic diseases, and tuberculosis on well-being, as well as on maternal and infant health (31-33). Unfortunately, in many underdeveloped countries, developmental health indicators continue to show problems, indicating persistent challenges in this area (34). Additionally, Health indicators and SDG showed a long-term relationship with causal links in different directions. In the long term, health indicators explained approximately 23% of the SDG score in OIC. While the change in the SDG score was mainly explained by its own lagged values (%77.95), health indicators such as tuberculosis (%6.57), vaccination rates (%5.76), and under-five mortality (%4.13) had significant contributions. These findings emphasize the importance of policies targeting infectious diseases, maternal and child health for sustainable development. In a study conducted using the same variables specifically for OECD countries, health indicators explained the SDG by approximately 10% in the long term (35). These results reveal the importance of focusing on health indicators in achieving SDG targets in OIC countries.

Conclusion

This study examined the link between health indicators and development in OIC countries, showing that maternal and newborn mortality negatively affects SDG achievement. Health indicators significantly influence SDG scores in the long term, so greater sustainable effort is needed to improve the health SDG as the literature stated (36-39). To improve health outcomes, policies should prioritize maternal and infant health, disease prevention, universal health coverage, and socio-economic factors like education and gender equality. Limitations include the study period (2008–2021), country scope, and methodology. Future research with broader data and methods can strengthen comparative insights.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of interest

The authors declare that there is no conflict of interests.

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