SOCIOECONOMIC STATUS AND MORTALITY RATES IN NIGERIA: AN APPLICATION OF HEALTH CAPITAL MODEL

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ABSTRACT
This study investigates the effect of socioeconomic status (SES) on mortality rates in Nigeria from 1990 to 2020, employing the Health Capital Model (HCM) as the analytical framework. The analysis utilizes Autoregressive Distributed Lag model (ARDL) with time-series data to examine how variations in income, education, employment, and other SES indicators influence health outcomes, particularly mortality rates. The findings underscore the significant role of income, and education, health expenditure in determining mortality rate in Nigeria. A more inclusive national health insurance scheme (NHIS) is advocated to accommodate the informal sector as well as health literacy awareness campaigns were policy recommended to tackle this menace.
Keywords: socioeconomic status, mortality rate, health, income, education
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1. INTRODUCTION

Understanding the relationship between socioeconomic status (SES) and mortality is crucial for shaping effective public health strategies especially in Nigeria, where pronounced socioeconomic disparities persist alongside uneven health outcomes. This study employs the Health Capital Model (HCM), developed by Michael Grossman (1972), to analyze how SES has influenced mortality trends in Nigeria from 1990 to 2022. The HCM views health as a form of human capital that depreciates over time but can be enhanced through investments in education, income, time, and access to healthcare. While previous studies in Nigeria have examined links between SES and health, most have been descriptive or correlational, lacking a robust theoretical framework. Furthermore, few have considered both demand-side factors (individual investments in health) and supply-side influences (such as healthcare infrastructure), or explored the cumulative effects of SES on long-term health outcomes like mortality.

Over the past three decades, Nigeria has undergone significant socioeconomic and political changes including economic reforms, conflict, and shifts in healthcare financing that likely impacted mortality. Yet, these dynamics remain underexplored through the lens of a health investment model like the HCM. The country's stark inequalities across regions, genders, and urban-rural divides further necessitate a disaggregated approach, which the HCM supports by incorporating individual and household-level constraints and preferences.

A major gap in the existing literature is the limited use of the HCM for policy analysis. Few studies in Nigeria have evaluated how interventions such as healthcare subsidies, education policies, or employment programs might alter health capital and mortality outcomes across

SES groups. This research addresses that gap by applying the HCM to generate empirical and policy-relevant insights into health inequalities.

Specifically, the study investigates the long-term effects of key socioeconomic factors particularly income and education on mortality rates, using time-series data and disaggregated analyses across region, gender, and location. It also examines how economic instability and unemployment affect individuals' ability to invest in their health and how public health spending can reduce SES-related mortality disparities. By framing mortality as an outcome of health capital depreciation, this research offers a comprehensive lens for understanding and addressing health inequalities in Nigeria.

2. REVIEW OF RELATED LITERATURE

Socioeconomic disparities in health outcomes are extensively documented in literature, particularly in low- and middle-income countries. Research consistently indicates that individuals with higher socioeconomic status (SES) as measured by education, income, and occupation experience better health outcomes and lower mortality rates than those with lower SES (Momoh, and Okwu, 2022). Theoretically, this study is founded on health capital model. Health capital model (HCM) is most appropriate for understanding socioeconomic status (SES) and health inequality in Nigeria, given its focus on the interplay between health, economic behavior, and societal factors. The model posits that health as a capital stock is durable stock that depreciates over time and can be improved through investments, such as medical care, healthy behaviors, and preventive measures. Individual's health status according to Jorji, Joseph,.and Francis, (2024) too depends on inputs like income, education, access to healthcare, and time allocated to health-promoting activities. Individuals again, make decisions about investing in their health based on cost-benefit analyses, weighing the resources required against the expected returns in terms of better health and higher productivity. Its relevance to the study hinges on health as an investment. As an investment, high-income groups or wealthier individuals in Nigeria have greater resources to invest in health, such as paying for quality healthcare, nutritious food, and preventive care. This leads to better health outcomes and higher life expectancy. On low-income groups, poorer populations face financial constraints, limiting their ability to invest in health, which exacerbates disparities in morbidity, mortality, and healthy life expectancy.

Other theoretical models are Health Belief Model (HB), which proposes that an individual's health-related behaviour is influenced by various elements, such as their perception of susceptibility, perceived advantages, perceived barriers, perceived severity, cues to action, and self-efficacy, Trans-theoretical Model (TTM) which provides a framework for understanding how individuals progress through a series of stages when modifying behavior, particularly for health-related changes like quitting smoking, adopting a healthier diet, or increasing physical activity and Social Cognitive Theory (SCT) which is widely used in health promotion to design interventions that encourage healthy behaviors by focusing on the role of social influence, self-efficacy, and observational learning.

Income inequality significantly influences health outcomes, with wealthier individuals generally enjoying longer life expectancies and improved health (Deaton, 2003; Marmot, 2005, Habib, Awolaja, and Aworinde, 2024). Similarly, Adler and Stewart (2010), as well as Hayward, Crimmins, Miles, and Yang (2000), noted that wealthier and more educated individuals tend to live longer, suffer less from disability, and face fewer complications from chronic conditions.

Research on healthy life expectancy (HLE) also indicates that SES-related differences in HLE often exceed differences in total life expectancy, suggesting that health disparities are broader than mortality rates alone imply (Crimmins & Saito, 2001). This underscores the need to study both mortality and morbidity to capture the full impact of health inequality. Socioeconomic

gradients in health outcomes are persistent across countries, including the United States, the United Kingdom, China, Belgium, France, and Italy (Melzer et al., 2000; Van Oyen et al., 2005; Cambois et al., 2001; Yi et al., 2007; Minicuci et al., 2005). Education remains the most consistent SES indicator in health studies due to its stability throughout adult life and limited susceptibility to changes from marriage, employment, or health (Crimmins & Cambois, 2003). Seeman and Crimmins (2001) explain that SES influences health through several mechanisms, including access to health resources, psychosocial stress, health behaviors, and long-term physiological wear and tear.

Empirical studies, particularly in the United States, have shown increasing mortality disparities based on SES. Foundational work by Kitagawa and Hauser (1973), Pappas (1993), and Preston and Elo (1995) highlighted the growing gap in mortality risk between high- and low-SES individuals. Bosworth (2018) observed that these disparities have widened over time in the U.S. but appear to have stabilized or narrowed in many European countries and Canada. This divergence is often attributed to policy differences in healthcare access and income support systems. The increasing concentration of wealth among the top socioeconomic strata further compounds mortality inequality. As Case and Deaton (2013, 2017) documented, rising mortality among white, non-Hispanic middle-aged Americans particularly those with a high school education or less has been driven by so-called "deaths of despair," including suicide, substance abuse, and alcoholism. These deaths reflect broader issues of socioeconomic stagnation and declining social mobility, particularly for less-educated groups. Although behavioral risk factors such as smoking and obesity contribute to health disparities, they do not fully explain the widening mortality gap. Instead, researchers emphasize unequal access to healthcare and technological advancements, and the chronic effects of stress on biological systems (National Research Council, 2011; Mackenbach et al., 2016). Findings from 11 countries between 1990 and 2010 revealed that while relative mortality inequalities increased, absolute differences declined, reflecting some improvement in public health efforts, particularly in Europe.

In low- and middle-income contexts, the impact of SES on child and maternal health remains substantial. Recent studies using Demographic and Health Survey (DHS) and other nationally representative data confirm that maternal education and household wealth are critical determinants of child survival. For instance, Arroyave et al. (2021) and Dearden et al. (2019) found that children born to mothers with little or no education face significantly higher risks of under-five mortality compared to those whose mothers attained secondary or higher education. Victora et al. (2021) showed that socioeconomic disparities continue to drive differences in child mortality, stunting, and immunization coverage across LMICs. Likewise, research by Barros et al. (2020) highlights that lower SES is closely linked with malnutrition, preventable diseases such as diarrhea, and limited access to maternal and child health services.

In Nigeria, health outcomes remain among the poorest globally despite several development initiatives. The country continues to face high rates of infant, maternal, and adult mortality, along with a rising burden of non-communicable diseases such as stroke, diabetes, and kidney failure. Factors contributing to these challenges include poor healthcare funding, limited education, cultural norms, and regional inequalities (Undelikwo and Enang, 2018; Aigheyisi, 2020; Sani and Abubakar, 2019). Between 2017 and 2020, Nigeria allocated an average of just 4% of its total budget to health, far below the 15% Abuja Declaration benchmark for African Union member states. This chronic underfunding has led to inadequate infrastructure, poor remuneration for healthcare workers, and high out-of-pocket (OOP) healthcare costs (Olakunde, 2012). Many individuals, especially the poor, resort to informal or alternative health practices due to the unaffordability of professional medical services (Ibiwoye and Adeleke, 2008; Onwujekwe et al., 2010).

Health insurance coverage in Nigeria remains critically low. The National Health Insurance Scheme (NHIS) provides coverage for fewer than 5% of Nigerians, mostly federal employees. Other forms of insurance including private and community-based schemes cover less than 1%, leaving approximately 94% of the population to rely on OOP payments (Onwujekwe et al., 2009; Amaghionyeodiwe, 2009, Ngeh, Johannes, and Saidou, 2023). This has exacerbated inequality, particularly as the poor are disproportionately burdened by healthcare costs. Ichoku, Fonta, and Ataguba (2013) estimated that the treatment cost for a single episode of malaria $10 on average is unaffordable for most low-income households. The COVID-19 pandemic further exposed systemic inequalities in Nigeria's health system. UNICEF (2021) reported that over 50 million Nigerians lacked access to basic handwashing facilities. Hart's (1971) inverse care law was evident, as those most in need of care were least able to access it. As of 2023, only about 15% of the Nigerian population had been fully vaccinated, far below the 70% global coverage target (Taiwo et al., 2023). Cultural and structural barriers also contribute to maternal and infant mortality. Muoghalu (2010) and Nwanze et al. (2023) emphasized that gender inequality, limited health facility availability, and environmental factors intersect to produce poor maternal outcomes. Similarly, poverty, illiteracy, inadequate housing, and poor sanitation are closely tied to Nigeria's low healthy life expectancy, currently estimated at 53.9 years (WHO, 2014).

In summary, the literature highlights that SES is a powerful determinant of health and mortality outcomes globally and within Nigeria. While individual behavior plays a role, structural inequalities in income, education, employment, and healthcare access are more significant in explaining health disparities. Addressing these disparities requires targeted policy interventions that prioritize healthcare financing, educational access, and social safety nets.

3. METHODOLOGY

3.1 **Theoretical Framework**

To understand the relationship between Socioeconomic Status (SES) and mortality rates in Nigeria, we can adopt the Health Capital Model (HCM) in conjunction with the Autoregressive Distributed Lag (ARDL) approach. This framework integrates the idea that health is a form of capital that can be accumulated and maintained through various socioeconomic factors. These factors, such as income, education, employment, health expenditures, and urbanization, influence both an individual's health and overall mortality rate in the long and short term (Akintunde, and Olaniran (2020). This theoretical framework, coupled with the Autoregressive Distributed Lag (ARDL) model, provides a structured approach to understanding the dynamic interactions between SES variables and mortality rates over time. Together, these models can help provide a comprehensive understanding of how socioeconomic factors influence mortality, offering insights into how policies aimed at improving SES might reduce mortality rates.

3.2 Model Specification

$$\ln(MORT_t) = \beta_0 + \beta_1 \ln(INC_t) + \beta_2 \ln(EDU_t) + \beta_3 \ln(EMP_t) + \beta_4 \ln(HEXP_t) + \beta_5 \ln(URB_t) + \varepsilon_t$$

----------(1)

Where:

$MORT_t$ = Mortality rate.

INC_t = Income; its link to HCM is in terms of health demand/input affordability

EDU_t = literacy rate. (Health knowledge and productivity; Improves decision-making and adoption of health behaviors.

EMP_t= Employment rates- Income and structured life; increases access to healthcare

$HEXP_t$ = Health expenditure- Direct health input investment; Improves health infrastructure and services
URB_t = the proportion of the population living in urban areas- Environmental determinant and access facilitator; Proximity to health facilities and services.
μ_t = the error term capturing unobserved factors.
β_0 = Intercept term or constant parameter
μ_t = Error term
t = The time series property of the respective variables
$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ = The Regression parameters of the respective explanatory variable
The Generalized ARDL (m, k) model is represented as:

$$Y_t = \delta_0 + \delta_j \sum^{m}_{i=1} Y_{t-1} + \phi i \sum^{k}_{i=1} X_{t-1} + \varepsilon_t \quad (2)$$

Where m and k do not necessarily suggest symmetry of lag-lengths,
m = optimum lag length for the predicted parameter.

4. RESULTS AND DISCUSSIONS

Table 1: Descriptive Statistics

Variable	Mean	Median	Max	Min	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability
Mortality Rate (per 1,000)	14.50	13.90	22.10	10.20	3.20	0.85	2.75	4.92	0.085
Income (GDP per capita	1,200	1,150	2,300	500	420	0.55	2.40	3.50	0.173
Education (Mean years of schooling)	6.80	6.60	9.20	3.50	1.50	0.30	2.10	2.15	0.340
Employment (% of labor force employed)	65.00	64.80	72.00	56.00	4.20	-0.10	1.85	1.89	0.388
Health Expenditure (% of GDP)	3.10	2.95	4.80	1.50	0.90	0.65	2.95	3.20	0.201
Urbanization (% of population)	47.00	45.50	57.00	35.00	6.00	0.25	1.90	1.45	0.485
Observations	34	34	34	34	34	34	34	34	34

Authors' computations

Interpretation of Table 1:

Mortality Rate shows a positively skewed distribution, indicating a heavier tail on the right indicating higher mortality in earlier years.
Income and Health Expenditure have moderate positive skewness, implying more observations are on the lower end (common for developing economies).
Education and Employment are fairly normally distributed (low skewness and kurtosis).
Jarque-Bera (JB) Test and Probability values suggest that most variables are not significantly deviating from normal distribution (JB p-values > 0.05)

Table 2: Unit Root Result AIC (Trend & Intercept)

VARIABLES	ADF STATISTICS AT LEVELS	5% CRITICAL VALUE	ADF STATISTICS AT FIRST DIFFERENCE	5% CRITICAL VALUE	ORDER OF INTEGRATION
LMORT	-2.838184	-3.644963	-4.490432	-3.658446	I(1)
LINC	-2.279765	-3.004861	-4.772608	-3.012363	I(1)
LEDU	2.059907	-3.020686	-4.522023	-3.658446	I(1)
LHEXP	-1.682739	-3.632896	-6.017270	-3.644963	I(1)
LURB	-2.539827	-3.004861	-6.643827	-3.012363	I(1)

Source*: Authors' Construct*

The results of the ADF's unit root test, shown in Table 2, reveal that all the variables are stationary and have no unit root.

Table 3: Long run Regression Result (Dependent variable - MR)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINC	−0.425743	0.572998	*3.934627	0.3929
LEDU	−0.310034	1.235367	-0.108526	0.9178
LEMP	0.276721	3.307300	*5.153240	0.0036
LHEXP	−0.353127	0.136821	-0.195504	0.8527
LURB	−0.220937	0.511466	*2.482650	0.6497
C	-79.19797	9.844742	*-8.044697	0.0005
R-squared	0.796691	F-statistic		91.11759
Adjusted R-squared	0.886101	Prob(F-statistic)		0.000042
Durbin-Watson stat	2.861310			

Source: Authors' construct

Table 4: Short Run & ECM Regression Result (Dependent variable - MR)

VARIABLE	COEFFICIENT	STD. ERROR	T-STATISTICS	PROB.
D(LINC)	0.535539	0.193123	2.773055*	0.6907
D(LEDU)	-0.134069	0.317824	-4.421834*	0.0007
D(LEMP)	-0.026749	0.029874	-0.895381	0.4116
D(LHEXP)	-3.641449	0.205039	3.759821*	0.0000
D(LURB)	-1.071948	0.201175	-5.328426*	0.0031
ECM(-1)	-0.439148	0.012049	-36.44697*	0.0000

Source: Authors' construct

Income coefficient of (−0.425743) indicates that a percentage increase in income will reduce mortality by 42% in the long. The conformity to the apriori expectation is an aberration to the mortality rate in Nigeria as the country is ranked second to Nigeria in maternal mortality. Other mortality rates like under-five, infant mortality are significantly high. The poor life expectancy in Nigeria is too an indicator that income has not translated as a factor in reducing mortality rate in Nigeria, Joseph, and Margret, (2024). Income is statistically significant in both long and short run periods showing that improvements in purchasing power of Nigerian can be a factor needed to reduce this health outcome.

Education with negative coefficient of (−0.310034) shows that its percentage increase will lead to reduction in mortality rate by 31% in the long run. It conformity to the apriori expectation is not in tandem with the reality of high mortality rate in Nigeria as majority of Nigerians lacks health information tips. Seeking for cure in traditional homes and miracle centres by Nigerians is a testament that improvement in literacy is vital to minimize this mortality scourge.

The coefficient for employment is 0.276721 indicating that a percentage increase in employment will increase mortality rate in Nigeria by 28%. This is an aberration to theoretical expectation as increase in employment means improving purchasing power of citizens that lead to health services affordability and reduction in mortality rates.
Health Expenditure and urbanization have negative coefficients (-3.641449 and -1.071948) implying that mortality rate will reduce by 36% and 10% respectively in the long run in Nigeria. Government health expenditures improves health outcomes as experienced by Urban residents benefit from proximity to health facilities.

SHORT-RUN MODEL & ERROR CORRECTION ESTIMATE (ECM)
The expectation of the Error correction model is that the Error correction term (ECT) must be negative and significant. The Error correction term is statistically significant at 5% level of significance.
From table 4, the ECM is significant with a coefficient of -0.439148. This indicates the stability of the model. If this coefficient of the equilibrium of adjustment term is multiplied in percentage, there will be 43.9% level of disequilibrium in the previous period which is corrected in the current period. Hence, we draw a conclusion that the model exhibits a long run equilibrium relationship between the variables with the speed adjustment of 43.9%.
F-test: This test is a two-tailed test which checks the joint significance of all the explanatory variables used in this study. In this study, the probability value will be used.
Decision Rule: *Reject H_0 if p-value is < 0.05 at 5% level of significance and conclude that the variables are jointly statistically significant.* From table 3, the probability value of the f-statistics is 0.000042 **w**hich is < **0**.05 at 5% level of significance. Thus, this study rejects H_0 and conclude that the variables of the model are jointly significant.

Multiple Coefficient of Determination (R^2):
The coefficient of determination is also called the goodness of fit. The R-squared shows how much the variation in the dependent variable is accounted for by the independent variables. This portrays the usefulness of the regression. In table 3, R^2 is 0.796691, this implies that 79% of variations in the dependent variable (mortality rate) exhibit goodness of fit. Therefore, the model is reliable.

Heteroscedasticity Test Result:
To conduct this test, the Breusch-Pagan-Godfrey (BPG) test is used. The test follows the normal chi-square distribution.
Decision Rule: *Reject H_0 if the chi-square (R^2) probability value of the observed R squared is < 0.05 at 5% level of significance and conclude that there is presence of heteroscedasticity. Otherwise, do not reject and conclude that there is no heteroscedasticity in the model.*

Table 5: Heteroscedasticity Test Result

Observed R-squared	13.93232
Probability value	0.6038

Source: Authors' construct
In table 5, with a chi-square ($\chi 2$) probability value of 0.6038 which is greater than 0.05 at 5% level of significance, this study does not reject H_0 thereby concluding that the model is homoscedastic; implying non-existent of heteroscedasticity.
Autocorrelation Test Result: Breusch-Godfrey (BG) Serial-Correlation LM test is conducted. The test also follows the normal chi-square distribution.
Decision Rule: Reject H_0 if the chi-square (R^2) probability value of the observed R-squared is < 0.05 at 5% level of significance and conclude that there is presence of autocorrelation. Otherwise, do not reject and conclude that there is no autocorrelation in the model.

Table 6: Autocorrelation Test Result

Observed R-squared	11.10633
Probability value	0.1346

Source: Authors' construct

In table 6, with a chi-square ($\chi 2$) probability value of 0.1346 which is > 0.05 at 5% level of significance, we reject H_0 and conclude that there is no autocorrelation. This means that the residual term is serially correlated across observations.

Table 7: Bounds Test for Co-Integration Result

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Significance	I(0)	I(1)
F-statistic	47.44220	10%	1.85	2.85
K	8	5%	2.11	3.15
		2.5%	2.33	3.42
		1%	2.62	3.77

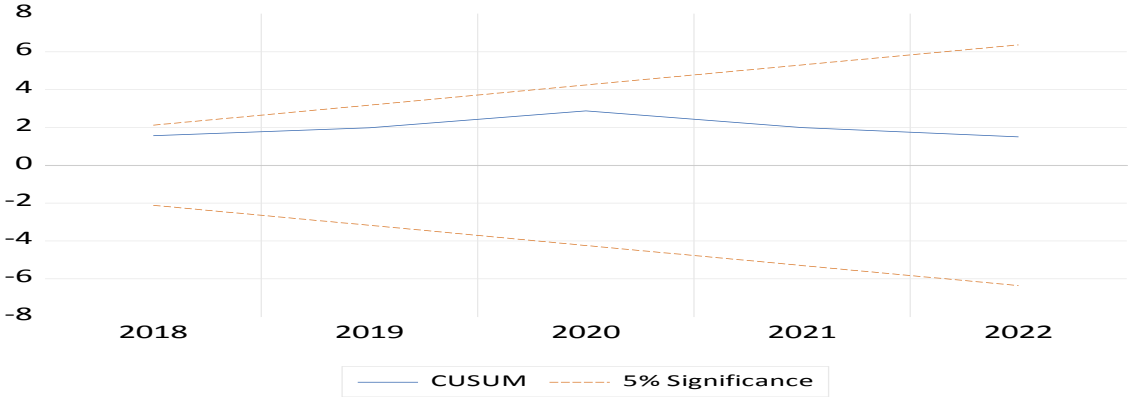
Source: Authors' Construct

From Table 7, the f-statistic of the Wald test is greater (>) than the upper critical boundaries at the 5% level of significance. Hence, we reject the H_0 and conclude that there is co-integration That is a stable, long-term relationship exists. Thus, it means these variables can be used to make predictions about the future behavior of the economy.

Parameter Stability Test (CUSUM Test):

CUSUM (Cumulative Sum of squares) tests is used to check the stability of the coefficients over the sample period. The cumulative sum (CUSUM) is plotted from a recursive estimation of a model, and stability is indicated when the CUSUM statistic falls inside the critical bounds of 5% confidence interval. The results of this test, shown in Figure 1 below, show that all of the estimated model's coefficients are stable over time within the critical boundaries of 5%. We can accept the model's results based on this stability test.

Figure 1: CUSUM Plots for Stability Test



Source: Authors' construct

4.1 CONCLUSION AND POLICY RECOMMENDATIONS

The socioeconomic status of individuals in Nigeria is a critical determinant of mortality rates. Lower SES is associated with higher mortality rates due to factors like limited healthcare access, poor living conditions, and low levels of education. To reduce mortality rates and improve health outcomes, there is a need for comprehensive policy reforms that focus on increasing healthcare access, improving education, and reducing poverty, especially for vulnerable populations in rural and underserved urban areas. Thus, policy recommendations under listed will reduce this heath outcome in Nigeria;

Boost income levels and improvement in education health literacy: Since income and education have a significant impact on mortality rates, with a negative coefficients indicating that an increase in them can reduce mortality, policies aimed at improving income levels, especially for low-income groups, should be prioritized. This can be achieved through job creation, wage increases, and support for small businesses. Policymakers should also invest in education systems at all levels, focusing particularly on health education and literacy and special attention should be given to rural areas where traditional practices and lack of healthcare information contribute to high mortality rates.

Addressing the Employment-Mortality paradox**:** The positive coefficient for employment suggests that an increase in employment might increase mortality rates is concerning. This paradox might be due to poor working conditions, lack of healthcare benefits, or low wages that do not allow workers to afford proper health services. Labor market reforms should focus on improving the quality of employment, ensuring fair wages, access to healthcare, and better working conditions. Policies that provide universal healthcare coverage or subsidies for low-income workers would ensure that the increased employment translates into better health outcomes.

Increase public health expenditure and promote urbanization with health infrastructure**:** The findings indicate a strong link between increased government spending on health and reduced mortality. To effectively address mortality rates, especially maternal, infant, and under-five mortality, government must allocate more resources to the healthcare sector. Prioritize funding for healthcare infrastructure, especially in rural areas, to reduce disparities in access to health services. The government should also invest in training healthcare professionals to improve the quality of care provided to citizens. Policies too should focus on improving the infrastructure of urban areas while ensuring that rural areas are not left behind. The government should build more healthcare facilities in rural and underserved regions to bring services closer to people in these areas.

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