

COVID-19 in Ethiopia: A Regional Geographical Analysis and Examination of Complex Interactions between a Pandemic, Geopolitics, Domestic War, Drought, and Poverty

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Abstract

COVID-19 arrived in Ethiopia - a least developed country – amidst internal instabilities including a civil war, drought, and a contentious national election, all taking place concurrently with international pressures linked to disagreements with Egypt and Sudan over the construction of the Great Ethiopian Renaissance Dam (GERD) along the Ethio-Sudanese border. External challenges also came in the form of US and European Union's pressures on Ethiopia, a close trading partner of China, over perceived threats posed by growing influences of Russia and China in the Horn of Africa and Red Sea regions. External pressures emboldened internal grumblings resulting in an all-out domestic war. Not much is known about the combined or isolated impacts of these events on Ethiopia's COVID-19 response and on the spread of the disease. To fill this knowledge gap, a descriptive analysis is conducted for the July 27, 2020 through May 9th, 2022 period using data obtained from the Ministry of Health websites. In a possible sign of the impacts of the stated influences, the capital city Addis Ababa, home to just four percent of the country's estimated population of 120 million, accounted for roughly two-thirds of the 470,760 COVID-19 cases, and of the 7,510 deaths, as testing and death reporting outside of the capital was constrained by security concerns. A peak daily count of 5,185 cases and a case-positivity ratio of 39 percent were reached on December 28, 2021. It is uncertain to what extent the low national and regional counts of cases and deaths are the results of prevention or demographic invulnerability as opposed to limited testing and underreporting of cases and deaths outside of Addis Ababa. Ethiopia needs to put in place rigorous systems of data generation through testing, as well as pipelines for its dissemination, both in normal times and during unforeseen exigencies.

Keywords: Ethiopia, COVID-19, Addis Ababa, Kilil, Transmission, Pandemic, War, Poverty

1. Introduction

1.1 Statement of the Problem

The arrival of COVID-19 in Ethiopia was preceded and succeeded by external and internal pressures including a devastating domestic military conflict that posed an existential threat to the country's government. No study results exist regarding the effects of these pressures on the COVID response and the spread of the disease. Studies published so far are limited in scope to addressing prevention and preparedness measures (Shigute Z, Mebratie AD, Alemu G, Bedi A., 2020, and Yimam Getaneh, et.al., 2020), opportunities the disease brought for the adoption of technologies for coping and for remote work as well as distance learning (Wondimu W, and Girma B, 2020), knowledge, attitude and practices (KAP) of the COVID-19 disease among nurses (Tadesse D.B., Gebrewahd G.T., and Demoz G.T., 2020), vaccination acceptance among adults (Abebe H, Shitu S, Mose A, 2021), cross infections with other agents, for example, Tuberculosis, and the implications of the inadequate COVID-19 response for future patient care and academic research (Hussen Mohammed, 2020).

This study seeks to fill knowledge gaps regarding the impacts of internal and external pressures on the COVID-19 response and disease spread in Ethiopia as measured by: a) the country's inability to do widespread testing b) the total number of cases and deaths Ethiopia was able to report to the rest of the world given its status as the second-most populous country in Africa, c) the level of preparedness of its health institutions, and finally d) the country's capacity to generate timely data and share with the wider public as well as domestic and

international researchers. Additionally, the study will examine regional variations in infection rates and case fatality ratios, based on data reported by the country's health institutions and publicized through social media outlets. The paper also aims to shed light on the problems of obtaining data that is disaggregated by demographic characteristics such as age and sex and by known socioeconomic determinants of health such as income, educational attainment, and urban-rural residence, all stratified by geographic subdivisions below regional (*Kilil*) levels. The study period is July 27, 2020, through May 9th 2022.

1.2 COVID-19, Internal Instability, and External Pressures

Having been preceded by two natural disasters – draughts, and a locust infestation – as well as a societal discord linked to a postponed national election, COVID-19 was then succeeded about half a year later by yet another national emergency - the start of an all-out war between the Tigrayan People Liberation Front (TPLF) that is administering Tigray Region (see Figure 1 for the location of regions), and the national military. This is a *dejavu* rehash of hostilities that were typical of northern Ethiopia in the 1970s and 1980s (Seifulaziz Milas and Jalal Abdel Latif, 2000). The conflict which quickly garnered international attention triggered the displacement of over two million individuals from their homes (Eliza Mackintosh – CNN, 2021; Global Conflict Tracker, 2022; New York Times, 2022, World Vision, 2021, Human Rights Watch, 2020). It is also said to have played a part in amplifying the spread of COVID-19 through neglect, and by redirection of scarce resources to the war effort (The Conversation, 2021). The World Health Organization (2021) has confirmed that the conflict had disrupted COVID-19 responses.

Data trends in Ethiopia's COVID-19 dashboard run by the Ethiopian demography and health website (Ethiopia: COVID-19 Data Dashboard, 2022; Ethiopian Demography and Health, 2022) reveal that the intense military engagements in the north and localized fire-fights in nearly all of the other regions by forces allied with TPLF may have impacted COVID testing and reporting outside of the capital Addis Ababa. There are clear indications that this is true for the Amhara and Afar Regions, two neighboring regions that saw great devastations of war and population displacements due to TPLF's human-wave-styled incursions (Farouk Chothia, 2021). TPLF's desire to widen the conflict outside of Tigray's borders into neighboring regions was, as it were, a desperate effort to open up by force, economic links that were frayed by the conflict upon disruption of banking, telecommunications, electricity, etc. services. Proof of the war's impacts on testing and reporting may be found in COVID-19 totals for Afar and Amhara Regions which remained low throughout 2021 and 2022. Undoubtedly, the stagnation in COVID-19 numbers for Tigray Region, as its numbers remained virtually unchanged for the better part of 2021 and 2022, is one such proof. It is also logical to assume that the instabilities and population displacements that the draught in the Somali and Oromiya Regions caused, also had a bearing on pandemic-related government operations including testing, death registration by cause, and reporting of results to the public.

The above-used phrase “forces allied with TPLF”, requires in-depth examination as it is a linchpin to explaining the presence in Ethiopia's COVID-19 mix, of foreign influences that constrained the government's ability to mount an effective response - hence, the use of the word “Geopolitics” in the title of the paper. Foreign influences existed in two forms, the first one being efforts by the countries of Egypt and Sudan to thwart the progress of a massive dam (the largest in Africa) known as the Grand Ethiopian Renaissance Dam (GERD) which is nearing completion on the Ethio-Sudan border (John Mukum Mbaku, 2021). As reported in the British Broadcasting Corporation's (2020) coverage of the Tigray war, the GERD-related external pressures included an encouragement by the former US President Donald Trump for Egypt to “blow up” the dam. The second influence, at least in the eyes of Ethiopian government officials (Seleshi Tessema, 2021), was Western European and American efforts to secure the Red Sea trading lane and the Bab el Mandeb maritime routes, by combating perceived Chinese and Russian influences through destabilization of Ethiopia (Bronwyn Bruton, 202), or even its break up. If accomplished, this would be a repeat of Yugoslavia's fracturing in the 1990s (Politico, 2022). The destabilization was alleged to be taking place through overt and covert US and European Union supports for TPLF and its franchisee combatants including the Oromo Liberation Front. An article entitled, “Global Rivalry in the Red Sea” addresses what the European Union's approaches should be in achieving its ends in the region (Danish Institute for International Studies, 2021). The article, which starts by acknowledging that “geopolitical competition in Africa is here to stay”, lists the EU's priorities as being inclusive of a) supporting regional initiatives to create and shape effective maritime governance, and b) promoting global public goods by safeguarding maritime security so that “the blue economy” can flourish. The phrase “blue economy” has been defined variously by different institutions including the World Bank, the United Nations, the Commonwealth of Nations, and the Center for the Blue Economy (United Nations, 2020). The EU (cited in the United Nations, 2020) defines it as “all economic activities related to oceans, seas, and coasts”.

Not to be forgotten in the cyclic interactions of a pandemic, war, drought, instability, displacements, and poverty, is the proposition that COVID-19 was itself the cause-cum-accelerant of the domestic political and military conflicts detailed in the preceding paragraphs, at least indirectly. The logic of this argument relies on a sequence of events triggered by a delay in a national election due to COVID-19. The delay was followed by a unilateral decision by TPLF – the party in power in Tigray Region - to conduct a regional election. This, it is alleged, placed TPLF on a direct collision course with the federal government (Congressional Research Service, 2021). In the words of Susan Stigant (2020) “disagreement over the postponement of the anticipated August 2020 elections set the stage for the crisis”. The TPLF launched a self-admitted preemptive nightly strike (Tesfa News, 2020), against Ethiopia’s military on November 4, 2020, nearly eight months after the arrival of COVID-19 in the country.



Figure 1. Map of Africa and Ethiopia’s Administrative Regions (*Kilil*)

Just over a month later, on December 7, 2020, an online news report (KFF, 2020) announced that “Ethiopia’s month-long war in its northern Tigray region has severely hampered efforts to fight one of Africa’s worst

coronavirus outbreaks”, thereby confirming the start of the vicious cycle of complex interactions between the COVID-19 epidemic, a national election dispute, domestic war, political instability, drought, poverty, population displacements, and intense international pressures led by Egypt, Sudan, the US, and the European Union.

1.3 COVID-19, Poverty, Food Insecurity, and Foreign Aid

Ethiopia has a population of approximately 120 million (Worldometer, 2022) distributed across its ten primarily rural administrative regions, also known as *Kilil*, and two chartered cities - the capital city Addis Ababa, and Dire Dawa (Administrative Divisions/Ethiopia, 2021) (see Figure 1 for the location of the country and its administrative regions). The capital city Addis Ababa is home to an estimated five million people or roughly four percent of the country’s total population (World Population Review, 2022) who live mostly in neighborhoods that are describable at best as slum-like, with densities reaching into thousands per square kilometer (Ethiopia Demography and Health, 2022). Having arrived in the capital first, COVID-19 quickly spread to two regions where, in combination, over three-fifths of the population lives – the Oromia Region (41,568,713 people) and Amhara Region (30,848,988 people) (Ethiopian Demography and Health, 2022). The two regions were already grappling with a fair degree of economic hardship and societal instability linked to political disagreements and the proliferation of armed combatants vying for power. Additionally, Oromia was and still is in the grips of an intense drought that is being blamed on global warming (Famine Early Warning System, 2022; United Nations Office for the Coordination of Humanitarian Affairs, 2022). The draught was itself a successor natural disaster to a locust infestation that had covered much of the eastern half of the country through 2020 and 2021 (Food and Agricultural Organization, 2021, United States Agency for International Development, 2021).

The co-occurrence of COVID-19 and armed conflicts is not unique to Ethiopia for the 2020 through 2022 period as exemplified by the ongoing Ukraine-Russia war. However, one could argue persuasively that Ethiopia’s weak economic baseline and the very low educational status of its population, have meant that efforts to marshal resources and combat the disease have faced greater challenges relating to launching data-driven policy interventions. Meanwhile, the decades-old poverty-related challenges persist. The World Food Program (2022) which has been involved in Ethiopia’s safety-net food assistance programs has reported that 20.4 million Ethiopians are food insecure. On the bright side, reports also show that without these safety net assistance regimes, dubbed Productive Safety Net Program (PSNP), COVID-19 would have brought greater suffering linked to food shortages. Kibrom et. al. (2022) have brought to light, PSNP-related examples relating to community resilience and successful blunting of the impacts of COVID-19. Their report holds up Ethiopia as an encouraging test case for fashioning policy interventions to overcome sudden shocks such as those presented by COVID-19. The authors shared evidence of Ethiopia’s PSNP role in protecting household food security and added that “...the program offset virtually all adverse pandemic-related impacts for participating households.”

The national response effort against COVID-19 needed to go hand in hand with the ability of government security forces including the police and special regional forces known locally as *Liyuhail*, to make conditions safe for the continuation of the non-pandemic era assistance in poverty alleviation programs. The programs included those provided by the United States Agency for International Development (USAID) and the International Committee of the Red Cross (ICRS) in the areas of food delivery and assistance in re-establishing livelihoods by building and maintaining water-supply systems, expanding healthcare services, visiting detainees in conflict zones, reuniting separated families, providing physical rehabilitation, etc. This is done through close collaboration with the Ethiopian Red Cross (International Committee of the Red Cross, 2022, USAID, 2022). USAID’s ground-level activity is described as an engagement on behalf of the American people to invest in Ethiopia’s future by building the country’s self-reliance through increased economic growth as well as delivery of quality educational services and basic public health care, while at the same time “promoting a governance environment that is conducive to sustainable economic development” (USAID, 2020).

1.4 COVID-19 Preparedness by Health Institutions and the Undeveloped Data Culture

It appears that COVID-19 testing, which is the exclusive means of generating data on infection levels and trends, has not been preceded by published guidelines governing the number of individuals to be tested in the ten primarily rural administrative regions and the two chartered cities. This, ideally, would depend on predetermined proportions of the populations to be targeted for testing. Also missing are guidelines on mechanisms for ensuring continuity of tests at predetermined intervals. Furthermore, there is no evidence that data collection systems were put in place guaranteeing uninterrupted operations irrespective of expected or unforeseen challenges including armed conflicts. For instance, the fact that there were no alternative mechanisms for obtaining COVID-19 case and death counts for Tigray Region after the war broke out there, is proof that no such systems existed. The difficulty of obtaining good quality disaggregated data on the ongoing COVID-19

pandemic is exemplified by the Public Health Institute's week 17 report (May 9 to May 15, 2022) which reminds the public of over seventy years of service to the community (Ministry of Health, National Public Health Institute, 2022). In this report, the nationwide case total was accurately reported as 470,949 for the end of the reporting week. However, a table on page 5 entitled, total COVID-19 cases by region, mistakenly reported regional totals as being in the millions for the capital city Addis Ababa (9,984,078 cases) and for Oromia Region (1,984,830 cases). The table remained publicly viewable as of June 20, 2022.

In the forthcoming sections, the paper will present the objectives of the research followed by the methodology used, types of analyses conducted, results obtained, and conclusions made.

2. Objectives

The main goal of the research is to fill the knowledge gap regarding the magnitude, spread, and time trends of the COVID-19 pandemic in Ethiopia at the national level, and to show regional differences in infection and death rates, all in the context of a mix of intense international geopolitical pressures and daunting domestic challenges including a civil war, drought, poverty, population displacements, and a pressing need to conduct a national election. Even though COVID-19's presence in Ethiopia dates back to March 13, 2020, when the Federal Ministry of Health confirmed its arrival in the capital Addis Ababa (World Health Organization, 2020), the study's focus would be limited to the July 27, 2020, through May 9th, 2022 period.

3. Methods

Publicly available data were obtained from various websites, including the Ministry of Health's and Public Health Institute's webpages as channeled through social media outlets such as Telegram (Tikvah Ethiopia, 2022). These related to daily and cumulative totals of the number of COVID-19 tests, and daily increases in cases and deaths, which allowed calculations of case-positivity rates and case fatality ratios. The lack of COVID-19 data disaggregated at small geographic scales and by demographic attributes of individuals that are tested or infected, as well as, by rural-urban residence, income, educational attainment, religion, ethnicity, etc. precluded the use of inferential statistical techniques, leaving descriptive analysis as the only option. The ArcGIS Pro application is used for making the introductory map which shows the boundary outlines of African countries and Ethiopia's regions (*Kilil*). Microsoft Excel was used for making graphs and tables.

4. Results

4.1 National-Level Trends in COVID-19 Cases and Deaths

As of May 9, 2022, a total of 470,760 COVID-19 cases had been diagnosed nationally out of 4,816,457 individuals that were tested for the presence of the virus, and a total of 7,519 individuals had died (Ethiopian Public Health Institute, 2022). The 20 cases that were diagnosed on May 9 represented a tiny fraction of the daily maximum of 5,185 registered on December 28, 2021 (Figure 2). This day also saw the highest case positivity rate ever (39 percent). The Ethiopia daily maximum occurred three weeks ahead of the global single-day peak of 23,266,037 cases reached on January 17, 2022 (World Health Organization, 2022). Even when adjusted to a per capita basis, Ethiopia's single-day record pales in comparison with the single-day maximum of 1.35 million reached on January 22, 2022, in the most severely hit country – the United States (Lisa Shumaker, Reuters, 2022). According to Reuters, the highest single-day total of 61,295 for all of Africa, was reached on January 11, 2022 (Reuters, COVID-19 Tracker, 2022), about two weeks after the peak daily occurrence in Ethiopia.

The COVID data in Figures 2 and 3 were gathered daily from Ethiopia's Ministry of Health (MoH) websites as channeled through social media outlets such as Telegram (Tikvah Ethiopia, 2022). Telegram's Tikvah daily news articles in the Amharic language included MoH cumulative totals of tests administered, positive cases, persons who have recovered, and persons who have died. When the channel suddenly stopped providing these data, it became necessary to rely on the Ministry of Health's updates (Ethiopia Ministry of Health, 2020) and the Ethiopian Public Health Institute's (EPHI) website located at <https://www.covid19.et/covid-19/>. EPHI updates had been reachable if accessed through the Mozilla Firefox search engine (not Google Chrome or Microsoft Edge), but are no longer accessible. Although its <https://ephi.gov.et/download/epdimology/> site is accessible, the information it contained consisted of non-searchable picture files turned into portable document formats (PDF) often with outdated data. For example, as of May 26, 2022, the COVID-19 data in display was for May 9th, 2022.

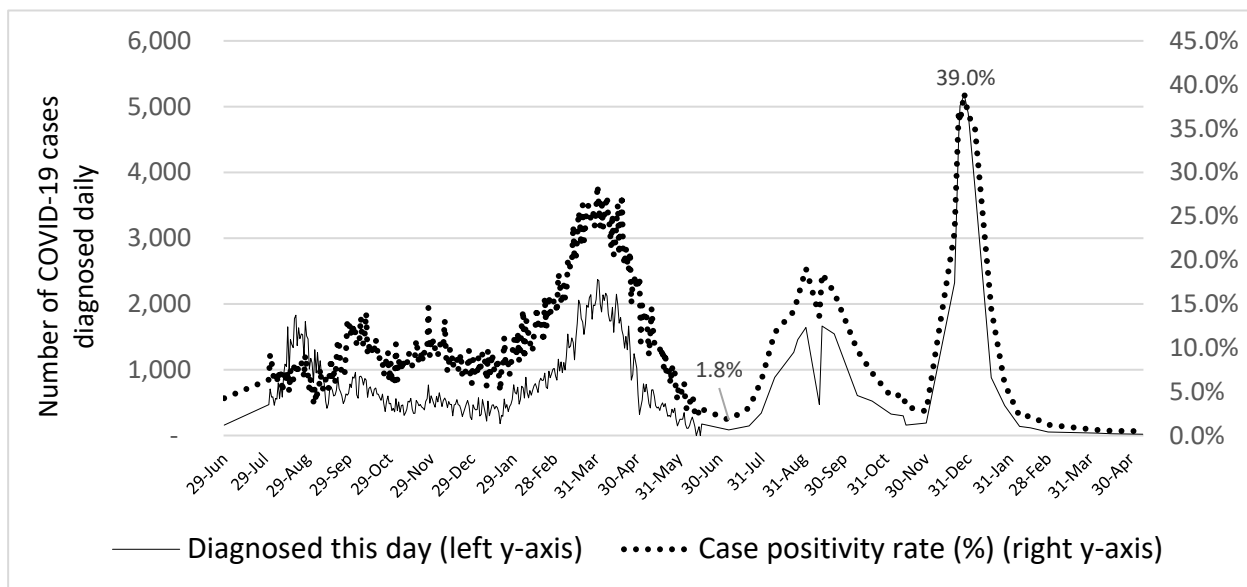


Figure 2. Daily COVID-19 Cases and Case Positivity Rates, August 9 2020 to May 9, 2022

Data source: Collected from the social media source Telegram and Ethiopia’s Ministry of Health websites

Figure 3 shows cumulative COVID-19 deaths for the August 2020 through April 2022 period. The trend is marked by the absence of the sharp rises and falls observed in Figure 2. Overall, the cumulative total of the deceased had increased from 572 on August 12, 2020, to 7,510 by May 9th, 2022. The appearance of a uniform gradual buildup in COVID-19 deaths masks periods of elevated mortality where the cumulative count increased substantially. For example, during the 70-day period between January 12, 2021, and March 23, 2021, the cumulative total increased by 689 from 2,004 to 2,693 (an average of roughly 89 deaths every 10 days). In contrast, it increased by 1,478 total deaths from 2,693 to 4,171 deaths (an average of about 211 deaths every 10 days) over the following 70 days between March 24, 2021, and June 2nd, 2021. Similarly, cumulative death totals increased by 2,044 deaths (from 4,711 to 6,755) over an 89-day period from September 2 to November 30 (an average of roughly 230 deaths every 10 days), while it increased by 707 total deaths (an average of roughly 79 deaths every 10 days) from 6,755 to 7,462 cumulative deaths, in the following 89 days (December 1, 2021 through February 28, 2022).

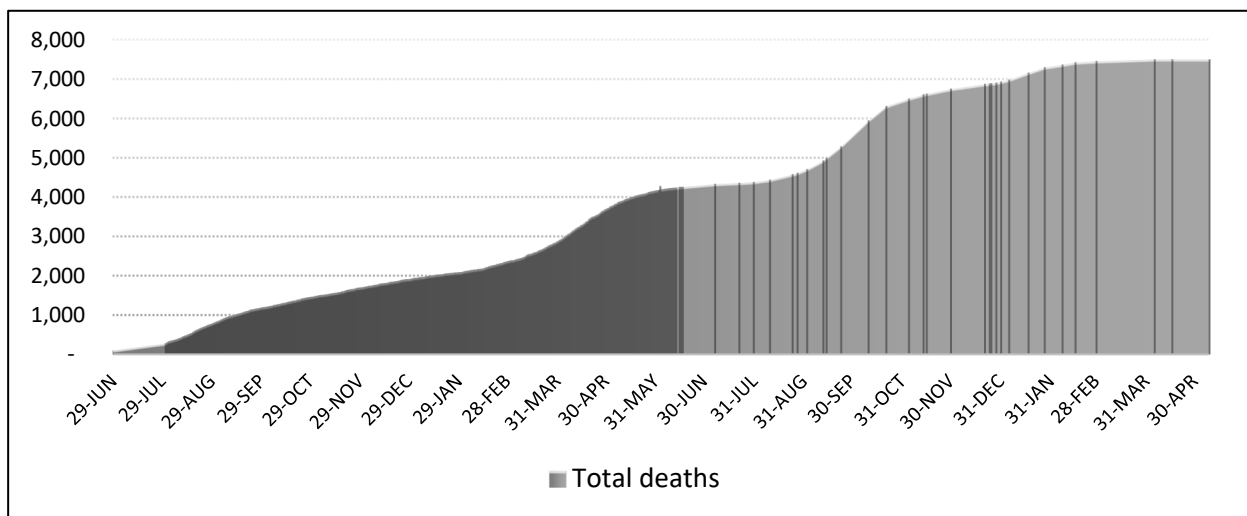


Figure 3. Ethiopia COVID-19; Cumulative Total of Daily Deaths, August 9 2020 to May 9, 2022

Data source: Ethiopia’s Ministry of Health and Public Health Institute websites

4.2 Region (*Kilil*) Level COVID-19 Levels and Trends

Looking at the regional distribution, the capital city Addis Ababa, had roughly two-thirds of the COVID-19 totals at each of the five reporting dates (Table 1). One might then ask why a city with a population size that is less than one-twentieth of the country's total have two-thirds of COVID cases. Direct response has been provided in the introductory sections by placing at the core, domestic sociopolitical, economic, and environmental challenges that the government of Ethiopia had to respond to, and international pressures related to the war with TPLF. It appears that these pressures had forced the government and its health institutions to adopt convenient sampling strategies and take advantage of the proximity and ease of access Addis Ababa provided. Being the capital, it is much more convenient and far safer to accomplish testing and to record and publicize consequent deaths, than anywhere else in the county. Another Table 1 entry worthy of note is the apparent stagnation in Tigray Region's COVID-19 numbers which had hardly moved over the 272 days between July 19, 2021, and April 17, 2022, settling at just over 8,000 COVID-19 cases. It is difficult to explain this stagnation in contexts other than the disruptions in COVID-19 testing and reporting in Tigray Region following TPLF's nightly attack on the country's national army on November 4, 2020, and the subsequent expansion of the conflict into the Amhara Region (*Kilil*) and Afar Region (*Kilil*). Border war also erupted between TPLF and the defense forces of the neighboring country of Eritrea. The conflict is continuing as of the writing of this paper.

Table 1. Regional Population Sizes, and COVID-19 Cases for Five Reporting Dates

	Population	Cases	Cases	Cases	Cases	Cases
Region (<i>Kilil</i>)	Jan. 1/2022	Jul. 27/2020	Dec. 13/2020	Jul. 19/2021	Dec. 26/2021	Apr 17,2022
Addis Ababa	4,764,322	10,583	63,667	180,704	273,446	314,783
Afar	2,382,162	256	1,830	2,720	2,993	3,241
Amhara	30,848,988	484	6,486	11,977	14,458	15,396
Beneshangul G.	1,071,972	149	2,525	3,579	3,992	5,344
Dire Dawa	595,540	459	2,889	5,306	8,123	9,858
Gambela	476,431	531	1,001	1,528	1,710	1,926
Hareri	238,216	94	2,770	4,334	5,462	6,591
Oromia	41,568,713	923	19,541	39,369	49,552	64,009
Sidama	4,532,169	182	3,545	8,364	11,259	12,908
SNNPR	15,097,110	83	4,181	9,137	16,498	23,640
Somali	7,146,483	651	1,672	2,542	3,032	3,633
Southwest	3,596,792					697
Tigray	7,027,376	713	6,662	8,136	8,171	8,171
Total	119,346,274	15,108	116,769	277,696	398,696	470,197

Data source: Ethiopia's Ministry of Health and Public Health Institute websites. *Regional population numbers are estimated using the national total obtained from a population website (Worldometer, 2022)

**The single entry for Southwest has to do with its status as the newest region in the country

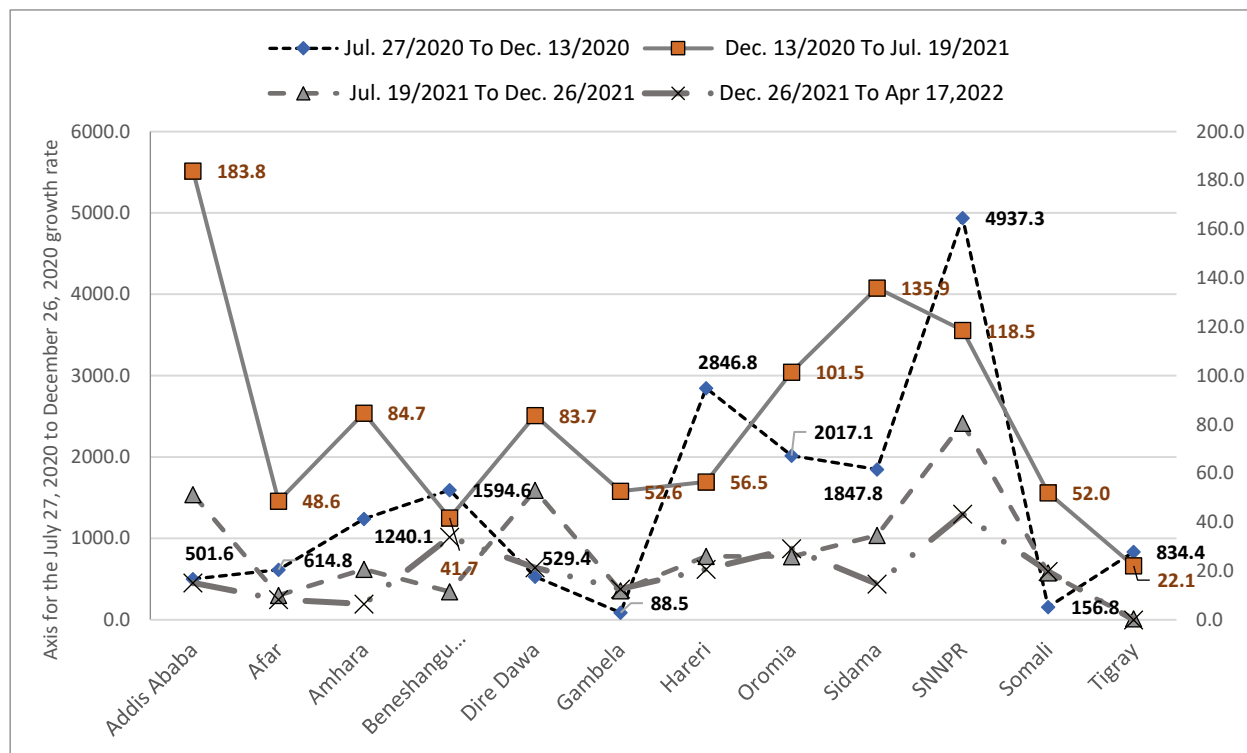


Figure 4. Regional (Kilil) Rate of Increase (percent) in COVID-19 Cases for Four Reporting Periods Starting July 27, 2020*

Data source: Ethiopia’s Ministry of Health and Public Health Institute websites

Figure 4 shows regional COVID trends for four reporting periods based on the five reporting dates shown in Table 1. The reporting periods are: (1) a 139-days period starting July 27, 2020, (2) a 218-days period starting December 13, 2020, (3) a 160-days period starting July 19, and (4) a 112-day reporting period starting December 26, 2021. A separate scale (left axis) was used for the first reporting period (dashed line with blue diamond vertices) due to the high growth in COVID-19 numbers in all regions. Nationwide, COVID-19 totals grew from a low starting baseline of just over 15,000 cases at the start of the reporting period, to 116,769 cases - a nearly eight-fold increase (773 percent) - by the end of the period. Note the 50-fold increase for the Southern Nations and Nationalities Region (Kilil) (SNNPR) whose COVID totals shot up from just 83 to 4,191. Addis Ababa’s growth rate was the highest in period 2. Tigray Region (Kilil) registered growth only in periods 1 and 2. Trends cannot be shown for the Southwest Region because it is a brand-new region, having come into existence in November 2021 (Fana Broadcasting, 2021). Its lone data entry in Table 1 is for April 17, 2022.

4.3 Region (Kilil) Level COVID19 Case Fatality Ratios (CFR)

Table 2 displays regional deaths totals with Addis Ababa accounting for about two-thirds of total COVID-19 deaths as it does of total cases. The COVID-19 case fatality ratios are calculated by dividing the number of deaths in a region by the number of cases in that region and then multiplying by 100. The numbers are, therefore, percentages. Given the very small percentages for some regions, using a constant other than 100 - for example 1000 - would produce rates that are easier to understand. For instance, afar (1.5 deaths per 1000 cases), Amhara (roughly 32 deaths per 1000 cases), etc.

The correlates of the regional variations in the case fatality ratios shown in Table 2 are not known. This is due to the absence of geographically disaggregated data on the demographic characteristics and socioeconomic backgrounds of the deceased. The lack of a robust vital statistics system (registration of births, deaths, and marriages) is also to blame. A paper-based system of registration of vital events was launched in most parts of the country just half a decade ago in 2016 (Ethiopia, Snapshot of Civil Registration and Vital Statistics Systems, 2022). It has yet to achieve the level of completeness needed to obtain an accurate count of deaths disaggregated by the demographic and socioeconomic backgrounds of the deceased. This means that we will not know for sure to what extent the results of COVID-19 mortality covariates in existing international studies apply to Ethiopia.

These studies have shown old age as being associated with high COVID-19 death ratios (2.61; 95% CI; 1.75–3.47) as was the male sex (1.45; 95% CI; 1.41, 1.51) and a current smoker status (1.42; 95% CI; 1.01–1.83) (Dessie, Z.G., Zewotir, T., 2021). They have also shown that, among hospitalized patients, the risk of COVID-19 mortality was highly influenced by obesity, chronic obstructive pulmonary disease (COPD), hypertension, cardiovascular disease (CVD), diabetes, cancer, acute renal (kidney) failure, and other diseases (Dessie, Z.G., Zewotir, T., 2021). Although we can expect these findings to also apply to Ethiopia, we will not know the exact magnitude of the effects as measured by risk ratio methods.

Table 2. Regional Deaths, Cases per 1000 Population, and Cases Fatality Ratio (CFR) (Percent)

Region (<i>Kilil</i>)	Total deaths as of February 2 2022	Cases per 1000 and 95% Confidence Level (CL) as of March 27 2022	Case Fatality Ratio (CFR) and 95% Confidence Level (CL) as of February 2, 2022
Addis Ababa	4,078	66.1, 65.8 - 70.8	1.30%, 1.26% - 1.51%
Afar	5	1.4, 1.3 - 5.8	0.15%, 0.02% - 0.32%
Amhara	488	0.5, 0.5 - 2.5	3.17%, 2.89% - 4.66%
Beneshangul G.	33	5.0, 5.0 - 16.1	0.62%, 0.41% - 1.64%
Dire Dawa	144	16.6, 16.2 - 28.1	1.46%, 1.22% - 2.47%
Gambela	8	4.0, 3.9 - 9.3	0.42%, 0.13% - 0.72%
Hareri	197	27.7, 27.0 - 60.0	2.99%, 2.58% - 6.19%
Oromia	1,136	1.5, 1.5 - 4.1	1.77%, 1.67% - 2.60%
Sidama	231	2.8, 2.8 - 10.5	1.79%, 1.56% - 3.59%
SNNPR	289	1.6, 1.5 - 4.1	1.22%, 1.08 - 3.45%
Somali	115	0.5, 0.5 - 2.2	3.17%, 2.60 - 4.39%
Tigray	59	1.2, 1.1 - 3.6	0.72%, 0.54 - 1.26%
Total	6,798	3.9, 3.9 - 4.9	1.45%, 1.41 - 1.63%

Data source: Ethiopia's Ministry of Health and Public Health Institute websites

$$CI = \hat{p} \pm Z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

The above formula is used to calculate the 95% confidence level; *Z = 1.96

As most of Ethiopia's regions have a case fatality ratio of at least 1.00, it is worth venturing a guess that, for locations where the case fatality ratio is below 1.00, underreporting of COVID-19 deaths may have prevailed during the study period of July 27, 2020, to May 9th, 2022. If true, the underreporting would include (1) COVID-19 deaths that were not reported at all, and (2) those that were misclassified as having resulted from a cause other than COVID-19. Indeed, the average case fatality ratio for Ethiopia (1.45%, 95% CI: 1.41%, 1.63%) is much lower than South Africa's (2.6%) and significantly lower than the highest rate in the world, which was reported for Mexico (5.6%). At 1.2%, the only country with million-plus cumulative deaths – the United States - (Johns Hopkins University and Medicine, 2022) had a lower-case fatality ratio than Ethiopia.

5. Discussion

It appears that the Ethiopian government's plans and actions to fight COVID-19 were buffeted by a literal firefight on several battlefronts to repel what it viewed as an existential threat, which was TPLF's unimpeded march, at least in its early stages, toward the capital Addis Ababa to topple it. It was also impacted by the government's need to reallocate resources in order to fend off attacks by regional proxy actors allied with TPLF and its international backers. In a spectacular sign of the government's COVID-19 fighting priorities going awry, the country's prime ministers who would have personally overseen the efforts, ended up joining the military firefight on the frontlines (Declan Walsh, 2021; ABC News, 2021). Moreover, in what the government of Ethiopia deemed a clear sign of collusion, the United States and European Union countries called thirteen United Nations Security Council meetings (Security Council Report, 2022) to discuss the war in Tigray. They also urged their embassy personnel and nationals of Ethiopian ancestry to leave the capital city Addis Ababa

immediately (US Embassy in Ethiopia, 2022; ABC News, 2021, EURACTIV, 2021).

In a possible sign of the impacts of the internal and external pressures discussed in the introductory sections of this paper, the three regions that saw the most intense military combat – Tigray, Afar, and Amhara – and two additional regions that had a fair degree of armed insurgencies – Beneshangul Gumuz and Gambela – all had some of the lowest COVID-19 growth rates over the chosen reporting periods (Figure 4). Overall, the half a million or so total cases in Ethiopia translate into approximately 4,000 COVID-19 infections per million. The relatively low infection rate and the 7,500 or so deaths by early May 2022 suggest that limited testing took place outside of the capital Addis Ababa on account of the government's need to respond to foreign and domestic political and military pressures by diverting resources. It can, therefore, be surmised that this is a major factor underlying Ethiopian's COVID-19 case and death data, making it more difficult to compare to other countries. On the other hand, the data for Addis Abba would allow comparisons to other cities, most notably the capital cities in developing countries.

Comparisons with South Africa where robust testing regimes revealed nearly four million infections leading to over 100,000 deaths (Ney York Times, 2022, Republic of South Africa, Department of Health, 2022), show the potential degrees of underreporting in Ethiopia. Moreover, Ethiopia's cumulative rate of 4,000 cases per million is low by the standards of the severely hit African countries such as Botswana (127,903 per million), Libya (72,135 per million), Namibia (63,714 per million), etc. (Our World in Data, 2022). Hypothetical scenarios whereby Ethiopia's COVID-19 case counts are theoretically inflated by doubling, tripling, or quadrupling the 4,000 COVID-19 infections per million to get closer to what might be the true figure for the country (8,000 infections per million, 16,000 infections per million, etc.), would still present a rosier picture than what was reported for the African nations mentioned above, not to mention the 475,000+ cumulative cases per million in the Netherlands, 471,000+ in Austria, 436,000+ in France, 434,000+ in Portugal, 419,000+ in Switzerland, 329,000+ in Greece, 327,000+ in the UK, 310,000+ in Germany, 250,000+ in the U.S., etc. (Our World in Data, 2022). The U.S., example, although lower than the rate for the European countries mentioned above, is still very important due to the country's large population size - over 330 million (U.S. and World Population Clock, 2022). Globally, there were 522 million cases and 6.23 million deaths at the last check of the World Health Organization's dashboard on May 20, 2022 (World Health Organization, 2022).

The study has revealed that, in the case of Ethiopia, the lack of data disaggregation, the delay in reporting, and inconsistencies in the contents and formats of online reports published by its health institutions is a problem. In a clear sign of misplaced priorities, the online reports focused on a continental and global scales rather than a breakdown of Ethiopia's COVID-19 numbers by small geographic units and by demographic and socioeconomic attributes. This is also a serious problem. Additionally, the absence of raw downloadable data has made the country's institutions' online reports inadequate as raw materials for sound scientific research. Allowing for the possibility, that government officials who needed to know had access to disaggregated data files that the public cannot see, the reports from Ethiopia's Ministry of Health and its Public Health Institutions may have proved irrelevant for local policy implementations directed at fighting the disease through targeted testing and deployment of other intervention measures. The Ethiopian demography and health website remains the only source of downloadable COVID-19 data (Excel format) going back to July of 2020. However, even these data are aggregated at national and regional levels.

6. Conclusion

It appears that as researchers begin to look into Ethiopia's experiences with COVID-19, particularly its data collection efforts, they will come to a quick realization of a) the country's unpreparedness, b) lack of data-driven response mechanisms, and c) misplaced reporting priorities by the country's premier health institutions including the Ministry of Health and its Public Health Institute. Particularly frustrating would be the absence of authoritative disaggregated data at levels below major administrative divisions, with consistency in content and periodicity. These data would ideally include the demographic characteristics and socioeconomic backgrounds of both the infected and the deceased. To the extent that person-level data existed at all, or were reported at some time from March 2020 when the disease arrived in the capital Addis Ababa until the writing of this paper at the end of May 2022, it was sporadic at best and was discontinued without warning after a few days or weeks. Moreover, if disaggregated and stratified data have been collected and made available to policymakers in the government so that targeted interventions could be implemented at regional and national levels, no literature was shared with the general public or researchers confirming it. If, on the other hand, no such proactive practices of data-to-policy-pipelines existed, and if all of the national and regional activities geared toward combatting the diseases remained unassisted by pertinent and timely information transmission, the institutions that were tasked with such undertakings by foundational decree would have to be held to account so that corrective measures

could be in place before the next epidemic hits.

One of the main lessons from this study for future efforts to combat an epidemic or a global pandemic in Ethiopia is the need to put in place a system of data gathering that seeks to canvas all reaches of the country, near and far. This is best done with predetermined sampling ratios or at the same sampling ratio as the capital city, Addis Ababa. The second lesson is the need for data disaggregation and reporting at the individual level without disclosing the identity of the person. This can be achieved by removing names and personally-identifying information, and by limiting locational information to the *Wereda* level, not the *Kebele* level (*Kebele* is the smallest geographic unit in Ethiopia). Also, disaggregation at sub-city or *Wereda* levels is absolutely necessary for Addis Ababa and other major cities.

Finally, even though density and crowding appear to be a factor in Addis Ababa, it is far from certain what the role of other covariates, including the traditional determinants of health - demographic characteristics, income, educational attainment of individuals, etc. - have been over the last two years and two months. Moreover, the degree to which COVID-19 testing was suppressed by the internal and international pressures discussed in this paper, and, therefore, the level of underreporting of COVID-19 cases and deaths in Ethiopia, will remain largely unknown, even though two-thirds of cases being from the capital Addis Ababa where only four percent of the country's population lived, points to the impacts being substantial.

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