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# COVID-19 in Africa: the poverty, governance and corruption challenges for prevention and control

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***Abstract:***
***Background:*** *As of 23 October 2020, the African continent had reported a total of 1,696,418 coronavirus disease (COVID-19) cases, which included 40,760 (2.4%) deaths; 1,390,786 (82.0%) recovered cases; and 264,872 (15.6%) active cases. The purpose of this study was to investigate the correlation between the number of coronavirus diseases (COVID-19) cases and the Multidimensional Poverty Index (MPI), the percentage of the population living in income poverty (PLP), overall governance index (OGI), Corruption Perceptions Index (CPI), and the domestic general government expenditure on health (GGEH-D) per capita in Africa.*
***Materials and Methods****: Ten linear regression equations are estimated with COVID-19 data from the Worldometer Database; MPI from the Oxford Poverty & Human Development Initiative Database; PLP from the UNDP human development report; OGI from the Mo Ibrahim Foundation Database; and CPI from Transparency International Database.*
***Results****: In Africa, an average of 46.46% (STDEV=26.10) of the population was in multidimensional poverty. The average OGI for Africa was 49.85 (STDEV=13.67). The average CPI for Africa was 32.4 (standard deviation=12.4). The study found a statistically significant association between COVID-19 cases and MPI, PLP, OGI, safety and the rule of law, sustainable economic opportunity, human development, CPI, and GGEH-D per capita at 5% confidence level.*
***Conclusion:*** *The study highlights the challenges poverty, poor governance, corruption, and low GGEH-D per capita poses for COVID-19 prevention and control in Africa. Persons living below the income poverty line will have an enormous challenge in implementing COVID-19 prevention and control interventions, including handwashing, physical distancing, and isolating at home. The African governments need to urgently develop and implement socio-economic protection programmes targeting persons living in multidimensional and income poverty.*

***Key Word****: Africa, corruption, COVID-19, governance, multidimensional poverty, income poverty.*

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## I. INTRODUCTION

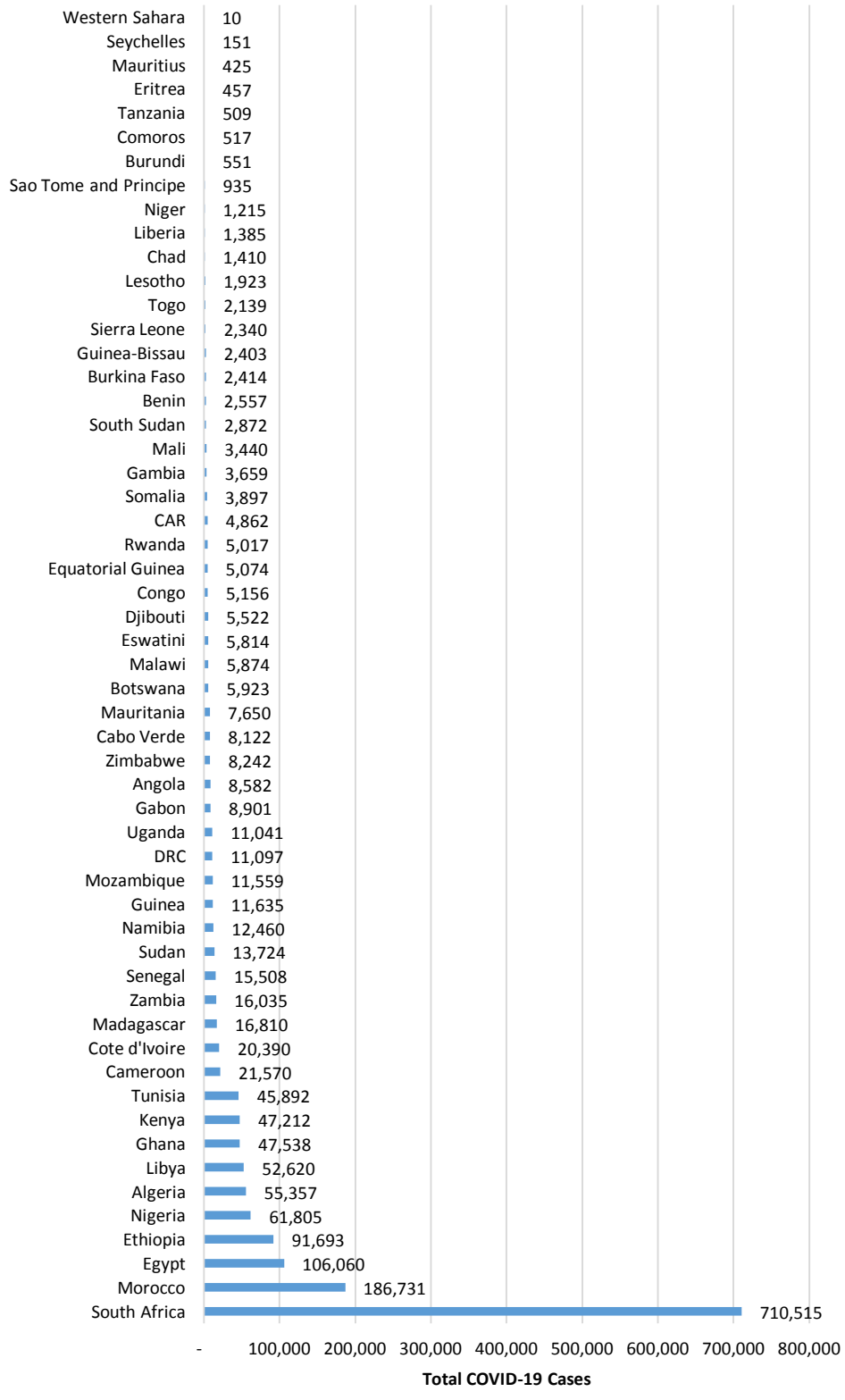
The continent of Africa consists of 55 countries, with a total population of 1,304,202,386 people, and a total gross domestic product (GDP) of International Dollars (Int$)7.6 trillion [1]. Before the global coronavirus disease (COVID-19) pandemic, the African Union (AU) had forecasted a GDP growth of 3.4% in 2020 for the continent [2]. However, following the COVID-19 outbreak, the African Union (AU) economic growth forecast is - 2.1% in the optimistic scenario and - 4.9% in the pessimistic scenario [2]. A recent study estimated the value per human life lost in Africa due to COVID-19 to be Int$87,442, which is 15-times Africa's GDP per capita in 2020 [3].

As of 23 October 2020, the African continent had reported a total of 1,696,418 (including 5,015 and 4,203 in territories of Reunion and Mayotte) COVID-19 cases, which included 40,760 (2.4%) deaths; 1,390,786 (82.0%) recovered cases; and 264,872 (15.6%) active cases [1]. The number of cases per country in Africa varied widely from 10 in Western Sahara to 710,515 in South Africa (See Figure 1). Five countries (Egypt, Ethiopia, Nigeria, Morocco and South Africa) bore 68.2% of the total number of cases in Africa. The actual burden of COVID-19 is likely to be far much higher since only about 1.2% of Africa's population has been tested [4].

The extent of further socioeconomic devastation from COVID-19 pandemic depends on the efficiency with which African countries implement public health measures recommended by the World Health Organization (WHO) to avert community-wide transmission [5,6,7]. Implementation of public health measures in most

African countries continue to be sub-optimal due gaps in coverage of essential health services caused by weak national health systems [8]; implementation of International Health Regulations (IHR) core capacities undermining disease surveillance and response systems [9]; and coverage of water and sanitation services [10].

**Figure 1: Total COVID-19 cases per country in Africa as of 23 October 2020**



The specific objective of this study was to investigate the correlation between the number of COVID-19 cases and the percentage of the population in multidimensional and income poverty, the overall governance, the corruption perceptions, and the domestic general government expenditure on health (GGEH-D) per capita in Africa.

## II. MATERIAL AND METHODS

**Study Design:** This cross-sectional study employs regression analysis to investigate the correlation between the number of COVID-19 cases and the percentage of the population in multidimensional and income poverty, the overall governance, the corruption perceptions, and the GGEH-D per capita in Africa.
**Study Location**: The analysis includes 54 sovereign countries in Africa.
**Study Duration:** December 2019 to 23 October 2020.
**Sample size:** Out of the 55 sovereign countries in Africa, 54 countries that had data were included in the analysis. Western Sahara and territories of Reunion and Mayotte were excluded for lack of data on independent variables.

**Conceptual framework**

The United Nations sustainable development goal (SDG) 1 aspires to "End poverty in all its forms everywhere" (p.14). SDG16 aspires to "Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels" (p.14) [11]. The multidimensional poverty [12,13,14,15], income poverty [15], quality of governance [16], and GGEH-D per capita [17] in each country will partially, but significantly, determine its capability to control the community transmission of COVID-19.

We use the Multidimensional Poverty Index (MPI), the percentage of the population in multidimensional poverty (PMP), the percentage of the population living below Int$1.90 a day (PLP) as measures of poverty. According to Alkire and Robles [12], the MPI has three dimensions' (health, education, living standards) and ten indicators. Alkire et al. [14] explain that "*a person who is deprived in at least one-third (33.33%) of the weighted indicators is identified as being multidimensionally poor, or MPI poor*" (p.2). According to UNDP [15], "*Multidimensional poverty headcount is percentage of population with a deprivation score of at least 33 percent*" (p. 321).

Furthermore, we use both the Ibrahim African Overall Governance Index (OGI) and the International Transparency Corruption Perceptions Index (CPI) as indicators of quality of governance in a country. The Mo Ibrahim Foundation (MIF) defines "*governance as the provision of the political, social and economic public goods and services that every citizen has the right to expect from their state, and that a state has the responsibility to deliver to its citizens*" (p.17) [16]. The overall OGI is a composite index consisting of four governance dimensions, namely, Safety & Rule of Law (SRL), Participation & Human Rights (PHR), Sustainable Economic Opportunity (SEO), and Human Development (HDE). The OGI and its dimensions are measured on a scale of 0 (very poor) to 100 (excellent) [17].

The CPI measures perceived levels of public sector corruption; where corruption is defined as "*the misuse of public power for private benefit*" (p.2) [18]. The CPI has a scale of 0 (highest level of perceived corruption) to 100 (lowest level of perceived corruption) [19].

Due to multicollinearity between OGI and CPI, we chose not to estimate a multivariate regression model. Instead, we estimated ten univariate linear regression models of the form shown below:

$$COVID-19_i = \alpha + \beta_i X_i + \varepsilon_i \qquad (i = 1,2,\dots,n) \qquad \dots\dots(1);$$

where: $COVID-19_i$ is the number of total cases of COVID-19 in i$^{th}$ country; $X_1$ is the MPI; $X_2$ is the PMP; $X_3$ is the PLP; $X_4$ is the OGI; $X_5$ is the SRL; $X_6$ is the PHR; $X_7$ is the SEO; $X_8$ is the HDE; $X_9$ is the CPI; $X_{10}$ is the GGEH-D per capita; $\alpha$ is the constant (or intercept term) that indicates the value of $COVID-19_j$ when $X_i$ equals zero; $\beta_i$ are the regression coefficients (or parameters) showing the amount that $COVID-19_j$ will change when $X_i$ changes by one unit; $n$ is the number of countries; $\varepsilon_i$ is the stochastic (or random) error term capturing variations in $COVID-19_j$ from other sources, e.g. omitted independent variables, data measurement errors, incorrect functional form [20]. COVID-19 is the dependent variable, while X's are independent variables. The results from the regression analysis shall be used to test two-sided hypotheses around zero: Null hypotheses $(H_O)$: $\beta_i = 0$ and Alternative hypothesis $(H_A)$: $\beta_i \neq 0$.

Once the computed t-value $(t_c)$ and critical t-value $(t_\alpha)$ are obtained, the decision rule will be to reject the null hypotheses $(H_O)$ if $|t_c| > t_\alpha$ at 5% two-sided significance level.

**Data sources**

Data on COVID-19 cases was from the Worldometer database [4]; data on $X_1$ and $X_2$ from the Oxford Poverty & Human Development Initiative database [22]; data on $X_3$ from the UNDP human development report

[15]; data on $X_4$, $X_5$, $X_6$, $X_7$ and $X_8$ from the Mo Ibrahim Foundation African Governance Index database [17]; and data on $X_9$ from the Transparency International CPI database [19]; and data on $X_{10}$ from the WHO Global Health Expenditure Database [20].

**Statistical analysis**

Data was analyzed using Stata software (College Station, Texas, StataCorp LP). Student's *t*-test was used to ascertain the significance of regression slope coefficients at 95% confidence level.

## III. RESULTS AND DISCUSSION

**Correlation between COVID-19 and poverty**

Figure 2 shows the percentage of population living in multidimensional poverty [22] and below the income poverty line [15] in 54 countries in Africa. In 50 countries with data, an average of 46.46% (STDEV=26.10) of the population was in multidimensional poverty. The PMP ranged from 0.79% in Tunisia to 91.92% in South Sudan. Over 50% of the population in 25 countries live in multidimensional poverty.

On average, across the 54 countries, 35.3% (STDEV=22.6) of the population lives below the income poverty line of PPP$ 1.90 a day. However, the percentage of the population living below the income poverty line varies widely from 0.3% in Tunisia to 77.6% in Madagascar. Over 50% of the population in 15 countries live below the international poverty line.

**Figure 2: Percentage of population living in poverty in Africa**

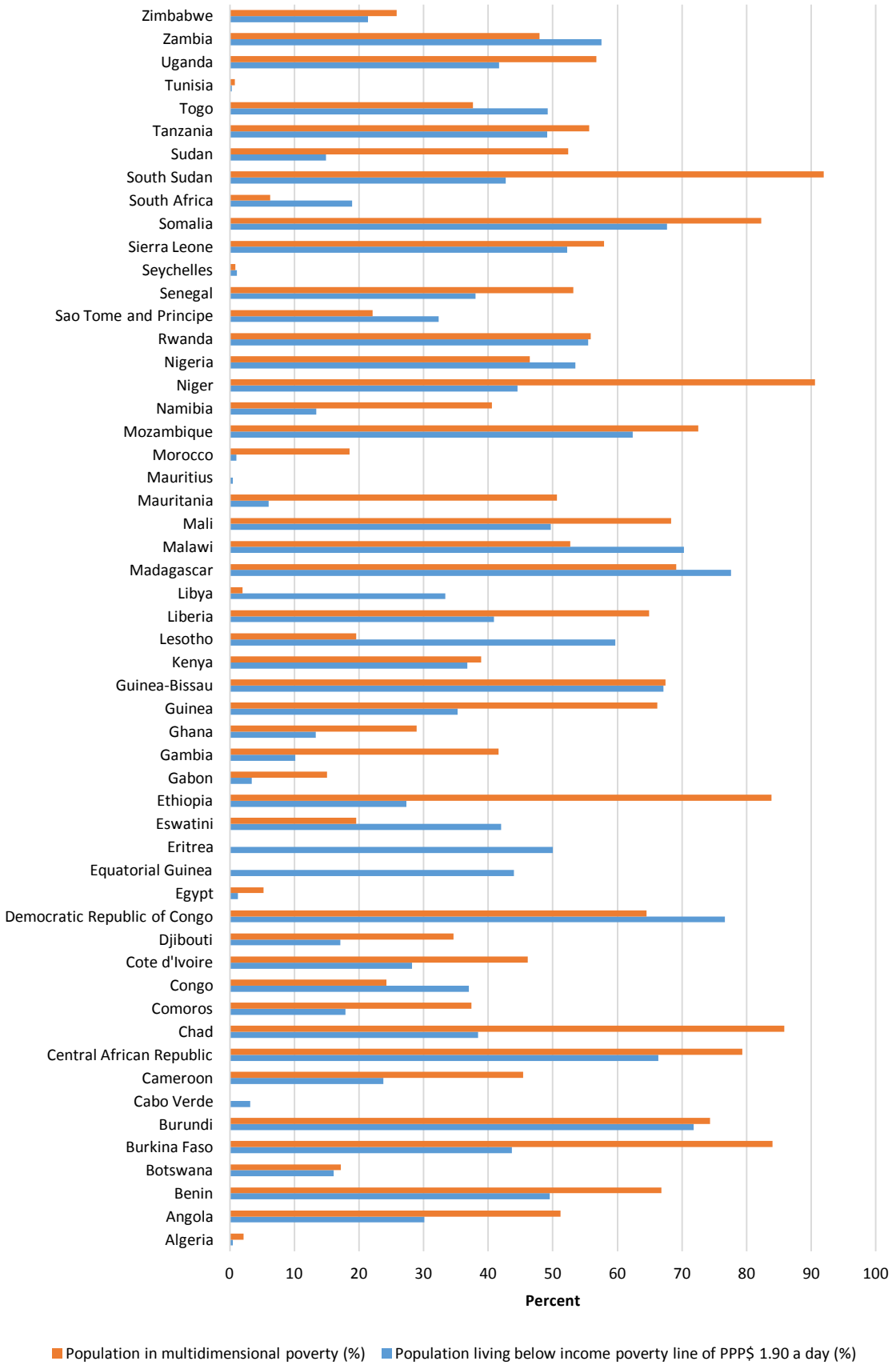


Table 1 presents the results of three regressions between COVID-19 cases per million population (dependent variable) and independent variables $X_1$, $X_2$, and $X_3$.

**Table 1: Results of regression between COVID-19 cases per million population and poverty indicators**

| Model & Independent variable | Constant | Coefficient | Computed t-statistic | $p > \|t\|$ | Adjusted $R^2$ |
|---|---|---|---|---|---|
| Model 1: Multidimensional poverty index ($X_1$) | 3544.145 | -7859.361 | -4.64* | 0.000 | 0.2957 |
| Model 2: Percentage of population living in multidimensional poverty ($X_2$) | 3996.661 | -51.98983 | -5.06* | 0.000 | 0.3346 |
| Model 3: Percentage of population living below poverty line of Int$1.90 per day ($X_3$) | 3644.259 | -52.00423 | -3.26* | 0.002 | 0.1540 |

Notes: Dependent variable in the models 1, 2, and 3 is the total COVID-19 cases per million population; *Statistically significant at 0.05 significance level ($t_\alpha = -2.007$ and $t_\alpha = 2.007$).

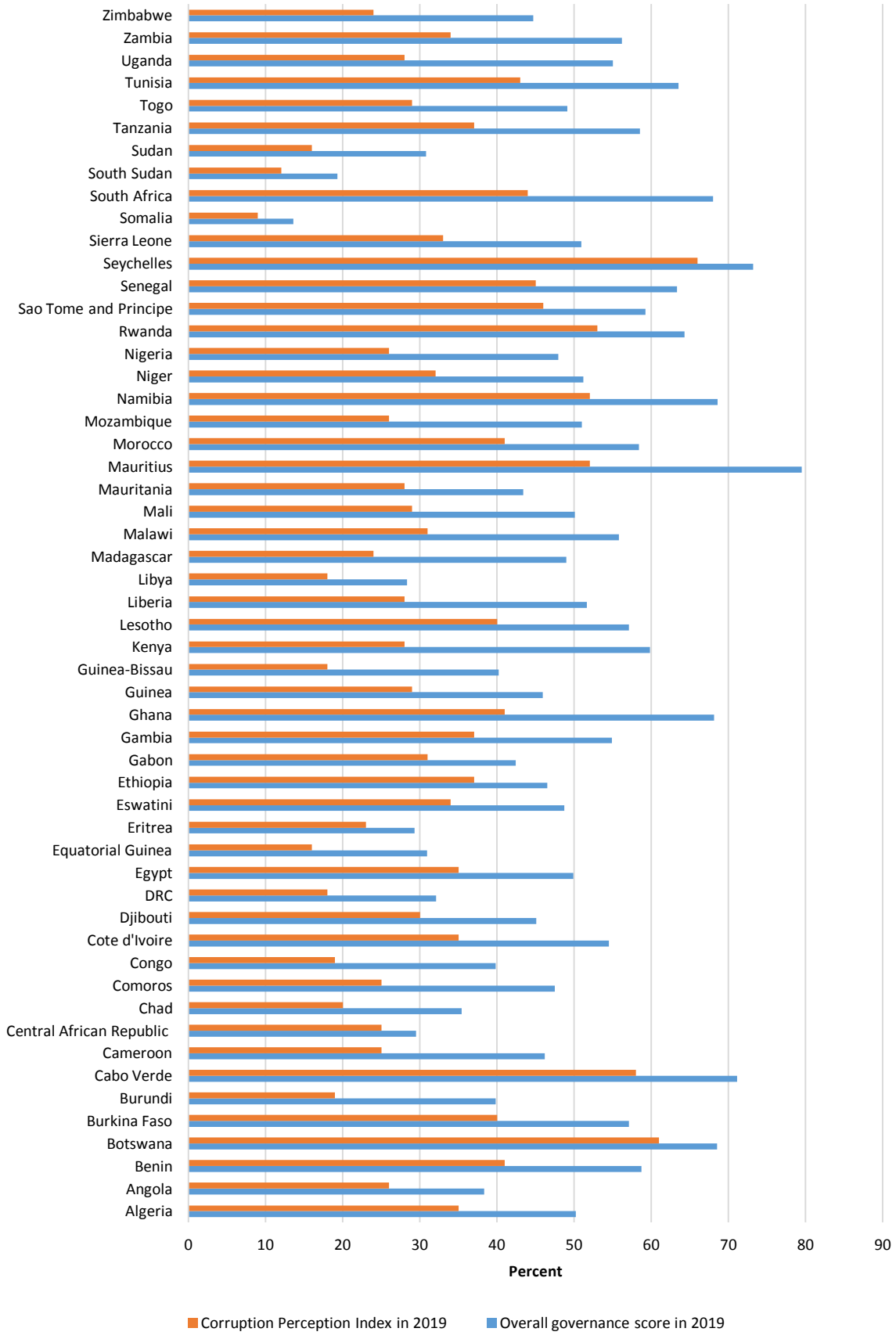
The adjusted R-squared values for model 1 of 0.2957, model 2 of 0.3346, and model 3 of 0.1540 denote that poverty-related indicator variables $X_1$, $X_2$ and $X_3$ explain 29.57%, 33.46%, and 15.40% of the variations in COVID-19 cases, respectively. The t-critical values ($t_\alpha$) for a two-tailed test at 52 degrees of freedom (n-K-1 = 54-1-1=52), for a significant level of 5% (0.05), equals $t_\alpha = -2.007$ and $t_\alpha = 2.007$. Since the computed $t_c$ values for variables $X_1$, $X_2$ and $X_3$ slope coefficients $\beta_1$, $\beta_2$ and $\beta_3$ are greater than critical $t_\alpha$ values in the three equations, the null hypotheses ($H_O$) are rejected; meaning the regression slope coefficients are significantly different from zero.

Why did the poverty-related variables slope coefficients take negative values, implying that as numbers of the population living in poverty increases, the reported COVID-19 cases decreases? The possible explanation is that countries with the highest percentages of people living below the poverty line (Int$1.90 a day) have significantly lower levels of testing, and hence, lower cases detected and reported. Burundi, DRC, Madagascar, Malawi, and Somalia had an average of 72.8% (STDEV=4.21) of population living below income poverty line compared to 0.68% (STDEV= 0.35) in Algeria, Mauritius, Morocco, Seychelles, Tunisia. Burundi, DRC, Madagascar, Malawi, and Somalia had an average of 263.8 COVID-19 cases per million population (STDEV=214) compared to 2,407 (STDEV=1,967) in Algeria, Mauritius, Morocco, Seychelles, Tunisia. A T-Test for 2 Independent Means, at 4 degrees of freedom and 5% significance level, resulted in a computed t-value of -2.42197 and a p-value of 0.020861, which meant that average number of COVID-19 cases between the two sets of countries are significantly different at $p < .05$. Thus, the lower COVID-19 cases per million population among low-income countries with very high percentages of people living in poverty than high- and middle-income countries with very low percentages living in poverty should not give the former a false sense of security regarding the seriousness of the pandemic.

**Correlation between COVID-19 and governance (including corruption)**

***Overall governance:*** In 54 countries, the average OGI was 49.85 (STDEV=13.67), which is below the average of 50. The OGI varied from a minimum of 13.6 in Somalia to maximum of 79.5 in Mauritius (See Figure 3) [17]. The 25 countries with an OGI of less than 50% may have significant problems garnering citizenry trust and using in accountable manner resources for combatting COVID-19.

**Figure 3: Overall governance and corruption perceptions indices for Africa in 2019**



We shall next touch on the OGI four component scores. First, the component of safety and the rule of law (SRL), among 54 countries, had an average score of 52.6 (STDEV=16.3). The SRL score varied from 12.3 in Somalia to 79.5 in Mauritius. Nineteen countries that had a SRL score of less than 50 may have challenges enforcing implementation of various interventions geared at forestalling community transmission of COVID-19.

Second, the component of participation and human rights (PHR), among 54 countries, had an average score of 49.2 (STDEV=16.7). The PHR score ranged from 17.5 in Eritrea to 77.2 in Mauritius. Of concern are the 26 countries with a PHR score of less than 50, which may have challenges of assuring respect for human rights in the process of enforcing various COVID-19 transmission containment measures, such as lockdown, physical distancing, wearing of facial masks, and quarantine.

Third, the component of sustainable economic opportunity (SEO), among 54 countries, had an average score of 44.79 (STDEV=14.14). It varied from 7.4 in Somalia to 74.8 in Mauritius. The 35 countries with a SEO score of less than 50 may find it difficult financing implementation of the public health interventions needed to halt the spread of COVID-19.

Fourth, the component of human development (HDE) had an average score of 52.8 (STDEV=13.3). The score varied from 16.4 in Somalia to 84.6 in Mauritius. Twenty-one countries had an HDE score of less than 50 (average).

Table 2 portrays the results of six models of regression between COVID-19 cases per million population and governance indicators.

**Table 2: Results of regression between COVID-19 cases per million population and governance indicators**

| Model & Independent variable | Constant | Coefficient | Computed t-statistic | $p > \|t\|$ | Adjusted $R^2$ |
|---|---|---|---|---|---|
| Model 4: Overall governance index score (IGI) (n=54) [$X_4$] | -897.591 | 54.28616 | 1.94** | 0.058 | 0.0496 |
| Model 5: Safety & Rule of Law (n=54) [$X_5$] | -416.161 | 42.27599 | 1.79** | 0.079 | 0.0401 |
| Model 6: Participation & Human Rights (n=54) [$X_6$] | 231.012 | 32.04979 | 1.37 | 0.176 | 0.0164 |
| Model 7: Sustainable Economic Opportunity (n=54) [$X_7$] | -340.701 | 47.991 | 1.76** | 0.084 | 0.0383 |
| Model 8: Human Development (n=54) [$X_8$] | -1429.72 | 61.37439 | 2.14* | 0.037 | 0.0635 |
| Model 9: Corruption perception index (n=54) [$X_9$] | -817.926 | 80.95378 | 2.69* | 0.009 | 0.1057 |

Notes: *Statistically significant at 0.05 significance level ($t_\alpha = -2.007$ and $t_\alpha = 2.007$); **Statistically significant at 0.1 significance level ($t_\alpha = -1.675$ and $t_\alpha = 1.675$); dependent variable in the models 4 to 9 is the total COVID-19 cases per million population.

The adjusted R-squared values in models 4 to 9 of 0.0496, 0.0401, 0.0164, 0.0383, 0.0635, and 0.1057 imply that about 5%, 4%, 2%, 4%, 6% and 11% of the variations in COVID-19 cases reported are explained by overall governance index score ($X_4$), safety and rule of law ($X_5$), participation and human rights ($X_6$), sustainable economic opportunity ($X_7$), human development ($X_8$), and corruption perception index ($X_9$). Since in models 4, 5, and 7, the $t_c$ is greater than critical values of $t_\alpha$=-1.675 and $t_\alpha$=1.675 (for a two-tailed test at 52 degrees of freedom and a significant level 0.10), we can conclude that the slope coefficients for $X_4$, $X_5$, and $X_7$ are significantly different from zero. Likewise, in models 8 and 9, the $t_c$ are greater than critical values of $t_\alpha = -2.007$ and $t_\alpha = 2.007$ (for a two-tailed test at 52 degrees of freedom and a significant level 0.05), and thus, it can be concluded that the coefficients for $X_8$ and $X_9$ are significantly different from zero.

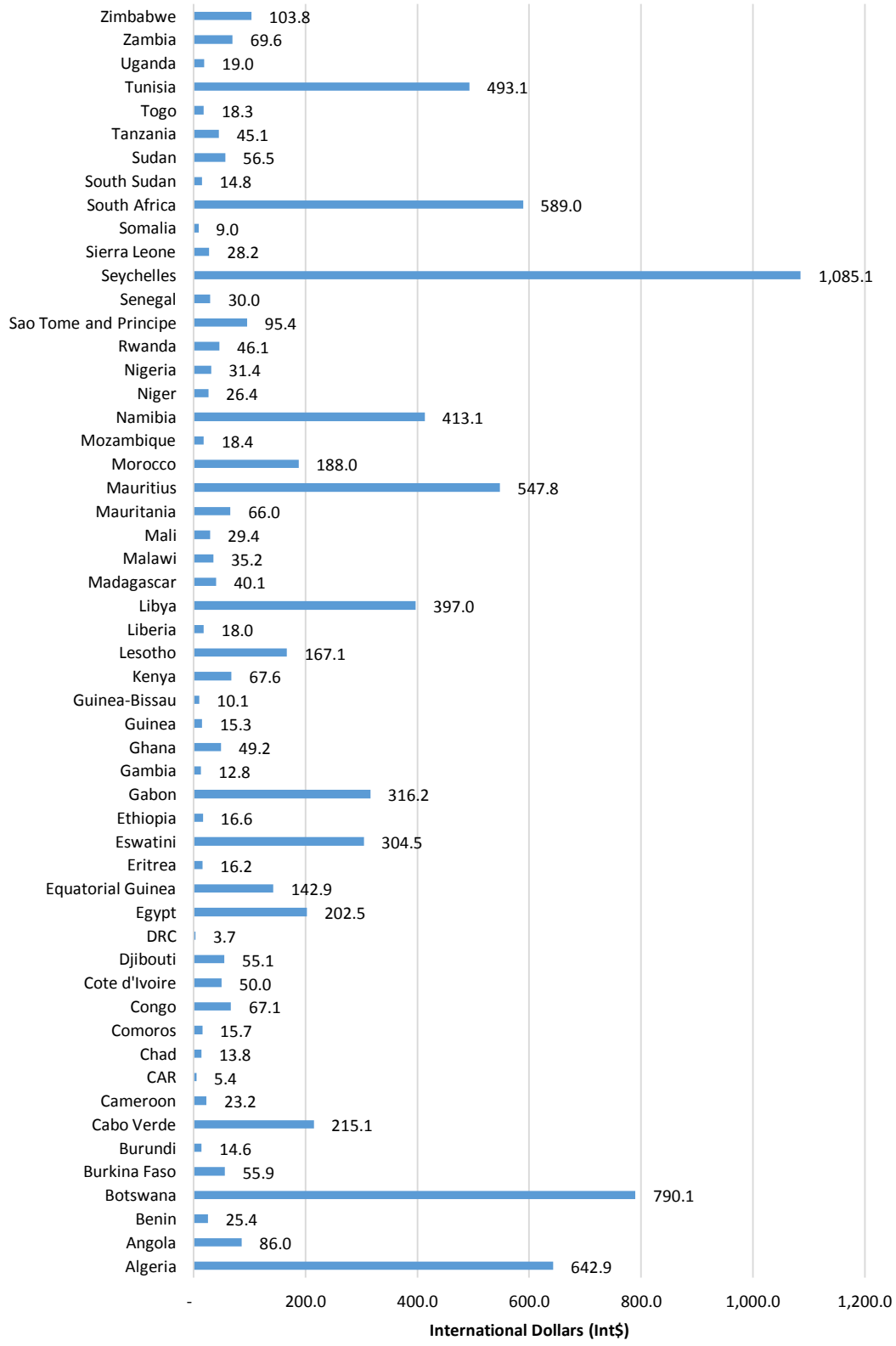
The findings in Table 2 imply that, mostly, as the overall governance improves, the number of COVID-19 cases detected increases, probably, due to more efficient use of resources mobilised and allocated for COVID-19 testing. Also, since good governance engenders trust among the population, maybe a higher proportion would adhere to a government call for testing. In the ongoing COVID-19 pandemic context, it seems from the evidence, that the most influential components of overall governance are safety and the rule of law, sustainable economy, and human development.

***Corruption perceptions:*** Figure 3 shows also the CPI scores for the 54 countries in Africa [19]. The average CPI for Africa was 32.4 (standard deviation=12.4) and a median of 30.4. The CPI varied from 9 in Somalia to 66 in Seychelles. Only six countries (Botswana, Cabo Verde, Mauritius, Namibia, Rwanda, and Seychelles) had a score of 50 and above. The remaining 48 countries public sectors were perceived as very corrupt.

Regression evidence in Table 2 also indicates that citizen's corruption perception, concerning their government, is directly correlated with the number of COVID-19 cases reported. For instance, since the slope coefficient ($\beta_9$) for Corruption perception index ($X_9$) is 80.95378, it signifies that a unit increase in $X_9$ results in a growth in the COVID-19 cases reported by 81. In other words, if citizens perceive their government as corrupt, the less likely they are to believe and adhere to its messages of actions geared at preventing individual infection and community transmission of COVID-19. Once again, these findings underscore the importance of citizenry positive perceptions of the government's political governance and integrity in the success of the ongoing war against COVID-19 pandemic in Africa.

**Correlation between total COVID-19 cases and general government expenditure on health per capita**
Figure 4 shows the GGEH-D per capita for each of country in Africa [20].

**Figure 4: Africa domestic general government expenditure on health per capita (Int$)**



The average GGEH-D per capita for Africa was Int$146 (STDEV=226.4), and the median was Int$47.6. The GGEH-D per capita varied widely from a paltry Int$3.7 in DRC to Int$1,085.1 in Seychelles. In 38 countries, the GGEH-D per capita was less than Int$100.

The Adjusted R-squared was 0.1388, meaning that general government expenditure on health (GGEH) per capita explained 13.88% of the variations in the total number of COVID-19 cases per million population. The results of the model 10, estimated with data for 54 countries, are as follows: $COVID - 19 = 1081.855 + 4.968037X_{10}$, with a $t_c$ of 3.09 and P>|t| of 0.003. Since the $t_c$ of 3.09 is greater than critical $t_\alpha$ value of between $-2.007$ and $2.007$, for 52 degrees of freedom and a 5% confidence level, the null hypothesis is rejected. The slope coefficient took a positive sign, implying that an increase in GGEH by one International Dollar, causes a rise in COVID-19 cases confirmed by five. Thus, an increase in GGEH per capita augments testing and detection of COVID-19 cases.

**Limitations of the study**

a) MPI and percentage of the population in multidimensional poverty data were not available for Cabo Verde, Equatorial Guinea, Eritrea and Mauritius.
b) Due to multicollinearity in the independent variables, it was not possible to conduct multivariate regression analysis.

## IV. CONCLUSION

Our analysis adds voice to those of Alkire *et al*. [14], that Africa's large proportion of the population living in severe multidimensional poverty and below the income poverty line will have an enormous challenge in implementing WHO [5,6] recommended handwashing, physical distancing, isolating at home, contact tracing, lockdown to prevent spread, and testing and treatment.

The situation of those living in multidimensional and income poverty requires the African governments to develop and implement socio-economic protection programmes to assure access to preventive public health interventions against COVID-19 [6,23]. Respective governments must wage war against corruption to create confidence in citizenry with a view to boosting uptake and adherence with recommended public health interventions aimed at combatting community spread of pandemics [16,24].

**Data (and Software) Availability**

The paper used data from the following sources:
(a). Total COVID-19 cases by country from Worldometer [4]: https://www.worldometers.info/coronavirus/.
(b). Multidimensional Poverty Index and percentage of population living in multidimensional poverty from the Oxford Poverty & Human Development Initiative (OPHI) [22]: https://ophi.org.uk/multidimensional-poverty-index/data-tables-do-files/
(c). Percentage of population living below income poverty line of Int$1.90 a day from the UNDP human development report 2019 [15]:
(d). The Ibrahim Index of African Governance from the Mo Ibrahim Foundation [17]: http://iiag.online/
(e). Corruption Perceptions Index from the Transparency International [19]: : https://www.transparency.org/en/cpi/2019/results/table
(f). Domestic general government expenditure on health per capita (Int$) from the WHO Global Health Expenditure Database [20]: https://apps.who.int/nha/database/Select/Indicators/en

**Consent**

Secondary data from publicly available International Databases was analysed, and thus, consent not applicable.

**Authors Contributions**

JMK, RNDKM, AMR, EKK and NGM contributed equally in the design, collation of data from secondary sources, data analysis, and writing of the manuscript.

**Competing interests**

No competing interests were disclosed.

**Grant information**

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