




# Health Burdens and Labor Productivity in Africa's Middle- and Low-Income Economies: Implication for the COVID-19 Pandemic

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## Abstract

The effect of health burdens on labour productivity in Africa's middle and low-income economies in the advent of Covid-19 pandemic was investigated in this paper. It employed Common Correlated Effects (CCE) estimation of Heterogeneous Dynamic Panel data Models to estimate a sample of 45 African countries with 30-panel series from 1990 to 2020. The authors discovered that the Covid-19 epidemic has aggravated the catastrophic health burdens (morbidity and mortality rates) in the panel countries. It shows that health burden has dynamic negative long-term spilling effect on labour productivity, such that a 1% increase in health burden, *ceteris paribus*, would reduce labour productivity by 13% in the upper middle income economy, 17% in the lower middle income economy, and 19% in the low-income economy, respectively. The findings also show divergence effects; with low- and lower-middle-income nations bearing the highest brunt of health burden crises due to Covid-19 pandemic and its mitigation measures, even in the face of inadequate health systems, lowering their labour productivity. As a result of this finding, an increase in health burdens devalues these countries' labour assets and raises the health risk of overburdened economies. The paper proposes that Africa countries should develop a regional inclusive health scheme with a financing target to raise the health system with particular attention to the low and lower-income countries. A healthy child grows into a productive adult in the future; hence the African Union should enact and enforce a regional health program that provides free child healthcare.

**Keywords** Africa · Covid-19 · Health burdens · Labour productivity

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## Introduction

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)–caused coronavirus disease 2019 (COVID-19) spread quickly in 2020, resulting in a pandemic that is still ongoing in most countries. The COVID-19 outbreak has exposed weaknesses in health systems in various African countries, necessitating prompt action. Despite the fact that Africa's response to the pandemic was largely decisive, with nonpharmaceutical intervention methods used at various levels, about 88% (43/49) of African countries implemented stringent nonpharmaceutical intervention at the start of the pandemic's first wave in the second quarters of 2020 (Inzaule et al., 2021). These measures include some form of public transportation closure, stay-at-home measures, and travel limitations, yet they have only added to the people's social and economic woes (Hale et al., 2020).

Although COVID-19 has been slowed in its spread across Africa, as the number of new cases dropped considerably at the end of 2020, a second wave has been reported in most African countries from early 2021 (Inzaule et al., 2021). The continent had 4.52 million cases and 120,420 deaths as of the second quarter of 2021, accounting for 3.1% of global cases and 3.9% of global deaths (Africa Center for Disease Control, CDC, 2019). Furthermore, significant constraints on social contact and transportation, as well as apprehension about visiting healthcare facilities, have had an influence on non-COVID healthcare services (WHO, 2020, and Partnership for Evidence-Based Response to COVID-19, 2020). In effect, rather than reallocating resources such as healthcare professionals and diagnostic equipment to effectively combat the pandemic, supply chain system disruptions have exacerbated COVID-19's indirect impact on other health conditions in Africa, worsening the continent's overall health burden (WHO, 2020).

Epidemics in the past have shown that interruptions in healthcare systems result in a considerable increase in health-related morbidity and mortality (Sochas, Channon & Nam, 2017). More deaths were ascribed to disruptions in malaria, tuberculosis (TB), HIV, and maternity and child health (MCH) services during the Ebola epidemic in West Africa from 2014 to 2016, according to studies (Parpia et al., 2016). In the present pandemic, significant increases in health burdens have been observed and projected as a result of interruptions in healthcare services. According to data from a national survey conducted in April 2020 in South Africa, 13.2% of those polled were unable to access medication for chronic diseases during the lockdown, implying that the COVID-19 mitigation measures in place could have a significant impact on access to critical healthcare services and increased health burdens on the continent (Ajibo, 2020). In August 2020, the Partnership for Evidence-Based Response to COVID-19 (PERC) conducted a household survey in 18 African countries, and finding shows that up to 44% of healthcare visits were delayed and up to 47% of medication was difficult to obtain (Guerrieri, Lorenzoni & Straub, 2020).

South Africa, Egypt, Morocco, Algeria, Nigeria, and Ghana are among the African countries that have seen their health costs rise. As of September 2020,

Africa had reported 63,293 confirmed cases of coronavirus infection, 2290 fatalities, and 21,837 recoveries (Africa Center for Disease Control, ACDC, 2020). Furthermore, South Africa has the greatest rate of coronavirus infection in Africa, with around 10,015 cases in October 2020, followed by Egypt (9400 cases), Morocco (6063 cases), Algeria (5723 cases), Nigeria (4399 cases), and Ghana (4263 cases) (Rahman & Shaban, 2020; Ajibo, 2020). In addition, from early May to late October 2020, over 28,000 non-COVID deaths were reported in South Africa, which could be attributable to increased health costs induced by COVID-19's indirect effects (South African Medical Research Council, 2020). By October 2020, Nigeria has reported 4399 coronavirus infections and 143 deaths (Nigeria Center for Disease Control, NCDC, 2020).

According to research, Africa accounts for around 22% of total global disability rate and 25% of global premature death, nearly twice that of Asia, the second worst region, and seven times that of the USA, although having less than 10% of the global population (WHO, 2017, 2019). A newborn in Africa can expect to live for 42 years on average, whereas a youngster born in a sophisticated European or American country can expect to live for 70 years on average (World Bank, 2017). In SSA, the average number of neonates who died before reaching the age of 1 year was estimated to be 154 per 1000 live births, compared to slightly more than 27 in developed countries (WHO, 2019). Not only is Africa's health situation dire and concerning, but its dynamics are also concerning.

Despite the scale of economic policies and programs, African countries have long grappled with the twin evils of a catastrophic health burden and stagnate or declining labor productivity. Despite its population and human capital resources, Africa has traditionally lagged behind other areas in all labor productivity indexes. Apart from low labor productivity, Africa has the cheapest workforce in the world, followed by Asia, according to ILO data. Only Mozambique, Ethiopia, Tanzania, and Kenya have made considerable progress in transferring employees from low to high average productivity, according to the International Monetary Fund's structural transformation research (IMF, 2017). Labor productivity growth in the remainder of Africa has been static or dropping for a long time. The most significant impediment to Africa's productivity and production development potential is policy inconsistency in the region's two major economies, Nigeria and South Africa, which is exacerbated by the continent's tremendous healthcare burden (Economic outlook by IMF, 2016).

Furthermore, the COVID-19-induced health burden effect of productivity and output growth in Africa has begun to attract greater academic attention as a result of the shifting development mantra of Sustainable Development Goals (SDGs) (nationally and internationally). This has inspired additional empirical research into the impact of COVID-19 and its associated health consequences on society's social and economic well-being. The majority of studies looking at the detrimental consequences of COVID-19 increased disease and health burden on the development and expansion of LDCs have come to the same conclusion (LDCs). Although most health impact studies continue to adopt a microeconomic model, some integrate direct healthcare costs (out-of-pocket expenses) with indirect costs of lost production at the household level owing to missing working hours (Oguzoglu, 2007;

Adam & Ke, 2008; Heltberg et al., 2013; Sowmyy, 2016). Others used macroeconomic growth models to investigate the dynamic and diversified nature of societal losses (Bloom et al., 2004; Acemoglu & Johnson, 2007; Swift, 2011; Weil, 2007, 2013).

The purpose of this study is to investigate the impact of the increased health costs induced by the indirect impact of the COVID-19 pandemic on labor productivity in Africa's middle- and low-income economies. Most African-based studies on health growth and productivity have significant modeling flaws, prompting consideration of Africanizing the social determinants of health paradigm for health growth analyses (Ichoku et al., 2013). Most past health growth studies have omitted demographic aspects such as the fertility rate, governance features, and political climate, all of which have an impact on growth and productivity. In view of the ongoing need for macroeconomic level studies on the role of COVID-19 health-related impact on Africa's social and economic well-being (WHO Africa Health Monitoring, 2020), the following research question was estimated in this study. To what extent has COVID-19-induced health cost negatively impacted on African labor productivity? The researchers use this information to calculate the extent and dynamic effects of COVID-19 health cost on labor productivity in Africa's middle- and low-income economies.

## Review of Related Literature

Several empirical studies have explored the correlation between health and labor market outcomes. Lixin et al. (2008), for example, examined the impact of health and health burden on hours worked in Australia. They looked at the influence of persistently low health stock and new health burden on working hours using data from the Household, Income and Labor Dynamics in Australia (HILDA) survey. To investigate the combined influence of health status and health burden on working hours, the researchers utilized a dynamic random effect in the Tobit model. The study uses a static equation that uses information from the first wave of data to approximate the unknown initial conditions, with projected individual health stocks being employed to restrict the impacts of measurement error and endogeneity. They discover that lower health status leads to fewer working hours and that health burden has a negative and significant impact on working hours after isolating the time-permanent influence of health status from the purportedly more transient effect of health burden on working hours.

The impact of COVID-19 on Nigerians' socioeconomic well-being and the health sector's readiness to deal with the epidemic, and the role of Nigerian social workers in the fight against COVID-19 are all investigated by Ajibo (2020). This study used a phenomenological and exploratory research design. The study has a sample size of sixteen people. Data was collected using a Focus Group Discussion Guide and an In-Depth Interview Guide. According to the data, the COVID-19 epidemic has had a significant impact on Nigerians' socioeconomic level. Third, Nigerian social professionals, particularly medical social workers, have been essential in alerting the general public about COVID-19 preventive strategies. The Nigerian government,

according to research, needs to wake up and strengthen the health system in order to be more proactive in dealing with future epidemics and pandemics. To enhance social work practice in Nigeria, the government should institutionalize it.

Mohamed (2022) examines how the COVID-19 outbreak is influencing employment in Tunisia's various sectors.

The researcher employed the Markov chain approach. This method has the benefit of simulating a system that switches states based on a transition rule that is solely dependent on the current state. The COVID-19 had a negative impact on industrial and service employment, according to the findings. COVID-19 is also very advantageous to the agricultural industry.

Economic measures, particularly for small- and medium-sized businesses, must be planned in order to increase their resilience.

Inzaule, Ondo, Loembe, Tebeje, Ouma, and Nkengasong explored COVID-19 and indirect health implications in Africa: impact, mitigating methods, and lessons gained for enhanced disease control (2021). They discovered in their research that COVID-19 mitigation measures such as travel restrictions and lockdowns, as well as repurposing health resources and suspending prevention programs such as immunizations, resulted in an increase in new infections and deaths, reversing the gains made in controlling these health challenges in Africa. They also discovered significant gaps in African countries' ability to satisfy global disease control targets. They said that at the current rate of growth, most African nations will be unable to meet the 2030 targets for maternal and child mortality reductions set out in the Sustainable Development Goals (SDGs). They argued for a more comprehensive COVID-19 response to reduce Africa's indirect mortality rate. Among them are WHO guidelines such as multimonth drug dispensation, self-testing, virtual case management platforms, and community and home-based preventive and care services such as home distribution of test kits, immunizations, treatment, and mosquito nets.

Bouchoucha (2020) used a panel cointegration analysis to examine the long-run relationship between environmental degradation, health, and institutional quality in 17 Middle East and North African (MENA) nations over the period 1996–2018, using both FMOLS and DOLS methodologies. The findings suggest that environmental degradation has a long-term negative impact on health in MENA countries. The impact of environmental degradation on health, on the other hand, can be mitigated by the presence of high-quality institutions. As a result, policymakers in MENA nations should emphasize the importance of good governance in ensuring the effective implementation of environmental legislation.

According to a study by Trevisan and Zantomio (2016), acute health burden has a negative impact on people's labor supply, resulting in secondary health issues such as poor physical functioning and psychological instability. They looked at how acute health problems like stroke, cancer, or the initial symptoms of myocardial infarction affected older workers' labor supply in sixteen European countries. They combined data from the Survey of Health, Ageing, and Retirement in Europe and the English Longitudinal Study of Ageing in a panel data set spanning the years 2002 to 2013. The study discovered a strong significant correlation between the risk of an older worker leaving the labor market and accompanying deterioration in physical functioning, mental health, reduction in perceived life expectancy, and acute health

burden using the stratification method and propensity score matching. They discovered that men's labor market responses are influenced by the onset of impairment, but women's labor market responses are influenced by financial limitations and leisure. They also discover that social security generosity has a significant impact on the differences in behavioral responses among the nations studied.

Iandolo et al. (2021) reflecting on Chinese governmental approach for managing COVID-19 spread emphasize on the support that a technology-based collective approach to knowledge management can improve labor productivity in decision-making processes in an unpredictable environment.

Health is resilient to normal economic cycles; Tammy and Chris (2019) used input/output analyses to demonstrate that health is a critical stabilizer during times of stress in communities. They discovered that the home health sector reduces productivity, income, and job insecurity, as well as serving as a substantial economic shock absorber during difficult times. Tammy and Chris discovered that, in addition to the thousands of jobs directly created by health systems, thousands more jobs are created outside of the system. Four new employment are created in the rest of the economy for every €100,000 invested on the health system. According to the report, this multiplier is substantially higher in some countries; for example, in Bulgaria, every €100,000 spent on healthcare creates ten jobs. Furthermore, each new job created in the healthcare industry raises overall employment (in the entire national economy) by 1.3 or 1.7 (direct and indirect effects) (when induced effects are included). The employment multipliers for the health sector were found to be greater than the average across 62 sectors of the economy in the vast majority of the nations Tammy and Chris studied. Furthermore, all 19 nations surveyed have high socioeconomic quality healthcare occupations.

## Methods and Data

The extended neoclassical models' framework for health growth production is followed in this paper's methodology. The simplest channel via which health burden affects worker productivity is through their time committed to work and ability to work successfully, according to the literature. Because a healthier population is likely to work more successfully, both physically and cognitively, and because people with high childhood health will have greater cognitive learning ability and, as a result, will have more human capital, which will boost wages (proximate health effect on income).

In effect, as measured by GDP per person employed (constant 2011 PPP \$), labor productivity (LP) is defined as a linear function of Disability-Adjusted Life Years (DLs) lost (per 100,000), Years of Healthy Life Expectancy (HLX), and Child Mortality Rate (MOR), i.e., the percent of children dying before the age of 5. The Human Capital Index (HCI), which assesses years of schooling and returns to education across countries, is also included as a control variable. Annual Population Growth Rate (PGR) measures both the crude birth rate and the crude mortality rate, and Capital Stock (K) gauges a country's capital stock levels in terms of prices in a given period (number of births or deaths per 1000 people in a

given population in a year). The PGR variable is useful for comparing population dynamics in nations with varying population sizes.

Equation 1 converts the aforementioned theoretical specification into an aggregate production function by going from general to specific and enhancing the extended version of the neoclassical growth model.

$$\ln \text{lp}_{i,k,t} = \pi Y_{i,k,t} + \bar{\omega}_p \sum_{p=1} X_{p,i,t} + \varepsilon_{i,k,t} + \nu_i \quad (1)$$

where

$\ln(\text{lp}_{i,t})$  = labor productivity measured in this study as GDP per person employed (constant 2011 PPP \$).

$Y_{i,t}$  = health burden indicators (Disability-Adjusted Life Years (DLS) lost per 100,000, Years of Healthy Life Expectancy (HLX), and Child Mortality Rate (MOR)).

$\sum_{p=1} X_{p,i,t}$  = Human Capital Index, capital stock, and demographic variable that are capable of influencing labor productivity such as return to education and annual population growth rate of countries.

$\varepsilon_{it}$  = idiosyncratic error with 0 mean and  $\sigma^2$  variance.

$\nu$  = overall constant that accounts for seasonal and cyclical effects.

The subscript  $i$  represents the cross-sectional units (countries) ( $i = 1, 2, \dots, ni$  and  $N = 45$ ),  $k$  represents different income blocks ( $k = 1, 2,$  and  $3$  with the fall sample block making  $4$ ), and  $t$  represents time, years ( $t = 1, 2, \dots, T = 28$ ).

Thus, Eq. 1 can be specified, explicitly, in mathematical function to form the following function:

$$LP_{i,t} = f(DLs, HLX, MOR, HCI, K, PGR)_{i,t} \quad (2)$$

where

LP = labor productivity measured in this study as GDP per person employed (constant 2011 PPP \$).

DLs = Disability-Adjusted Life Years lost per 100,000.

HLX = Years of Healthy Life Expectancy.

MOR = Infant Mortality Rate (per 1000 live births).

HCI = Human Capital Index.

K = Physical Capital Stock Levels.

PGR = Annual Population Growth Rate.

Some unique panel equation features will be incorporated when converting the mathematical function of Eq. 2 into an econometric model. For starters, a panel structure allows for the inclusion of a country's specific unobservable, reducing biases in the computed coefficients. To account for time-invariant country-specific impacts and the starting endowment associated with steady-state growth, the preceding equation



(Eq. 3.6) is modified so that the labor productivity in the nation  $I$  at time  $t$  has the following function in its general dynamic panel format:

$$\ln lp_{k,i,t} = \varnothing_1 dls_{k=1,i,t} + \varnothing_2 hlx_{k=2,i,t} + \varnothing_3 mor_{j=3,i,t} + \rho_1 hci_{j=1,i,t} + \rho_2 k_{j=2,i,t} + \rho_3 pgr_{3,i,t} + \bar{\omega}_p lp_{i,t-1} + \alpha_{i,t} + \varepsilon_{i,t} + \mu \quad (3)$$

where

$\ln lp_{i,k,t-1}$  = log value of the initial level or steady-state labor productivity across different income blocks in Africa. This account for the time-invariant country-specific effects associated with the initial endowment.

$\alpha_{it}$  = country- and period-specific effects.

$k, j,$  and  $p$  = number of explained variables associated with the three categories of incomes or developmental levels (upper-middle-income block, lower-middle-income block, and low-income block).

For the estimation of the aforesaid specification, the paper employed Common Correlated Effects (CCE) estimation of Heterogeneous Dynamic Panel Data Models in line with Chudik and Pesaran (2013) to estimate a sample of 45 African countries with 30-panel series from 1990 to 2020. This estimate is calculated in STATA using the `xtdcce2` command. The data for the specified model's studies was gathered from three separate sources. These include the Burden of Disease Research from the United Nations (UN) Institute for Health Metrics and Evaluation (IHME, 2020), health statistics from the World Health Organization (WHO, 2020), World Bank development indicators (2020 version), and Penn World data (version 10.0, 2021). The data, their definitions, and potential sources are presented in Table 1.

The cross-sectional units' developmental levels were measured using the income grouping (INC). According to the World Bank (2020), it was divided into four categories: low-income countries (with GNI per capita less than US\$1045), low-middle-income countries (with GNI per capita between US\$1046 and US\$4095), upper-middle-income countries (with GNI per capita between US\$4096 and US\$12,695), and upper-income countries (with GNI per capita greater than US\$12,695), and upper-income countries (2020). Surprisingly, among the African countries covered by the 2020 World Bank member income categorization of 189, only Seychelles is classified as an upper-income country. Seychelles, however, was excluded from the research due to a lack of data on labor productivity; as a result, none of the 45 African countries considered in this paper is classified as upper-income. The analyses in this study were carried out with StataMP 13; however, data were first sorted and maintained in a Microsoft Excel spreadsheet (Windows 8).

## Results

Table 2 shows the short-run dynamic influence of health burdens on labor productivity (LP) across different African income blocks, while Table 3 shows the long-run impact of health burden on labor productivity (LP) across different



**Table 1** Variable description, definitions, and sources

Acronym	Variable name	Measures	Source
<b>Health burden measures</b>			
DLS	Disability-Adjusted Life Years lost per 100,000	The Disability-Adjusted Life Years (DLs) lost per 100,000 individuals. It is a measure of overall health burden, expressed as the number of years lost from all causes. It measures both years of life lost due to early death and years lived with a disability due to ill health. In so doing, mortality and morbidity are combined into a single, common metric. This measure was introduced in the 1990s as a way of comparing the overall health and lifespan of different countries. A DL equals one lost year of a healthy life. This indicator was proposed by the World Bank and WHO in 1993 as a more suitable measure of health burden	United Nation (UN) Institute for Health Metrics and Evaluation (IHME, 2020)
HLX	Healthy life expectancy at birth (years)	Healthy life expectancy (HLX) is the expected number of remaining years of life spent in good health from a particular age, typically birth or age 65, assuming current rates of mortality and morbidity. Healthy life expectancy serves as an indicator to measure health improvement efforts in different countries	WHO Health Statistics (2020)
MOR	Infant Mortality Rate (per 1000 live births)	The <i>Infant Mortality Rate</i> (IMR) refers to the number of deaths per 1000 live births. It generally reflects the level of mortality and the effectiveness of preventive care and the attention paid to maternal and child health	<i>World Bank Development Statistics</i> (2021 update)
<b>Labor productivity measure</b>			
LP	Labor productivity measured as GDP per person employed (PPP \$)	GDP per person employed (LP) measures GDP at constant prices divided by the number of employed persons in a country. The choice of purchasing power parities (PPP) is to account for price differences in countries	<i>World Bank Development Statistics</i> (2021 update)

Table 1 (continued)

Acronym	Variable name	Measures	Source
<b>Other variables included in the models</b>			
HCI	Human Capital Index	Index of human capital per person (HCI) measures the average years of schooling and return to education	Penn World Statistics version 10.0 (2021)
K	Capital Stocks	Capital stock at current PPPs. It means the capital stock levels in terms of the prices in that period	Penn World Statistics version 10.0 (2021)
PGR	The Annual Population Growth Rate	This measures the percentage annual growth of a population. It comprises the crude birth rate (CBR) and the crude death rate (CDR) which accounts for a number of births or deaths per 1000 people in a given population in a year. This helps to compare population dynamics in countries with different population sizes. It also helps to calculate the rate of natural increase in different countries	<i>World Bank Development Statistics (2021 update)</i>
GOV	Government effectiveness ranking	This reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies	<i>World Bank Government Effectiveness Index (2021 update)</i>
INC	Income grouping	This measure classifies countries by gross national income per capita. The classes comprise low-income ( <i>inc1</i> ), low-middle-income ( <i>inc2</i> ), upper-middle-income ( <i>inc3</i> ), and upper-income ( <i>inc4</i> ) countries respectively	<i>World Bank Development Statistics (2021 update)</i>

Source: Authors' computation (2021)

**Table 2** Results of the short-run dynamic impact of COVID-19-induced health burdens on labor productivity (LP) across different income blocks in Africa

Regressors	Upper-middle-income	Lower-middle-income	Low-income
Dependent var.	D.LP	D.LP	D.LP
Intercept	−0.0859 (−0.08)	2.7599 (1.98)	−0.3557 (−0.66)
LOG_LP(t-1)	0.2419 (−0.30)	0.2284*** (−10.82)	0.2067** (−2.54)
LOG_DLS(t-1)	−0.2413 (0.72)	−0.3360 (−0.74)	−0.37677 (0.89)
HLX(t-1)	−0.00024 (−0.06)	−0.0070 (−1.45)	0.0008 (0.42)
MOR(t-1)	−0.01575 (−2.35)*	−0.0178*** (−3.22)	−0.0214 (−1.85)
HCI(t-1)	0.0042 (0.18)	0.0534 (1.03)	0.00006 (0.59)
LOG_K(t-1)	0.1020* (2.74)	0.0840 (1.55)	0.0129 (0.71)
PGR(t-1)	0.00033 (0.04)	0.0056 (0.42)	0.0073*** (4.40)
GOV(t-1)	0.00535 (1.32)	0.0002 (0.43)	0.00001 (0.09)
<i>R</i> -Sq			
Within	0.2658	0.2667	0.0530
Btw	0.0021	0.0522	0.0705
Overall	0.0222	0.0330	0.0123
CS average	−0.9283	−0.9470	−0.6224
<b>Intercept</b>	0.3775*** (5.25)	−0.0272*** (−3.74)	−0.0001 (−0.06)
D.LOG_LP(t-1)	−0.0824 (−5.36)***	−0.6993*** (−12.88)	−0.0734 (−1.82)
D.LOG_DLS(t-1)	−0.2096 (−0.04)	−0.2285 (−0.11)	−0.2403 (−1.56)
D.HLX(t-1)	−0.0273 (−0.24)	−0.0253 (−1.26)	0.0219 (1.52)
D.MOR(t-1)	−0.0366 (−1.31)	−0.0818*** (−4.43)	−0.0968 (−1.81)
D.HCI(t-1)	0.1211 (0.56)	0.9720*** (7.40)	0.00002 (0.27)
D.LOG_K(t-1)	0.3495*** (3.70)	0.0344 (0.20)	0.2039** (2.98)
D.PGR(t-1)	0.01148 (0.40)	−0.0532 (−1.49)	0.0158*** (3.98)
D.GOV(t-1)	0.00005 (0.09)	0.0001 (−0.22)	0.0015 (0.53)
<i>R</i> -Sq			
Within	0.2846	0.4284	0.0652
Btw	0.6557	0.0270	0.2129
Overall	0.3368	0.4023	0.0706
CS average	−0.2941	−0.4023	0.0395
<b>Intercept</b>	4.626 (64.76)	3.996 (94.55)	3.484 (33.24)
D.LOG_LP			
D.LOG_DLS	−0.1209 (0.09)	−0.155 (−0.24)	−0.185*** (−3.91)
D.HLX	0.0941** (2.30)	0.1562 (0.99)	0.2419*** (3.57)
D.MOR	−0.1073** (−2.70)	−0.1305 (−0.17)	−0.1674 (−0.86)
D.HCI	0.147 (2.33)	0.0262 (0.99)	0.001 (1.05)
D.LOG_K	0.199** (2.03)	0.249 (0.93)	0.531*** (3.34)
D.PGR	−0.117 (−0.97)	−0.0447 (−0.77)	−0.044*** (−4.81)
D.GOV	0.0012 (−0.98)	0.0005 (−0.52)	0.0011 (−1.58)
<i>R</i> -Sq			
Within	0.1247	0.4284	0.1030
Btw	0.2022	0.0270	0.0751

**Table 2** (continued)

Regressors	Upper-middle-income	Lower-middle-income	Low-income
Dependent var.	D.LP	D.LP	D.LP
Overall	0.1450	0.4023	0.0372
CS average	−0.0656	−0.4023	0.0482
No. of Obs	182	338	650
No. of groups	7	13	25

**Source:** Authors' estimation

Values in parentheses are *t* values

Significance levels: \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ . Lag 1, fixed effects with robust std error

African income blocks. The report in Table 2 is divided into three (3) parts to check for the robustness of the result: part 1 presents short-term dynamic results with lag one ( $t-1$ ) regressors, part 2 presents dynamic short-term results with difference—lag one ( $d(t-1)$ ) regressors, and part 3 presents short-term results with only difference ( $d$ ) regressors. Finally, Table 3 shows the long-term outcomes of the previously mentioned connections.

In the whole sample estimate, the coefficient of the initial values of labor productivity (LP) reveals a significant partial dynamic link. When all other parameters are maintained constant, it demonstrates a negative spill-over effect of historical labor productivity of 46% on current levels in Africa. These correlations attenuated significantly in the lag-difference result, indicating that a 1% increase in the starting values of labor productivity might boost current growth by 36% in the short term. In the first part of Table 2, the result demonstrates that a 1% rise in starting values of LP might improve their current set values by 22% in the lower-middle-income block, and 20% in the low-income block, while other factors remain constant. According to the findings, labor productivity has been increasing in a decreasing order across Africa's countries (i.e., decreasing returns to initial values). It implies that higher labor productivity has led to poorer returns on past outputs or inputs. It suggests that in Africa, changes in labor productivity

**Table 3** Results of the long-run impact of health burden on labor productivity (LP) across different income blocks in Africa

Regressors	Upper-middle-income	Lower-middle-income	Low-income
	LP	LP	LP
Intercept	−2.968** (−3.17)	−9.96e−08 (−0.00)	2.50e−07 (0.00)
LOG_LP	−0.137** (−3.19)	−0.175* (−4.24)	−0.199*** (−22.77)
<i>R</i> -Sq			
Within	0.0513	0.1884	0.4347
Btw	0.4086	0.5774	0.0001
Overall	0.0206	0.2113	0.0080

Values in parentheses are *t* values. Significance levels: \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ . Lag 1, fixed effects with robust std error

are dynamic in response to changes in health burdens. It has a similar outlook, but to varied degrees, across different income classes.

In Africa, the Disability-Adjusted Life Years lost per 100,000 individuals (DLS) (an important health cost measure for this study) demonstrates a negative association with labor productivity across socioeconomic categories. Keep in mind that the DLS considers the whole health burden (i.e., years of life lost due to early death and years lived with disability due to ill health—expressed as the number of years lost from all causes). A negative spill-over has been found in the existing collection of relationships between DLS and labor productivity. This indicates that the impact of the health burden on labor output will take longer. Table 2 shows that a one-percentage-point increase in lag DLS reduces labor productivity by 24% for the upper-middle-income block, 33% for the lower-middle-income block, and 37% for low-income nations, all other factors being equal.

Furthermore, presenting the DLS (health burden) indicator in a purely difference manner (2nd segment result) amplifies its negative relationship, implying that a significant increase in DLS lowers LP when compared to the spill-over effect result (i.e., the 1st segment). It shows that a 1% increase in DLS in one year reduces labor productivity (LP) in the following year by 20% in the upper-middle-income block, 22% in the lower-middle-income block, and 24% in the low-income economies, respectively, when all other factors are held constant. In the short run, reducing the health burden by 1% per year would increase labor productivity in Africa by 20% in upper-middle-income countries, 22% in lower-middle-income countries, and 24% in low-income countries.

Aside from the difference in spill-over (lag), the third segment finding, expressed in changes with no lag influence (3rd segment), also confirmed the negative association between DLS and LP throughout Africa's diverse socioeconomic categories. According to the result, a 1% rise in DLS in a year reduces LP by 12% in the upper-middle-income block, 15% in the lower-middle-income block, and 18% in the low-income block, all other factors being equal. In the absence of lag value, the impacts of health burden on labor productivity are minimized in the near run, according to the aforementioned result. It also shows that, in the near term, ill health is a disincentive to labor output in the economy. This is because, during and after severe health crises, countries, especially the most vulnerable, are unlikely to reduce current levels of labor productivity due to significant increases in medical spending and/or lost work time and income in general.

Another key health burden indicator in this paper is Years of Healthy Life Expectancy (HLX). Contrary to predictions, lagged HLX has been revealed to be one of the least favorable predictors of labor productivity in Africa. In fact, Table 2 shows that there are negative but small short-run spill-over connections between HLX and labor productivity (LP) throughout Africa's various socioeconomic categories. In a pure short-run model with no lag, HLX, on the other hand, demonstrates a positive association with LP across all revenue blocks. While holding other factors constant, a 1% increase in HLX increased LP by 9% in the upper-middle-income block, 15% in the lower-middle-income block, and 24% in the low-middle-income block.

The outcome of Infant Mortality Rate is another remarkable finding (MOR). Table 2 shows that, with or without lag, labor productivity is a negative short-run

linear function of infant mortality rate across various income groups. When all other factors are held constant, a 1% increase in lag MOR reduces LP by 2% for the upper-middle-income block, 1.7% for the lower-middle-income block, and approximately 2% for the lower-middle-income and low-income blocks, respectively. There are no changes in these correlations between the difference with lag and difference with no lag data. Holding other parameters constant, a 1% increase in MOR for the difference with lag result would reduce LP by 3.6% for upper-middle-income countries, 8% for lower-middle-income countries, and 9.6% for low-income countries. When all other factors are held constant, the final segment result (difference) shows that a 1% rise in MOR reduces LP by 10% in the upper-middle-income block, 13% in the lower-middle-income block, and 16% in the low-income block, respectively. According to the aforementioned finding, lowering Africa's infant mortality rate by 1% would increase labor productivity by 10% in the upper-medium-income block, 13% in the lower-middle-income block, and 16% in low-income economies.

In general, it is safe to say that, provided all other factors are constant, LP in Africa demonstrates negative lag short-run linear functions of Disability-Adjusted Life Years Lost per 100,000 individuals (DLS) and Infant Mortality Rate (MOR). When there is no lag, LP, on the other hand, demonstrate positive short-run linear functions of Years of Healthy Life Expectancy (HLX). This suggests that lowering the rate of child mortality and enhancing the health and quality of life of the population would enhance Africa's labor production. The results also demonstrate slight variances across different income categories, while the results show that the low-income and lower-middle-income groups lose the most labor productivity as a result of health burdens. Economic theories support this conclusion, demonstrating that health quality is a positive linear function of labor productivity (the new growth theory and extended neoclassical growth theory).

Table 2 also reveals that the two control variables (Annual Population Growth Rate, PGR, which measures the fertility rate or the number of births or deaths per 1000 people in a given population in a given year, and Government Effectiveness, GOV, which reflects perceptions of the quality of public services, the quality of the civil service, and the degree of its independence from politics) have a positive relationship with LP. When all other parameters are held constant, a 1% partial increase in PGR lag raises LP by 0.03% for the upper-middle-income block, 0.56% for the lower-middle-income block, and 0.7% for low-income countries. The fact that PGR has a minor but positive impact on labor productivity suggests that, over time, population expansion improves labor productivity. It shows that if population growth is skewed toward younger people who are not actively participating in the labor market, productivity will suffer.

Political meddling, inadequate policy design, and a government's lack of commitment to policy implementation, on the other hand, have been a substantial hindrance to productivity in most African countries, as measured by the poor government effectiveness in this study. With the exception of the full sample estimate of the lag result of the first segment, the government effectiveness (GOV) indicator in this research has no significant impact on labor productivity in Africa across income blocks. As seen in Table 2, a 1% improvement in good governance in Africa enhances LP by 0.5% in upper-middle-income nations, 0.002% in lower-income

countries, and 0.0001% in low-income countries, while all other variables stay constant. In the remaining two segments, the result is similar.

In light of the last finding, it is not unreasonable to assert that African countries have a checkered history of poor governance when compared to other parts of the world. These countries have been plagued by political instability, government ineffectiveness, a lack of rule of law, and substantial corruption issues, all of which are symptoms of poor governance. Foreign investors are increasingly basing their investment decisions on strong governance and indices of ease of doing business. Political insecurity, institutional ineffectiveness as a result of poor regulatory quality, and growing corruption in most African countries have driven away legitimate investors. The poor's ability to participate in and profit from labor outputs has been severely hampered as a result of these factors. Corruption has a negative impact on overall economic gains by impeding the growth of some drivers of prospective labor productivity.

The entire sample estimate of the labor productivity (LP) equation shows negative coefficients for each of the three income groups. With greater absolute coefficients, the divergence from the long-run equilibrium of labor productivity with regard to shocks in health burdens and other covariate factors included in the model will take substantially longer to recover if other components are maintained constant. Surprisingly, the findings suggest that the total sample's adjustment coefficients are faster than the three income divisions.

According to this empirical study, the speed of adjustment to the long-run equilibrium differs structurally between upper-middle-income, lower-middle-income, and low-income economies. This means that a considerable reduction in health burdens would unavoidably lead to deviations from the equilibrium in labor productivity, which would drive it upward. As a result, labor productivity would adjust to correct the imbalance, with the deviation decreasing by 13% in the upper-medium-income case, 17% in the lower-middle-income case, and 19% in the low-income example in each subsequent time period. That is, as a result of the decline occurring at a rate of its coefficients per interval over successive future measurement intervals, labor productivity would fall by an average of the above values. If all other factors remained constant, labor productivity would increase by 1% over successive future measurement intervals at a rate of 13% for the upper-middle-income block, 17% for the lower-middle-income block, and 19% for the low-income countries, respectively, to re-establish equilibrium.

## Implications for Policy and Research

The findings of this article have a lot of policy implications in terms of health burdens and labor productivity in the advent of the COVID-19 pandemic in Africa's middle- and low-income economies. The following are some of them:

- i. The significant and dynamic impact of health burdens on labor productivity in Africa across different income categories, both in the short and long term, illustrates that labor is a major African asset. It suggests that any increase in COVID-19-induced healthcare costs devalues this asset, leading these already-stressed countries to further



lose of labor output. Worryingly, the COVID-19 pandemic's severe influence on people's socioeconomic well-being may contribute to a further drop in African labor productivity. In contrast, improving people's health status, particularly in Africa's low- and lower-middle-income countries, boosts productivity and, as a result, improves the continent's long-term economic performance.

ii. In the absence of a lag value, the impact of COVID-19 aggravated health burdens on Africa's middle- and low-income countries' labor productivity reduces over time. It appears that the COVID-19 epidemic has exacerbated Africa's poor health, which is a disincentive to labor productivity, independent of the country's development stage or wealth level. This is because, due to considerable increases in medical costs and/or lost work time and revenue, countries, particularly those most vulnerable with high COVID-19 infection, are unlikely to maintain high levels of labor productivity during and after COVID-19 health crises.

### **Suggested Way Forward for Future Research**

Based on the huge negative long-term dynamic effects of COVID-19-induced health burden on labor productivity (LP) across different income blocks in Africa, this study recommends the following. To begin, a regional health summit should be called to build a comprehensive policy framework to handle Africa's rising COVID-19 cases, as well as the accompanying increase in medical costs and loss of revenue and income due to reduced work time. COVID-19 infection control should go along side with the eradication of malaria and HIV/AIDS at this time, and other health-related issues, since COVID-19 pandemic and its control measures have exposed society to increased effect of other diseases. This, as our studies show, will help to increase labor productivity across the continent. Second, because rising health burdens in Africa have such a detrimental influence on labor productivity, disease prevention measures should emphasize the active labor force and the child population. This is because a healthy child grows into a healthy adult with higher labor productivity than a sick child who may spend some of his or her active time in the hospital. Third, a powerful regional and sub-regional health scheme should be constructed to compel every employer of labor (private or public) to prioritize employee healthcare, knowing well that some of Africa's health crises arise from hazardous working conditions. Every company should develop a standard healthcare plan for its employees that are legally enforceable. It will go a long way toward reducing individual COVID-19-induced health burdens while also raising their labor intensity and production.

### **Conclusion**

The importance of investing in health to enhance productivity has been overlooked in Africa, according to this paper's conclusion. Health is a core goal and a critical component of human welfare. One of Africa's most unpredictable and costly causes of economic hardship as it stands currently is COVID-19-induced health burdens

(i.e., a summary of population health quality in terms of mortality and morbidity, as well as patterns (trends) within and among populations, as well as the likelihood of becoming sick or disabled, recognizing some risk factors and financial costs over time). If concerted effects are not given to health sector, the COVID-19-induced health burdens in Africa would damage their potential growth in labor assets in the short and long terms.

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