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RESEARCH PAPER

Economic Development and Public Health Expenditures Nexus for South Asian Countries

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ABSTRACT

Public health and well-being rank third among seventeen Sustainable Development Goals because they are crucial to economic development worldwide. This study is exploring the linkage between growth and health-development priorities in South Asian countries. The bidirectional relationship between economic development and public health expenditures has been investigated using three Stage Least Squares regression with Least Square Dummy Variable technique to form fixed effects from 1980-2022. First equation explores the health-related determinants of growth while second equation explores the determinants of public health expenditures. The results showed that Economic development and public health expenditures affecting each other positively correlated in South Asian countries, whereby economic growth to health expenditure effect is higher than health expenditure to economic growth. This study proposed that considering the two way causality between health policy and economic growth, sustained growth can be achieved health sector development is prioritized while achieve growth targets.

KEYWORDS 3SLS, Economic Development, Public Health Expenditures, South Asia

Introduction

"South Asia is facing epidemic health problems; this is a palpable hurdle in developing South Asian economies" (IFPRI, 2015). One-fourth of the world's population is nested in the South Asia region. Developmental statistics show that South Asia has cultivated remarkable economic growth over the past decades (Welt hunger hilfe, 2016). Despite its rapid and dynamic growth, governments' expenditure on public health remains low. South Asia is also a haven for the vast majority of the world's poorest people, and the majority of its people are mired in hunger and poverty, and out-of-pocket payments for health services could lead to dire flashbacks on the health and development system. Access of Asian people to health, education, food, shelter, clean drinking water, and safe sewerage systems is poor and inadequate as well. The COVID-19 epidemic exposed the faulty and deficit healthcare system of South Asian countries, which has hurt not only their Gross Domestic Growth (GDP) growth rate during the COVID-19 outbreak but also will lead to their sluggish growth rate in years to come (Gadsden et al., 2022). These facts induce governments to play a vital role in investing in public health systems and device-effective health system policies to ensure equitable access to health facilities, thus paving the way toward inclusive and sustainable development in these countries.

Health is a basic human right and is imperative for economic growth and development. Healthy labor significantly contributes to national income, growth, and development (Clay & Mirvis, 2008). In this stance, Acemoglu, Robinson, and Johnson (2001) argued that health affects economic development in these different ways: i. "unhealthy people are less productive, they will not only miss working days, but their job efficiency

remains low", ii. "poor health conditions reduce life expectancy, may reduce investment in human capital because agents have short horizons", iii. "poor health may directly reduce human capital investments", iv. "meager health conditions could lead to low on-the-job investment", resulting in poor accumulation of human capital. Importantly, childhood health could positively affect learning and school attendance. Furthermore, adult mobility and mortality could lower the potential investment return of schooling; therefore, improved adult health could lead to an increase in investment in schooling and education (Mărginean, 2014). Additionally, a longer life expectancy could lead to high savings for retirement, thus accelerating the national savings and inclusive wealth (Weil, 2014). Public health is the basic ingredient of increasing income levels and an effective instrument of human welfare. There are multiple mechanisms through which governments' investment in public health can affect national income by taking decreased mortality and morbidity rates on the productivity of labor, investment through savings, and children's education into account (Bloom & Canning, 2009). The governments' expenditures on improving the public health system follow increasing national income, thus, the growth of national income should be the focus of sustainable developmental strategies. At the same time, the increase in income is a consequence of an investment in the public health system and its outcomes. A good state of public health goes parallel with a good level of national income, hence having a nexus between public health and economic development. The study in hand aims to explore the operative mechanism and major determinants of this nexus for South Asian countries.

The organization of the study is as follows: section 1 relates to the introduction, research question, and objectives, section 2 provides an extensive literature review of previous studies, a theoretical framework is presented in Section 3, and Section 4 consists of research methodology, data sources and estimated results of the study and last section is based on conclusion and policy implications.

Literature Review

Public Health Expenditures and Economic Development

Health and well-being are enlisted as the third and most important goal among the 17 Sustainable Development Goals (SDGs) by the United Nations. At the same time, this goal has forward and backward linkages with other SGDs. The relationship between health and sustainable development is well traced back to the first Rio Declaration of 1992, where the 1st principle loudly speaks that "human beings as the central concern of sustainable development living a healthy and productive life in harmony with nature" (Boyacioğlu, 2012). United Nations University (2014) mentioned Universal Health Coverage (UHC) as an important development goal to achieve worldwide.

Xu and Gu (2014) found a significant positive association between public health expenditures and economic development for 89 countries from 1990 to 2003 around the world. They captured the possible effects of age, payment type, and levels of income, a sample of people with health issues, and the extent of the financial catastrophe on GDP per capita. They strongly argued that if the public sector covers health expenditures, the probability of households landing in financial catastrophe will decrease. While mentioning that a relative amount of payment on health can lead to "financial catastrophe" for a poor person/ household as it would push them to decrease the expenditures on necessities of life, e.g., food, safe housing, and education of their children, etc. Following the same large amount of health care can push even rich households into a "financial catastrophe" as well. The rich households' "financial catastrophes" will lead to low savings and investments, resulting in poor economic development in the long run.

Mirvis et al. (2008) investigated the health and economic development relationship in the Mississippi Delta of the U.S.A. They developed a health and economic development model that considered health as an investment that determines the paths and levels of

economic growth in the long run. It is empirically found that healthy people produced more per capita income, leading to economic development in the Mississippi Delta. Heshmati (2018) uses the Solow growth model to explore the relationship between economic development and governments' health expenditure for OECD countries from 1970-1992. He concluded that there is a positive economic relationship between economic development and public health expenditures.

Stubbs et al. (2017) analyzed the International Monetary Fund's (IMF) structural reforms program for 16 West African countries from 1995 to 2014 to investigate the impact of investing in public health systems on economic development. They applied the cross-country fixed effect model to investigate the relationship between IMF structural reforms, public health expenditures, and economic development. They found that IMF reforms have decreased the fiscal fund for public health spending and reduced the number of nurses and doctors in these countries. They also found that the IMF structural reforms system brought down the overall per capita public health care spending by 0.248 in 16 West African countries, which proved an obstacle to economic development in those countries.

Li et al. (2017) explored the role of public health expenditure as a part of the socioeconomic development of Shandong province of China. The data on "GDP, gross social fixed asset investment, government expenditures on research and development, total number of high school teachers, number of middle school teachers with a bachelor degree or above, medical practitioner (charted physicians and nurses) number, number of hospitals (not including rural clinics), number of population covered by medical insurance and total population" for seventeen cities of Shandong for the period of 2000-2015 have been taken for the analysis. They adopted the Cobb-Douglas production function to check the hypothesis of public health expenditures and economic output and applied a unit root test and the Generalized Least Square (GLS) method with heteroscedasticity correction for the estimation. Public health expenditures are considered an essential input for the productivity of efficient labor and have a significant positive impact on "economic output" over there. In addition, they recommended that government decisions on public health expenditures should be based on fairness, equity, and effective public health expenditure allocation to optimize the benefits of public health expenditure in Shandong, China.

Seth et al. (2020) carried out a study to examine the long-run and short-run effects of domestic and foreign investment, institutional quality, and health expenditures on the economic growth of South Asian countries (Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan while and Sri Lanka). They used a panel data set from 1996 to 2018. They applied the Ordinary Least Square (OLS), Johansen-Fisher Cointegration test, Random Effect Models, and Granger Causality test to investigate the causality among variables. Strong bidirectional causality was found between healthcare expenditures and economic growth. Moreover, the institutional quality of a country is found to be a vital factor in improving the health quality of a nation. Effective enforcement of law and order, strict checks on corruption, political stability, and good governance could lead to the productive use of health expenditures. Productive and efficient allocation of health expenditures improves the productivity of the labor force which leads the economy toward a sustainable development trajectory.

Economic Development and Public Health Expenditures

The relationship between public health expenditures and development is a critical area of study, the foundational theory “the Human Capital Theory” as proposed by (Caire & Becker, 1967), asserts that investments in human capital, including health, education, and training, lead to increased productivity and economic growth, with public health expenditures being a crucial component of these investments. Amartya Sen's Capability Approach further emphasizes that health is a fundamental capability, enabling individuals to lead more productive lives, and substantial public health expenditures contribute to

better health, ultimately affecting income and overall human development. Empirical evidence supports this linkage, with cross-country analyses demonstrating a positive correlation between public health expenditures and human development indicators, exemplified by Filmer (1999). At the microeconomic level, Cutler and Lleras-Muney (2006) highlighted that early healthcare investments result in higher educational attainment and earnings, underscoring the long-term benefits of public health expenditures. The role of public health expenditure efficiency and equitable distribution, as discussed by Stiglitz (2002) and Sen (2004), respectively, reinforces the importance of not only the quantity but also the quality and accessibility of healthcare spending. In conclusion, this theoretical literature review underscores the pivotal role of public health investments in shaping the health and well-being of a population, contributing significantly to enhanced human development, and highlighting the need for informed policy decisions to improve public health outcomes and economic development.

WHO (2001) released a report on developing nations' social and economic development initiatives based on 1960-1990 data. Only 15% of GDP growth was employed to improve life expectancy and health systems, they hypothesized. From 1990 to 2000, South Asian diseases could not be better taken care of (De Silva et al., 2015) due to limited resources. Renton, Wall, and Lintott (2012) updated the UNDP (1999) study using 2005 developing country data to provide new economic development evaluation methods. Education, improved health outcomes, technical advancement, and GDP were examined using cross-sectional time series data and the random effect model. They concluded that socioeconomic development improves emerging countries' health systems more than technical improvement. The technical development-led GDP of rich countries, not underdeveloped countries, is increasing health inequalities.

Infant mortality rates are linked to countries' socioeconomic position, according to Santelli et al. (2017). They examined national wealth (GDP), income inequality (Gini Coefficient), 15 to 19 women per 1000 birth rate, and education spending in 142 nations of seven regions from 1990 to 2012. Empirical analysis revealed that higher GDP per capita increased health expenditures and reduced income inequality. And higher GDP per capita. Liang and Mirelman (2014) used panel data from 120 countries from 1995 to 2010, applied and 2SLS with fixed effects models to explain the complex relationship between international aid, economic development, socio-political risks, and public health expenditures. They found that economic development enables countries to improve public health sectors and public health spending boosts economic growth in return.

Chaabouni et al. (2016) examined the "casual association between CO_2 emissions, health spending and economic growth". The Simultaneous Equation Model analyzes yearly panel data from 51 countries from 1995 to 2013. Environmental quality deteriorates public health and calls for more public health spending, and economic growth is required to cover increased health expenditures. Health expenditures affect CO_2 emissions unidirectionally, but economic development affects them bi-directionally. Reich et al. (2011) examined regional healthcare expenses in Switzerland from 1997 to 2007, taking per capita public health expenditures as the dependent variable. The demand for health care comprised of per capita income, urbanization, jobless labor force, and population under 5 and over 65. While, on the supply side health care spending, No. of Pharmacies, No. of physicians/doctors, No. of beds in health care units, No. of dispensaries have been considered. They found that Switzerland has transformed its healthcare system into an accessible, feasible, and high-quality dynamic system.

Continuously, rising health costs are among the biggest economic issues in the U.S. Murthy and Okunade (2016) took per capita income, age group over 65, and healthcare technology used for research development spending health care and applied yearly Autoregressive Distributed Lag (ARDL) models to examine the technological advancement

of U.S. health from 1960 to 2012. The study found that despite technological advancement and increased GDP per capita, health cost is also increasing in the USA.

"Do we offer inexpensive, accessible, manageable healthcare? An assessment of socioeconomic status differences in Indian out-of-pocket delivery care costs" was investigated by Pradhan and Dwivedi (2017) by using the January-June 2014 survey data. Multivariate Generalized Linear Regression shows expensive and fragile health infrastructure, particularly, for rural communities.

Tandon et al. (2020) claimed that lockdown and WHO health restrictions devastated the world economy during COVID-19, hence the reduced financial capacity of the governments to make investments in healthcare delivery to their masses. High rates of unemployment, reduced GDP, destitution, income inequality, and public debt have plagued several nations. Health might be prioritized again in government budgets with higher health levies and debt relief as the health and economy of every country are interconnected.

Nazir, Mohey-ud-din and Siddique (2021) study examined the effects of poverty, income, and education on human health. Panel data from 1980–2017 was obtained from South Asian countries. They used panel OLS and the Fixed Effect Method to examine these indicators' correlation. They concluded that poverty is the main health indicator, due to poverty, countries have low per capita income, low levels of education, and low public health spending, which increases infant mortality in South Asian countries. The study also recommended education, income, and poverty reduction programs to improve this region's health along with the GDP growth rate.

Gillani et al. (2021) found that government health spending is vital to economic growth in the South Asian region. The Hausman Specification test with Fixed Effect Method for the period of the 2000–2018 South Asian panel data on GDP, decent sanitation, and trade openness lower infant mortality. Additionally, this study concentrated on building three key management sources i.e. man, money, and material, as mediating variables to promote human and environmental health. Effective budget allocation and management are needed to improve the health system in the region.

Hafeez and Naseem (2023) found that COVID-19 has devastated South Asian developing nations' economies and generated a gloomy public health expenditure system situation. Slow economic growth as a result of the epidemic has become a major issue for these emerging and developed nations. COVID-19 aftershocks will continue to affect the economic growth of these countries, not only reducing the current caring capacity of their health system but also reducing the financial capacity of these countries to improve their health system in the coming years.

Material and Methods

Theoretical Framework

The study revolves around the new "Endogenous Growth Theories"; these theories relate to investing human capital, innovation and knowledge, and sustainable economic development. (Barro, 1996; Barro & Sala-i-Martin, 1995; Meltzer & Richard, 1981) investigated and highlighted that health is key to sustainable development. They examined the two-way relationship between health and economic development. Better health status of the labor force promotes the development of an economy, while better economic conditions enable economies to improve and strengthen their health sectors.

Empirical Model Specification

The main objective of the study is to measure the two-way relationship (nexus) between public health expenditures and economic development, for this purpose, Simultaneous Equation Model has been developed.

$GDP_{it} = f(PHE_{it} + GFCF_{it} + LFR_{it} + CGD_{it} + DCPF_{it} + EGS_{it} + DC_{it} + CO_{2it})$ ……eq(1)

And

$PHE_{it} = f(GDP_{it} + GS_{it} + POP65_{it} + POP5_{it} + LEB_{it} + ERH_{it} + HDI_{it})$…….eq(2)

Where,

GDP_{it} = Gross Domestic Product Growth (% of GDP), measured in annual percentage in growth for ith countries for time t.

$GFCF_{it}$ = Gross Fixed Capital Formation, measured in percentage of GDP for ith countries for time t.

LF_{it} = Labor Force Ratio, measured as a ratio of workers to the total population for ith countries for time t.

CGD_{it} = Central Government Debt, measured in total percentage of GDP for ith countries for time t.

$DCPF_{it}$ = Domestic Credit Provided by Financial Sector, measured in percentage of GDP for ith countries for time t.

EGS_{it} = Export of Goods and Services, measured in -percentage of GDP for ith countries for time t.

DC_{it} = Democracy, taken as an index. The values of the index lie between -10 + 10. If the value is close to -10 it means there is autocracy, if the value is close to +10 it shows the strong existence of democracy for ith countries for time t.

CO_{2it} = Carbon Dioxide, measured in kilo tons (kt) for ith countries for time t.

GS_{it} = Gross Saving (% OF GDP), measured in percentage of GDP for ith countries for time t.

$POP65_{it}$ = Population above 65, measured as the no. of persons above age 65 in the population for ith countries for time t.

$POP5_{it}$ = Population under 5, measured as the no. of persons under age 5 in the population for ith countries for time t.

LEB_{it}= Life Expectancy at Birth, measured in years for ith countries for time t.

ERH_{it} = External Resources for Health (% of total health expenditures), measured in -the percentage of GDP for ith countries for time t.

HDI_{it} = Human Development Index, it is measured -regarding a score on a scale of 0 to 1 for ith countries for time t.

There are different methods for the estimation of the Simultaneous Equation Model, the precise method is an instrumental variable method that is mostly used to estimate simultaneous equations (Meharara et al., 2012). The study used the Three Stages Least

Square estimation(3SLS) Simultaneous Equations Method (SEM) to estimate eq(1) and eq(2).

The study proceeds step by step by using a correlation coefficient to check the correlation between dependent and independent variables, 3SLS has been used to check the causality between the dependent and independent variables; the use of Fixed Effect 3SLS also takes care of the probable endogeneity in the model, and finally, diagnostic tests have been used to check heteroscedasticity and normality in the extensive data set.

Data Sources

The secondary data have been retrieved for World Bank Development Indicators (WDI) from 1980 to 2022 for Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka.

Results and Discussion

Table 1
Descriptive Statistics of the Data

Variables	Observations	Mean	Std. Dev	Min	Max
LGDP	322	23.93	2.229	18.92	28.46
PHE	322	41.26	24.11	-17.26	98.94
GFCF	322	28.58	14.40	12.33	77.43
LFR	322	13.6	563.8	10.000	35.01
CGD	322	52.31	25.14	-16.43	156.6
DCPF	322	39.00	18.73	-5.734	85.63
EGS	322	28.22	27.04	-4.824	166.3
CO2	322	8.806	2.793	3.091	14.62
GS	322	18.27	15.35	-18.04	69.86
Pop65	322	4.14	1.545	2.176	9.30
Pop5	322	25.26	10.44	2.996	40.54
LEB	322	54.84	20.40	3.55	76.97
ERH	322	10.89	11.00	0.78	54.89
HDI	322	0.501	0.136	0.181	0.766

The descriptive statistics in table 1 show the mean values of LGDP, PHE, GFCF, CGD, DCP, EXGS, ICO, GS, POP above 65, and POP under 5, LAB, and HDI greater than their standard deviation values. This means that the data is less dispersed while the mean values of LFR and ERH are less than their standard deviation, which shows more dispersion in the values.

Correlation Coefficient Results

The correlation coefficient describes the association between dependent and independent variables. The value of the correlation coefficient lies between -1 to +1. If the value is close to +1, it means a very strong positive association, while the value closer to -1 shows a very strong negative correlation between dependent and independent variables. If the correlation value is zero, it shows there is no correlation among the variables. The correlation coefficient only tells how similar changes occur between different variables.

Table 2 shows the association variables as described in eq(1) and eq(2). The results of correlations are low pairwise correlation which indicate no multicollinearity problem

exists because none of the independent variables correlate higher than 0.9 in its magnitudes. Hence, there is no issue of multicollinearity in both equations.

Three Stage Least Square (3SLS)

Three Stage Least Square has been used to check causality between dependent and independent variables. The 3SLS is considered more effective as compared to 2SLS as it uses more information. 3SLS envelopes the whole structure of the model as well as restrictions imposed by the structure of the model's parameters (Zellner & Theil, 1962). It also captures the complex interaction of the economic relationship of the variables (of the whole model) and correlations of the error terms across model equations

Table 2
Correlation Coefficient of Variables

	GDP	PHE	GFCF	LFR	CGD	DCPF	EGS	DC	CO2	GDS	Pop65	LEB	ERH	HDI
GDP	1													
PHE	0.15	1												
GFCF	-0.00	0.21	1											
LFR	0.45	-0.11	-0.26	1										
CGD	-0.01	0.00	0.03	-0.11	1									
DCPF	0.16	-0.03	0.25	0.00	0.12	1								
EGD	0.05	0.06	0.23	0.21	0.05	0.08	1							
DC	0.24	0.06	-0.06	0.22	0.24	0.52	0.05	1						
CO2	-0.26	-0.32	-0.20	-0.31	0.12	0.29	-0.21	0.21	1					
GDS	0.29	0.17	0.39	0.19	-0.00	0.19	0.33	0.177	-0.16	1				
Pop65	-0.18	-0.41	0-0.27	-0.27	0.16	0.31	-0.29	0.11	0.71	-0.29	1			
LEB	-0.39	-0.35	0.01	-0.06	-0.29	-0.13	0.08	-0.27	0.18	-0.01	0.00	1		
ERH	-0.26	0.12	0.03	-0.20	-0.10	-0.14	-0.21	-0.24	0.10	-0.27	-0.06	0.12	1	
HDI	0.35	0.38	0.23	0.10	0.17	0.27	0.21	0.19	-0.30	0.36	-0.16	-0.45	-0.45	1

Table 3
Three Stage Least Square (3SLS)

Equations	**Obs**	**Parms**	**RMSE**	**"R-Sq."**	**Chi_2**	**P**
GDP	322	15	5.07	0.4588	290	0.0000
PHE	322	13	18.22	0.3192	25.30	0.0000
	Coef.	**Std. Err.**	**Z**	**P>Z**	**[95 Conf. Interval]**	
			GDP			
PHE	0.059	0.036	1.26	0.006	0.117	0.025
GFCF	0.008	0.004	-1.83	0.057	-0.017	0.000
LFR	0.004	0.0001	5.93	0.000	0.002	0.005
CGD	0.020	0.011	1.68	0.093	-0.043	0.003
DCPF	0.031	0.017	1.83	0.057	0.002	0.063
EGS	-0.237	0.192	-1.24	0.217	-0.161	0.139
CO2	-0.341	0.154	-2.21	0.027	-0.644	-0.037
			Id			
2	13.39	1.79	7.62	0.000	10.17	17.22
3	15.28	2.40	6.54	0.000	-11.10	-1.562
4	16.41	1.68	9.74	0.000	-13.10	19.70
5	17.98	2.53	7.09	0.000	-13.01	-22.96
6	-12.96	2.18	5.93	0.000	-8.66	-17.21
7	-13.32	1.53	8.70	0.000	-10.36	16.32
8	14.89	1.98	7.50	0.000	-10.99	18.78
-cons	-1.71	2.01	-0.85	0.395	-5.66	2.23
			PHE			
GDP	2.05	40.39	5.16	0.000	-2.83	-1.27
GS	0.198	0.149	1.32	0.185	-0.095	0.492
Pop65	-3.176	0.795	-399	0.000	-4.736	-1.616
Pop5	3.33	.8901	-3.75	0.000	-5.083	-1.59
LEB	0.298	0.193	1.55	0.122	-0.677	-0.079
ERH	0.454	0.093	0.86	0.000	-0.271	0.637
HDI	49.01	12.06	4.06	0.000	-25.37	72.65

			Id			
2	-51.42	9.613	5.35	0.000	-35.58	70.27
3	-42.80	13.34	3.21	0.001	-16.65	68.96
4	39.56	12.71	3.11	0.002	-14.63	64.39
5	-47.05	14.09	3.34	0.001	-19.43	74.67
6	-46.76	12.47	0.75	0.000	-22.34	71.19
7	-30.65	12.16	2.52	0.012	-6.80	54.49
8	-44.53	12.27	3.63	0.000	-20.47	68.61
-cons	24.78	14.37	1.73	0.084	-3.313	52.89

Endogenous Variables: GDP, PHE
Exogenous Variables: GFCF, LFR, CGD, DCP, EGS, CO_2, GS, Pop65, Pop5, LEB, ERH, HDI

In the first equation, GDP is endogenous, while PHE, GFCF, LFR, CGD, DCP, EXDG, and ISO are exogenous variables. In the second equation, PHE is endogenous, while GDP, GS, POP 65, POP5, LAB, ERH, and HDI are exogenous variables.

After estimation, results in table 3 show that in the first equation, all the variables have a positive effect except carbon dioxide emission (CO_2 emission) and exports of goods and services (EGS). At the same time, the p-value is also positively significant, which means that except for carbon dioxide (CO_2 emission) and exports of goods and services (EGS), all the independent variables of the first equation are positively related to the dependent variable, i.e., Gross Domestic Product (GDP). Those variables are considered significant in the p-value compared to z, where P > |z| is less than 0.05. The result shows that P > |z| of Public Health Expenditures (PHE), Labor force ratio (LFR), Gross Fixed Capital Formation (GFCF), Domestic Credit provided by the Financial Sector (DCP), and CO2 emission have values less than 0.05 which means that one unit increase in Gross Domestic Product will increase PHE by 0.05 percent, 0.004 increase in LFR, 0.03 increase in DCP and 0.34 decrease in CO2 emission.

In the second equation, Gross Domestic Product (GDP), Human Development Index (HDI), Gross Savings (GS), Population under 5, Life Expectancy at Birth (LEB), and External Resources for Health (ERH) have a positive effect. While the Population above 65 has negative effects. If we check the results regarding p-value compared to z, variables whose P > |z| is less than 0.05 are significant. One unit increase in Public Health Expenditure (PHE) leads to a 0.25 increase in Gross Domestic Product (GDP), 0.19, 3.33, 0.29, 0.45, and 49.0 increase in Gross Savings (GS), Population under 5 (POP5), Life Expectancy at Birth (LEB), External Resources of Health (ERH) and Human Development Index (HDI) respectively.

Diagnostic Test

Diagnostic tests indicate whether a regression model is correctly specified regarding the regressors that have been included, enhancing the robustness of the model. Heteroscedasticity and non-normality test has been used in the study as follows:

Table 4
Heteroscedasticity Test

System Heteroscedasticity Test (3SLS)					
	H_o: Homoscedasticity Test		H_1: Heteroscedasticity Test		
GDP	Hall-Pagan LM Test	E_2=LYH$_2$	=3.1167	p-value > chi_2 (1)	0.0775
PHE	Hall-Pagan LM Test	E_2=yh	=3.804	p-value > chi_2 (1)	0.0511

At a 5% level of significance, the majority of tests reveal that there is no heteroscedasticity. At a 5% level of significance, the majority of tests reveal that there is no

heteroscedasticity. The results of Table 4 show that the p-value is greater than the chi-square for all the observations, accepting the null hypothesis, and indicating no heteroscedasticity in the model.

Table 5
Normality Test

***System non-normality test 3SLS**				
*** Single Equation Non-Normality Test				
	H_o: Normality Test		H_1: Non-Normality Test	
Eq.GDP	Jarque-Bera LM Test	1.8081	p-value > chi_2 (2)	0.4049
Eq. PHE	Jarque-Bera LM Test	7.1727	p-value > chi_2 (2)	0.0264

The sample size is above 30, and this model is asymptotically normal as suggested by the central limit theorem (Lind et al., 2022). The above-given results in table 5 show that the p-value is greater than the chi-square for both models, which shows that both models are normally distributed.

Conclusion

Based on the estimated two-way relationship with the help of the Three-Stage Least Square Model, it can be concluded that the results of both equations show a strong correlation between all the variables. Therefore, it is safely said that there is a nexus between GDP and PHE, economic development, and public health expenditures.

In the first equation, Gross Domestic Product (GDP) is a dependent variable with Public Health Expenditure (PHE), Gross Fixed Capital Formation (GFCF), Labor Force Ratio (LFR), Central Government Debt (CGD), and Domestic Credit provided by the Financial Sector (DCPF), which has a positive and significant relationship with Gross Domestic Product (GDP) as dependent variables. GDP positively influences the labor force Ratio (LFR) positively and significantly, As the development of human capital of a country develops, the working efficiency of the labor force increases the phenomenon will lead the GDP to grow.

While in the second equation, Public Health Expenditure (PHE) is a dependent variable. The Gross Domestic Product (GDP), Population under 5 (Pop5), Life Expectancy at Birth (LEB), External Resources for Health (ERF), and Human Development Index (HDI) have a positive relationship with Public Health Expenditures (PHE) are taken as independent variables. The Population above 65 (Pop65) shows a negative effect on Public Health Expenditure (PHE), all other variables are positively related to PHE and public health expenditures.

The results prove that there is a two-way relationship between economic development (GDP) and Public Health Expenditures (PHE)for all South Asian countries. If a country's GDP increases, the Public Health Expenditures (PHE) of that country will also be increased and an increase in Public Health Expenditures will pave the way to increase GDP as well. The governments should regulate the Gross Fixed Capital Formation (GFCF), Exports of Goods and Services (EGS), and employment opportunities to the Labor Force (LF), and need to utilize Central Government Debt (CGD) and Domestic Credit provided by the Financial Sector (GCPF) in productive ways to increase GDP. The Gross Domestic Product (GDP) will also increase if these variables grow. With the development of all these sectors, GDP will increase, enabling the government to strengthen their health sectors, too. The Population under 5 also is positively related to health expenditures, strengthening the health sector will ensure a reduced infant mortality rate and an increase in life expectancy. Increased CO_2 emissions indicate the increased economic activity in South Asian countries,

but putting a burden on their health system. It indicates a trade-off for the development and environment of these countries.

The high elasticity of effect of growth on public health policy as compared to effect of public health policy to growth showed that if the country is pursuing to a sustained growth, it must ensure a significant portion of resources for health care development. This effect will develop robust human capital contributing in the productivity of labor force.

References

Acemoglu, D., Johnson, S., & Robinson, J. A. (2001). The Colonial Origins of Comparative Development: An Empirical Investigation. *American Economic Review*, *91*(5), 1369–1401. https://doi.org/10.1257/aer.91.5.1369

Barro, R. (1996). *Determinants of Economic Growth: A Cross-Country Empirical Study*. National Bureau of Economic Research. https://doi.org/10.3386/w5698

Barro, R., & Sala-i-Martin, X. (1995). *Technological Diffusion, Convergence, and Growth*. National Bureau of Economic Research. https://doi.org/10.3386/w5151

Bloom, D. E., & Canning, D. (2009). Chpater 3—Population Health and Economic Growth. In *Health and Growth*. The World Bank.

Boyacioğlu, E. Z. (2012). The importance of health expenditures on sustainable development. *International Journal of Social Sciences and Humanity Studies*, *4*(2), Article 2.

Caire, G., & Becker, G. S. (1967). Human Capital, A Theoretical and Empirical Analysis with Special Reference to Education. *Revue Économique*, *18*(1), 132. https://doi.org/10.2307/3499575

Chaabouni, S., Zghidi, N., & Ben Mbarek, M. (2016). On the causal dynamics between CO 2 emissions, health expenditures and economic growth. *Sustainable Cities and Society*, *22*, 184–191. https://doi.org/10.1016/j.scs.2016.02.001

Clay, J. A., & Mirvis, D. M. (2008). Health and Economic Development: Introduction to the Symposium. *Journal of Health and Human Services Administration*, *31*(1), 4–9.

Cutler, D., & Lleras-Muney, A. (2006). *Education and Health: Evaluating Theories and Evidence*. National Bureau of Economic Research. https://doi.org/10.3386/w12352

De Silva, A. P., De Silva, S. H. P., Haniffa, R., Liyanage, I. K., Jayasinghe, K. S. A., Katulanda, P., Wijeratne, C. N., Wijeratne, S., & Rajapakse, L. C. (2015). A cross sectional survey on social, cultural and economic determinants of obesity in a low middle income setting. *International Journal for Equity in Health*, *14*, 6–6. PubMed. https://doi.org/10.1186/s12939-015-0140-8

Filmer, D. (1999). Child Mortality and Public Spending on Health: How Much Does Money Matter? *Policy Research Working Papers*. https://doi.org/10.1596/1813-9450-1864

Gadsden, T., Ford, B., Angell, B., Sumarac, B., de Oliveira Cruz, V., Wang, H., Tsilaajav, T., & Jan, S. (2022). Health financing policy responses to the COVID-19 pandemic: A review of the first stages in the WHO South-East Asia Region. *Health Policy and Planning*, *37*(10), 1317–1327.

Hafeez, N., & Naseem Naik, S. (2023). *Economic Consequences of the COVID-19 Eruption: A Study of Selected South Asian Countries* [MPRA Paper]. University Library of Munich, Germany

IFPRI. (2015). *Global Hunger Index 2015, Asia Fact Sheet*. International Food Policy Research Institute.

Li, L., Wu, M., & Wu, Z. (2017). *The Impact of Public Health Expenditure on Economic Development—Evidence From Prefecture-level Panel Data of Shandong Province*.

Proceedings of the International Conference on Transformations and Innovations in Management.

Liang, L.-L., & Mirelman, A. J. (2014). Why do some countries spend more for health? An assessment of sociopolitical determinants and international aid for government health expenditures. *Social Science & Medicine*, *114*, 161–168.

Lind, D. A., Marchal, W. G., & Wathen, S. A. (2022). *Basic statistics for business & economics*. McGraw-Hill

Mărginean, I. (2014). Public Expenditure with Education and Healthcare in EU Countries. *Procedia Economics and Finance*, *8*, 429–435. https://doi.org/10.1016/s2212-5671(14)00110-5

Meharara, M., Sharzei, G., & Mohaghegh, M. (2012). The Relationship between Health Expenditure and Environmental Quality in Developing Countries. *Journal of Health Administration*, *14*(46), 79–88.

Meltzer, A. H., & Richard, S. F. (1981). A Rational Theory of the Size of Government. *Journal of Political Economy*, *89*(5), 914–927. https://doi.org/10.1086/261013

Mirvis, D. M., Chang, C. F., & Cosby, A. (2008). Health as an Economic Engine: Evidence for the Importance of Health in Economic Development. *Journal of Health and Human Services Administration*, *31*(1), 30–57.

Murthy, V. N. R., & Okunade, A. A. (2016). Determinants of U.S. health expenditure: Evidence from autoregressive distributed lag (ARDL) approach to cointegration. *Economic Modelling*, *59*, 67–73. https://doi.org/10.1016/j.econmod.2016.07.001

Nazir, S., Ghulam Mohey-ud-din, & Siddique, M. A. (2021). Human health and poverty: an empirical analysis of selected south Asian countries. *PalArch's Journal of Archaeology of Egypt / Egyptology*, *18*(4), Article 4.

Pradhan, J., & Dwivedi, R. (2017). Do we provide affordable, accessible and administrable health care? An assessment of SES differential in out of pocket expenditure on delivery care in India. *Sexual & Reproductive Healthcare*, *11*, 69–78. https://doi.org/10.1016/j.srhc.2016.10.006

Qaiser Gillani, D., Gillani, S. A. S., Naeem, M. Z., Spulbar, C., Coker-Farrell, E., Ejaz, A., & Birau, R. (2021). The Nexus between Sustainable Economic Development and Government Health Expenditure in Asian Countries Based on Ecological Footprint Consumption. *Sustainability*, *13*(12), 6824. https://doi.org/10.3390/su13126824

Reich, O., Weins, C., Schusterschitz, C., & Thöni, M. (2011). Exploring the disparities of regional health care expenditures in Switzerland: Some empirical evidence. *The European Journal of Health Economics*, *13*(2), 193–202. https://doi.org/10.1007/s10198-011-0299-x

Renton, A., Wall, M., & Lintott, J. (2012). Economic growth and decline in mortality in developing countries: An analysis of the World Bank development datasets. *Public Health*, *126*(7), 551–560. https://doi.org/10.1016/j.puhe.2012.03.011

Santelli, J. S., Song, X., Garbers, S., Sharma, V., & Viner, R. M. (2017). Global Trends in Adolescent Fertility, 1990–2012, in Relation to National Wealth, Income Inequalities, and Educational Expenditures. *Journal of Adolescent Health*, *60*(2), 161–168. https://doi.org/10.1016/j.jadohealth.2016.08.026

Sen, A. (2004). Why Health Equity? *Public Health, Ethics, and Equity*, 21–34. https://doi.org/10.1093/oso/9780199276363.003.0003

Sethi, N., Mohanty, S., Das, A., & Sahoo, M. (2020). Health Expenditure and Economic Growth Nexus: Empirical Evidence from South Asian Countries. *Global Business Review*, 097215092096306. https://doi.org/10.1177/0972150920963069

Stiglitz, J. E. (2002). Information and the Change in the Paradigm in Economics. *American Economic Review*, *92*(3), 460–501. https://doi.org/10.1257/00028280260136363

Stubbs, T., Kentikelenis, A., Stuckler, D., McKee, M., & King, L. (2017). The impact of IMF conditionality on government health expenditure: A cross-national analysis of 16 West African nations. *Social Science & Medicine*, *174*, 220–227. https://doi.org/10.1016/j.socscimed.2016.12.016

Tandon, A., Roubal, T., McDonald, L., Cowley, P., Palu, T., de Oliveira Cruz, V., & Kurowski, C. (2020). *Economic impact of COVID-19: Implications for health financing in Asia and Pacific*. World Bank.

UNDP. (1999). Human Development Report 1999. In *Human Development Reports*. United Nations. https://hdr.undp.org/content/human-development-report-1999

United Nations University. (2014). *Inclusive Wealth Report 2014: Measuring Progress Toward Sustainability*. Cambridge University Press

Weil, D. N. (2014). Chapter 3—Health and Economic Growth. In P. Aghion & S. N. Durlauf (Eds.), *Handbook of Economic Growth* (Vol. 2, pp. 623–682). Elsevier. https://doi.org/10.1016/B978-0-444-53540-5.00003-3

Welt hunger hilfe. (2016). *Annual Report 2016*. Welt Hunger Hilfe Foundation Germany.

WHO. (2001). *The World Health Report 2000: Health Systems: Improving Performance*. World Health Organization.

Xu, D., & Gu, T. (2014). Carbon source starvation triggered more aggressive corrosion against carbon steel by the Desulfovibrio vulgaris biofilm. *International Biodeterioration & Biodegradation*, *91*, 74–81. https://doi.org/10.1016/j.ibiod.2014.03.014

Zellner, A., & Theil, H. (1962). Three-Stage Least Squares: Simultaneous Estimation of Simultaneous Equations. *Econometrica*, *30*(1), 54. https://doi.org/10.2307/1911287