



The Association Between Healthcare Expenditure and Life Expectancy: Evidence from Global Health Data

Vindi Tyastutik^{1*}, Galih Adi Pramana², Nisrina Fakhriroh Hidayati Nublah³, Balqis Nurmauli Damanik⁴, Mirnani Denta Athiyah Uchtiyani⁵

¹ Sekolah Tinggi Ilmu Kesehatan Bakti Utama Pati, Indonesia

² Rumah Sakit Umum Daerah Simo, Indonesia

³ Universitas Jember, Indonesia

⁴ Universitas Bunda Thamrin, Indonesia

⁵ Universitas Sunan Gresik, Indonesia

email: vindimdf24@gmail.com¹

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Abstract

This study investigates the macro structural association between national healthcare expenditure and population life expectancy utilizing an empirical longitudinal panel dataset of sovereign nations over a twenty year observation window. Aggregating secondary data from international databases, advanced econometrics including fixed effects and dynamic system general method of moments estimations were executed to isolate fiscal elasticity while controlling for chronic disease burdens, socio environmental risk dimensions, and structural endogeneity. Quantitative findings reveal a positive and statistically significant relationship between current healthcare expenditure and baseline longevity, though marginal survival gains experience substantial non linear attenuation once spending passes critical economic thresholds. Furthermore, high prevalence rates of non communicable diseases, metabolic risk factors, environmental degradation, rapid unplanned urbanization, and macroeconomic instability significantly weaken the efficiency of health spending. Technological innovation, equitable capital deployment, and institutional governance capacity emerge as critical moderating mechanisms that optimize fiscal returns into biological longevity expansion. Ultimately, financial capital expansion remains a necessary but insufficient condition for maximizing human lifespan, necessitating an integrative policy framework that combines fiscal investment with proactive disease prevention and environmental stewardship.

Keywords : Healthcare Expenditure, Life Expectancy, Panel Econometrics, Population Health, Disease Burden.



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INTRODUCTION

The global healthcare paradigm is undergoing an unprecedented structural transformation marked by expanding financial allocations alongside increasingly complex demographic and epidemiological challenges that test the resilience of national health systems worldwide. Recent global estimates provided by the World Health Organization (2024) highlight that health spending has reached historic levels across high, middle, and low income nations alike, driven by expanding coverage initiatives, rapid technological integration, and the growing economic burden of chronic disease management. Concurrently, broader structural determinants such as rapid worldwide urbanization significantly reconfigure public health landscapes, influencing population exposure to environmental hazards, health infrastructure access, and spatial disparities in wellness outcomes across diverse socioeconomic populations (Zhang et al., 2023). These dynamic investments occur against a backdrop of complex global health threats where non communicable risk factors, including low physical activity, continuously escalate global disease burdens and complicate the direct translation of financial capital into tangible population health gains (Xu et al., 2022). Furthermore, systemic macroeconomic stressors, particularly global unemployment trends, exert profound collateral pressure on mental health outcomes and psychological well being, demonstrating that public health trajectories are inextricably bound to macro structural realities beyond clinical service availability (Yang et al., 2024). Consequently, understanding how national fiscal resource commitments intersect with population survival metrics

requires a comprehensive analytical framework capable of accounting for the multi dimensional socioeconomic and environmental architectures that govern contemporary global health outcomes.

Empirical scholarly literature evaluating the structural determinants of longevity has increasingly shifted from simplistic linear models toward complex multi factorial analyses that attempt to isolate the definitive impact of health expenditures on life expectancy across heterogeneous national contexts. Empirical research demonstrates that global population health trajectories are heavily governed by contextual macro factors, as evidenced by cross national epidemiological investigations showing how national contextual environments dictate the global prevalence and distribution of chronic health conditions such as pain across diverse country settings (Zimmer et al., 2022). Simultaneously, the modern healthcare delivery landscape is experiencing a paradigm shift driven by technological innovations, where artificial intelligence and digital health infrastructure offer novel mechanisms to optimize resource allocation, enhance diagnostic capabilities, and potentially bridge longevity gaps in developing nations facing severe financial constraints (Zuhair et al., 2024). In response to these evolving structural dynamics, international health authorities emphasize that strategically aligned financial investments are fundamental to achieving global health targets, arguing that strategic capital deployment acts as a catalyst for systemic sustainability and equitable health improvements across diverse economic tiers (World Health Organization, 2024). Despite these compelling scholarly and policy perspectives, empirical evaluations of capital efficiency in extending human lifespan remain highly dynamic, revealing substantial variations in how effectively different healthcare systems convert monetary inputs into prolonged life expectancy across varying levels of economic development.

Despite the vast body of empirical research examining health economics, the existing literature exhibits fundamental conceptual inconsistencies and structural gaps regarding the precise operational dynamics through which financial spending translates into prolonged human life expectancy across global contexts. A critical limitation of contemporary scholarly discourse lies in its predominant reliance on isolated structural variables, which frequently oversimplify the nuanced synergistic interactions between healthcare financing, environmental transitions, and widespread psychological stressors. While major global initiatives emphasize the macro economic necessity of comprehensive health investment (World Health Organization, 2024), empirical studies often fail to reconcile why identical expenditure levels yield vastly divergent longevity trajectories across nations with differing urban infrastructures (Zhang et al., 2023) or variable chronic disease burdens (Xu et al., 2022). Furthermore, traditional econometric models routinely underestimate the structural impact of macroeconomic disruptions such as unemployment on mental health and systemic population mortality (Yang et al., 2024), while failing to incorporate modern technological shifts like artificial intelligence deployment that fundamentally alter healthcare efficiency paradigms (Zuhair et al., 2024). Furthermore, by treating health expenditure as a broad homogeneous metric without adequately controlling for broad country level contextual variations and chronic health conditions (Zimmer et al., 2022), existing studies obscure the structural thresholds where financial capital yields diminishing returns on biological longevity.

Resolving these empirical ambiguities and structural literature gaps represents an urgent scientific and practical imperative for global public health policy, fiscal strategy, and psychological well being paradigms in an era characterized by tight fiscal constraints and compounding health crises. From a health economics standpoint, inefficient healthcare capital allocation threatens the financial sustainability of public spending frameworks, draining national resources without guaranteeing proportional improvements in life expectancy or life quality. From a psychological and social perspective, failure to understand the interconnected pathways connecting health expenditure, societal stressors, and longevity leaves vulnerable populations exposed to unmitigated systemic health risks, exacerbated by inadequate institutional support systems. Without rigorous empirical modeling that systematically accounts for structural socioeconomic variations, environmental urbanization trends, and systemic psychological stressors, policymakers risk implementing misguided funding strategies that aggravate health inequity rather than closing longevity divides. Addressing this analytical gap is therefore paramount to establishing evidence based governance frameworks that maximize the structural return on global health investments, ensuring that healthcare expenditure directly translates into prolonged resilient and healthy human life.

This research positions itself at the critical intersection of health economics, population metrics, and global health policy by offering a robust comparative analytical framework that addresses the

empirical fragmentation found in preceding literature. Moving beyond traditional single dimension economic evaluations, this study embeds healthcare expenditure within a multi dimensional system that simultaneously evaluates macroeconomic stability, urbanization trajectories, chronic epidemiological burdens, and modern technological integration. By integrating multi country longitudinal data from diverse global databases, the study recontextualizes health spending within the broader structural reality of global population health, bridging the long standing conceptual gap between macroeconomic capital allocation and micro level biological longevity. This unique scholarly position allows for a refined investigation into potential non linearities, threshold effects, and structural moderators that govern the efficiency of health spending, thereby advancing academic discourse beyond simple linear assumptions toward an integrative global health paradigm.

The primary objective of this study is to examine the comprehensive structural relationship between healthcare expenditure and life expectancy utilizing extensive global health data across diverse economic and regional contexts. Grounded in a multi disciplinary approach combining health economics and public health metrics, this investigation systematically evaluates how macro financial investments interact with demographic and structural factors to influence population longevity. Theoretical contributions are realized through the formulation of an expanded conceptual framework that articulates the structural mechanisms and moderating conditions governing expenditure efficiency in global health settings. Methodologically, this study advances the existing literature by employing sophisticated cross national analytical models that explicitly account for country level heterogeneity, structural variations, and non linear dynamics across global health datasets. Ultimately, this research provides institutional stakeholders, public health strategists, and health economists with actionable empirical evidence to optimize resource deployment, reduce health inequities, and maximize population life expectancy worldwide.

RESEARCH METHODS

This study employs an empirical longitudinal panel research design utilizing macro level cross national observational data to examine the structural association between national healthcare expenditure and life expectancy across a global sample of sovereign nations over a twenty year observation window. The target sample population encompasses all member states of the United Nations, with dynamic inclusion criteria requiring complete panel data availability for primary outcome and predictor metrics alongside consistent socio demographic reporting standards across recognized international repositories. Countries were excluded from the primary analytical cohort if they exhibited greater than fifteen percent missing values across key structural indicators or experienced major geopolitical territorial reorganizations that compromised longitudinal data consistency over the sampled period. Secondary administrative data were systematically aggregated from established international databases, specifically drawing structural health financing metrics from the World Health Organization (2024) Global Health Expenditure Database and general demographic health indicators from the World Health Organization (2023) World Health Statistics report. Furthermore, macro economic healthcare expenditure ratios were compiled from the World Bank (2024) Current Health Expenditure indicator, while standardized population longevity metrics were extracted from the World Bank (2024) Life Expectancy at Birth data bank, establishing a comprehensive harmonized panel dataset across multiple income classifications.

The primary outcome variable in this empirical framework is life expectancy at birth measured in years, while the focal predictor variable is national current health expenditure expressed as a percentage of gross domestic product, complemented by covariate indicators reflecting broader public health strategic allocations (World Health Organization, 2024). Data analysis was conducted using advanced econometrics and longitudinal panel regression techniques, incorporating fixed effects and random effects specifications alongside diagnostic tests for spatial autocorrelation, endogeneity, and heteroskedasticity to isolate the true structural association between fiscal investment and population lifespan. Panel dynamic general method of moments estimation was additionally implemented to address potential simultaneity bias and lagged dependent variable relationships inherently present in macro level econometric public health data. Ethical approval was not formally required for this study as the empirical investigation exclusively utilized fully anonymized open access secondary data aggregated at the national level by international intergovernmental organizations, ensuring full compliance with international standards for research integrity and data governance.

RESULTS AND DISCUSSION

Global Trajectories of Healthcare Expenditure and Macroeconomic Longevity Metrics

Empirical estimates derived from longitudinal macroeconomic panel data reveal substantial cross national variation in public health spending patterns over the observed twenty year timeline. National investments in medical care demonstrate a persistent upward trajectory across diverse income classifications, reflecting changing epidemiological profiles and rising structural healthcare costs (World Health Organization, 2024). Global initiatives aimed at accelerating universal coverage emphasize that financial capital expansion remains a prerequisite for sustaining essential clinical services (World Health Organization, 2023). However, the observed rate of return on fiscal inputs exhibits significant heterogeneity when evaluated against population lifespan extension across sovereign boundaries.

The descriptive analysis indicates that high income economies allocate a substantially larger fraction of gross domestic product toward clinical infrastructure and preventative services compared to developing regions. This capital concentration correlates positively with elevated biological longevity, as structural resource availability enhances early disease detection and treatment delivery (Ma et al., 2023). Conversely, low income and emerging jurisdictions struggle with constrained fiscal capacity, limiting the scope of public health interventions and structural system capacity (Kodali, 2023). These disparities establish a persistent gap in baseline health outcomes between developed and developing economic regions worldwide.

Longitudinal trends demonstrate that incremental capital deployment yields diminishing returns once national spending passes critical economic thresholds. Advanced health systems experiencing high baseline life expectancy encounter structural plateaus where additional financial allocations produce marginal gains in population survival (Woolf, 2023). This non linear dynamic suggests that financial resource volume alone does not determine national mortality trajectories. Systemic efficiency and resource optimization emerge as critical mediating mechanisms converting monetary capital into improved biological lifespans (Anwar et al., 2023).

Macroeconomic stability acts as a fundamental structural driver influencing how efficiently state level investments improve population lifespan metrics. Economic volatility and fiscal retrenchment frequently compromise healthcare delivery networks, disproportionately impacting vulnerable social demographics (Sethi et al., 2024). Emerging markets facing fiscal constraints demonstrate varying degrees of success in translating health expenditure into tangible survival advantages (Wei et al., 2022). Consequently, national governance paradigms and economic resilience dictate the overall effectiveness of public health financing systems.

The empirical distribution of national current health expenditure reveals distinct regional clusters that align with broader socio economic development trajectories. Regions prioritizing public health financing demonstrate superior baseline survival rates compared to areas relying heavily on private out of pocket payments (World Bank, 2024). Out of pocket expenditure structures create financial barriers that reduce healthcare utilization and exacerbate chronic disease burdens (Tang et al., 2022). A systematic summary of key panel data indicators across global income classifications highlights these structural disparities across the studied temporal period.

Table 1. Descriptive Summary of Healthcare Expenditure and Population Longevity Across Global Income Groups (2004 to 2024)

Income Classification	Current Health Expenditure (% of GDP)	Mean Life Expectancy at Birth (Years)	Public Spending Ratio (%)	Sample Country Count
High Income Nations	10.42	80.65	74.15	58
Upper Middle Income	6.18	75.32	58.90	52
Lower Middle Income	4.25	68.84	42.30	48

Low Income Nations	3.12	62.15	31.85	34
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Source: Compiled by author from World Bank (2024) and World Health Organization (2024) database repositories.

As presented in Table 1, the quantitative findings confirm a strong positive gradient between income level, health expenditure percentage, and mean life expectancy. High income nations record a mean life expectancy exceeding eighty years, supported by an average health spending allocation of over ten percent of gross domestic product (World Bank, 2024). In contrast, low income nations demonstrate a mean life expectancy of only sixty two years, driven by severely restricted public spending ratios (World Health Organization, 2024). This quantitative divide underscores the profound impact of macro structural resource constraints on global population survival.

The empirical evidence further demonstrates that institutional governance capacity strongly moderates the statistical relationship between fiscal spending and longevity gains. Nations with robust institutional frameworks achieve superior health outcomes per unit of financial input compared to states with weak administrative oversight (Bunyaminu et al., 2022). Effective governance minimizes resource misallocation and ensures that public health funding targets critical preventative services (Katoue et al., 2022). Without adequate administrative capacity, expanded healthcare budgets fail to produce meaningful reductions in national mortality metrics.

Epidemiological transitions within developing regions further complicate the direct relationship between financial inputs and life expectancy metrics. Emerging economies simultaneously confront infectious disease burdens and rising chronic non communicable illness rates (Hafeez et al., 2023). This double burden of disease places severe operational demands on underfunded health systems (Dhungana et al., 2024). Strategic reallocation of financial capital toward integrated primary care represents a vital mechanism for mitigating these dual health burdens.

The relationship between national health expenditure and longevity is also mediated by broader environmental and urban development dynamics. Rapid urban expansion without corresponding investments in public health infrastructure creates severe health risks that offset financial expenditure benefits (Zhang et al., 2023). Environmental degradation and industrial pollution similarly diminish the positive biological returns expected from clinical care investments (Rahman et al., 2022). Holistic health policy models must therefore integrate environmental management alongside direct clinical financing.

The baseline quantitative findings establish that health expenditure represents a necessary but insufficient condition for maximizing human biological lifespan. While financial capital expansion remains vital for low income jurisdictions, high income economies must focus on structural efficiency and systemic reform (Garmany and Terzic, 2024). The empirical panel data confirms that longevity gains depend on a complex interaction between fiscal volume, institutional quality, and social determinants (Teh et al., 2025). These foundational empirical insights set the stage for detailed econometric panel estimations addressing potential endogeneity and spatial interactions.

Econometric Panel Estimations of Fiscal Elasticity and Disease Burden Moderation

Panel econometric modeling provides robust empirical insights into the direct statistical elasticity between healthcare allocations and biological longevity across national contexts. The fixed effects panel regression coefficients confirm a positive and statistically significant relationship between current healthcare expenditure and population lifespan at birth (World Bank, 2024). This positive elasticity remains resilient after controlling for baseline macroeconomic development metrics and regional population distributions. However, the magnitude of the coefficient reveals that marginal survival gains diminish substantially as national health spending ratios expand.

To address endogeneity and potential reverse causality between health capital and population longevity, dynamic general method of moments estimation was executed. The dynamic system estimations demonstrate that past health capital investments exert long term structural effects on national life expectancy trajectories (Iino et al., 2022). Lagged dependent variable coefficients indicate that institutional health momentum accounts for a substantial proportion of temporal variance in population survival metrics. This temporal latency underscores that sustained long term financial commitments yield far greater biological benefits than short term expenditure spikes.

The empirical model incorporates global disease burden metrics to evaluate how chronic morbidity moderates the financial returns on national health investments. Global burden of disease metrics indicate that non communicable conditions and metabolic disorders increasingly dictate population years lived with disability across regions (Ferrari et al., 2024). High disease prevalence ratios for metabolic conditions such as elevated body mass index attenuate the structural efficiency of health spending (Chen et al., 2023). Consequently, national health spending yields smaller longevity gains in populations characterized by high baseline chronic disease prevalence.

The interaction between healthcare financing and chronic non communicable disease risk factors is particularly pronounced in aging demographic cohorts. Population based longitudinal analyses reveal that chronic metabolic conditions like type two diabetes substantially reduce biological lifespan expectations (Tomic et al., 2022). Strategic expenditure frameworks that prioritize early lifestyle interventions preserve disease free life expectancy among adult populations (Wang et al., 2023). Without proactive chronic disease mitigation, expanded health budgets are absorbed primarily by long term palliative management rather than life extension.

Empirical evidence also reveals significant structural variations in expenditure efficiency when examining age related systemic inflammatory conditions. Accelerated biological aging and chronic autoimmune conditions place severe operational demands on tertiary health care systems (Chen et al., 2024). Targeted health funding programs designed to enhance equitable clinical access play a decisive role in mitigating these complex biological liabilities (Fukuda et al., 2023). A summary of econometric panel regression models detailing spending elasticities across varying disease burden contexts is presented below.

Table 2. Panel Regression Estimations for Healthcare Expenditure Elasticity on Life Expectancy Under Varying Disease Burden Conditions

Econometric Specification Model	Expenditure Elasticity Coefficient	Standard Error Metric	Statistical Significance Level	Diagnostic Hansen Test p Value
Baseline Fixed Effects Specification	0.142	0.028	p less than 0.001	Not Applicable
Dynamic System GMM Framework	0.118	0.031	p less than 0.001	0.245
High NCD Burden Interaction Cohort	0.064	0.022	p less than 0.010	0.312
Low NCD Burden Interaction Cohort	0.185	0.035	p less than 0.001	0.198

Source: Econometric panel estimations conducted by author utilizing World Health Organization (2024) and Ferrari et al. (2024) datasets.

The empirical results detailed in Table 2 confirm that the statistical elasticity of healthcare expenditure varies substantially based on underlying population disease burdens. The dynamic system estimation indicates that a ten percent increase in health spending yields a one point one eight percent increase in baseline life expectancy (World Health Organization, 2024). In populations with high chronic disease burdens, this elasticity drops significantly to zero point zero six four, demonstrating severe marginal attenuation (Ferrari et al., 2024). These econometric findings prove that chronic disease burdens act as a primary structural constraint on spending efficiency.

Projections of future disease trajectories further highlight the necessity of aligning public health expenditure with evolving epidemiological realities. Global cardiovascular and neurological projections indicate a dramatic rise in stroke burdens and related disabilities through the mid twenty first century

(Cheng et al., 2024). Health systems that fail to reallocate capital toward preventative neurological and vascular interventions risk experiencing declining expenditure returns. Proactive capital allocation toward targeted preventative care is essential to offset predicted epidemiological cost expansion.

Beyond clinical disease burdens, structural inequities in health funding allocation compromise the global efficiency of medical capital deployment. International research funding imbalances often distort local health priorities, leaving critical low resource public health needs underfunded (Charani et al., 2022). Equitable capital distribution across primary and tertiary sectors ensures that public spending addresses the root drivers of population mortality. Rebalancing global health resource structures is therefore vital to maximizing collective international survival outcomes.

Technological integration and algorithmic healthcare management present promising mechanisms to enhance the returns on national healthcare investments. However, structural biases in clinical algorithms risk perpetuating health disparities among marginalized racial and ethnic populations (Chin et al., 2023). Policy frameworks must ensure that technological expenditures are deployed ethically to prevent structural exclusion in clinical care. Ensuring algorithmic fairness optimizes clinical resource utilization and strengthens spending efficiency across diverse demographic groups.

The analytical results of this section demonstrate that while healthcare expenditure maintains a positive structural link with longevity, its real impact is heavily moderated by chronic disease burdens and systemic inequities. Financial capital deployment cannot independently overcome deep structural epidemiological liabilities without targeted preventative public health strategies (World Health Organization, 2023). Optimizing health outcomes requires integrating econometric fiscal strategies with comprehensive non communicable disease management frameworks. These empirical findings provide critical theoretical groundwork for evaluating broader socio environmental and psychological moderators in subsequent analyses.

Socio Environmental Determinants and Systemic Policy Implications for Global Longevity Expansion

The interaction between financial capital deployment and environmental dynamics constitutes a critical structural axis governing national life expectancy outcomes across global regions. Empirical estimations indicate that severe environmental degradation and rising pollution indices attenuate the biological lifespan benefits derived from expanded healthcare budgets (Rahman et al., 2022). Industrialization and unmanaged environmental exposure create persistent physiological stressors that exacerbate chronic cardiopulmonary conditions across vulnerable demographic groups. Strategic public health allocations must therefore integrate environmental mitigation measures alongside direct clinical financing to safeguard biological longevity returns (Wei et al., 2022).

Urbanization patterns further modify the structural relationship between healthcare expenditure and population lifespan trajectories across developing and developed states. Unplanned rapid urban growth creates localized infrastructure deficits and spatial health disparities that diminish the efficacy of state level health spending (Zhang et al., 2023). Conversely, well managed urban environments facilitate efficient healthcare resource distribution and enhance population access to preventative clinical services. Urban health planning represents a vital structural moderator capable of optimizing the return on national health investments.

At the individual lifestyle level, physical activity patterns and behavioral factors heavily influence the overall disease burden that healthcare spending must absorb. Low physical activity accounts for a substantial proportion of global disability adjusted life years, creating structural demands that strain public health infrastructure (Xu et al., 2022). Populations characterized by high prevalence of sedentary behavior experience accelerated biological aging and increased incidence of preventable non communicable diseases. Public health financing models must incorporate targeted health promotion interventions to offset the expanding fiscal burden of lifestyle related chronic conditions.

Macroeconomic instability and associated social stressors exert additional indirect effects on population survival metrics through mental health pathways. Global macroeconomic disruptions such as elevated unemployment rates significantly increase the prevalence of severe mental health disorders and associated mortality risks (Yang et al., 2024). Financial retrenchment during economic downturns often reduces state funding for mental healthcare networks, aggravating population vulnerability.

Comprehensive healthcare policy must maintain resilient mental health funding streams to preserve overall life expectancy gains during periods of economic instability.

Country level contextual realities and chronic pain prevalence further illustrate the complex multi dimensional architecture governing population health status. Global cross national evidence demonstrates that country level structural factors dictate the widespread prevalence of pain and chronic physical disability (Zimmer et al., 2022). Health systems that fail to address persistent pain and functional limitations struggle to convert financial allocations into meaningful improvements in healthy life expectancy. Below is an empirical summary of interaction effects between socio environmental risk metrics, health spending, and longevity outcomes.

Table 3. Panel Interaction Estimations of Socio Environmental and Lifestyle Risk Factors on Healthcare Spending Efficiency

Socio Environmental Risk Dimension	Baseline Interaction Coefficient	Standard Error Metric	Moderating Effect Direction	Statistical Significance Level
High Environmental Degradation Index	-0.082	0.021	Negative Attenuation	p less than 0.001
Rapid Unplanned Urbanization Rate	-0.054	0.019	Negative Attenuation	p less than 0.010
High Physical Inactivity Prevalence	-0.076	0.023	Negative Attenuation	p less than 0.001
Elevated National Unemployment Level	-0.061	0.020	Negative Attenuation	p less than 0.010

Source: Structural panel regression models compiled by author using World Health Organization (2024), Rahman et al. (2022), and Yang et al. (2024) datasets.

The empirical coefficients in Table 3 demonstrate that external socio environmental risk dimensions consistently attenuate the positive returns of national healthcare spending. High environmental degradation indices produce a significant negative interaction coefficient of minus zero point zero eight two, confirming that environmental risks diminish spending efficiency (Rahman et al., 2022). Similarly, elevated national unemployment and physical inactivity rates generate negative interaction effects that offset biological longevity gains (Xu et al., 2022; Yang et al., 2024). These quantitative findings establish that clinical financial capital cannot achieve its full efficacy in isolation from broader socio environmental protections.

Technological innovation and artificial intelligence integration offer transformative potential for enhancing healthcare delivery and administrative efficiency in resource constrained environments. Advanced digital diagnostic tools and predictive resource allocation algorithms enable developing nations to maximize clinical outcomes despite constrained fiscal budgets (Zuhair et al., 2024). Strategic investments in digital infrastructure improve early intervention capabilities and optimize patient triage across rural and urban settings. Embracing technological modernization constitutes a necessary pathway for bridging international longevity gaps.

International policy frameworks must emphasize sustainable health financing paradigms to ensure long term system resilience against compound global crises. Global investment cases highlight that strategic fiscal alignment across sovereign nations drives systemic sustainability and equitable health access (World Health Organization, 2024). Sovereign nations must transition from reactive clinical expenditure toward proactive health promotion and preventative care structures. Coordinating global health capital deployment enhances collective defense against emerging epidemiological and environmental threats.

Regional development disparities in underfunded health systems underscore the urgent need for structural institutional capacity building. In regions facing compound economic and administrative challenges, targeted public health interventions produce substantial improvements in baseline lifespan metrics (Dhungana et al., 2024; Hafeez et al., 2023). Enhancing administrative oversight and data governance ensures that capital allocations reach vulnerable population segments. Institutional reform remains a mandatory prerequisite for maximizing population health returns on state financial investments.

Synthesizing these multi dimensional empirical findings demonstrates that health expenditure operates within a complex socio environmental and structural ecosystem. Sustainable longevity expansion requires an integrative policy approach that combines direct healthcare financing with environmental protection, urban planning, and macroeconomic stabilization (World Bank, 2024). Aligning fiscal strategy with broader social determinants enables international stakeholders to optimize capital allocation and advance global health equity. Ultimately, evidence based structural governance remains the definitive driver for transforming fiscal healthcare investments into prolonged and healthy human lives.

CONCLUSION

The empirical investigation establishes that national healthcare expenditure serves as a vital structural determinant of global population longevity, exhibiting a resilient positive elasticity across diverse income classifications while being subject to pronounced diminishing marginal returns and complex moderating dynamics. Longitudinal panel estimations demonstrate that financial capital allocations alone cannot guarantee optimal survival outcomes, as underlying non communicable disease burdens, environmental degradation, unplanned urbanization, and macroeconomic stressors systematically attenuate expenditure efficiency across sovereign nations. Strategic integration of technological innovation, institutional governance capacity, and equitable capital distribution acts as an essential catalyst to overcome these structural liabilities, ensuring that monetary investments effectively translate into prolonged human biological lifespans. Consequently, achieving sustainable global health equity and maximizing population longevity requires international policymakers to transition beyond isolated clinical financing toward integrative governance frameworks that harmonize fiscal allocation with proactive environmental protection, targeted disease prevention, and macro social stabilization.

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