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THE EFFECT OF ENVIRONMENTAL QUALITY ON HEALTH EXPENDITURE IN SOME SELECTED SUB-SAHARAN AFRICAN COUNTRIES

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ABSTRACT

This research aims to examine the effect of environmental quality on Health Expenditure in Some Selected Sub-Saharan African Countries. Data from 41 select countries in sub-Saharan Africa from 1996 to 2020 was collected from the World Development Indicators (WDI). The statistical results were estimated using the Pool Mean Group (PMG) method. The study findings revealed that greenhouse gases have a negative and insignificant effect on health expenditure in the short run, while in the long run; greenhouse gases have a direct and significant effect on health expenditure. GDP per capita has a positive effect on health expenditure both in the short run and the long run. Population and industrialization have a positive effect on health spending, whereas urbanization has a negative correlation. The co-integrated link between the variables is demonstrated by the one lag error correction term (ECT), whose coefficient of -0.4237 and statistical significance at the 1% level of significance indicates a moderate level of convergence to equilibrium.

Keywords: Environmental Quality, Health Expenditure, Sub-Saharan African Countries.

INTRODUCTION

Environmental quality and health spending are the most frequently discussed issues that have attracted the attention of policymakers and scholars internationally (Karaaslan & Çamkaya, 2022), this is due to the fact human activities have been revealed to have detrimental repercussions on the natural environment. Human activities such as agricultural practices, trade, urbanization, industrialization, and health issues, which are necessary for any country to strive toward development, are highly affected as a result of poor environmental quality (Shobande, 2020). The degree to which human activities increase carbon dioxides (CO_2 emissions), nitrogen dioxide (NO_2), and carbon monoxide (CO), affects the ecosystem is closely correlated with the size of the economy, their level of income, the size of gross domestic product, trade policy quality, and environmental policy governing that environment or country (Shobande, 2020), urbanization, industrialization, trade, and other human activities raise carbon dioxide (CO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), and other harmful ambient substances, lowed the quality of the environment of these Sub-Sahara Africa Countries which has an adverse effect on the health budget of these countries.

Sub-Sahara African countries still striving for growth usually have to compromise their environment with high trade and heavy exploitation of the natural environment (Nyiwul, 2019), as a result of this surge for growth, the rate of atmospheric pollution increases, which reduces the quality of their environment and adversely affects the health costs of these countries. Furthermore, these countries are faced with low levels of income, resulting in their inability to mitigate the effects of human activities on the environment, thus contributing to the rise of carbon dioxide (CO_2), nitrogen dioxide (NO_2), and carbon monoxide (CO), which adversely affects the health outcomes of these countries, resulting in an increase in health costs as a result of an increase in these diseases associated with environmental degradation, such as cardiovascular, vision impairment problems, skin cancer, and respiratory tract infections (Shobande, 2020; Benjamin *et al.,* 2023; Rahman *et al.,* 2022). Several factors account for the quality of the environment as well as the level of health expenditure in every nation through many indirect channels. Human activities such as agricultural practices, urbanization industrialization, and mining activities raise CO_2, particularly CO_2, which has detrimental repercussions on human health outcomes; reduces life expectancy, increases child mortality, mother mortality, pregnancy disorder, and thus health care spending, especially in sub-Saharan African countries that are faced with weak trade policies, weak environmental policies, and corrupt top officials and poor institutions this effect is greater compared to other higher income countries (Chowdhury & Mavrotas, 2006; Yean *et al.,* 2018).

In their studies, researchers like Chanda (2017), Bettcher *et al.* (2000), Blouin *et al.* (2009), Nazar *et al.* (2022) found that although the relationship between human activities, environmental quality, and health spending is complex, humanity's close proximity to the planet affects its environment through the exploitation of natural resources for sustainable living. When these resources are exploited beyond the capacity of the environment to absorb them, global warming results, which in turn affects human health. Additionally, direct solar radiation causes skin cancer, vision impairment, an increase in ectopic pregnancies, reduced agricultural yields, and other conditions that have a negative impact on the health budget. According to scholars such

as Chanda (2017), Bettcher *et al.* (2000), Blouin *et al.* (2009), and Nazar *et al.* (2022), human activities open up markets and bring competition from large corporations. It also causes issues with equity and affordability in the provision of healthcare through competition, which drives up the cost of health services and thus increases health expenditure in these sub-Saharan African countries. The driving-up cost of technology that is environmentally friendly is mostly left out by most foreign direct investors since these regions are guided by poor environmental policy and corrupt institutions that are less concerned with environmental sustainability issues. In this respect, for Sub-Saharan African (SSA) countries to achieve environmentally sustainable goals and stable healthcare spending, human activities through environmental quality and in the healthcare system ought to be seen as a way to improve the quality of the environment, affordability, and accessibility of health care, which has not been translated in Sub-Saharan African health sectors.

The significance of environmental policies and health policies, and their impact, Waage *et al.* (2015) propose that achieving a sustainable environment, health, and well-being for everyone can only be achieved through specific goals or policies. Over the years, various policies have been implemented, such as the Sustainable Development Goals (SDGs) 3 focusing on well-being and health, SDG 13 addressing climate change, goal 7 with the aim for achieving affordable and clean energy which primarily to achieve a sustainable environment and the Abuja declaration in April 2001 aimed at addressing health issues like HIV/AIDS and Tuberculosis make it crucial to seek strategies to enhance the health conditions in developing nations through human activities. Despite these policies being put in place, health problems continue to be a significant issue in Sub-Saharan African countries. Understanding the connection between environmental quality and health expenditure is important in this region, as Sub-Saharan African countries carry a large portion of the world's disease burden, with a majority of deaths in Sub-Saharan African countries caused by infectious diseases such as HIV/AIDS and environmental related disses such as skin cancer, respiratory infection diseases, cardiovascular diseases, vision impairment, malaria. Out of the 37.4 million individuals with HIV worldwide, 25 million reside in Africa (Alkire *et al.,* 2018).

The Sustainable Development Goals (SDGs) 3 and 13, which focus on wellbeing and health and climate change, as well as the April 2001 Abuja Declaration, which addressed health issues like HIV/AIDS and tuberculosis, are examples of sound health and environmental policies that have been implemented to achieve a sustainable environment, health, and wellbeing for everyone, as stipulated by SDGs 3 (Waage *et al.,* 2015). The significance and effects of health and environmental policies make it imperative to look for ways to improve the state of health in developing countries by taking into consideration human activities since they play a crucial role in the quality of the environment. However, despite all the measures to mitigate the effect of human activities on the environment which have a long-term effect on health outcomes and health costs, health issues are still a major concern in Sub-Saharan African nations, given that Africa suffers an unfavorable proportion of the global disease burden and that infectious diseases like respiratory tract infections, cardiovascular diseases, skin cancer, HIV/AIDS and malaria account for the majority of deaths in Sub-Saharan Africa, this evidence from the fact, 25 million of the 37.4 million people living with HIV/AIDS globally live in Africa (Alkire *et al.,* 2018). For example, Nigeria has among of the worst health indices among Sub-Saharan African nations; a large number of individuals either

pass away from various illnesses or quit their jobs. Meanwhile, several illnesses plague some of them, such as meningitis, malaria, ischemic heart disease, stroke, congenital abnormalities, lower respiratory infections, newborn disorders, diarrheal diseases, HIV/AIDS, and tuberculosis (Oladosu *et al.,* 2022).

Trade policies, and environmental policies, such as sustainable development goals (SDGs), adopted by the United Nations in 2015 as part of Agenda 2030 for sustainable development, SDGs 7 and 13 which address man action on affordable and clean energy and climate respectively, all these are action made to address the effect of human activities on the environment, these SDGs combine to have the power to either support or obstruct sustainable measures that lessen the damaging effects that these pollutants have on the environment which therefore improved air quality and eventually lowering health expenses related to environmental pollution can be achieved by enforcing rules and providing incentives for industries to cut emissions thereby achieving objective 3 of the SDGs which stipulate all countries to achieved good health and wellbeing by 2030 (Shobande, 2020; Benjamin *et al.,* 2023; Rahman *et al.,* 2022). However, these sub-Saharan African countries are facing increasing energy demands due to human activity and urbanization, especially during the COVID-19 pandemic and economic downturn. To address climate issues, it is crucial to develop cities and buildings towards net-zero goals and implement renewable scenarios in the building industry (Aboulnaga & Elsharkawy, 2022). The Glasgow Climate Pact (GCP) was established at the UNFCCC Conference of Parties (COP26) to address climate and weather extremes. It aims to limit global warming to 1.5°C by reducing greenhouse gas emissions by 45% by 2030 and achieving net zero by 2050. To achieve climate neutrality by 2050, city officials should focus on lowering carbon emissions by 2050 (Aboulnaga & Elsharkawy, 2022).

Despite these measures put in place to address environmental-related health problems, Sub-Sahara African countries are facing the challenges of stagnant economic development, a huge gap in energy demand and supply, high mortality rate, and an increase in the incidence of respiratory diseases due to poor environment quality and weak trade policies (Rudnicka *et al.,* 2020). For instance, in Sub-Saharan African countries, many people lose their livelihoods or die from different health conditions. At the same time, some suffer from disease burdens, including malaria, lower respiratory infection, neonatal disorders, diarrheal diseases, HIV/AIDS, ischemic heart disease, stroke, congenital defects, tuberculosis, and meningitis (Oladosu *et al.,* 2022). Sub-Saharan African countries still struggle with high HIV prevalence, with the region being home to more than 69% of adults living with HIV (Frimpong, 2022). Additionally, the under-five mortality rate in Sub-Saharan Africa was calculated to be 89.2 per 1,000 live births in 2013 (Frimpong, 2022). Moreover, most nations in the region did not achieve the Millennium Development Goal (MDG) targets related to health.

The paper's implication is based on the fact that many sub-Saharan African nations have not been able to capitalize on the opportunities presented by a more globalized business environment, meaning that poverty rates and healthcare costs are still very high on the continent. As a result, the gains from trading off environmental quality have not been enjoyed in these nations. It is therefore essential to investigate the effects of environmental quality on health expenditure in emerging nations like the SSA countries since this evidence predates significant environmental quality on health expenditure in these Sub-Sahara African countries. Moreover, it is clear that the benefits

of trade in sub-Saharan African nations do not always translate into lower health costs since human activities exhibit high rates of environmental degradation in these countries which has a greater impact on its health cost, and income growth as a result human activities in the environment is insufficient to explain the level of health financing in these countries. The goal of this study is to close a significant gap in the literature by examining the relationship between environmental quality and health spending in Sub-Saharan Africa. The current study assesses how health spending in SSA nations is impacted by environmental quality. More significantly, this study clarifies the methods by which the population, industrialization, gross domestic product per capita, environmental quality, and health expenditure levels in SSA nations are all influenced.

LITERATURE REVIEW

The study provides more insights into the ways in which population, industrialization, health expenditure levels, and environmental quality are transmitted in Sub-Saharan Africa. While trade openness contributes significantly to GDP in every economy involved in trade liberalization, it also leads to major environmental problems, such as excessive carbon dioxide emissions (CO_2). The Environmental Kuznets Curve (EKC), which depicts an inverted-U relationship between environmental degradation and GDP in 1993, is similar to the negative relationship between trade openness and environmental degradation (Dasgupta *et al.,* 2002; Perman & Stern, 2003; Perman & Stern, 2003).

Looking from a theoretical perspective, the environmental Kuznets Curve (EKC) developing countries such as sub-Sahara African countries are in the quest to achieve economic growth which means most countries in this region have to compromise the quality of their environment to increase their GDP, this usually demonstrated at the initial stage of environmental Kuznets Curve (EKC) which show an increase in environmental degradation as trade increases which usually represent the first phase of environmental Kuznets Curve (EKC) and the second phase are usually experienced at peak of the environmental Kuznets Curve (EKC) with a lower environmental degradation, the economy peaked at this time revealed an increase in income and, consequently, the ability for economic actors to pay a greater price for improved environmental standards. This is when the curve turns. There have been discussions on the EKC's decreasing slope and whether or not it is an illusion brought on by the transfer of polluting businesses (Perman & Stern, 2003)

Empirically, several studies offer support for the relationship between trade openness and emissions of carbon dioxide (Sulaiman & Abdul-Rahim, 2017; Ling *et al.,* 2020; Awan & Azam, 2022; Chang, 2015). Their studies revealed that free trade increases the emission of carbon dioxide (CO_2) particularly in countries with higher levels of corruption, and weak environmental policies, and reduces it in countries with low levels of corruption and strong environmental policies. Van-Tran (2020) and Hultberg, (2018), confirm in their studies that the exist detrimental effects of trade liberation on the environment as a result of the increase in pollutants in the environment such as CO_2, ambient particular matters, Carbon monoxide (CO) and intensified nitrous oxide emissions in the previous period.

Anwar *et al.,* (2022) investigated the effect of environmental factors on health spending in emerging nations. The findings indicate that temperature and air pollution have a beneficial impact on healthcare costs, with private health spending coming before government health spending. Ecevit *et al.,* (2023) found health expenditure to be causally related to trade openness, GDP per capita, and greenhouse gas emissions. Nasreen *et al.,* (2023), examine how GDP per capita, air pollution, and non-economic factors influence health expenditure in the Asian area. The findings reveal the positive correlations between overall health expenditures and both public and private health expenditures, as well as the effects of environmental pollution, health care costs, urbanization, and hospital bed capacity. It's intriguing to note that at lower levels, money per person has a detrimental effect on healthcare spending, whereas at higher levels, it has a beneficial effect. The proportion of older individuals affects total health expenditure negatively, while life expectancy affects spending positively at lower levels and negatively at higher levels.

Increased trade leads to the release of greenhouse gases like particulate matter, CO2, NOx, and NO2, which harm the environment and make ecosystems more fragile. Usman et al. (2019) found that higher CO_2 emissions and lower environmental quality were linked to increased government spending on healthcare. The study confirmed a negative and substantial correlation between CO_2 emissions and health expenditure, and gross domestic per capita impact demonstrated a uniformly favorable correlation with both public and private health spending. Government and private health spending were significantly positively impacted by the aging population. Bilgili *et al.,* (2021) confirm that CO_2 has a negative impact on both private and public health spending but is greater in private-sector health spending than public health spending. Their study concludes that investment in the health sector will further increase the quality of the environment in the Asian region.

METHODS

The study uses panel data from 41 countries spread across four sub-regions of sub-Saharan Africa to investigate the relationship between environmental quality and health expenditure. The existence of data on significant research-related factors influences the selection of the 41 nations. Data for every selected component was available between 1996 and 2020; hence, the study covered 24 years. Using the appropriate instruments and context, the study makes use of the dynamic panel framework to estimate the heterogeneous data. We used the pooled mean group (PMG) estimators as the sole estimators for the error correction and the autoregressive distributed lag (ARDL, p, q) model based on the characteristics of the data. Furthermore, the pooled mean group (PMG) estimator is included in this model, according to Pesaran and Smith (1995) and Pesaran *et al.* (1999), respectively. Based on Loayza and Ranciere (2006), the ARDL specification is written as follows:

$$\nabla(\gamma_i)t = \sum_{j=1}^{p-1} \gamma_j^i \Delta(y_i)t - j + \sum_{j=0}^{q-1} \delta_j^i \Delta(X_i)t - j + \varphi^I[(y_i)t - j - \{\beta_0^i + \beta_1^i(X_I)t - 1\}] \in_{it} (1) \dots EQ \dots . (1)$$

Whereby Y stands for health expenditure, X for a set of independent variables, such as population, urbanization, industrialization, gross domestic product per capita, and environmental quality; **γ** and **δ**, respectively, represent the short-term coefficients of dependent and independent variables, β for long-term coefficients, and **φ** for the coefficient of speed of adjustment to the long-term status. Additionally, the subscripts i and t stand for nation and time, respectively. Regression of long-term growth is indicated by terms enclosed in square brackets. Moreover, Equation (1) can be computed using the panel ARDL methods of PMG, where all PMG models account for the heterogeneity of the dynamic adjustment process as well as the long-term equilibrium (Demetriades & Hook-Law, 2006).

RESULTS

The parametric tests of Pesaran and Friedman, as well as the Pesaran slope homogeneity test, were utilized in the investigation to look for cross-sectional dependence between variables. The probability values in the results demonstrated the cross-sectional dependence of the model. The study of panel data entailed assessing each variable's level of integration and looking for the presence of a unit root. To look at whether stationarity was present in the data, the cross-sectionally augmented Dickey-Fuller (CADF) developed by Pesaran (2007) was employed. Heteroscedasticity was tested using the modified Wald test for GroupWise heteroscedasticity, which at a 1% level of significance strongly rejected the null hypothesis. To ensure proper inference and account for heteroscedasticity, robust standard errors were reported in the estimation. These tests offer solid and dependable standard errors for precise inference.

Table1. Pool Mean Group (PMG) Estimation Regression Results

Variables	(1) EC	(2) SR
Ect		-0.4237005*** (0.1163096)
D.Inghg		-0.0205574 (0.1661002)
d.lngdppc		0.4951709** (0.2265948)
d.lnpop		20.44312 (13.6715)
d.urb		-0.8346288 (0.7141869)
d.ind		-0.0023149 (0.0053214)

Inghg	0.3438072*** (0.1163096)	
Lngdppc	0.7164989*** (0.1765171)	
Lnpop	2.235411*** (0.2703621)	
Urb	-0.0512566*** (0.087598)	
Ind	0.0067337* (0.0039386)	
Constant		-16.31108*** (2.020863)
Observation	815	815
Number of Groups	41	41
Log-likelihood	807.3383	807.3383

Source: author; Notes: *The regression coefficients and standard errors are enclosed in parenthesis in each cell. ** p<0.05, * p<0.1, and *** p<0.01*

The results in Table 1 above revealed that, in the long run, the coefficient of greenhouse gases is positive and statistically significant at the one percent level of significance, which implies that health spending will eventually rise by 0.34 units for every unit increase in greenhouse gas emissions. The finding further revealed that, in the short term, there is a negative but statistically negligible link between greenhouse gases (GHG). This shows that all things being equal, lowering greenhouse gas emissions into the atmosphere enhances environmental quality and, in the short term, lowers health spending in these sub-Saharan African nations.

The findings also revealed that gross domestic product per capita has a positive and significant effect on health expenditure in the long run at the one percent significance level and five percent in the initial period. This implies that a unit increase in gross domestic product per capita will lead to a 0.71 unit increase in health expenditures in the long run and 0.495 units over the short run for every unit increase in gross domestic product per capita, everything being equal.

The results also showed that population and health expenditures have an upward correlation and that the population coefficient is positive and statistically significant at the one percent level of significance. There is a chance that, in the long run, population growth may cause sub-Saharan African countries' health expenditures to rise by 0.71 units.

Furthermore, the study revealed that there is a negative long-run effect between urbanization and health expenditure; this shows that a unit increase in urbanization will eventually decrease health spending and this result was statistically significant at the one percent level. This showed that, over time, a one (1) unit increase in urbanization will result in a 0.051 percent decrease in health expenditures in sub-Saharan Africa. This is due to the fact that less urbanization entails compromising the built environment; in other words, less urbanization equates to less natural

environment destruction caused by human activity, which ultimately results in less health expenditure in sub-Saharan African nations.

The findings also showed that, at the 10% level, the coefficient of industrialization is positive, elastic, and statistically significant, and that there is a positive correlation between industrialization and health expenditure. An increase of one (1) unit in industrialization will increase 0.0067-unit sub-Saharan African health expenditure in the long run. By implication, in the long run, an increase in industrial activity caused an increase in degradation of the environment, which has detrimental effects on human health by increasing diseases such as lung cancer, respiratory infection diseases, and eye defects, which resulted in an increased concentration of pollutants in the atmosphere, leading to high health costs or expenditures in these sub-Saharan African countries.

It is found that the one lag error correction terms (ECT) are highly statistically significant and have the expected negative sign. This attests to the co-integrated link between the model's variables. ECM (-1) has a coefficient of -0.4237, meaning that deviations from the long-term health expenditure are adjusted by 0.424 percent during the next year, and convergence to equilibrium is presumably quite low. This indicates that the adjustment happens somewhat gradually. This demonstrates that there is a long-term relationship between the variables and all of their substantial delays.

DISCUSSION

The findings revealed that, in the long run, the coefficient of greenhouse gases is positive and statistically significant at the one percent level of significance, which implies that health spending will eventually rise by 0.34 units for every unit increase in greenhouse gas emissions. This is a result of the striving for economic growth and international integration by these countries, leading to an increase in environmental pressure, which in turn negatively impacts the quality of these nations' ecosystems by raising greenhouse gas levels. Combined with these nations' lax trade policies, lax environmental policies, and institutional corruption, which contribute to the environmental degradation of these nations, this in turn causes a significant increase in diseases linked to environmental degradation, such as respiratory tract infections, skin cancer, and cardiovascular diseases thus leading to an increase in the health expenditure of these selected sub-Saharan African countries. This situation further exacerbates the already existing challenges in the healthcare systems of sub-Saharan African countries, as they struggle to allocate sufficient resources for healthcare infrastructure and services. As a result, the increased health expenditure due to environmental deterioration hampers their ability to provide adequate healthcare to their populations, leading to a vicious cycle of poor health outcomes and limited capacity for environmental conservation efforts. In the short term, there is a negative but statistically negligible link between greenhouse gases (GHG). This suggests that all things being equal, lowering greenhouse gas emissions into the atmosphere enhances environmental quality and, in the short term, lowers health spending in these sub-Saharan African nations. The finding was in line with the result of Anwar *et al.,* (2022) investigated the effect of environmental factors on health spending in emerging nations. The findings indicate that temperature and air pollution have a beneficial impact on

healthcare costs. This was consistent with the finding of Usman et al. (2019) that higher CO_2 emissions and lower environmental quality were linked to increased government spending on healthcare. The study confirmed a negative and substantial correlation between CO_2 emissions and health expenditure, and gross domestic per capita impact demonstrated a uniformly favorable correlation with both public and private health spending.

The results also showed that health expenditure and gross domestic product per capita have a favorable and statistically valuable connection and that the coefficient of GDP per capita is favorable and statistically significant in the long run at the one percent significance level and five percent in the initial period. The region's health expenditures will rise by 0.71 units over the long term and 0.495 units over the near term for every unit increase in gross domestic per capita. In the sub-Saharan region of Africa, there is an upward and strong correlation between GDP per capita and healthcare expenditures, meaning that rising GDP per capita is accompanied by rising expenditure on healthcare. This link results from changes in the population's age distribution as economic development causes an aging population, a rise in demand for healthcare services from a wealthier population, and the need for new healthcare infrastructure to support a rising population. The finding was similar to the works of Nasreen *et al.* (2023), who found that GDP per capita, air pollution, and non-economic factors influence health expenditure in the Asian area.

The results also showed that population and health expenditures have an upward correlation and that the population coefficient is positive, elastic, and statistically significant at the one percent significance level. There is a chance that, over time, population growth may cause sub-Saharan African countries' health expenditures to rise by 0.71 units. It was discovered that improvements in environmental quality, when measured by greenhouse gases, are consistent with population growth and can have both positive and noticeably detrimental effects on the environment in the chosen sub-Saharan nations. The finding was similar to the work of Yaqoob *et al.* (2018), their finding revealed a direct association between population and health spending. The majority of these populations primarily rely on biomass as a fuel source, which over time has more of an impact on the quality of the environment because these activities, as a result of population growth, negatively impact the environment by increasing pollutants like CO_2, NO_2, CO, and $PM_{2.5}$. This pollution significantly degrades the environment, which has an adverse effect on these countries' health outcomes and ultimately increases healthcare spending.

Furthermore, the study discovered a negative long-term association between urbanization and health expenditure, suggesting that urbanization eventually decreased health spending. This conclusion is statistically significant at the one percent level. This showed that, over time, a one (1) unit increase in urbanization will result in a 0.051 percent decrease in health expenditures in sub-Saharan Africa. This is due to the fact that less urbanization entails compromising the built environment; in other words, less urbanization equates to less natural environment destruction caused by human activity, which ultimately results in less health expenditure in sub-Saharan African nations. The finding was contrary to the work of Bekhet and Othman (2017) who found that an increase comes alongside with increase in carbon dioxides which reduces the quality of the environment with a negative effect on health costs.

The findings also showed that, at the 10% level, the coefficient of industrialization is positive, elastic, and statistically significant, and that there is a positive correlation between industrialization and health expenditure. An increase of one (1) unit in industrialization will increase 0.0067-unit sub-Saharan African health expenditure in the long run. By implication, in the long run, an increase in industrial activity caused an increase in degradation of the environment, which has detrimental effects on human health by increasing diseases such as lung cancer, respiratory infection diseases, and eye defects, which resulted in an increased concentration of pollutants in the atmosphere, leading to high health costs or expenditures in these sub-Saharan African countries. the result was similar to the work of Yu *et al. (*2018), they found a positive association between industrialization in China and the health budget. By implication, an increase in industrial activities causes environmental deterioration, which as a consequence reduces the quality of the ecosystem and has a long-term effect on population health, such as increased cardiovascular diseases, cancers, and lung problems, which have a direct effect on the cost of health in these sub-Saharan African countries.

It is found that the one lag error correction terms (ECT) are highly statistically significant and have the expected negative sign. This attests to the co-integrated link between the model's variables. ECM (-1) has a coefficient of -0.4237, meaning that deviations from the long-term health expenditure are adjusted by 0.424 percent during the next year, and convergence to equilibrium is presumably quite low. This indicates that the adjustment happens somewhat gradually. This demonstrates that there is a long-term relationship between the variables and all of their substantial delays.

CONCLUSION

To concur, the finding revealed a positive and significant effect of environmental quality on health expenditure in sub-Saharan African countries, according to the study findings, human activities turn to increase greenhouse gases such as carbon dioxide (CO_2), Nitrous oxide (N_2O), Nitrogen dioxide (NO_2), ambient of particular matter $PM_{2.5}$ which has reduced the quality of the environment resulting to environmental degradation associated diseases such as cardiovascular diseases, respiratory tract infection and the driving up of such diseases as a result of reduced environmental quality is connected with increased health expenditure in sub-Saharan African countries, This is the outcome of these sub-Saharan African countries lax institutional, lax trade policy, and lax environmental regulations, as result of all human activities, exacerbate pressure on the natural resources above sustainability leading a detrimental effect on the ecosystem habitats. The findings further conclude that GDP per capita and healthcare spending are positively connected, with higher GDP per capita translating into higher healthcare spending. Despite the increase in GDP per capita, the health budget is not yet translated to take care of environmental problems in these sub-Saharan African countries. This increase results in increased atmospheric pollution, which causes an increase in disease and eventually drives up health costs. Population growth and health spending are positively correlated, this findings revealed that, sub-Saharan African countries recently have seen the needs to take care of the increase youthful population who are vulnerable to poverty and highly exposed to sexually transmitted diseases and environmental exposed infection with the majority within the sub-Saharan African countries already suffering from deadly diseases such as HIV/AIDs,

such needs are increases health expenditure as the population keep driving up as needs of healthcare system infrastructure increases, health campaign on those diseases also rise up, and environmental safety campaign also drive up health sector budget in this sub-Saharan African countries but urbanisation and health expenditure are negatively correlated, this shows that most health funds are more concentrated in the rural area in this sub-Saharan African countries resulting to such inverse relationship, which implies increase in urbanisation instead reduces the budget health allocated for urban areas. The relationship between industrialization and health spending is positive since increased industrial activity leads to diseases and environmental damage, thereby increasing the cost of health in these sub-Saharan African countries. Based on the conclusion, the sub Africa countries government are recommended to strengthen environmental regulation policies, such as affordable and clean energy consumption as stipulated by sustainable development goals, restricting heavy polluting foreign industries, while encourages industries which uses advanced technology which are eco-friendly, since the most habitat activities are close to the earth, the types pesticides use for agricultural purposes should be control by restricting those are very dangerous to the environment, the level of environmental exploitation in this region should match with the ability of the environment to be able sustained future generation by limiting the amount resources of non-renewable to be exploited and encouraging enforcement of renewable resources afforestation by the provision of seedlings to institutions responsible for reinforcing institutional capacity by putting in place strong penalties that deal with corrupt officers, such as refunding and imprisonment, declaration of wealth upon appointment and annual internal control to ensure that resources that are allocated for a particular purpose are properly managed

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