



EFFECT OF INCOME LEVELS ON HEALTH OUTCOMES OF COUNTRIES IN SUB-SAHARAN AFRICA

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Abstract

Persistent disparities in health outcomes across countries in Sub-Saharan Africa (SSA) continue to undermine regional human capital development despite ongoing economic reforms and improvements in healthcare interventions. While income is widely regarded as a key determinant of population health, empirical evidence on its influence on health outcomes across SSA countries remains inconclusive and context-specific. Consequently, this study sought to determine the effect of income levels on health outcomes of countries in Sub-Saharan Africa. The study was guided by the positivist research paradigm and adopted a longitudinal non-experimental panel research design. Annual panel data covering the period 2000–2024 for 27 SSA countries were obtained primarily from the World Bank's World Development Indicators database. Health outcomes were measured using life expectancy and under-five mortality, while income levels were proxied by GDP per capita. The study employed panel data econometric techniques, including fixed and random effects models, with the Hausman specification test

guiding model selection. Diagnostic tests for stationarity, cointegration, multicollinearity, autocorrelation, heteroskedasticity, and cross-sectional dependence were conducted to ensure robustness and validity of the estimates. The findings revealed that income levels had a positive and statistically significant effect on life expectancy and a negative and statistically significant effect on under-five mortality across SSA countries. The results imply that improvements in income levels contribute to better health outcomes by enhancing access to nutrition, healthcare services, sanitation, and overall living conditions. The study concluded that income remains a critical determinant of population health outcomes in Sub-Saharan Africa. The study recommends that governments in SSA should strengthen policies that promote inclusive economic growth, income generation, and poverty reduction in order to enhance population health and accelerate human capital development.

Keywords: Income levels; Health outcomes; Life expectancy; Under-five mortality; Sub-Saharan Africa

INTRODUCTION

Health outcomes remain among the most important indicators of human development because they reflect both the wellbeing of populations and the effectiveness of national health systems. Indicators such as life expectancy and under-five mortality are widely used to evaluate the social and economic progress of countries, particularly in developing regions where healthcare access and living standards remain uneven. According to the World Health Organization (2023), global life expectancy improved from approximately 67 years in 2000 to about 73 years by 2019, although substantial disparities persist across regions and income groups. Similarly, the World Bank (2024) reported that countries with stronger economic conditions and higher standards of living consistently record lower mortality rates and longer life expectancy compared to poorer economies. These patterns suggest that improvements in health outcomes are closely associated with broader socioeconomic conditions rather than healthcare interventions alone.

Income has consistently been identified as one of the most influential socioeconomic determinants of health outcomes because it shapes the capacity of households to access healthcare services, nutritious food, sanitation, education, and other welfare-enhancing necessities. Higher income levels generally improve living conditions and reduce vulnerability to disease by enabling individuals to afford preventive and curative healthcare. Conversely, low income constrains access to quality healthcare, increases exposure to malnutrition and poor housing conditions, and limits households' ability to cope with health-related shocks. Marmot

and Allen (2020) argued that income inequalities are strongly associated with inequalities in life expectancy and mortality across populations, while Thornton (2020) demonstrated that rising income levels contribute significantly to improvements in population health outcomes through enhanced healthcare utilization and improved standards of living. In many developing countries, income therefore serves as a critical pathway through which economic growth translates into human wellbeing.

The relationship between income and health outcomes is strongly anchored in Grossman's Theory of Demand for Health, which conceptualizes health as both a consumption good and an investment good. According to Michael Grossman, individuals invest in health in order to increase productivity, extend healthy life years, and improve overall utility. The theory assumes that higher income increases the ability of households to invest in health-enhancing inputs such as medical care, nutrition, sanitation, and healthier living conditions. Schneider-Kamp (2020) observed that the Grossman model remains one of the most influential frameworks in explaining how economic capacity affects healthcare-seeking behavior and long-term wellbeing, while Yorke et al. (2023) noted that income and education significantly shape health investment decisions across the life cycle. The theory therefore provides an important conceptual basis for understanding how differences in income levels contribute to disparities in health outcomes across countries and populations.

Despite the strong theoretical linkage between income and health, substantial disparities in health outcomes continue to persist globally. High-income countries such as Japan, Switzerland, and Norway consistently report life expectancy levels above 80 years and significantly lower under-five mortality rates due to stronger economic capacity and well-developed healthcare systems. According to OECD Health Statistics (2023), average life expectancy in OECD countries exceeded 80 years by 2021, while under-five mortality rates remained below five deaths per 1,000 live births in most member states. In contrast, many low-income and developing countries continue to experience poor health outcomes associated with poverty, inadequate healthcare financing, and unequal access to essential services. Powell and Pring (2024) emphasized that countries with sustained income growth tend to record substantial improvements in long-term population health, whereas economically vulnerable regions continue to lag behind global progress.

Sub-Saharan Africa (SSA) remains one of the regions most affected by poor health outcomes despite experiencing episodes of economic growth over the past two decades. Although several countries in the region recorded average GDP growth rates above 4 percent between 2010 and 2019, improvements in population health have remained relatively slow and uneven. According to the World Health Organization African Region (2023), average life

expectancy in SSA remained below 62 years in 2023 compared to the global average of approximately 73 years. Similarly, World Bank (2024) estimates indicate that under-five mortality rates in many SSA countries continue to exceed 70 deaths per 1,000 live births, far above the global average. Countries such as Mauritius and Botswana have achieved relatively higher life expectancy levels due to stronger economic and institutional systems, whereas fragile economies such as South Sudan and the Central African Republic continue to experience severe health challenges associated with widespread poverty and weak health infrastructure.

The persistence of poor health outcomes in SSA has increasingly been linked to inadequate household income and widespread economic vulnerability. Large segments of the population in the region remain dependent on informal employment characterized by unstable earnings, weak social protection, and limited access to health insurance. According to IMF (2023), more than 40 percent of the population in SSA still lives below the international poverty line despite improvements in macroeconomic performance across some countries. In such contexts, low income reduces healthcare utilization, delays treatment-seeking behavior, and increases reliance on out-of-pocket expenditure, thereby worsening mortality and morbidity outcomes. Günther and Harttgen (2021) observed that income deprivation remains a major barrier to improvements in child survival and life expectancy in developing economies, while Odoch et al. (2023) linked weak household income to persistent inequalities in access to healthcare services across SSA countries.

The relationship between income and health outcomes has also been explained through broader human capital and social determinants perspectives. Grossman's health capital model argues that individuals allocate resources toward health investments because health improves productivity and lifetime earnings (Grossman, 1972). Similarly, the social determinants of health framework emphasizes that socioeconomic conditions such as income, employment, and living standards significantly shape exposure to disease and access to healthcare services (Marmot & Allen, 2020). These perspectives suggest that higher income enables households to make productive investments in nutrition, education, preventive care, and treatment-seeking behavior, ultimately improving long-term health outcomes. Conversely, persistent poverty and low income constrain such investments and expose populations to adverse health risks.

Existing empirical studies generally support the positive relationship between income and health outcomes, although findings vary across contexts and methodological approaches. Choi et al. (2020), in a comparative study between the United States and England, found that the income–health gradient was substantially steeper among low-income households, implying that individuals in poorer income categories consistently experienced worse health outcomes.

Similarly, Thomson et al. (2022), through a systematic review and meta-analysis, reported that increases in income improved mental health and overall wellbeing, while income losses significantly worsened health outcomes. Pega et al. (2022) further demonstrated that income support interventions such as unconditional cash transfers reduced illness and improved dietary diversity among vulnerable populations in low- and middle-income countries. These studies collectively suggest that income plays a critical role in shaping population health through multiple socioeconomic pathways.

Within Africa, empirical evidence also points toward a strong relationship between income and health outcomes, particularly among vulnerable populations. Ibegbulam et al. (2022) found that children from low-income households in Nigeria faced significantly higher risks of under-five mortality compared to those from wealthier households. Similarly, Mkama et al. (2024) established that children in higher-income households in Rwanda recorded substantially lower odds of dying before the age of five. In Ghana, Edusei et al. (2025) observed that malaria prevalence among under-five children was disproportionately concentrated among poorer households, highlighting the influence of income disparities on child health outcomes. Chicumbe and Martins (2022) further found that women from lower-income households in Mozambique were significantly more likely to underutilize maternity healthcare services compared to wealthier groups.

Despite the growing body of evidence, important gaps remain in the literature concerning the relationship between income and health outcomes in SSA. Much of the existing research relies on cross-sectional or country-specific analyses that fail to capture long-term dynamics across countries and over time. Furthermore, several studies have focused primarily on high-income economies where institutional and healthcare systems differ substantially from those of SSA countries. Lopes et al. (2023) and Schenkman and Bousquat (2021) highlighted the importance of institutional and socioeconomic conditions in shaping how income translates into health outcomes, yet such relationships remain insufficiently explored within the SSA context. In addition, many studies have concentrated on specific health outcomes or population groups without providing broader panel evidence on long-term health trends across countries in the region.

The persistence of poor health outcomes alongside varying income levels across SSA countries therefore raises important empirical and policy concerns regarding the extent to which income contributes to improvements in population health. While economic growth remains a central policy objective across many African economies, evidence on whether rising income levels consistently translate into improved health outcomes across countries remains limited. Addressing this gap is important for informing economic and public health policies aimed at

improving human wellbeing and accelerating progress toward sustainable development goals in the region. This study therefore sought to examine the effect of income levels on health outcomes across countries in Sub-Saharan Africa using panel data analysis. Specifically, the study sought to answer the following research question: What is the effect of income levels on health outcomes of countries in Sub-Saharan Africa?

The conceptual framework presented in Figure 1 illustrates the hypothesized relationship between income levels and health outcomes in Sub-Saharan Africa. The framework assumes that changes in income levels influence population health outcomes directly through improvements in living standards, healthcare access, nutrition, and other welfare-enhancing conditions. The framework further recognizes that demographic, institutional, and environmental factors may independently affect health outcomes and are therefore controlled for in the analysis.

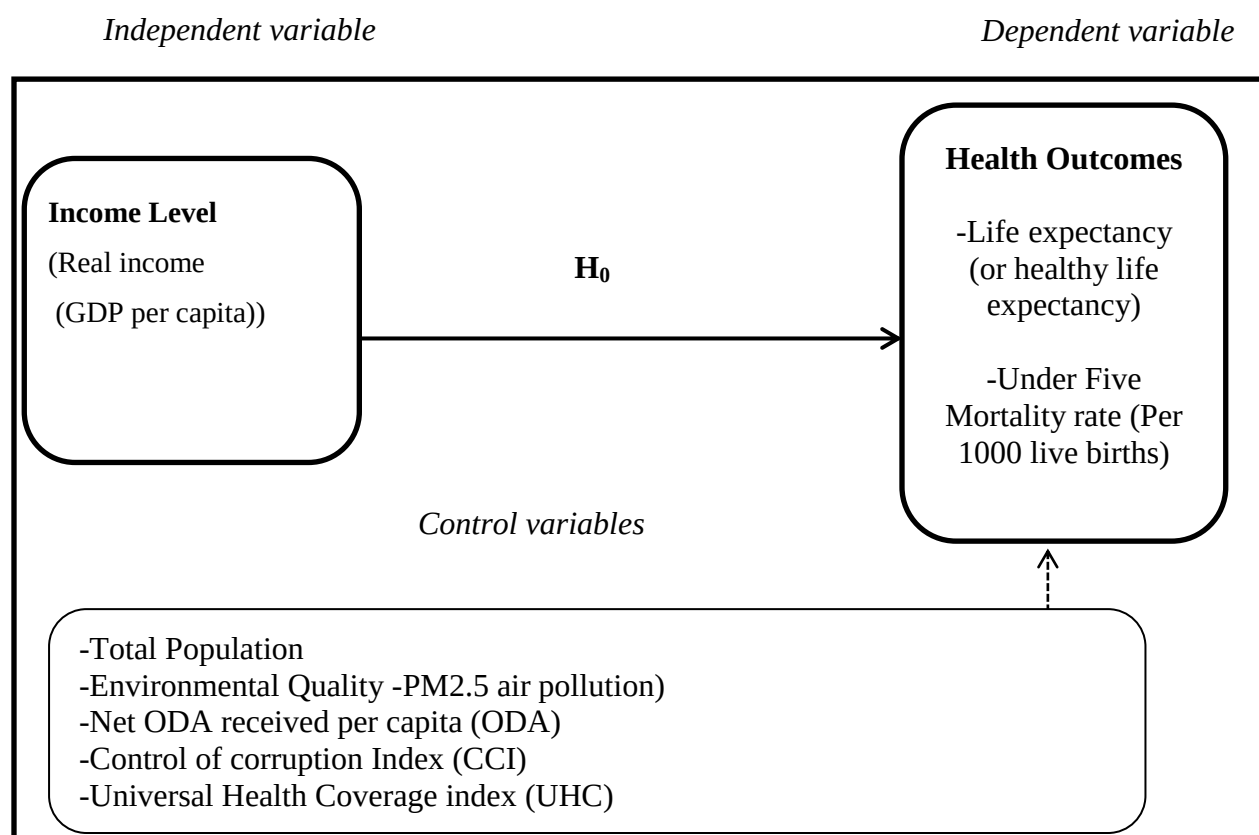


Figure 1: Conceptual Framework

RESEARCH METHODOLOGY

This study was guided by the positivist research philosophy and adopted a longitudinal non-experimental panel research design. The design was appropriate because it enabled the analysis of the relationship between income levels and health outcomes across countries in

Sub-Saharan Africa using annual panel data from 2000 to 2024. Panel data analysis was preferred due to its ability to capture both cross-country differences and temporal variations while controlling for unobserved heterogeneity among countries (Wooldridge, 2010; Baltagi, 2021).

The study focused on countries in Sub-Saharan Africa (SSA), a region characterized by substantial disparities in income levels and health outcomes. SSA was considered appropriate for the study because it continues to experience significant health challenges, including low life expectancy and high under-five mortality rates, alongside varying levels of economic development and household income (World Bank, 2024; WHO, 2023). The target population comprised all 48 SSA countries as classified by the World Bank and IMF. However, the study specifically focused on countries classified as lower-middle-income, upper-middle-income, and high-income economies, while low-income countries were excluded due to persistent gaps and inconsistencies in macroeconomic and health-related data over the study period. Based on these inclusion criteria and data availability, the final analytical sample comprised 27 SSA countries, generating a balanced panel dataset suitable for longitudinal econometric analysis and comparative assessment across countries (Ataguba et al., 2023).

This study utilized secondary data obtained primarily from the WB WDIs for the period 2000 to 2024. The study period covering 2000–2024 was selected because it captures major economic, institutional, and healthcare transitions that shaped health outcomes across Sub-Saharan Africa during the post-Millennium Development Goals (MDGs) and early Sustainable Development Goals (SDGs) eras. The period also provided sufficiently consistent and comparable macroeconomic and health-related panel data across the sampled countries, thereby enabling robust longitudinal analysis of the relationship between income levels and health outcomes over time.

Annual country-level data were collected on income levels measured using GDP per capita, health outcomes measured using life expectancy at birth and under-five mortality rate, and selected control variables including population growth, environmental quality, official development assistance per capita, universal health coverage index, and control of corruption index. Data extraction followed a structured and systematic procedure in which relevant indicators aligned with the study objective were identified and collected country-by-country and year-by-year using standardized secondary data collection schedules. The extracted data were cross-checked for consistency and completeness, after which they were cleaned, coded, and organized into a balanced panel dataset suitable for econometric analysis using Stata version 16.0.

The analysis incorporated both descriptive and inferential statistical techniques. Descriptive statistics and correlation analysis were used to summarize and examine the distribution and relationships among variables, while panel econometric techniques including fixed effects and random effects models were employed to estimate the effect of income levels on health outcomes across Sub-Saharan African countries. The Hausman specification test guided model selection between fixed and random effects estimators. Given the panel structure of the data, the empirical model incorporated both country-specific and time-specific effects to control for unobserved heterogeneity and common macroeconomic shocks affecting countries over the study period (Wooldridge, 2010). The empirical model was specified as follows:

$$HO_{it}^k = \alpha_0 + \beta_1 GDP_{it} + \beta_2 POP_{it} + \beta_3 ENQ_{it} + \beta_4 ODA_{it} + \beta_5 UHC_{it} + \beta_6 CCI_{it} + \mu_i + \lambda_t + \epsilon_{it} \dots \dots \dots (1)$$

Where:

HO_{it}^k : Health outcomes (where k =Life expectancy at birth, under five mortality); GDP_{it} : Income Level (GDP per capita); POP_{it} : Population Growth; ENQ_{it} : Environmental Quality; ODA_{it} : Official Development Assistance; UHC_{it} : Universal Health Coverage; CCI_{it} : Control of Corruption Index; μ_i : Country-specific effect; λ_t : Time specific effect; ϵ_{it} : Error term; α_0 is the intercept or constant; β_{1-6} is regression coefficients; ϵ_{it} is a random error term that accounts for unexplained variations.

If the coefficient of GDP per capita is statistically significant ($p < 0.05$), reject H_{o1} and conclude that income levels significantly influence health outcomes. The study variables were operationalized using internationally recognized indicators consistent with previous empirical literature. Health outcomes were measured using life expectancy at birth and under-five mortality rate, while income levels were proxied using real GDP per capita in constant United States dollars. Population growth, PM2.5 air pollution exposure, official development assistance per capita, universal health coverage index, and control of corruption index were included as control variables to account for demographic, environmental, institutional, and healthcare system factors influencing health outcomes (Choi et al., 2020; Mkama et al., 2024). Logarithmic transformation was applied to GDP per capita, population, and official development assistance per capita to stabilize variance and facilitate elasticity-based interpretation of coefficients.

To ensure robustness and validity of the estimates, several panel diagnostic tests were conducted prior to model estimation. Stationarity of variables was examined using the Fisher-type Augmented Dickey-Fuller panel unit root test, while the Kao residual-based cointegration test was used to assess long-run relationships among variables. Multicollinearity was examined using the Variance Inflation Factor test, whereas the Wooldridge test and Modified Wald test

were employed to detect autocorrelation and heteroskedasticity respectively. In addition, the Pesaran cross-sectional dependence test and Hausman specification test were conducted to assess cross-sectional dependence and guide model selection between fixed and random effects estimators. Where violations of classical regression assumptions were detected, robust standard errors were applied to ensure reliable statistical inference (Baltagi, 2021).

RESULTS AND DISCUSSIONS

Table 1 presents the descriptive statistics of the study variables for the period 2000–2024. Life expectancy recorded a mean of 4.09 with relatively low variation across countries, while under-five mortality exhibited greater dispersion, indicating persistent disparities in child health outcomes within Sub-Saharan Africa. Income levels, measured using the logarithm of GDP per capita, recorded a mean of 7.67 and showed considerable variation across countries, reflecting differences in economic capacity and living standards.

Table 1: Panel Descriptive Statistics of Study Variables (2000–2024)

Variable	Observations	Mean	Std. Dev.	Min	Max
Life expectancy at birth (log)	648	4.09	0.12	3.77	4.35
Under-five mortality rate (log)	648	4.12	0.63	2.45	5.31
GDP per capita (log)	648	7.67	0.85	5.49	9.88
Total population (log)	675	15.54	1.86	11.30	19.27
Environmental quality (Air pollution (PM2.5 exposure))	567	32.28	16.72	8.50	85.10
Official development assistance per capita (log)	640	3.86	1.03	-0.99	6.54
UHC service coverage index	648	45.67	14.70	13.00	81.00
Control of corruption index	621	-0.45	0.69	-1.65	1.70

Source: Researcher's computation based on secondary panel data (2000-2024)

The control variables also exhibited notable variation across the sampled countries, particularly environmental quality, official development assistance, universal health coverage, and control of corruption, suggesting substantial differences in institutional, environmental, and healthcare system conditions across the region. Thus, the descriptive statistics confirmed the existence of significant heterogeneity in both income levels and health outcomes across Sub-Saharan African countries, thereby justifying the application of panel econometric analysis.

Diagnostic tests were conducted to ensure the validity and robustness of the panel regression models. The Fisher-type ADF panel unit root test revealed mixed orders of integration, where variables such as life expectancy and income per capita were non-stationary at level but became stationary after first differencing with all Fisher statistics significant at $p = 0.0000$, while under-five mortality, pollution, and ODA were stationary at level. The Kao panel cointegration test confirmed the existence of long-run relationships among the variables, with the life expectancy model recording a Modified Dickey–Fuller statistic of 2.2347 ($p = 0.0127$) and the under-five mortality model recording an Augmented Dickey–Fuller statistic of 2.3361 ($p = 0.0097$). The Variance Inflation Factor results showed no evidence of serious multicollinearity, with the highest VIF recorded for tax revenue (VIF = 4.26) and a mean VIF of 2.84. However, the Wooldridge test detected autocorrelation in both models, with F-statistics of 111.812 ($p = 0.0000$) for life expectancy and 31.380 ($p = 0.0000$) for under-five mortality, while the Modified Wald test confirmed heteroskedasticity with chi-square statistics of 7248.67 and 13587.76 respectively, both significant at $p = 0.0000$. Consequently, robust standard errors were applied in the final estimations. The Pesaran cross-sectional dependence test further showed no statistically significant cross-country residual dependence, with CD statistics of 0.317 ($p = 0.7515$) for life expectancy and -0.221 ($p = 0.8251$) for under-five mortality, supporting the suitability of the adopted panel estimation approach (Baltagi, 2021; Pesaran, 2004).

The findings in Table 2 show that income exerts a statistically significant effect on both health outcome indicators. Specifically, income has a positive and significant effect on life expectancy ($\beta=0.0798$, $t=2.76$, $p<.05$), implying that improvements in income are associated with gains in longevity. In contrast, income has a negative and statistically significant effect on under-five mortality ($\beta=-0.2610$, $t=-3.18$, $p<.05$), indicating that higher income levels are associated with reductions in child mortality. These results suggest that income improvement is health-enhancing, with a stronger effect observed for child survival outcomes.

The positive relationship between income and life expectancy is consistent with Grossman's (1972) health capital model, which conceptualizes health as both a consumption and investment good. According to this framework, higher income increases the capacity of individuals and households to invest in health-enhancing inputs such as medical care, nutrition, and improved living conditions, thereby increasing the stock of health over time. In the context of Sub-Saharan Africa, this implies that rising income levels enhance both private and public capacity to finance healthcare, contributing to improvements in longevity.

Table 2: Regression Results on the Effect of Income on Health Outcomes of Countries

	(1)	(2)
	Life Expectancy	Under-Five Mortality
Log of GDP per capita (constant 2015 US\$)	.0797635** (2.760437)	-.2609851*** (-3.178104)
Log of total population	.170971*** (3.07616)	-.9730799*** (-5.036904)
PM2.5 air pollution exposure (micrograms per cubic meter)	-.000057 (-.2824355)	-.0006906 (-.4399052)
Log of net ODA per capita	.0039865 (.7097776)	-.0246754 (-1.401791)
UHC service coverage index	.0027313* (1.946027)	-.0084125** (-2.426962)
Control of corruption Index	-.0380498* (-1.851088)	.1378469* (1.734958)
Constant	.6648326 (.7602964)	21.83922*** (7.64468)
F-statistic	17.65721	37.69145
Prob > F	0.0000	0.0000
Hausman chi2	86.61918	158.8431
Hausman p-value	0.0000	0.0000
Wooldridge F	187.2593	147.9672
Wooldridge p-value	0.0000	0.0000
Modified Wald chi2	11126.73	53822.41
Modified Wald p-value	0.0000	0.0000
Observations	535	535
Within R-squared	.6939419	.7919211
Overall R-squared	.0754361	.243353

Source: Researcher's computation based on secondary panel data (2000-2024)

On the other hand, the stronger negative effect of income on under-five mortality suggests that child health outcomes are more immediately responsive to changes in economic conditions. A 1% increase in income is associated with an approximate 0.26% reduction in under-five mortality compared to a 0.08% increase in life expectancy. This finding aligns with the theoretical expectation that short-term improvements in purchasing power can directly influence child survival through better nutrition, increased access to preventive care such as immunization, and improved utilization of maternal health services.

This pattern can further be interpreted through the lens of the Permanent Income Hypothesis (PIH) and the Life Cycle Hypothesis (LCH), which suggest that households' base consumption decisions on expected lifetime income rather than current income alone. In settings where households perceive income improvements as sustainable, they are more likely to maintain or increase health-related expenditures, thereby improving health outcomes. However, in many Sub-Saharan African contexts characterized by income volatility and limited access to credit, the ability to smooth consumption is constrained, making health investments highly sensitive to current income levels.

Empirically, the findings are consistent with the reviewed literature. Thomson et al. (2022) demonstrated that increases in income are associated with improvements in mental health and wellbeing, while income losses significantly worsen health outcomes. Similarly, Pega et al. (2022) found that income gains through cash transfers reduced illness and improved dietary diversity in low- and middle-income countries, highlighting the direct link between economic resources and health improvements. On the other hand, the results for under-five mortality are also supported by evidence from Sub-Saharan Africa. Ibegbulam et al. (2022) found that children from lower-income households in Nigeria experienced higher mortality risks, while Mkama et al. (2024) reported significantly lower odds of child mortality among children from wealthier households in Rwanda. Additionally, Chicumbe and Martins (2022) showed that women from poorer households were more likely to underutilize maternal healthcare services, illustrating a key mechanism through which income constraints translate into poorer child health outcomes.

However, the findings also highlight that income does not operate in isolation. As noted in the reviewed literature, institutional arrangements and health system characteristics influence how income translates into health outcomes. For instance, Choi et al. (2020) observed that income-related health disparities vary across countries depending on healthcare systems and financial protection mechanisms, while Schenkman and Bousquat (2021) showed that broader socioeconomic inequalities can undermine health system efficiency and outcomes. Therefore, the results confirm that income is a critical determinant of health outcomes in Sub-Saharan Africa. They further suggest that policies aimed at improving income levels and reducing economic vulnerability can yield significant health gains, particularly in reducing under-five mortality. However, the effectiveness of such income improvements depends on complementary policies that enhance access to healthcare services and strengthen institutional capacity.

CONCLUSIONS AND RECOMMENDATIONS

The study concluded that income significantly influences health outcomes across countries in Sub-Saharan Africa. Specifically, higher income levels were associated with improvements in life expectancy and reductions in under-five mortality, confirming the critical role of economic capacity in shaping population health. The findings remained consistent across different model specifications, suggesting that income is both statistically and structurally important in explaining variations in health outcomes across countries. The stronger effect observed for under-five mortality further indicated that child health outcomes are highly responsive to changes in household economic conditions.

The study further confirmed that improvements in income enhance the ability of households and governments to invest in healthcare services, nutrition, sanitation, and other welfare-enhancing conditions that support better health outcomes. These findings are consistent with Grossman's health capital theory and broader health economics literature, which emphasize the importance of economic wellbeing in improving population health.

The findings suggest the need for governments in Sub-Saharan Africa to strengthen policies that promote inclusive economic growth, income generation, and poverty reduction. Since income was found to significantly improve life expectancy and reduce under-five mortality, economic policies aimed at increasing employment opportunities, improving household earnings, and enhancing productivity can generate substantial health benefits. Governments should therefore integrate health considerations into broader economic development strategies to ensure that economic gains translate into improved population wellbeing.

The study further recommends increased investment in healthcare systems and social protection programs that enhance access to essential health services, particularly among vulnerable populations. Policies aimed at strengthening universal health coverage, improving maternal and child healthcare, and expanding access to preventive services can amplify the positive effects of rising income on health outcomes. In addition, maintaining macroeconomic stability and improving institutional efficiency remain important for sustaining long-term health improvements across the region.

LIMITATIONS AND FURTHER STUDIES

The study acknowledged several limitations associated with the use of aggregate country-level panel data. Although macro-level indicators provided broad insights into the relationship between income and health outcomes, they masked important within-country disparities in income distribution, healthcare access, and population health conditions. In addition, differences in data reporting standards across countries and the transformation of

some variables may have introduced measurement inconsistencies. The study further recognized the possibility of omitted variable bias arising from exclusion of certain determinants such as education quality and healthcare system efficiency. However, these limitations were minimized through the use of balanced panel data, inclusion of relevant control variables, fixed-effects estimation, and robust standard errors, which strengthened the reliability and consistency of the estimated relationships.

Based on these limitations and findings, the study recommends further research using household-level or micro-level data to provide deeper understanding of how income influences health outcomes across different population groups within countries. Future studies should also incorporate more disaggregated indicators of healthcare expenditure, governance quality, and social protection systems to better capture institutional and fiscal dynamics affecting health outcomes. In addition, the application of advanced econometric techniques capable of examining causal and non-linear relationships, alongside comparative country-specific case studies, would provide richer and more policy-relevant insights into the income–health nexus in Sub-Saharan Africa.

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