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Health Outcomes in Developing Countries: The Role of Government and Market Institutions

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Abstract

Experts nowadays judge public health status mostly by looking at life expectancy and maternal and infant mortality. As such, this paper assesses human health outcomes in 23 developing nations in relation to public and private health investment, a stable political environment, the efficiency of the government, regulatory quality, education, and the development of financial institutions from the years 2000–2019. This paper employs the panel-corrected standard error (PCSE) strategy developed by Beck and Katz (1995). This technique is applied if the dataset violates the assumptions of serial correlation or autocorrelation and heteroskedasticity. The outcomes confirm that health spending in the public and private sectors, government effectiveness,

regulatory quality, education, and financial institutions favor life expectancy while having a detrimental impact on maternal and infant mortality, except primary school enrollment and private spending on health areas. This paper's findings imply that the authorities should prioritize public and private health sector development, institutional fairness, and financial institutions to strengthen public health outcomes.

Keywords: infant mortality, maternal mortality, political stability, regulatory quality, government effectiveness.

1. Introduction

Global health outcomes have been a mounting concern worldwide. According to the United Nations, human health is the cornerstone of all social status and development. Nevertheless, every year, over 5.2 million children below the age of five die from preventable diseases, while each day, more than 800 mothers and underaged girls will die from difficulties associated with childbirth and pregnancy (WHO, 2020). However, from 1960–2020, the average life expectancy (LE) at birth for developing economies climbed considerably, moving from 45 to 71 years (World Bank, 2022). The infant mortality (IM) rate is still somewhat high in developing economies, while the LE is around the standard of living (Ali, 2015). The issue of child mortality is more nuanced than that of adult mortality, as a country's health and economic standing become increasingly vulnerable when child death rates are elevated (Madise et al., 2003).

Nevertheless, several developing economies still experience a high percentage of IM, which disrupts economic progress and highlights the vulnerability of essential health sectors (Rahman & Alam, 2021). The UN and other organizations have initiated programs to diminish IM and address this particular concern (UNDP, 2015; WHO, 2015). Maternal mortality (MM), the number of pregnant women passing away from pregnancy-related causes per 100,000 live births, is another significant issue. The average MM rate was 231 deaths per live 100,000 live births in 2017, and is substantially greater in underdeveloped nations (World Bank, 2022).

Researchers typically utilize a wide range of indicators, including mortality, morbidity, health status, disability, and other health metrics, to judge global health outcomes. This study employs specific subgroups of health indicators, such as life expectancy and infant and maternal mortality,

to illustrate health conditions in developing economies. In order to gauge the health of a population as a whole, LE has been used for a very long time (Majumder et al., 2022). It offers a brief overview of death rates across all age categories, taking into consideration the age distribution of the population as a whole. One simple figure, the average number of years anticipated to live from birth, signifies LE, making it simpler to comprehend and communicate. The more we go into its contextualization and meaning, the better we can observe how a country is doing in state development. IM refers to the death of a baby prior to turning one year of age (Masuy-Stroobant & Gourbin, 1995; Alam, 2021). One common way to measure a nation's or community's health is to look at its IM rate. Issues with quantifying well-being can be connected to the factors that lead to IM (Rahman & Alam, 2021). Decisions regarding the distribution of funds can be made based on the IM rate for states and health administrations. In today's world, the rate of MM serves as an important barometer of the development that society has made. It makes many claims about women's status in general, how simple it is for them to access health care, and how effectively the system as a whole satisfies their needs. It is vital to have precise knowledge of MM rates in order to have a full comprehension of the risks associated with pregnancy and childbirth, as well as the current state of women's well-being and, consequently, their socioeconomic standing.

Collectively, a range of variables may influence public health outcomes. To assess the risks to people's health in developing nations, this paper considers several factors, such as government effectiveness (GE), political stability (PS), regulatory quality (RQ), spending on public and private health sector (PHS and PRHS), educational enrollment on primary and secondary segment (PSE and SSE), and financial institutions (FI). An upsurge in public health spending will inevitably result in enhanced healthcare facilities and infrastructure, proper

sanitary services, and improved nutrition, all of which will enhance LE (Shahbaz et al., 2016) and reduce mortality rates (Mosley & Chen, 1984). Though health expenditure must influence a country's health sector or healthcare conditions, it is essential to remember that different health outcomes can be attained through the effectiveness of the government. If we look at the COVID-19 pandemic timeframe, the effectiveness of the various governments' responses to the pandemic varies greatly among nations. Countries that quickly responded and implemented reasonable prevention measures were inclined to have a lower infection rate than those with low efficiency. A crucial consideration in assessing people's health outcomes is RQ. To recognize and combat contagious diseases that elevate mortality rates, government regulation should ensure the required adequacy of the necessities (OECD, 2021). Even in crisis situations, a highly efficacious regulatory authority may incorporate concepts for regulative approaches or policies as well as execute effective governance (OECD, 2012).

However, an efficient government amid political turmoil and conflicts provides significant improvements in public health conditions (Balabanova et al., 2011). Klomp and Haan (2009) claim that political instability has a detrimental impact on people's health structure. The PS, partially responsible for the growth of healthcare, should be maintained by all governments worldwide (Brinkerhoff et al., 2009). Increased violence makes public areas insecure, making it difficult to provide services on time. The suspension of health services during a period of political unrest puts thousands of people with severe health issues in worse circumstances (Bandyopadhyay, 2020; Bennett, 2021). PS encourages investors to increase their investments in the health sectors, which in turn promotes economic growth by adopting better policies. Average LE is augmented due to such stability, and the maternal and infant

mortality rates decline (Mohamed et al., 2021). Meanwhile, Kirikkaleli and Adebayo (2022) found that political insecurity hampers the eco-friendly environment and generally degrades health.

The development of FI and LE are connected in several ways (Claessens & Feijen, 2007). First, it accelerates growth and economic productivity (Alam et al., 2021). The second benefit of the growth of FI is that it encourages more investment in advanced training that will upsurge productivity. Third, improved household health results from women's self-determination, facilitated by economic progress. Unlike her male counterpart, an empowered woman is more likely to offer better care for her children and devote a greater share of the household budget to boosting the welfare of her family (UNICEF, 2014). This is because an empowered woman is more likely to have more control over her own life. Fourth, it enhances LE through the development of the infrastructure. Increasing public and private investment, such as offering credit and other financial assistance to the health sector, upgrades a population's health by making healthcare facilities more accessible (Alam et al., 2021). Moreover, Kirikkaleli et al. (2022) found financial development to be a favorable push for environmental sustainability, which ultimately lessens the health outcomes in society.

Another significant factor in determining health is education. The nexus between LE and education is positive, both hypothetically and experimentally. People become more health-conscious as a result of increased school enrollment, which enhances the standard of living (Wang et al., 2020). Women's education has a direct effect on IM rates because educated women are more able to positively impact their children's health and diet (Hojman, 1994).

No empirical study exists on health outcomes in developing countries that consider a wide range of factors, including GE, PS, RQ, PHS and PRHS,

PSE and SSE, and FI. In light of these factors, this paper aims to analyze health outcomes in developing countries. This work incorporates the Panel Corrected Standard Error (PCSE) model to assess the linkage among variables.

This article's three main strengths are:

(a) The attention it devotes to vital indicators of institutional governance related to GE, RQ, and PS to discover its impact on LE, IM, and MM.

(b) Its attempt to determine the impacts of FI, PSE, and SSE, knowing that previous research has entirely overlooked LE, IM, and MM when weighing human health outcomes.

(c) The incorporation of the PCSE model, which is perhaps the most feasible approach for small panels.

The following is the format of this study: The second segment presents prior literature, relying on the basis laid in the introduction. Data and methods are provided in the third section. After discussing the findings and their significance in section four, the analysis draws to a conclusion in section five.

2. Literature Review

Regardless of time series or panel data, a limited range of worldwide analyses has been conducted on people's health outcomes. In this section, the study explains a subset of the prior literature that is most relevant to this investigation. Anwar et al. (2012) found a long- and short-term association between government health expenditure and health outcomes in Pakistan. Both IM and LE are strongly affected by the alternation of government health spending and the upgrading of health services. Ullah et al. (2021) and Ma et al. (2022) found that PHS and PRHS influence IM and LE.

Lleras-Muney (2005) discovered that each additional year of schooling diminishes the possibility of dying within the next ten years by as much as 3.6%. This finding is based on approximating state-level variations in compulsory education regulations in the USA. The causal link between health and education is clarified by Fonseca et al. (2020); additionally, having more education is linked favorably to living longer and having better overall health. Studies on the relationship between education and health (Chowdhury et al., 2020) addressed theoretical and empirical arguments.

Ding et al. (2022) investigated the potential impact of government efficiency on health outcomes and determined that increasing government efficiency can significantly improve health outcomes. They also disclosed that the association between GE and health outcomes could be moderated by the political ideology of the governing party and overall democracy. Klomp and Haan (2009) validated the relationship between PS and health disparities among nations, claiming that political instability has a negative association with people's health. Following 1997–2018 data from Iran, Dehkordi et al. (2021) explored the connection between PS and PHS in the healthcare system. The findings show that both factors have a detrimental influence on infant and child mortality and also have a negative effect on LE. Adebayo et al. (2023) found political instability to be a positive booster to control the ecology that escalates health quality.

Using data from 1990–2020, Niaz et al. (2022) investigated the effects of FI development and education on LE and IM rates. According to the empirical analysis, FI growth and education lead to a long-term significant rise in LE and meaningful declines in mortality rates. Wang et al. (2020) determined the linkage between the development of FI and LE, where the development of FI has a detrimental influence over LE. However, Kousar et al. (2020), for the

period of 1990–2017, disclosed a negative relationship between child mortality, education, and health expenditure. Adebayo et al. (2023) and Adebayo (2023) found a positive influence between financial risk and the quality of ecology.

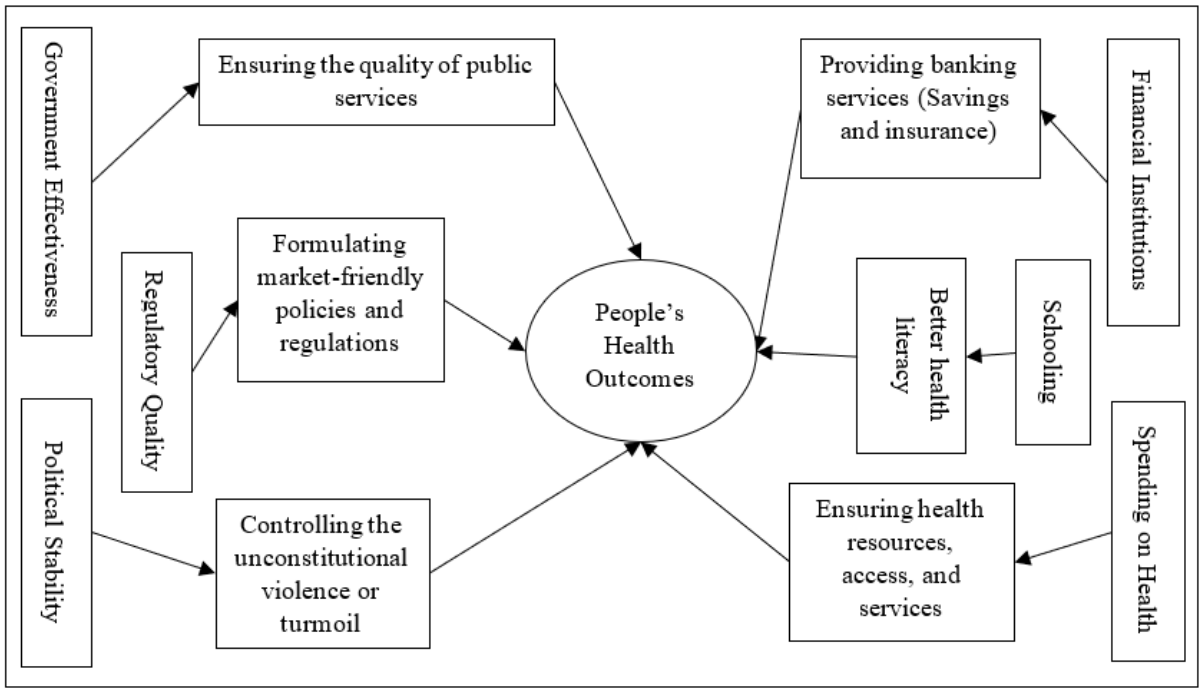
While reviewing the existing literature, we found that none of the studies took the three health outcomes indicators into consideration. No available analysis has scrutinized the link between health outcomes, expenditure on health, education, GE, RQ, PS, and development of FI by employing a large set of panel data of developing countries. This study overcomes these drawbacks and attempts to fill this gap in the literature. This article aims to answer the following two hypotheses:

1) H_0 (Null hypothesis): Spending on health, education, GE, RQ, PS, and FI have a positive influence on IM and MM.

2) H_0 (Null hypothesis): Spending on health, education, GE, RQ, PS, and FI have a negative influence on LE.

Health outcomes were given little consideration when allocating funds for healthcare, education, government regulation, or financial institutions despite their evident advantages. The present inquiry offers a theoretical link between them (Figure 1).

Figure 1. Theoretical linkage



3. Data and Methodology

3.1 Data

The current study examines health outcomes around the globe in the context of 23 developing economies. For the period of 2001–2019, a panel dataset was employed for this study. Data was gathered from a variety of sources in order to empirically test the linkage between three of the most significant health outcomes indicators, i.e., LE, IM, and MM, and factors such as GE, RQ, PS, PHS, PRHS, FI, and PSE and SSE. The World Development Indicators (WDI) and Worldwide Governance Indicators (WGI) were used to collect the data. Table 1 reports the summary statistics of the model. There is a lack of information regarding the rate of MM, FI, and PSE and SSE, so a significant number of countries were removed from the model. With regard to these concerns, this research covered the 23 developing nations with the most

data available. It was fairly challenging to create a balanced dataset because the majority of developing nations struggle with a lack of data availability.

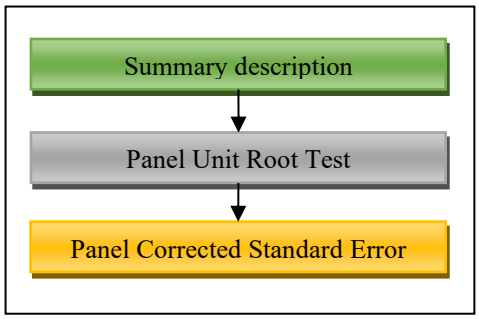
Table 1. Summary description

Variables	Obs.	Mean	Std. Dev.	Data Source
IF	414	39.202	21.251	WDI
MM	414	109.644	76.910	WDI
LF	414	66.719	6.173	WDI
PHS	414	1.629	1.032	WDI
PRHS	414	57.371	17.067	WDI
PS	414	-.774	.798	WGI
GE	414	-.497	.467	WGI
RQ	414	-0.633	0.481	WGI
PSE	414	171.289	116.891	WDI
SSE	414	118.942	103.376	WDI
FI	414	167.681	116.324	WDI

Life expectancy at birth is the estimated number of years a person will live. Compared to MM, the average number of deaths among mothers per 100,000 live births, IM is the average number of infant deaths per 1,000 live births. A population's PSE and SSE is a measure of how many people chose to attend primary and secondary school. Health spending, both public and private, as a percentage of gross domestic product, is known as public and private health expenditure. This study also uses domestic credit to the private sector as a variable of FI, with GDP as the percentage share. Beyond that, this paper utilizes three of the six aspects of institutional quality, namely GE, RQ, and PS. Each of these dimensions has its own unique index that falls between -2.5 and +2.5. As described by Kaufman et al. (2010), these characteristics are expected to significantly affect health outcomes.

This study chose panel data rather than comparison to time series or cross-sectional data because panel data assists in controlling normality, multicollinearity, and serial correlation issues. Since the panel dataset comprised a wide range of observations rather than the former two, it can regulate those restrictions credibly (Haque et al., 2022). All the countries are listed in Table A.1 (Appendix). Figure 2 reports the flow of the paper.

Figure 2. Flow of analysis



3.2 Methods

3.2.1 Panel unit root tests

The stationarity of the data was evaluated by incorporating panel unit root tests. The LLC (Levin et al., 2002) and HT (Harris & Tzavalis, 1999) tests were performed to run unit root tests. The LLC Panel unit root test is reliant on the panel's homogeneity. While it is different from other unit root tests, it is most similar to the Augmented Dickey-Fuller Test in the case of procedural operations (Ali & Senturk, 2019). Another panel unit root test, the HT test, was initiated for the auto-regressive (1) panel data model with serially uncorrelated errors, which has an assumption that N tends to infinity when the mean time T is constant. The Bias-Corrected OLS estimator of the AR coefficient was the basis for this test, demonstrating that this statistic's

asymptotic normality and the convergence rate, or $\sqrt{N}$, are identical to that of the static panel data (De Blander et al., 2012).

3.2.2 Model specification

The panel data model choice depended on certain criteria, e.g., if the dataset violates the assumptions of serial correlation or autocorrelation, then researchers tend to use the Feasible Generalized Least Square (FGLS) or Panel Corrected Standard Error (PCSE) models. If the number of observations $N > T$, then the study needs to employ the PCSE (Haque et al., 2022). Other studies will require employing the Driscoll and Kraay Standard Error (DKSE) model if the datasets breach the cross-sectional dependency. This paper initially incorporated the PCSE model to assess the baseline models.

The basic estimation model for the PCSE method is below:

$$LE_{i,t} = \beta_0 + \beta_1 \times PHS_{i,t} + \beta_2 \times PRHS_{i,t} + \beta_3 \times PS_{i,t} + \beta_4 \times GE_{i,t} + \beta_5 \times RQ_{i,t} + \beta_6 \times PSE_{i,t} + \beta_7 \times SSE_{i,t} + \beta_8 \times FI_{i,t} + \varepsilon_{1i,t} \quad (1)$$

$$MM_{i,t} = \beta_0 + \beta_1 \times PHS_{i,t} + \beta_2 \times PRHS_{i,t} + \beta_3 \times PS_{i,t} + \beta_4 \times GE_{i,t} + \beta_5 \times RQ_{i,t} + \beta_6 \times PSE_{i,t} + \beta_7 \times SSE_{i,t} + \beta_8 \times FI_{i,t} + \varepsilon_{2i,t} \quad (2)$$

$$IM_{i,t} = \beta_0 + \beta_1 \times PHS_{i,t} + \beta_2 \times PRHS_{i,t} + \beta_3 \times PS_{i,t} + \beta_4 \times GE_{i,t} + \beta_5 \times RQ_{i,t} + \beta_6 \times PSE_{i,t} + \beta_7 \times SSE_{i,t} + \beta_8 \times FI_{i,t} + \varepsilon_{3i,t} \quad (3)$$

The PCSE method, as developed by Beck and Katz (1995), produces panel-corrected standard errors that operate best with small panels and corrects finite sample bias. Panel data frequently include correlation via units and heteroskedasticity at the unit level, making it inappropriate to draw conclusions from the standard error given by the Ordinary Least Squares (Sundjo & Aziseh, 2018). However, in this situation, PCSE is more appropriate. Also, Variance Inflation Factors (VIF) are employed to test the presence or absence of

multicollinearity. When VIF values come out to 10 or less than 10, the model does not encompass notable multicollinearity in its variables (Mahalik et al., 2022).

4. Results and Discussion

This study examined the impact of several variables on health outcomes. The research began by performing unit root tests to decide whether the model was stationary or non-stationary, with a specific focus on the discussion of the mechanism. Next, the study analyzed three regression estimations to assess how the explanatory factors affect health outcomes in developing nations.

A known impact states that the presence of unit roots in panel data could lead to a misinterpretation of expected results, which is why it is crucial to verify them beforehand. Table 2 exhibits the two first-generation stationarity testing methods, the Levin-Lin-Chu and Harris Tzavilis tests. The table indicates that both methods have two types of stationarity: 1) stationarity at I(0), which means stationarity at the level, and 2) stationarity at I(1), referring to stationarity at the first difference. Therefore, the findings suggest that the variables of LE, IM, PHS and PRHS, PS, GE, RQ, PSE and SSE, and financial institution's development reject the null hypothesis of no stationarity at the level and first difference. The outcome of these stationarity tests validates the use of the next panel methods.

Table 2. Panel unit root test

Variables	LLC		HT	
	Level	1st diff.	Level	1st diff.
IF	-4.404***		2.300	-35.856***
MM	3.970**		2.891	-26.381***

LF	-5.367***		0.997	-24.608***
PHS	-0.925	-7.107***	0.875	-21.742***
PRHS	-2.860***		-3.646***	
PS	-3.855***		-0.7723	24.700***
GE	-3.344***		-5.951***	
RQ	-2.636***		-0.197	-29.468***
PSE	-0.994	-5.158***	-10.018***	
SSE	-2.048**		-7.588***	
FI	-4.307***		-1.3827*	

Note: ***p < 0.01, **p <0.05, *p < 0.1

The outcomes of the PCSE testing demonstrate that IM has a negative connection with both government and private health spending (Table 3). More precisely, IM will decrease if domestic government and private spending on health is increased. It reveals that if domestic government and private spending on health increase by 1%, IM will decrease by 10.75% and 0.35%, respectively. Theoretically, an increase in public health spending on both the government and private levels improves the quality of the healthcare system. Spending on healthcare enables technological advancement in hospitals and facilitates overall healthcare, which improves health outcomes and lowers IM rates. This conclusion is consistent with Dehkordi et al. (2021) and Ma et al. (2022).

Table 3. Findings for infant mortality

Variables	PCSE
PHS	-10.750***
PRHS	-0.351***
PS	-2.085**
GE	-8.809***
RQ	-6.044***
PSE	0.013

SSE	-0.046***
FI	-0.024***
Constant	74.397***

Note: ***p < 0.01, **p <0.05, *p < 0.1

This study also finds a negative connectivity between PS and IM. A strengthening in PS in a nation lowers IM rates significantly. If PS increases by 1%, IM will decrease by 2.08% at the 1% level of significance. PS secures the governance of the healthcare infrastructure. Additionally, it shields the country against political turmoil. This increases the accessibility and effectiveness of healthcare services, which lowers the IM. This finding is also backed by Dehkordi et al. (2021) and Feyzabadi et al. (2015). In the analysis, IM and GE were also adversely connected. The IM would decrease as GE rose; statistically, if GE increased by 1%, IM would be reduced by 8.809%.

Moreover, the outcomes illustrate that the IM rate is negatively linked with RQ. If there is any improvement in RQ, the IM rates will be reduced. The estimated coefficient value of 6.044 means that if the RQ improves by 1%, then the IM reduces by 6.044% at a 1% significance level. Theoretically, when the RQ of the healthcare system is effectively maintained, adequate medical facilities are available to newborns, which lowers the death rate. However, in general, education has a detrimental effect on IM rates, based on the findings for the secondary level of education. Meanwhile, the PSE and IM demonstrate a positive connection, which is exceptional. In the given economies, the IM doesn't increase by higher levels of basic education. Mothers of newborns become more health-conscious as a result of education, which lowers the IM rate.

A negative correlation between the development of FI and IM explains that a 1% increase in FI development reduces IM by 0.024%. In the theoretical

explanation, when FIs become developed, they provide banking services, health insurance, and other benefits to the health care system as well as to the individuals who improve infant health. This outcome is in line with Zhan et al. (2022).

Now, focusing on the results of Table 4, the findings of the PCSE analysis reveal that the government's domestic health spending has an insignificant and detrimental effect on the rate of MM. It states that if PHS increases by 1%, MM will decrease by 1.457%. The nexus between the two can be attributed to how better healthcare facilities and infrastructure lead to a reduction in MM. This negative linkage is identical to Ali and Şenturk, (2019). Nevertheless, the findings indicate that MM is insignificant with PRHS, which is surprising. The results also show that PS has a positive relation with MM. As stated, development cannot take place without first setting up a secure political environment. In most cases, a functioning government over a long period is vital for trustworthy maternal healthcare. Nevertheless, ensuring continuity over an extended period is beyond the capabilities of the majority of the chosen nations. As a result, health outcomes degrade because governments struggle to adequately fund healthcare services. Maternal health is often overlooked in nations that prioritize the elimination of extreme poverty and famine. Moreover, PS does not reduce MM in developing nations due to a lack of healthcare access and family planning. This finding adds credence to the idea that developing nations' sluggish recovery from political volatility leads to a worse MM rate (Ruiz-Cantero et al., 2019).

A negative linkage between MM and GE shows that MM decreases by 45.5% if GE increases by 1%. It also indicates that the RQ has a positive connection with MM rates, which is also contrary to the theoretical expectation. In general, the effectiveness of regulations serves to control policies that are

harmful to the market while also impacting economic expansion and the autonomy of reproductive health decision-making for women. Because of their weaker regulatory frameworks, the chosen nations cannot come up with or even hint at comprehensive policies to foster growth in the private sector. At the end of the day, it doesn't lower the MM rate (Ruiz-Cantero et al., 2019).

Table 4. Findings for maternal mortality

Variables	PCSE
PHS	-1.457
PRHS	0.479
PS	26.725***
GE	-45.518***
RQ	36.022***
PSE	0.084***
SSE	-0.061*
FI	0.031
Constant	93.029***

Note: ***p < 0.01, **p <0.05, *p < 0.1

In general, education has a detrimental effect on the risk of MM, and that is true in the case of the SSE. If the SSE increases, the MM rates are reduced. The regression result for MM and PSE shows a positive connection, which is exceptional. Here, MM is not necessarily higher as the PSE increases. Education increases mothers' understanding of their own health, which lowers the mortality rate among expectant mothers. Moreover, the regression result shows an insignificant correlation between the development of FI and MM. This finding is different from the attempts of Zhan et al. (2022). Lastly, the findings of the PCSE method indicate that both PHS and PRHS are positively associated with LE (Table 5). If the domestic government and private

expenditure on health increase by 1%, the LE increases by 3.213% and 0.1%, respectively. As spending on health can provide resources, upgrade the sector's infrastructure, and improve services, the public sector is accountable for facilitating and providing funds, ensuring the availability of necessary health workers and incentives. This empirical outcome is in line with Lopreite and Zhu (2020), Nathaniel and Khan (2020), and Radmehr and Adebayo (2022).

Table 5. Findings for life expectancy

Variables	PCSE
PHS	3.213***
PRHS	0.100***
PS	-0.885***
GE	4.807***
RQ	0.214
PSE	-0.055**
SSE	0.009***
FI	0.007***
Constant	56.148***

Note: ***p < 0.01, **p <0.05, *p < 0.1

Moreover, this study finds that PS and LE have a negative relationship. This finding does not support Dehkordi et al.'s (2020) analysis. At least in theory, LE rises in conjunction with PS. When political, social, and economic factors are all well-predictable, we are fortunate to have a more stable government; public faith in government is negatively impacted by an unstable political climate. Ultimately, when government authority fails to guarantee the provision of effective, reliable, and affordable healthcare services, it is not beneficial to economic system stability (Hadipour et al., 2023).

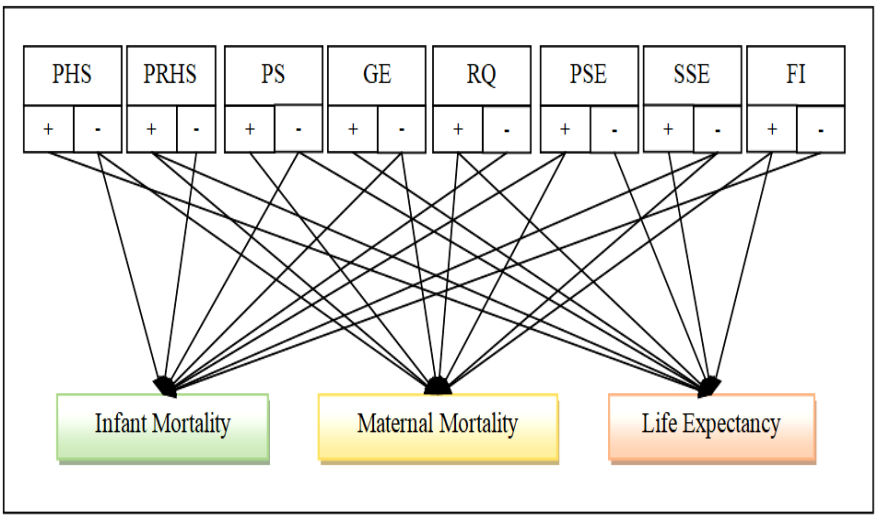
The outcomes also reveal a positive relationship between LE and GE, where the LE improves by 4.807% if GE increases by 1%. As a consequence,

health is strengthened, which ultimately raises the LE in developing economies. On the other hand, we found an insignificant causality between RQ and LE. Although education usually has a positive impact on LE, the regression for the secondary level of education came out positive while the primary level of education was negative. As education has both direct and indirect favorable impacts on the LE, it creates healthcare awareness, affecting people positively. This study shows that if the SSE increases by 1%, then the LE will increase by 0.009%, in line with the findings of Zhan et al. (2022), Irfan et al. (2023), and Adebayo et al. (2023). LE and health are worse for adults with a lower degree of education compared to those with more years of education. Having access to acute and proactive medical treatment is not under the control or choice of those enrolled in primary education. They are incapable of making effective use of their interpersonal, social, and mental capacities to boost their health (Raghupathi & Raghupathi, 2020).

As expected, the estimated result between the development of FI and LE is positive. So, a 1% upsurge in the FI enhances the LE rate by 0.007%; similar statistics are found by Zhan et al. (2022). The development of FI seems to be more likely to enhance LE via the influences on infrastructure, earnings, investment, gender equality, and technology (Shahbaz et al., 2019). It is to be considered alongside a very small growth in the development of FI and the ability to improve health through funding in clinical treatment, loans, and medical insurance (Singh & Yadava, 2021). Moreover, the models are free from multicollinearity issues, as each variable has a value of VIF less than 10 (Table A.2, Appendix). However, Figure 3 presents the aggregate graphical abstract of the PCSE model. The above results are based on a sample with missing observations, which are coded as 0 in the main regression analyses. To test whether the presence of missing data affected the study's conclusions,

robustness checks were performed. Here, missing observations pertaining to the years 2018 and 2019, as well as the nations of Angola, Bolivia, Indonesia, Morocco, and Tajikistan, were removed. PSE and SSE, which seem to be collinear with the other explanatory variables, were also removed. Due to the results of the robustness assessment being almost identical to those obtained previously, the accuracy of the model is confirmed. The results are detailed in Tables A.3, A.4, and A.5 in the Appendix.

Figure 3. Graphical abstract of the findings



5. Conclusion and Policy Suggestions

This study uses panel data from 2000 to 2019 to predict health outcomes in 23 developing nations. This assessment considers all factors of people's health from the perspective of developing economies. To achieve the aim of this research, we conducted an analysis of three regression estimations to determine the degree to which the aspects that explain health outcomes are impacted by the explanatory variables.

According to the findings of the PCSE model, spending on health enhances LE in developing nations and diminishes the rates of infant and maternal mortality. A stable political environment reduces IM rates, and when the effectiveness of the government raises LE, there is an adverse association with both infant and maternal mortality. Likewise, RQ increases LE rates and decreases IM. Education positively correlates with LE throughout time and decreases infant and maternal mortality. Regarding LE, financial inclusion is favorable but adverse when considering infant and maternal mortality.

In light of the empirical outcomes, this study presents policy suggestions to enhance human health. First, focusing on the positive attributes of education on human health status, governments of developing nations should undertake awareness programs to increase school enrolment, particularly for girls. Second, to improve health outcomes in developing economies, the GE needs to be more reliable by ensuring a high quality of public service delivery. We also suggest that the government practice high political, institutional quality by assuring less political pressure on its public and civil servants. Moreover, the government should provide flexible financial services by ensuring banking services and loans to households.

Concerning this paper's limitations, future attempts could include additional control variables, such as economic, social, and environmental factors, to explore the intensity of human health status in developing economies. Additionally, to handle any potential endogeneity issues, researchers could utilize dynamic models such as the country fixed effects, IV (2SLS), and IV (GMM) approaches.

References

Adebayo, T. S. (2023). Towards unlocking the chain of sustainable development in the BRICS economies: Analysing the role of economic complexity and financial risk. *Geological Journal*, *58*(5), 1810-1821.

Adebayo, T. S., Ağa, M., & Kartal, M. T. (2023). Analyzing the co-movement between CO2 emissions and disaggregated nonrenewable and renewable energy consumption in BRICS: Evidence through the lens of wavelet coherence. *Environmental Science and Pollution Research*, *30*(13), 38921-38938.

Adebayo, T. S., Kartal, M. T., Ağa, M., & Al-Faryan, M. A. S. (2023). Role of country risks and renewable energy consumption on environmental quality: Evidence from MINT countries. *Journal of Environmental Management*, *327*, 116884.

Alam, M. Z. (2021). Women outweighed men at life expectancy in Bangladesh: Does it mean a better quality of life?. *Heliyon, 7*(7).

Alam, M. S., Islam, M. S., Shahzad, S. J. H., & Bilal, S. (2021). Rapid rise of life expectancy in Bangladesh: Does financial development matter?. *International Journal of Finance & Economics*, *26*(4), 4918-4931.

Ali, A. (2015). The impact of macroeconomic instability on social progress: An empirical analysis of Pakistan (Doctoral dissertation). University of Lahore, Pakistan.

Ali, A., & Şenturk, İ. (2019). Justifying the impact of economic deprivation, maternal status and health infrastructure on under-five child mortality in Pakistan: An empirical analysis. *Bulletin of Business and Economics, 8*(3), 140-154.

Anwar, S., Rana, A. M., & Nasreen, S. (2012). Evaluation of the contribution of public health expenditure on health in Pakistan: A time-series analysis. *The Empirical Economics Letters*, *11*(10), 1.

Balabanova, D., McKee, M., & Mills, A. (2011). 'Good health at low cost': 25 years on. What makes a successful health system?. *Reproductive Health Matters, 20*(39), 212-214.

Bandyopadhyay, S. (2020). An institutionally racist lockdown policy. *Lancet*, *396*, 1802.

Beck, N., & Katz, J. N. (1995). What to do (and not to do) with time-series cross-section data. *American Political Science Review*, *89*, 634-647.

Bennett, C. (2020). Why are we so keen to 'save' Christmas rather than, say, the sick or the economy?. Retrieved from https://www.theguardian.com/commentisfree/2020/oct/18/why-are-we-so-keen-to-save-christmas-rather-than-the-sick-or-the-economy

Brinkerhoff, D., Catherine, F., & Stratton, S. (2009). Good governance and health: Assessing progress in Rwanda. *Health Economics*, *16*, 87-103.

Chowdhury, A. H., Hanifi, S. M. A., & Bhuiya, A. (2020). Social determinants of under-five mortality in urban Bangladesh. *Journal of Population Research*, 3*7*, 161-179.

Claessens, S., & Feijen, E. (2007). Financial sector development and the millennium development goals (World Bank Working Paper No. 89). Washington, DC: World Bank Group.

De Blander, R.,& Dhaene, G. (2012). Unit root tests for panel data with AR (1) errors and small T. *The Econometrics Journal*, *15*(1), 101-124.

Dehkordi, P. K., Ghobeyshavi, A., Abdollahi, F., & Heydari-Fathabadi, A. (2021). Examining the effects of governance on health in Iran using bounds testing approach. *Applied Economics Studies Iran*, *10*(38), 133-150.

Ding, Y., Chin, L., Li, F., & Deng, P. (2022). How does government efficiency affect health outcomes? The empirical evidence from 156 countries. *International Journal of Environmental Research and Public Health*, 19(15), 9436.

Feyzabadi, V. Y., Haghdoost, A., Mehrolhassani, M. H., & Aminian, Z. (2015). The association between peace and life expectancy: An empirical study of the world countries. *Iranian Journal of Public Health*, 44(3), 341.

Fonseca, R., Michaud, P. C., & Zheng, Y. (2020). The effect of education on health: Evidence from national compulsory schooling reforms. *SERIEs*, *11*(1), 83-103.

Hadipour, A., Delavari, S., & Bayati, M. (2023). What is the role of institutional quality in health outcomes? A panel data analysis on 158 countries from 2001-2020. *Heliyon*, 9(9).

Haque, M. A., Raza Shah, S. M., & Arshad, M. U. (2022). Sustainable economic growth and FDI inflow: A comparative panel econometric analysis of low-income and middle-income nations. *Sustainability*, *14*(21), 14321.

Harris, R. D., & Tzavalis, E. (1999). Inference for unit roots in dynamic panels where the time dimension is fixed. *Journal of Econometrics*, *91*(2).

Hojman, D. E. (1994). Economic and other determinants of infant and child mortality in small developing countries: The case of Central America and the Caribbean. *Applied Economics, 28*(3), 281-90.

Irfan, M., Ullah, S., Razzaq, A., Cai, J., & Adebayo, T. S. (2023). Unleashing the dynamic impact of tourism industry on energy consumption, economic output, and environmental quality in China: A way forward towards environmental sustainability. *Journal of Cleaner Production*, *387*.

Kaufmann, D., Kraay, A., & Mastruzzi, M. (2010). The worldwide governance indicators methodology and analytical issues. (World Bank Policy Research Working Paper, 5430). The World Bank.

Kirikkaleli, D., & Adebayo, T. S. (2022). Political risk and environmental quality in Brazil: Role of green finance and green innovation. *International Journal of Finance & Economics*, *29*(2), 1205-1218.

Kirikkaleli, D., Güngör, H., & Adebayo, T. S. (2022). Consumption-based carbon emissions, renewable energy consumption, financial development and economic growth in Chile. *Business Strategy and the Environment*, *31*(3).

Klomp, J., & De Haan, J. (2009). Is the political system really related to health?. *Social Science & Medicine*, *69*(1), 36-46.

Kousar, S., Shabbir, A., & Shafqat, R. (2020). Investigation of socioeconomic determinants on child death in South Asian countries: A panel cointegration analysis. *OMEGA—Journal of Death and Dying*, *84*(3).

Levin, A., Lin, C. F., & Chu, C. S. J. (2002). Unit root tests in panel data: Asymptotic and finite-sample properties. *Journal of Econometrics*, *108*(1), 1-24.

Lleras-Muney, A. (2005). The relationship between education and adult mortality in the United States. *Review of Economic Studies*, *72*, 189–221.

Lopreite, M., & Zhu, Z. (2020). The effects of ageing population on health expenditure and economic growth in China: A Bayesian-VAR approach. *Social Science & Medicine*, *265*.

Ma, Y., Hu, M., & Zafar, Q. (2022). Analysis of the impact of external debt on health in an emerging Asian economy: Does FDI matter?. *Frontiers in Public Health*, *10*(33).

Madise, N. J., Banda, E. M., & Benaya, K. W. (2003). Infant mortality in Zambia: Socioeconomic and demographic correlates. *Social Biology*, *50*(1-2).

Mahalik, M. K., Le, T. H., Le, H. C., & Mallick, H. (2022). How do sources of carbon dioxide emissions affect life expectancy? Insights from 68 developing and emerging economies. *World Development Sustainability*, *1*, 100003.

Majumder, S. C., Dilanchiev, A., & Rahman, H. (2022). Examination of a health production function: Evidence from South Asian countries. *Southeast Asian Journal of Economics, 10*(3), 75-102.

Masuy-Stroobant, G., & Gourbin, C. (1995). Infant health and mortality indicators. *European Journal of Population*, 11(1), 63-84.

Mohamed, K. S., Abasse, K. S., Abbas, M., Sintali, D. N., Baig, M. M. F. A., & Cote, A. (2021). An overview of healthcare systems in Comoros: The effects of two decades of political instability. *Annals of Global Health*, *87*(1).

Mosley, W. H., & Chen, L. C. (1984). An analytical framework for the study of child survival in developing countries. *Population and Development Review*, *10*.

Nathaniel, S., & Khan, S. (2020). Public health financing, environmental quality, and the quality of life in Nigeria. *Journal of Public Affairs*, *20*(3).

Radmehr, M., & Adebayo, T. S. (2022). Does health expenditure matter for life expectancy in Mediterranean countries?. *Environmental Science and Pollution Research*, *29*(40).

Raghupathi, V., & Raghupathi, W. (2020). The influence of education on health: An empirical assessment of OECD countries for the period 1995–2015. *Archives of Public Health, 78*(1), 1-18.

Rahman, M. M., & Alam, K. (2021). The role of socio-economic and female indicators on child mortality rate in Bangladesh: A time series analysis. *OMEGA-Journal of Death and Dying*, *86*(3).

Ruiz-Cantero, M. T., Guijarro-Garvi, M., Bean, D. R., Martínez-Riera, J. R., & Fernández-Sáez, J. (2019). Governance commitment to reduce maternal mortality. A political determinant beyond the wealth of the countries. *Health & Place*, *57*, 313-320.

Shahbaz, M., Loganathan, N., Mujahid, N., Ali, A., & Nawaz, A. (2016). Determinants of life expectancy and its prospects under the role of economic misery: A case of Pakistan. *Social Indicators Research*, *126*, 1299-1316.

Shahbaz, M., Shafiullah, M., & Mahalik, M.K. (2019). The dynamics of financial development, globalisation, economic growth and life expectancy in sub-Saharan Africa. *Australian Economic Papers*, *58*(4), 444-479.

Singh, B. P., & Yadava, A. K. (2021). Technical efficiency of financial inclusion and human development: Insights from the Indian states. *Economic Notes*, *51*(2), e12199.

Ullah, I., Ullah, A., Ali, S., Poulova, P., Akbar, A., Haroon Shah, M., & Afridi, F. E. A. (2021). Public health expenditures and health outcomes in Pakistan: Evidence from quantile autoregressive distributed lag model. *Risk Management and Healthcare Policy*, 3893-3909.

UNICEF. (2014). *Ending child marriage: Progress and prospects*. New York, NY: UNICEF.

United Nations Development Program. (2015). Sustainable development goals (Goal 3: Good health and well-being).

Wang, Z., Asghar, M. M., Zaidi, S. A. H., Nawaz, K., Wang, B., Zhao, W., & Xu, F. (2020). The dynamic relationship between economic growth and life expectancy: Contradictory role of energy consumption and financial development in Pakistan. *Structural Change and Economic Dynamics*, *53*, 257-266.

World Bank. (2022). Population statistics. Washington: World Bank.

World Health Organization. (2015). Sustainable development goal 3.

Zhan, Z., Su, Z. W., & Chang, H. L. (2022). Education and quality of life: Does the internet matter in China?. *Frontiers in Public Health*, *10*.

Zhan, Z., Tao, R., Niaz, M. U., & Kirikkaleli, D. (2022). Do higher education and financial institutions improve health in China? A new perspective. *Frontiers in Public Health*, *10*.

Appendix

Table A.1. List of countries

Algeria	Cameroon	Mongolia	Philippine
Angola	Egypt	Morocco	Senegal
Bangladesh	Ghana	Myanmar	Sri Lanka
Bhutan	India	Nepal	Tajikistan
Bolivia	Indonesia	Nigeria	Tunisia
Cambodia	Iran	Pakistan	

Table A.2. VIF testing

Variables	VIF	1/VIF
PHS	3.14	0.249
PRHE	4.01	0.318
PS	1.87	0.389
GE	2.57	0.520
RQ	1.92	0.533
PSE	1.03	0.805
SSE	1.17	0.856
FI	1.24	0.973

Table A.3. Findings for infant mortality

Variables	PCSE
PHS	-7.537***
PRHS	0.084
PS	-0.262
GE	0.132
RQ	-2.226*
FI	-0.550***
Constant	62.299***

Note: ***p < 0.01, **p <0.05, *p < 0.1

Table A.4. Findings for maternal mortality

Variables	PCSE
PHS	-55.758***
PRHS	1.397*
PS	28.078***
GE	-64.607***
RQ	27.567**
PSE	-5.749***
Constant	458.713***

Note: ***p < 0.01, **p <0.05, *p < 0.1

Table A.5. Findings for life expectancy

Variables	PCSE
PHS	2.101***
PRHS	-0.038**
PS	-1.634***
GE	2.286***
RQ	-0.910**
FI	0.170***
Constant	59.393***

Note: ***p < 0.01, **p <0.05, *p < 0.1