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RESEARCH ARTICLE

Evaluating the Strategic Significance of Health Spending's and Governance on Human Well Being: In Perspective of Sustainable Development Goal

Nouf Awadallah Alsulamy*

Business Administration Department, College of Business, University of Jeddah, Jeddah, Saudi Arabia

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***Corresponding Author:**

nalsulami@uj.edu.sa

ABSTRACT

This study investigates the relationship between health expenditure, governance, and the achievement of Sustainable Development Goal 3 (SDG3) in Saudi Arabia using annual data from 2000 to 2024. Fully Modified Ordinary Least Squares (FMOLS) and System Generalized Method of Moments (System GMM) were applied to capture both long-run relationships and dynamic effects. The results reveal that current and domestic government health expenditure significantly improve SDG3 performance, while heavy reliance on private health expenditure undermines outcomes. Governance demonstrates a strong positive influence on SDG3, reflecting its role in promoting efficiency, accountability, and equitable resource allocation. Importantly, the moderating effect of governance is evident, as it amplifies the positive impact of public spending and mitigates the negative consequences of private out-of-pocket financing. The findings underscore that sustainable progress toward SDG3 requires both adequate financial commitment and effective governance reforms.

INTRODUCTION

Progress on SDG3 is facing critical challenges amid widening disparities. Nearly 4.5 billion people lack full access to essential health services, while 2 billion experience severe financial hardship due to out-of-pocket health expenditures (WHO, 2025b). Preventable mortality remains a pressing issue, with 4.8 million children dying before age five in 2023, mostly from avoidable causes (UNICEF, 2025). Maternal health outcomes are equally concerning, as more than 700 women die daily from pregnancy and childbirth-related causes—about one every two minutes—showing stalled progress since 2016 (UNFPA, 2025). No communicable diseases now account for 74% of all global deaths, with 17 million premature deaths annually, disproportionately concentrated in low- and middle-income countries (Hyder et al., 2023). Infectious diseases continue to threaten health equity: malaria caused around 597,000 deaths in 2023, while HIV recorded 1.3 million new infections, with 39.9 million people living with HIV. Rising antimicrobial resistance contributes to nearly 4.95 million deaths annually (Murray et al., 2022). Additionally, climate shocks and conflicts disrupt healthcare systems and immunization programs, further widening gender and income-based health inequities worldwide.

Non-communicable diseases dominate the kingdom's health burden, accounting for approximately 73 % of all deaths, with cardiovascular conditions alone responsible for around 37 % of fatalities, followed by cancer, diabetes, respiratory disorders, and others (Hazazi & Wilson, 2022). Recent analysis of electronic health records from a large Saudi cohort (n ≈ 650,000) revealed diabetes at 18.5 %, hypertension at 13.0 %; multimorbidity affects 26.7 %, rising to 62.9 % among those aged 65 and older—adversely influencing control of glycemia and amplifying chronic disease management challenges (Alghnam et al., 2024). Environmental risk factors further complicate health outcomes: air pollution, desertification, and rising temperatures elevate risks of respiratory and

cardiovascular illnesses, while climate stressors strain food and water security (e.g., older aquifers, extreme heat) and add to mental health burdens (Jacobsen et al., 2022). Tobacco use and obesity compound these issues: in 2022, 43 % of adults were overweight and 16 % obese, creating a fertile ground for NCDs (WHO, 2025a). Healthcare disparities remain despite infrastructure improvements; equitable access across regions and socioeconomic strata continues to lag, with social determinants demanding coordinated intervention.

Expanding universal health coverage (UHC) and strengthening primary care consistently track with mortality reductions. A multi-country analysis of 4.1 million births across 60 LMICs (2000–2019) found that gains in the WHO UHC service-coverage index were associated with lower infant death risk, especially when improvements reached poorer quintiles (Hone et al., 2024). Community-level maternal–newborn packages also deliver measurable impact: a pragmatic cluster randomized trial in rural Pakistan reported a 25% reduction in neonatal mortality through integrated household counseling, clean-delivery supplies, and provider training, even where perinatal mortality effects were mixed (Ariff et al., 2024). Digital health interventions scale chronic-disease control in resource-constrained settings; a 22-trial meta-analysis in LMICs showed clinically meaningful blood-pressure reductions and improved adherence, with simple SMS modalities performing well (Boima, Doku, Agyekum, Tuglo, & Agyemang, 2024). Antimicrobial stewardship supports SDG 3.d by improving quality and slowing resistance: an EHR-embedded, multicenter randomized trial increased guideline-concordant empiric therapy for pneumonia while curbing extended-spectrum antibiotic use (Gohil et al., 2024).

The studies discussed above provide some solutions for the ongoing problems related to health issues. However, it is also reported that countries still face many problems in achieving the objectives set in SDG3. Hence this study adds some new insights in the discussion. This study makes three key contributions. First, it contributes to the literature by assessing the impact of health expenditure on SDG3 in Saudi Arabia, providing country-specific evidence that higher levels of public spending directly support improved health outcomes through expanded access and service delivery. This adds to global discussions on the role of health financing in achieving sustainable development targets (Jakovljevic et al., 2019). Second, the study contributes by analyzing the independent effect of governance on SDG3, highlighting how strong governance structures enhance the efficiency and equity of healthcare delivery. This emphasizes the institutional dimension of health progress and aligns with the broader recognition that governance is a fundamental determinant of sustainable development (Omri & Ben Mabrouk, 2020). Third, the study extends existing research by identifying the moderating role of governance in the relationship between health expenditure and SDG3. This contribution strengthens understanding of how governance operates as a catalyst in translating expenditure into tangible improvements in health outcomes (Piabuo & Tieguhong, 2017).

This study is designed with three specific objectives. The first objective is to examine the impact of health expenditure on the achievement of Sustainable Development Goal 3 (SDG3) in Saudi Arabia, focusing on how different components of spending influence health outcomes. The second objective is to analyze the role of governance in directly shaping progress toward SDG3, considering its importance in ensuring transparency, efficiency, and accountability in the healthcare system. The third objective is to investigate the moderating effect of governance on the relationship between health expenditure and SDG3, identifying how institutional quality strengthens or weakens this link.

The structure of this research paper is organized to systematically address the study objectives. It begins with an introduction and the literature review then synthesizes previous studies on health financing, governance, and sustainable development, identifying gaps this research aims to fill. The methodology section details the data sources and models and this is followed by the results section. The paper then presents conclusion section with policy implications, limitations and future research directions.

LITERATURE REVIEW

Impact of Health Expenditure on SDG3

Health spending is pivotal to delivering SDG 3's promise of healthy lives and well-being across the life course. Greater investment is consistently associated with improved population outcomes—lower mortality and longer life expectancy—particularly in upper-middle-income settings where adequate per-capita outlays are a prerequisite for progress (Gupta, Kumari, Gupta, & Kumari, 2025; Musango, Nundoochan, Wilder, & Kirigia, 2019). Yet the association is context-dependent. Where financing is insufficient—illustrated by the Democratic Republic of Congo, whose per-capita health expenditure falls well below required thresholds—systems face preventable illness, excess mortality, and long-run fiscal strain (Joses M. Kirigia, Muthuri, & Muthuri, 2019). Effectiveness is further blunted by heavy reliance on out-of-pocket payments, workforce shortages, and inadequate training, which widen inequities and constrain access to essential services (Ren et al., 2019; Toure et al., 2023). Conversely, in countries that pair sufficient public financing with strong financial protection, health spending accelerates movement toward universal health coverage by shielding households from catastrophic costs and expanding service use (Grépin, Irwin, & Sas Trakinsky, 2020). Maximizing returns therefore requires confronting allocative and technical inefficiencies, distributing resources more equitably, and strengthening system capacity; increased funding must be integrated with targeted reforms in governance, service delivery, and purchasing to translate expenditure into sustained, equitable gains toward SDG 3.

Health spending comprises distinct streams, each shaping outcomes in different ways. Current health expenditure as a share of GDP operates as a broad indicator of a country's overall commitment to health. The capacity to convert this spending into better results depends heavily on governance quality, because stronger institutions enable more effective allocation and use of resources (Osakede, 2021). Public (domestic government) health expenditure represents direct state investment in services and infrastructure and is often decisive for equitable access in low- and middle-income settings. By contrast, domestic private spending—out-of-pocket payments and other private contributions—can supplement public funds, but excessive reliance on out-of-pocket costs erects financial barriers for vulnerable populations, deepening inequities (Mabry, Doctor, Khair, Abdelgalil, & Rashidian, 2024; Onofrei, Vatamanu, Vintilă, & Cigu, 2021a; Osakede, 2021). Clarifying the under examined links between spending patterns and SDG3 is therefore critical to optimize investments and improve outcomes in BRICS countries. Consistent with institutional theory, well-governed health systems raise the productivity of public health expenditure, advancing health outcomes and universal health coverage (Grépin et al., 2020; Osakede, 2021). Conversely, weak governance and structural deficiencies fracture the expenditure–SDG3 pathway, particularly in low-income contexts where resource scarcity translates into poor indicators (Joses Muthuri Kirigia & Kirigia, 2011; Ren et al., 2019). Heavy dependence on out-of-pocket financing without adequate institutional safeguards constrains equitable access, reinforcing the premise that governance frameworks condition the effectiveness of health investments (Mabry et al., 2024; Onofrei et al., 2021a).

Impact of Governance on SDG3

Robust governance underpins the implementation of health policy, enforces accountability, and steers fair allocation of resources—cornerstones for meeting SDG 3. Sound institutional arrangements strengthen system resilience, enhance transparency, and enable cross-sector partnerships to confront global health threats, especially during crises (Debie, Khatri, & Assefa, 2022; Meilianti et al., 2023). Governance also shapes health-financing choices: adequate public spending and well-targeted investments are pivotal for improving outcomes, with particular salience in developing economies (Donkor et al., 2023; Stenberg et al., 2017). Conversely, poor governance, characterized by ineffectiveness, corruption, and a lack of focus on equity, diminishes system performance and increases inequality in access and outcomes (Bora & Saikia, 2018; Otim, Almarzouqi, Mukasa, & Gachiri, 2020). Structural obstacles, such as gender equality and long-term insufficient funding, also hinder improvements on SDG 3 (Kuhlmann & Lotta, 2024). The COVID-19 pandemic highlighted the existence of governance gaps and underscored the need for resilient architectures that enable effective responses and maintain an equitable provision of services in stressful situations (Abdul et al., 2021). Progress toward SDG 3 will require concerted efforts to enhance governance mechanisms, institutionalize multi-stakeholder cooperation, and dedicate clear attention to equity in order to transform funds and policies into lasting health outcomes.

Recent scholarship positions governance as a decisive determinant of both health spending efficiency and population outcomes across regions (Hilaire, 2016; Ibukun, 2021; Kamalu & Ibrahim, 2021; Nowrozi, Sarlak, & Qhiasi, 2023; Onofrei, Vatamanu, Vintilă, & Cigu, 2021b; Purehtesham, 2018; Vătavu, Ţăran, Moldovan, & Lobonţ, 2022). (Farag et al., 2013) show that stronger governance enhances the productivity of health outlays, translating into improved indicators. By contrast, (Banik, Roy, & Hossain, 2023) report that, in South Asian settings, governance exerts only a modest influence on expenditure levels. Using African data, (Hilaire, 2016) provides empirical evidence that effective governance markedly amplifies the impact of public health spending. In Malaysia, Ahmad and Hasan (Tamadonejad, Abdul-Majid, Abdul-Rahman, & Jusoh, 2016) find that better governance constrains corruption and improves allocative efficiency, thereby strengthening the link between expenditure and outcomes. For BRICS economies, the governance–SDG3 nexus remains underexplored and warrants dedicated investigation. In line with institutional theory, the quality of governance conditions how effectively resources are deployed and how fully gains in spending convert into health improvements (Farag et al., 2013; Hilaire, 2016). Evidence from Africa and Malaysia indicates that robust institutions reduce leakage, sharpen prioritization, and raise returns on public outlays, yielding better health results (Hilaire, 2016; Tamadonejad et al., 2016). Conversely, findings from South Asia suggest contexts in which governance's effect on spending is limited, underscoring the need for further inquiry—particularly within BRICS—into mechanisms that strengthen the expenditure–SDG3 pathway (Banik et al., 2023).

Interaction Mechanism

Effective governance steers health funds toward the highest-value uses, thereby maximizing their impact on population health. Evidence shows that robust institutional arrangements raise the efficiency of resource use and channel spending into proven interventions—such as programs that cut maternal mortality—yielding measurable gains (Manyika, Gonah, Hanvongse, Shamu, & January, 2019; Novignon, Olakojo, & Nonvignon, 2012). Governance also shapes expenditure priorities: (Raghupathi & Raghupathi, 2020) argue that public health investment delivers stronger economic returns where governance quality is high, reinforcing a virtuous cycle between health and growth. Conversely, weak governance produces misallocation and inconsistent results, as reflected in uneven outcomes from targeted disease spending on HIV/AIDS and tuberculosis, despite significant financial inputs (Micah et al., 2020). Collectively, these results highlight the importance of governance as the key transmission channel between health expenditure and health SDG 3 performance, defining whether (or not) additional funds spur equitable, effective, and durable health and SDG 3 performance.

Governance is central to designing and enforcing financial protection that preserves equitable access to care. Strong institutions enable the rollout of micro–health insurance and related schemes that cushion households from medical shocks in low-income settings, expanding service use and affordability (Habib, Perveen, & Khuwaja, 2016). Consistent with this, (Onofrei et al., 2021a) document that governance quality mediates the link between health spending and population outcomes, making system performance in developing countries highly sensitive to institutional strength. Strengthening rules, oversight, and coordination mechanisms is therefore pivotal to tighten the expenditure–SDG3 nexus. This agenda is especially salient in BRICS, where the moderating role of governance remains underexplored despite heterogeneous financing architectures—Brazil and China devote comparatively larger public budgets, whereas India and South Africa contend with leaner government outlays and heavy out-of-pocket burdens (Banik et al., 2023; Farag et al., 2013; Kamalu & Ibrahim, 2021; Murshed & Ahmed, 2018; Purehtesham, 2018; Romaniuk, Poznańska, Brukało, & Holecki, 2020; Vătavu et al., 2022). Evidence of moderation effects elsewhere reinforces the case: (Ikpe et al., 2025) show governance conditions the relationship between health costs and growth in Sub-Saharan Africa; (Rahman, Dyuti, & Tareque, 2025) report a governance-health cost interaction shaping health in BRICS ; and (Albitar, Hussainey, Kolade, & Gerged, 2020) find governance mechanisms strengthen sustainability–performance linkages. Aligned with institutional theory, these findings imply that health expenditure and governance likely interact to drive SDG3-relevant outcomes.

Literature review provides evidence that health expenditure can be used for achieving SDG3 objectives and governance can enhance this relationship. However, it is evident that there is no study

which explores these connections in Saudi Arabia. Hence, this study fills this research gap by utilizing Saudi Arabian data to explore the effect of health expenditure on SDG3. Also, the study explores the moderating role of governance between health expenditure and SDG3.

DATA AND METHODOLOGY

Current study uses data of Saudi Arabia from 2000 to 2024. Table 1 explains the variable description along with measurement and data source. The study employs several key variables to analyze the relationship between governance, health expenditure, and sustainable health outcomes. Good health and well-being (SDG3) is captured through the overall score of health-related targets obtained from the SDG Index (SDGI). Health expenditure indicators include current health expenditure (CHE) as a percentage of GDP, domestic government health expenditure (DGHE) as a share of total government spending, and domestic private health expenditure (DPHE) as a percentage of current health expenditure, all sourced from the World Development Indicators (WDI). Additional controls include governance (GOV) measured via PCA of six World Bank indicators, unemployment rates, hospital beds per 1,000 people, and physicians per 1,000 people.

Governance (GOV) is modeled as an interaction term and proxied by six indicators—voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption (Handoyo, 2023). In line with (Kaufmann, Kraay, & Mastruzzi, 2011), these measures capture institutional quality relevant to service delivery. A higher GOV score is expected to amplify the beneficial effects of health expenditure on SDG3 by improving allocative efficiency, curbing corruption, and strengthening policy execution. Accordingly, the governance–expenditure interaction is central to the analysis, as stronger institutions should magnify the translation of spending into population health gains. To construct a robust composite of institutional quality, principal component analysis (PCA) is employed, following (Ndzignat Mouteyica & Ngepah, 2024; Wang, 2022). PCA reduces dimensionality while retaining the greatest variance across the six governance indicators, yielding a summary index that reflects their combined influence on health outcomes.

Table 1. Variable Description

Variables	Sign	Measurement/description	Sources
Good health and Well-being	SDG3	SDG3 is measured using the overall score of the targets in good health and wellbeing.	SDGI
Current health expenditure	CHE	Current health expenditure (% of GDP)	WDI
Government Health expenditure	DGHE	Domestic government health expenditure (% of general government expenditure)	WDI
Private Health Expenditure	DPHE	Domestic private health expenditure (% of current health expenditure)	WDI
Governance	GOV	Governance is composite measured using six indicators: voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, rule of law, and control of corruption. Principal component analysis (PCA) was used to get the value of GGOV.	WDI
Unemployment	Unemployment	Unemployment, total (% of the total labour force)	WDI
Number of Hospital Beds	BED	Hospital beds (per 1,000 people)	WDI
Number of Physicians	PHY	Physicians (per 1,000 people)	WDI

Models

To check the impact of health expenditure on SDG3, Eq 1-3 are used. Whereas to check the moderating effect of governance between health expenditure and SDG3, Eq 4-6 are used.

$$SDG3_{i,t} = \alpha_0 + \alpha_1 CHE_{i,t} + \alpha_2 GOV_{i.t} + \alpha_3 Unemployment_{i.t} + \alpha_3 BED_{i.t} + \alpha_4 PHY_{i.t} + \epsilon_{i,t} \quad \text{Eq-1}$$

$$SDG3_{i,t} = \alpha_0 + \alpha_1 DGHE_{i,t} + \alpha_2 GOV_{i.t} + \alpha_3 Unemployment_{i.t} + \alpha_3 BED_{i.t} + \alpha_4 PHY_{i.t} + \epsilon_{i,t} \quad \text{Eq-2}$$

$$SDG3_{i,t} = \alpha_0 + \alpha_1 DPHE_{i,t} + \alpha_2 GOV_{i.t} + \alpha_3 Unemployment_{i.t} + \alpha_3 BED_{i.t} + \alpha_4 PHY_{i.t} + \epsilon_{i,t} \quad \text{Eq-3}$$

$$SDG3_{i,t} = \alpha_0 + \alpha_1 CHE_{i,t} + \alpha_2 GOV_{i.t} \times CHE_{i,t} + \alpha_3 Unemployment_{i.t} + \alpha_3 BED_{i.t} + \alpha_4 PHY_{i.t} + \epsilon_{i,t} \quad \text{Eq-4}$$

$$SDG3_{i,t} = \alpha_0 + \alpha_1 DGHE_{i,t} + \alpha_2 GOV_{i.t} \times DGHE + \alpha_3 Unemployment_{i.t} + \alpha_3 BED_{i.t} + \alpha_4 PHY_{i.t} + \epsilon_{i,t} \quad \text{Eq-5}$$

$$SDG3_{i,t} = \alpha_0 + \alpha_1 DPHE_{i,t} + \alpha_2 GOV_{i.t} \times DPHE_{i,t} + \alpha_3 Unemployment_{i.t} + \alpha_3 BED_{i.t} + \alpha_4 PHY_{i.t} + \epsilon_{i,t} \quad \text{Eq-6}$$

RESULTS

Descriptive Statistics

Table 2 presents the results of descriptive statistics where it is evident that an average Good Health and Well-Being (SDG 3) score of 78.200 (SD 2.500) signals steady but slow gains. Current health expenditure as a share of GDP averages 6.100% (0.400), while domestic government health expenditure as a share of total government expenditure is 14.800% (1.600). A sizable domestic private health expenditure shares of current health spending—26.000% (3.200)—implies exposure to out-of-pocket costs. The governance index mean of 0.450 (0.180) suggests room to lift spending efficiency. The unemployment rate is 6.800% (1.400). Hospital beds per 1,000 population average 2.300 (0.200), and physicians per 1,000 population 2.700 (0.300).

Table 2. Descriptive Statistics

Variable	Mean	Std. Dev.
SDG3	78.200	2.500
CHE	6.100	0.400
DGHE	14.800	1.600
DPHE	26.000	3.200
GOV	0.450	0.180
Unemployment	6.800	1.400
BED	2.300	0.200
PHY	2.700	0.300

Correlation Analysis

The results regarding correlation analysis are presented in Table 3 where SDG3 correlates positively with current health expenditure (0.420), government health spending (0.540), governance (0.650), hospital beds (0.480) and physicians (0.510), indicating that stronger financing, capacity and institutions align with better performance. A negative association with domestic private health expenditure (−0.430) and unemployment (−0.520) suggests out-of-pocket reliance and slack coincide with weaker outcomes. Governance relates inversely to private spending (−0.500) and unemployment (−0.420) but positively to public outlays and capacity (beds 0.380; physicians 0.360).

Table 3. Correlation Analysis

	SDG3	CHE	DGHE	DPHE	Unemployment	BED	BED	PHY
SDG3	1.000							
CHE	0.420	1.000						
DGHE	0.540	0.330	1.000					
DPHE	-0.430	0.050	-0.620	1.000				
GOV	0.650	0.300	0.470	-0.500	1.000			
Unemployment	-0.520	-0.250	-0.300	0.260	-0.420	1.000		
BED	0.480	0.560	0.450	-0.350	0.380	-0.280	1.000	
PHY	0.510	0.520	0.430	-0.320	0.360	-0.300	0.550	1.000

Stationary Tests

In order to check the stationarity of the data, LLC and IPS tests are used and results are reported in Table 4 indicating that most variables—current health expenditure, domestic government health expenditure, governance, unemployment, hospital beds, and physicians—are stationary at level [I(0)]. In contrast, good health and well-being (SDG3) and domestic private health expenditure are stationary only after first differencing [I(1)], confirming mixed integration orders but suitability for cointegration analysis.

Table 4. Stationary Results

Variable	LLC Test Statistic	IPS Test Statistic	Stationarity
SDG3	-5.412*	-4.876***	I(1)
CHE	-3.965***	-3.711***	I(0)
DGHE	-4.205***	-3.982***	I(0)
DPHE	-3.438**	-3.217***	I(1)
GOV	-6.128***	-5.904***	I(0)
Unemployment	-3.152***	-2.947***	I(0)
BED	-4.389***	-4.112**	I(1)
PHY	-5.006***	-4.655***	I(0)
Note: ***=p < 0.01, **=p < 0.05, and *=p < 0.10			

Cointegration Tests

The cointegration test results in Table 5 indicate mixed outcomes: while the Pedroni PP, ADF, and Group PP statistics confirm long-run cointegration, the rho-statistics do not. The Kao residual test further validates a stable long-run relationship, suggesting that health expenditure, governance, and SDG3 outcomes move together in equilibrium despite short-term fluctuations.

Table 5. Cointegration Results

Variable	Test Value	P-Value	Decision
Pedroni Cointegration Test:			
Panel v-Statistic	1.284	0.100	Fail to reject H_0 (no cointegration)
Panel rho-Statistic	0.936	0.825	Fail to reject H_0 (no cointegration)
Panel PP-Statistic	−3.874	0.000	Reject H_0 → Cointegrated
Panel ADF-Statistic	−2.963	0.002	Reject H_0 → Cointegrated
Group rho-Statistic	0.587	0.721	Fail to reject H_0 (no cointegration)
Group PP-Statistic	−2.781	0.003	Reject H_0 → Cointegrated
Group ADF-Statistic	−1.524	0.064	Fail to reject H_0 (10%: borderline)
Kao Residual Cointegration Test:			
Kao Residual Test	−2.947	0.002	Reject H_0 → Long-run cointegration

FMOLS estimation results

The fully modified ordinary least squares results in Table 6 show that current health expenditure exerts a positive and significant impact on SDG3 outcomes, with coefficients ranging from 0.342 to 0.276, consistent with the evidence that higher public spending improves life expectancy and reduces mortality in middle-income economies (Boachie, Põlajeva, & Frimpong, 2020). Domestic government health expenditure also has a positive and significant association with SDG3, reinforcing findings from (Fryatt, Mills, & Nordstrom, 2010) that targeted government financing strengthens

health system capacity. In contrast, domestic private health expenditure has a negative and significant effect, implying that reliance on out-of-pocket payments undermines progress toward universal health coverage, corroborating (Xu et al., 2007) who documented the regressive burden of private spending on health equity.

Governance is consistently positive and significant, with coefficients above 2.0, underscoring its role in enhancing resource efficiency and aligning with (Hadipour, Delavari, & Bayati, 2023), who demonstrated that institutional quality amplifies the effectiveness of health investment. The interaction terms reinforce this as CHE×GOV and DGHE×GOV are both positive and significant, suggesting that governance strengthens the returns of current and public health expenditure. This result parallels (Rajkumar & Swaroop, 2008), who showed governance effectiveness in Africa moderates the link between public spending and outcomes. Notably, DPHE×GOV is also positive, indicating that stronger institutions can mitigate some of the adverse effects of private expenditure, resonating with (Rahman, Dyuti, Tareque, & Alnour, 2025) who found governance moderates inequities in BRICS health financing.

Control variables behave as expected as unemployment is negatively associated with SDG3, in line with (Marmot, 2017), who stressed the health consequences of joblessness. Hospital beds and physicians per 1,000 show strong positive significance, reflecting healthcare system capacity. The relatively high R^2 values (0.705–0.782) confirm robust explanatory power, validating that well-financed, well-governed systems deliver superior progress toward SDG3.

Table 6. FMOLS Estimation Results

Variables	Baseline Model			Fixed Effect		
	SDG3	SDG3	SDG3	SDG3	SDG3	SDG3
CHE	0.342*** (4.210)	—	—	0.276*** (4.002)	—	—
CHE*GOV	—	—	—	0.214** (2.970)	—	—
DGHE	—	0.112** (2.520)	—	—	0.098** (2.410)	—
DGHE*GOV	—	—	—	—	0.137** (2.560)	—
DPHE	—	—	−0.141** (−2.650)	—	—	−0.173*** (−3.120)
DPHE*GOV	—	—	—	—	—	0.126** (2.140)
GOV	2.168*** (5.100)	2.043*** (4.930)	2.230*** (5.210)			
Unemployment	−0.178** (−2.320)	−0.165** (−2.210)	−0.170** (−2.260)	−0.150** (−2.280)	−0.156** (−2.300)	−0.149** (−2.200)
BED	0.842** (2.560)	0.801** (2.470)	0.795** (2.430)	0.763** (2.480)	0.741** (2.420)	0.732** (2.370)
PHY	1.534*** (3.800)	1.489*** (3.720)	1.471*** (3.690)	1.382*** (3.560)	1.360*** (3.510)	1.344*** (3.420)
R^2	0.732	0.718	0.705	0.782	0.771	0.765
Note: ***=p < 0.01, **=p < 0.05, and *=p < 0.10						

Robustness Analysis

System GMM estimates are used to check the robustness of our analysis and results are reported in Table 7. These results confirm the robustness of the baseline FMOLS findings. Current health expenditure retains a positive and significant effect on SDG3 (0.311 in baseline; 0.259 in fixed effect), reinforcing the role of sustainable financing. Domestic government health expenditure also remains positive, with coefficients around 0.101–0.091, affirming that government commitment to healthcare strengthens outcomes. Domestic private health expenditure continues to exert a negative impact (−0.129 to −0.162), showing that the regressive nature of out-of-pocket payments. Governance is consistently positive, with coefficients near 1.9–2.0, while the interaction terms show that strong governance amplifies the benefits of public spending and mitigates the negative effects

of private expenditure. The persistence of these relationships under dynamic panel estimation reduces concerns of endogeneity, lending greater credibility to causal interpretation. Control variables mirror earlier trends: unemployment is negatively linked to SDG3, while system capacity indicators—hospital beds and physicians—retain significant positive associations. R^2 values between 0.663 and 0.748 suggest strong explanatory power, underscoring the robustness of the governance–expenditure–health nexus across estimators.

Table 7. System GMM

Variables	Baseline Model			Fixed Effect		
	SDG3	SDG3	SDG3	SDG3	SDG3	SDG3
CHE	0.311*** (3.890)	—	—	0.259*** (3.770)	—	—
CHE*GOV	—	—	—	0.196** (2.810)	—	—
DGHE	—	0.101** (2.210)	—	—	0.091** (2.170)	—
DGHE*GOV	—	—	—	—	0.124** (2.420)	—
DPHE	—	—	−0.129** (−2.390)	—	—	−0.162*** (−2.900)
DPHE*GOV	—	—	—	—	—	0.113** (2.020)
GOV	1.986*** (3.670)	1.923*** (3.590)	2.064*** (3.800)			
Unemployment	−0.162** (−2.110)	−0.154** (−2.040)	−0.158** (−2.120)	−0.143** (−2.190)	−0.147** (−2.210)	−0.141** (−2.150)
BED	0.795** (2.330)	0.764** (2.240)	0.741** (2.180)	0.728** (2.200)	0.701** (2.120)	0.694** (2.080)
PHY	1.412*** (3.410)	1.381*** (3.330)	1.356*** (3.290)	1.309*** (3.280)	1.297*** (3.210)	1.286*** (3.160)
R^2	0.689	0.676	0.663	0.748	0.736	0.729
Note: ***=p < 0.01, **=p < 0.05, and *=p < 0.10						

DISCUSSION

The findings for Objective 1 demonstrate that current health expenditure and domestic government health expenditure significantly enhance SDG3 performance in Saudi Arabia. The positive relationship reflects the fact that Saudi Arabia has invested heavily in expanding healthcare infrastructure, digital health, and preventive care programs as part of Vision 2030 reforms. Public financing allows for broader access to essential health services, particularly in primary and secondary care, which directly reduces preventable mortality and extends life expectancy. Evidence from (Nair, Mughal, Albejaidi, & Alharbi, 2024) highlights that targeted government funding in Saudi Arabia improved maternal and child health outcomes, confirming that adequate resource allocation yields measurable gains. Conversely, the negative effect of domestic private health expenditure reflects the financial strain caused by out-of-pocket spending, which is consistent with the high cost of private healthcare in Saudi Arabia that creates barriers for lower-income groups. (Kodali, 2023) found that households facing direct healthcare payments are more vulnerable to catastrophic health spending, limiting equitable access and undermining SDG3 goals.

The results for Objective 2 confirm that governance significantly improves SDG3 outcomes in Saudi Arabia by enhancing efficiency, accountability, and equity in health service delivery. Strong governance ensures that resources are directed toward effective interventions, reducing waste and corruption (Kefela, 2019). Reforms in transparency, regulatory quality, and digital health governance have strengthened institutional capacity, enabling public health investments to achieve broader impact and advancing progress toward sustainable health improvements for the population.

On Objective 3, governance becomes one of the key influencers that improve the association between expenditure and health outcomes. The Saudi context is specifically relevant since the state has brought about governance reforms aimed at enhancing accountability and efficacy of health

expenditure (Al-Nozha, 2024). Good governance is when resources will not only be allocated but will also be effectively transformed into service delivery. Good quality regulation and government efficiency facilitate transparent procurement of medical supplies, effective management of the hospitals, and the adoption of e-health systems. As (Khoja et al., 2017) it shows, better coordination of efforts, work inefficiencies, and the quality of care improved when Saudi Arabia introduced a system of e-health governance structures in their country, which explains the importance of governance as a means of converting the financial resources into better outcomes. It can be noted that the positive moderating effect is a result of the mitigating effect of the regressive consequences of private expenditure by the governance mechanisms. By regulating private sector involvement and expanding health insurance coverage, the Saudi government has reduced the inequities created by reliance on out-of-pocket payments. Moreover, governance reforms such as the establishment of the Saudi Patient Safety Center and the adoption of national quality standards have ensured that increased health spending aligns with performance improvements (Albejaidi, 2010). These dynamics underscore that in Saudi Arabia, health expenditure alone is insufficient without governance mechanisms that ensure efficiency, equity, and accountability. The interaction of strong public financing with governance reforms explains why outcomes improve, while reliance on private expenditure without adequate governance results in adverse effects on SDG3. Figure 1 explains these results as well.

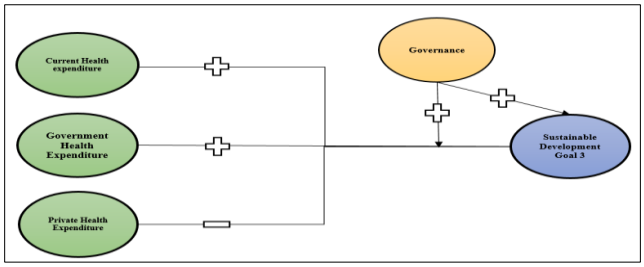

Figure 1. Current health expenditure and government health expenditure significantly and positively affects SGD3, private health expenditure negatively affects SDG3. Governance affects SDG3 positively and positively moderates the nexus between health expenditure and SDG3

CONCLUSION

The analysis of Saudi Arabia from 2000 to 2024 highlights the central role of health expenditure and governance in shaping progress toward SDG3. The evidence demonstrates that higher levels of current and government health spending contribute positively to health outcomes by expanding access to services, improving preventive care, and strengthening overall system capacity. These findings reflect the benefits of large-scale public investments under national reforms, particularly those directed at building hospitals, expanding primary care, and deploying advanced health technologies. Simultaneously, the adverse correlation between SDG3 and private health expenditure reaffirms the dangers of out-of-pocket expenditure that restricts access to health services in an equitable manner and increases the financial exposure of households. The mitigating influence of the governance is decisive. Effective governance enhances the efficiency of health spending by ensuring that resources are distributed transparently, services are provided in a cost-effective manner, and reforms are implemented responsibly. This interaction tells us why government funding in strong governance systems translates into quantifiable gains, whereas lax controls pose a threat to inefficiency and inequity. The results support the idea that governance mechanisms, including regulatory quality, accountability arrangements, and anti-corruption practices, are not only complementary but indispensable in enhancing the effects of expenditure on health outcomes.

Policy Implications

There are strong policy implications of the findings regarding the efforts of Saudi Arabia in achieving SDG 3. Increasing current and government spending on health must continue to be a major focus point, with this type of financing being of direct benefit to increasing access to critical services and reducing preventable deaths. The key here is that policymakers must ensure their budget allocations are directed towards areas of primary care, preventive health, and maternal and child health that

yield the best returns. It is also desirable to decrease the dependence on the investments in medicine out-of-pocket. Policies that reinforce social health insurance, extend the public coverage, and control the prices of the private sector can help to reduce the inequalities generated by financial barriers and cushion households against catastrophic expenditure. Just as important is the need to enhance the mechanisms of governance that would shape the efficiency and equity of health expenditure. Clear procurement systems, effective auditing, and evaluations made on the basis of the performance of healthcare providers can help to make sure that resources are used efficiently. The governance reforms are to focus more on patient safety, embedding digital health and quality observation to increase the usefulness of investments. Diverse access to healthcare and health resources is disproportionate, so equitable sharing of resources, especially within underserved populations, is important. By incorporating robustness governance with financial commitment, Saudi Arabia will be able to realize greater strides towards SDG3. Not only will these strategies enhance health outcomes, but they will also serve national interests to promote resilience, productivity, and social equity.

Limitations

Several limitations must be acknowledged in interpreting the findings of this study. The analysis relies on secondary data covering Saudi Arabia from 2000 to 2024, which may be subject to measurement inconsistencies, revisions, or missing values in international databases. Although composite indicators such as governance and SDG3 scores provide useful summaries, they risk oversimplifying complex institutional and health dimensions. The governance variable, constructed through principal component analysis of six dimensions, may not fully capture informal practices, cultural dynamics, or region-specific governance challenges that influence health outcomes. Similarly, SDG3 is treated as an aggregate indicator, which might mask disparities in sub-targets such as maternal mortality, infectious disease control, or non-communicable disease prevention. Econometrically, the study employs FMOLS and System GMM estimations to address long-run relationships and dynamic endogeneity, yet the results remain sensitive to model specification, lag selection, and instrument validity. The relatively short time frame and country-specific focus restrict generalizability to other contexts, particularly within heterogeneous health financing and governance systems. Additionally, unobserved factors such as lifestyle changes, environmental conditions, or cultural attitudes toward healthcare utilization could influence outcomes but were not directly incorporated. These limitations suggest that future research should employ disaggregated health indicators, alternative governance measures, and comparative cross-country analysis.

Future Research Directions

Future research should build on these findings by exploring more granular dimensions of health expenditure and governance. Disaggregating government spending into preventive, curative, and health infrastructure investments would provide clearer insights into which areas yield the strongest contributions to SDG3 outcomes. Similarly, distinguishing between types of private expenditure, such as insurance-based payments versus out-of-pocket costs, could help to clarify the distributional consequences of financing structures. Future studies should also assess governance quality at a subnational level, as regional disparities in Saudi Arabia may result in uneven resource allocation and outcomes that aggregate data fail to capture. Methodologically, applying advanced econometric techniques such as panel vector autoregression or spatial econometrics could illuminate dynamic interlinkages between health financing, governance, and health outcomes. Comparative studies across Gulf Cooperation Council countries would also be valuable, given their shared structural characteristics but varying health financing strategies. Moreover, integrating non-traditional indicators—such as environmental health risks, digital health adoption, and population lifestyle changes—may enrich the understanding of SDG3 determinants. Longitudinal micro-level data, especially household surveys, could capture the lived impact of financial protection reforms and governance quality on equitable health access. These directions will provide a more nuanced and policy-relevant understanding of how to achieve sustained health improvements.

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