

# The First Hundred Days of Novel Corona-virus Disease 2019 in Ethiopia, 13 March to 21 June 2020: Retrospective Analysis

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# Abstract

## Background

The Novel Coronavirus Disease 2019 (COVID-19) pandemic was originated from Wuhan city, China and spread to almost all countries and territories in the world. Ethiopia reported its first COVID-19 confirmed case on 13 March, 2020. This study aims to show the epidemiological characteristics of the pandemic in Ethiopia in the first hundred days, which would help to guide the ongoing national response efforts to control and prevent the spread of the disease through generating scientific evidence.

## Method

We conducted secondary data analysis of COVID-19 data extracted from a national database at Ethiopian Public Health Institute from 13 March to 21 June, 2020. We anonymized personal information for privacy protection. Data was cleaned and descriptive analyses was employed. We used Arc GIS to illustrate the geographical distribution of COVID-19 cases.

## Results

Of the 216,328 examined individuals, 4,534 (2.1%) tested positive for COVID-19 of which 74(CFR: 1.6%) have died. People aged between 20–49 years attributed for 76.3% of the total cases. Majority, 2,851 (62.9%) of the cases were male, 3,222 (71.3%) reported from Addis Ababa, 982 (21.7%) of the cases were imported, 413(9.1%) had contact with confirmed cases, 3,139 (69.2%) had no travel history nor contact with confirmed case, and 4,180 (92.2%) of the cases reported were asymptomatic. Health Care Workers contributed for 3.7% of the total cases reported.

## Conclusion

The magnitude and distribution of COVID-19 cases and deaths and Health Care Workers infection has increased throughout the country over-time. Due emphasis needs to be given by the government, all stakeholders, and partners to scale-up and expand laboratory diagnosis capacities, strengthen surveillance and contact tracing, implement proper Infection Prevention and Control measures, improve case management services and the community should strictly follow social distancing measures. There should be an appropriate health care workers risk factors assessment and intervention to adequately protect the health care workers exposure and infection. Further study shall be conducted to describe the knowledge gaps on the asymptomatic transmission of the virus.

## Background

Coronavirus is a single-stranded, positive-sense RNA, belongs to the family Coronaviridae and the order Nidovirales and consists of four genera namely Alpha-coronavirus, Beta-coronavirus, Gamma-coronavirus and Deltacoronavirus. Among these, Alpha-coronavirus and Beta-coronavirus infect only mammals and are responsible for respiratory infection in humans and enteritis in animals (1). Coronaviruses infect

many species of animals, including humans (2). They can infect respiratory, gastrointestinal, hepatic, and central nervous system of human, livestock, birds, bat, mouse, and many other wild animals (3).

Coronavirus was first identified as a cause of the common cold in 1960s (4). In humans, coronavirus infection results in respiratory tract complications with varying degree of severity and has been associated with gastroenteritis. Seven different coronavirus infections including the recently isolated novel coronavirus are known to cause infection in humans. These include: HCoV-OC43 (5), HCoV-229E in mid 1960s (6), HCoV-NL63 in 2003 (7), SARS-Cov in 2003 (8), HCoV- HKU1 (9), MERS-COV in 2012 (10), and SARS-CoV-2 in 2019 (11).

Four human coronaviruses namely HCoV-229E, HCoV-OC43, HCoV-NL63 and HCoV-HKU1 are endemic in the human population and are mainly associated with mild, self-limiting respiratory illnesses and continuously circulating in human for at least decades or centuries (12–14) while SARS-CoV, MERS-CoV and the newly-identified SARS-CoV-2 are highly pathogenic, causing severe lower respiratory tract infection in relatively more patients with a higher chance to develop acute respiratory distress syndrome (ARDS) and extrapulmonary manifestations (15).

Like SARS-CoV and MERS-CoV, the SARS-CoV-2 belongs to the genus Beta-coronavirus and suggested to be originated from bats (11, 16, 17). The SARS-Cov-2 is a disease that can transmit from animal to animal, animal to human, and human to human (18). The SARS-Cov-2 transmission may occur from both symptomatic and asymptomatic patients, with secondary infection rates ranging 0.5-5% (19–21). They cause more severe disease in neonates, the elderly, and in individuals with underlying illnesses (22).

A novel coronavirus caused by SARS-CoV-2 was first identified and recognized in Wuhan town of China on 7 January 2020 (23). On Feb 11, 2020, the World Health Organization officially named the disease as Coronavirus Disease 2019 (COVID-19) (24).

As of June 21, 2020, based on the World Health Organization (WHO) report, about 8,732,984 cases including 468,761 deaths (CFR = 5.37%) were reported from 216 countries/territories globally. The United States of America (USA) reported the highest number of cases (2,208,829) and deaths (119,923) with CFR of 5.43% followed by Brazil (1,032,913 cases and 48,954 deaths with a CFR of 4.74%). Among the confirmed cases the highest proportion of death occurred in the United Kingdom with CFR of 14.02% (25).

The First case of COVID-19 in Africa was reported from Egypt on 4 February 2020. As of June 2020 (26), in Africa, 56 countries/territories have reported COVID-19 cases (26). As of June 21, a total of 298,832 cases and 7,917 deaths were reported across the continent (CFR = 2.65%). The highest number of cases were reported from South Africa, 92,681 (31.01%) cases followed by Egypt, 53,758 (17.99%) cases, and Nigeria, 19,808 (6.63%) (25).

Ethiopia activated its Incident Management System (IMS) at the national Public Health Emergency Operation Center (PHEOC) on 27 January, 2020 for Novel Corona Virus (2019-nCov) preparedness and

response coordination. The first COVID-19 case in Ethiopia was detected and reported on 13 March, 2020 (27).

Since the detection of the first case on 13 March 2020 in Addis Ababa, a foreign citizen with known travel history from COVID-19 affected area, the magnitude and distribution of COVID-19 cases and deaths in Ethiopia has been increasing across the country (28).

This study describes epidemiological characteristics of COVID-19 in Ethiopia during the first hundred-days of the pandemic. It aimed to generate scientific evidence to guide government and other responding agencies to implement appropriate interventions to control the spreading of the disease and to minimize social and economic impact associated to COVID-19.

## Methods

Secondary COVID-19 data obtained from the national data base at Ethiopian Public Health Institute was used. We considered the COVID-19 data reported from 13 March to 21 June, 2020 in Ethiopia. Socio-demographic, clinical, and laboratory information including age, sex, occupation, residency, date of illness onset, symptoms, date of confirmed diagnosis, contact history, travel history, co-morbidities and contacts information were analysed.

A confirmed case is defined if the patient had a positive test of SARS-CoV-2 virus by the real-time reverse-transcription-polymerase-chain-reaction (RT-PCR) assay.

Death is defined as dead body for which RT-PCR test become positive for SARS-COV-2 virus from swab sample unless there is a clear alternative cause of death that cannot be related to COVID-19 (e.g. trauma).

Recovery defined as two tests done 24 hours apart to be negative, which was done on weekly basis until 21 days for asymptomatic cases from the time of diagnosis and for symptomatic cases from the time of last symptom.

Comorbidity refers to the presence of known medical conditions (e.g. Hypertension, Diabetic Mellitus, Retroviral Infection, Cancer and so forth) among the COVID-19 confirmed cases.

Contacts is a person who experienced exposures with COVID-19 confirmed cases without using proper personal protective equipment or other situations as indicated by risk assessments, during the 4 days before and the 14 days after the onset of symptoms of a confirmed case.

We computed count, percentage, median and interquartile ranges to summarize the socio-demographic and clinical variables included in the dataset. We estimated attack rates by age, sex, occupation, and place of residence of the confirmed cases. We used Arc Geographic Information System (Arc-GIS) to show distribution of COVID-19 cases by District.

As this is a secondary data collected during an on-going pandemic response, oral or written consent of the patients or Guardians was not obtained. However, a verbal consent was obtained from EPHI leadership to access the data and use it for scientific publication. No personal identifiers were used for data confidentiality and privacy purpose.

## Results

Between 13 March and 21 June, 2020, a total of 216,328 individuals were tested for COVID-19 using oropharyngeal and nasopharyngeal swab. Among these examined individuals, 4,534 were tested positive for COVID-19 with a positivity rate of 2.1%.

**Socio-demographic characteristics of cases:** The median age of the cases was 28 years with a range of 3 months to 115 years and Inter Quartile Range (IQR) of 22 - 37 years. Majority of the cases, 1,978(43.6%) were found in the age-group 20-29 years followed by 30-39 years, 1,018(22.5%) and 63% of all the cases were male (Figure 1 below).

Health Care Workers contributed for 244 (5.4%) of the total COVID-19 cases, which comprise 151 technical staff, and 93 supportive staff (see Table 1 for the specific professions).

Of the total cases, 4180 (92.2%) were asymptomatic on detection. On admission, the most common clinical manifestations for the symptomatic cases were cough 255 (72%) and fever 169 (47.7%). Other symptoms detected includes shortness of breath, sore throat, headache and generalized body weakness (Table 2).

**Table 1:** Distribution of COVID-19 infected Health Care Workers by professions, Ethiopia, March 13-June 21, 2020 (N=244)

Professions	Number	Percent
<b>Health professionals (collectively)</b>	<b>151</b>	<b>61.9%</b>
Nurses	69	45.7%
Physician	35	23.2%
Health officer	12	7.9%
Midwifery	9	6.0%
Laboratory technicians	11	7.3%
Anesthetists	7	4.6%
Pharmacists	6	4.0%
Radiographer	2	1.3%
<b>Support staffs[1]</b>	<b>93</b>	<b>38.1%</b>
<b>Total</b>	<b>244</b>	

**Table 2:** Distribution of COVID-19 confirmed cases by common symptoms, Ethiopia, 13 March -21 June, 2020

Symptoms	Number of cases (%)	Percent
Cough	255	72%
Fever	169	47.7%
Headache	109	30.8%
Generalized Body Weakness	80	22.6%
Sore throat	75	21.2%
Shortness of breath	60	16.9%

**Geographical distribution of case:** All (nine) regional states[2] and two city administration have reported confirmed cases. Majority, 171(69.8%) of the cases were reported from Addis Ababa city administration followed by Somali, 387 (8.6%) and Amhara, 278 (6.1%) regional states (see Table 3).

Looking at the distribution of cases outside of Addis Ababa City Administration, cases were more concentrated along border areas where there are international ground-crossing entry points (Aisha, Humera, Metema) that connects Ethiopia with Djibouti and Sudan (Map 1).

**Table 3:** Distribution of COVID-19 confirmed cases by region states and city administration, Ethiopia, 13 March – 21 June, 2020 (N=4534)

Regions	Total cases (%)	Total deaths (%)
Addis Ababa	3,222 (71.1%)	63 (85.1%)
Somali	388 (8.6%)	0
Amhara	278 (6.1%)	2 (2.7%)
Oromia	254 (5.6%)	6 (8.1%)
Tigray	182 (4.0%)	1 (1.35%)
Afar	65 (1.4%)	0
SNNPR	51 (1.1%)	0
Dire Dawa	46 (1.0%)	1 (1.35%)
Harari	32 (0.7%)	1 (1.35%)
Gambella	10 (0.2%)	0
Benishangul Gumuz	6 (0.1%)	0
<b>Total</b>	<b>4534</b>	<b>74</b>

**Possible sources of infection:** Of the total cases, 982 (21.7%) had travel history to COVID-19 affected areas, 413 (9.1%) had contact with confirmed COVID-19 cases, and source of infection for 3,139 (69.2%) cases could not be identified. Among the cases, 1,254 (27.7%) were reported from quarantine centers (Figure 2).

**Death:** Ethiopia reported its first COVID-19 related death on April 05, 2020, which is after 24 days of detection of the first COVID-19 confirmed case in the country. From 13 March to 21 June 2020, a total of 74 deaths were recorded with a CFR of 1.6%. Of the total deaths 63 (85.1%) were reported by Addis Ababa City Administration followed by Oromia Regional State 6 (8.1%). Of the total deaths, 24(32.4%) were people aged 60 years and above, 38(58.5%) were male, and nine (12.2%) had comorbid medical conditions. About 87.8% of the deceased people were cases from an Intensive Care Unit in the treatment centers admitted for about three days on average, while nine deaths were detected after post mortem examination.

**Recovery:** Of the total COVID-19 confirmed cases in Ethiopia, 1,213 (26.8%) have recovered as of 21 June, 2020. The average duration between diagnosis and recovery was 17.4 days (4 to 49 days). Average duration between diagnosis and recovery for age-group 60 and above is 19.5 days, age-group less than 5 years 19 days, symptomatic cases 20 days, asymptomatic cases 16.4 days, and no difference by sex, which was 17 days.

**Comorbidity:** the study revealed that of the total cases reported, 179 (3.9%) had comorbidity and other medical condition that include Hypertension (30.7%), Diabetic Mellitus (28.5%), Other type of cardiovascular diseases (12.3%), Chronic respiratory diseases such as Bronchial Asthma (10.1%), Retroviral Infection (6.7%) and Cancer of any type (5%).

**Contacts:** A total of 31,753 contacts of confirmed cases have been identified. Of the contacts identified, 18,352 (57.8%), 13,401 (42.2%), 18,378 (57.88%), 8,147 (25.7%) were close contacts, casual contacts, male, and Health Care Workers respectively. On average, seven contacts were identified per confirmed case. Among contacts of confirmed cases, 708 (2.23%) tested positive of which 550 (77.7%) among close contacts and 484 (68.4%) were asymptomatic.

**Cases and deaths description by time:** Of the total cases and deaths recorded in 100 days (from 13 March to 21 June, 2020), 85% and 86% were reported in the fourth quarter respectively. Dividing a hundred days in to quarters (which is 25 days), 44 cases detected during the first 25 days, 133 cases at day 50 (showing a 67% increment in cases), 700 cases at days 75 (showing a 94% and 81% increase in cases compared with day 25th and 50th respectively) and 4,534 at day 100, which shows a 99%, 97% and 84% increase in cases compared with the days 25th, 50th and 75th respectively.

## Discussion

This analysis of COVID-19 data provides insight into the epidemiological characteristics and control of the pandemic in Ethiopia.

As of 21 June 2020, Ethiopia contributed 4,534 (1.52%) COVID-19 cases and 74 (0.93%) deaths in Africa. South Africa was reported the highest 92,681 (31.01%) cases followed by Egypt, 53,758 (17.99%), and Nigeria, 19,808 (6.63%) during the same period (25). Compared to other African countries, the number of COVID-19 cases reported in Ethiopia were less. Case load of COVID-19 is dependent on the testing capability of countries, the more tests a country performed, the more cases are diagnosed. Ethiopia conducted the second highest (216,328) number of SARS-COV2 testing in Africa next to South Africa (1,328,060) (29). However, the number of tests per million population was 1,881, which is much lower compared to South Africa, which tested 22,372 people per one million population. The lower positive yield among tested individuals in Ethiopia indicates, the infection is having a slow progression and is unlikely to have community transmission in the Regional States other than Addis Ababa city administration, the capital in the first hundred days. Cases were more concentrated along border areas where there are international ground-crossing entry points (Aisha, Humera, Metema) that connects Ethiopia with Djibouti and Sudan.

The fact that the highest number of cases were registered among age group 20–39 years might be a reflection of the population demography of Ethiopia, in which majority of the population falls within this age category and young adults are relatively more mobile and represent active population group with increased risk of exposure for SARS-COV-2 infection.

Most of the cases were reported from the capital city, Addis Ababa which might be attributed to better testing capacity compared to the other Regional States in the country. The fact that Addis Ababa city is a political and diplomacy hub of Africa coupled with the presence of the Ethiopian Airlines, the biggest passenger and cargo carrier in Africa, might also favor for the pandemic to expand as there is high community mobility to and across the city. Moreover, a study reported evidence of community and cluster transmission in Addis Ababa as of the second week of May, 2020 as substantiated by the findings from the current study (30).

Findings of our study shows that source of exposure could not be identified for more than 69% of the cases which is an evidence for the existence of SARS-CoV-2 virus transmission in the community, calling the Ministry of Health to strengthen community surveillance and testing. During the study period, number of cases were exponentially increasing every month. During the early phase a majority of COVID-19 cases in Ethiopia were either imported by foreign travels or have linkage with confirmed cases and localized transmission (30).

According to the data in the first hundred days, SARS-CoV-2 virus infection prevalence among Health Care Workers in Ethiopia is significantly increasing over the course of the pandemic. Though, further study is needed to identify the source of exposure for Health Care Workers, shortage of appropriate infection prevention and control supplies and infrastructure, negligence of HCWs, crowding of treatment centers, and un proper utilization of Personal Protective Equipment might have contributed for HCWs infection by SARS-COV-2 virus.

By the time Ethiopia reported its first COVID-19 related death, the number of deaths worldwide and in Africa were about 65,000 and 334 respectively. The death rate increases as the age increases and all people who died following hospital admission required intensive care with an average stay in the ICU about 3 days before their death. This suggest that the cause of the death might be respiratory distress. Unlike many other studies where more than 80% of deaths were among people aged 60 years and above, in Ethiopia, only 32.4% of the COVID-19 related deaths were among people in this age group. This is partly related to the proportion of cases in the age groups. Number of days for recovery from COVID-19 was longer in children less than 5 years old and people above 60 years old. This may be attributed to the difference in natural immunity with age. The average duration between diagnosis and recovery was 17.4 days, which is lower by few days compared to a study conducted in Shenzhen, China where the median time to recovery was 20.8 days (31).

Up on diagnosis, 92.2% of cases were asymptomatic, suggesting that some asymptomatic cases could be overlooked and more testing is needed to detect. A study suggests that COVID-19 could be transmitted asymptotically but more study is needed to confirm (32). This finding is by far higher compared to a retrospective cohort study conducted in Shenzhen, China where 25 (6%) of 391 cases had no signs or symptoms (31).

The attack rate among the contacts of confirmed cases was 2.23% which is lower compared to a study conducted in Shenzhen, China where the attack rate among close contact was 11.2% (31).

This work has numerous limitations. There was lack of information on the number of tests conducted by the Regional States except Addis Ababa City Administration which presents a challenge to calculate positivity rate and testing capacity in the Regional States. Moreover, we couldn't analyze the cases by personal characteristics like occupation for non-Health Care Workers. The number of days it takes to become symptomatic was not well recorded, which makes difficult to calculate incubation period for contacts

## Conclusion

The trend of the pandemic is significantly increasing in number and geographical coverage throughout the country and there is a community transmission in most of the areas reporting the cases. Appropriate intervention is needed to protect Health Care Workers infection, shield the vulnerable groups elderly and with comorbid conditions, halt the community transmission and control the spread of the SARS-CoV-2 virus. National laboratory capacity for SARS-CoV-2 virus testing should be scaled-up and expanded to detect more cases in the country.

A comprehensive strategy, case identification, isolation, contact tracing, testing and care shall be enhanced to reduce transmission and control the pandemic. Cross-border surveillance and border controlling shall be maintained at the point of entries to stop spread of cases across the international boundaries connecting with the neighbouring countries.

Gaps in our knowledge of the asymptomatic transmission need fulfilment by future studies.

## Abbreviations

Novel Coronavirus Disease 2019 (COVID-19), Case Fatality Rate (CFR), Severe acute respiratory syndrome coronavirus 2 (SARS-COV-2), Reverse transcription polymerase chain reaction (RT-PCR), Health Care Workers (HCWs), World Health Organization (WHO), Epidemic Week (Epi-Week), Public Health Emergency Management (PHEM).

## Declarations

**Ethical approval and consent to participate:** This work is a retrospective surveillance data analysis that is part of routine disease monitoring and outbreak response operations. The data we presented here was collected through the routine surveillance system. Biological specimen and demographic information were collected based on national PHEM technical guideline for surveillance purpose. Laboratory analysis had been conducted aiming to detect and confirm COVID-19 cases as part of the routine activity.

Permission obtained from the National Public Health Institute of Ethiopia the secondary data. Name and any other information that discloses personal information of the patient was excluded from this report. Hence, an ethical review was not be sought for this work. Consent to participate in the study was not applicable to this study.

**Availability of data:** The datasets that have used to prepare this report are available at the Ethiopian Public Health Institute and can be obtained from corresponding author.

**Competing interest:** All authors declared no competing interests.

**Funding:** We used secondary surveillance data collected through routine surveillance and did not receive funding.

**Consent for publication:** Not Applicable.

**Authors' contribution:** SH conceived the study, SH, MA and NY cleaned data, SH, ZA and NY were involved in data analysis, SH, HT, FL, AH and DS drafted the manuscript, SH, HT, ZA and FL write the final manuscript. All authors reviewed and approved the final manuscript for submission.

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## Figures

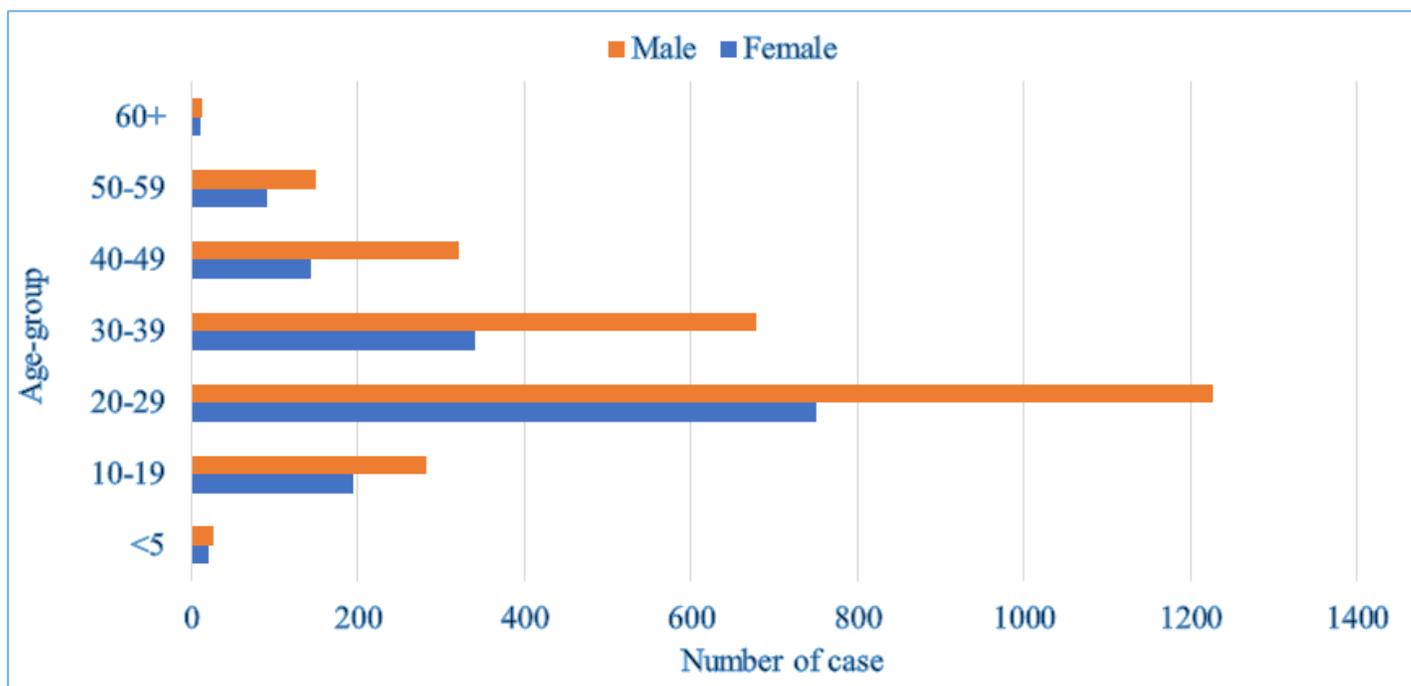


Figure 1

Distribution of confirmed COVID-19 cases by age and sex, Ethiopia, between 13 March, 2020 to June 21, 2020

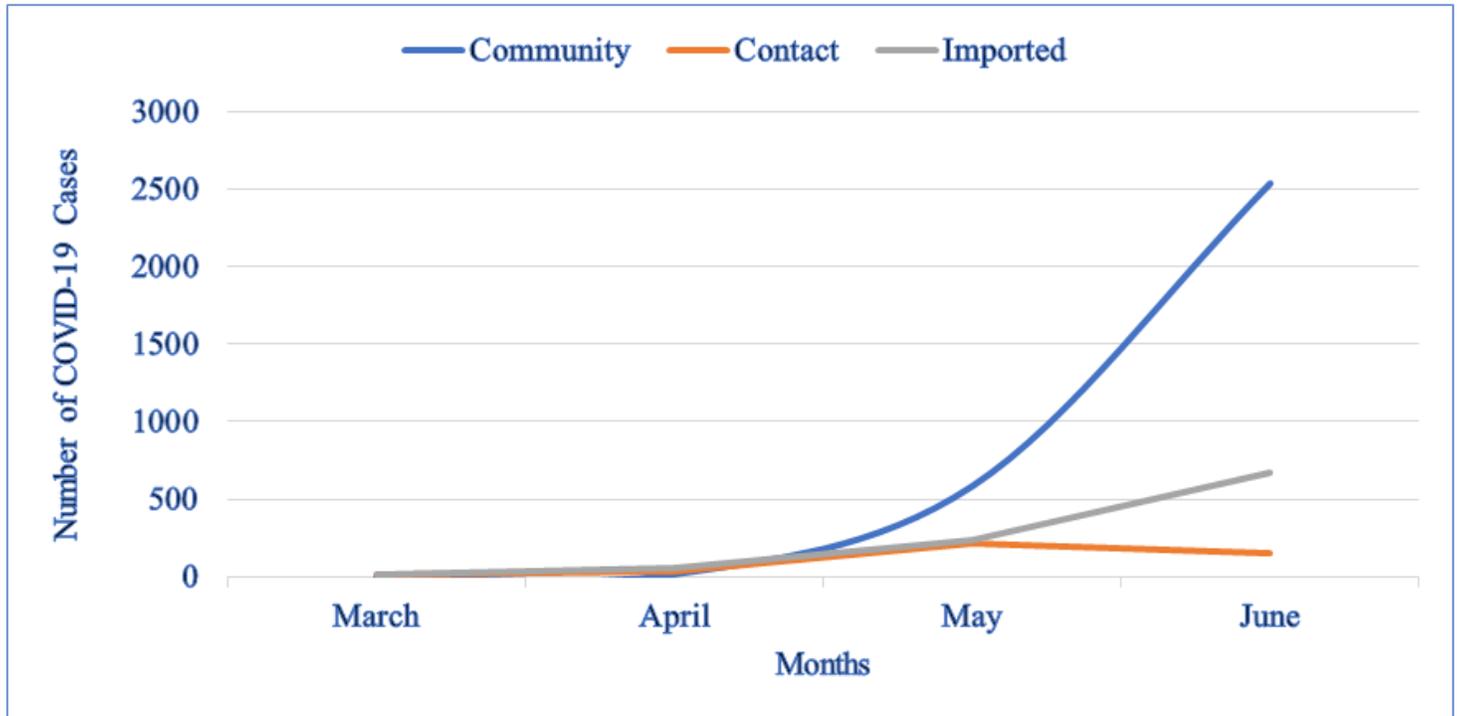


Figure 2

The progress of COVID-19 confirmed cases by sources of infection COVID-19 in Ethiopia, between 13 March to 21 June, 2020

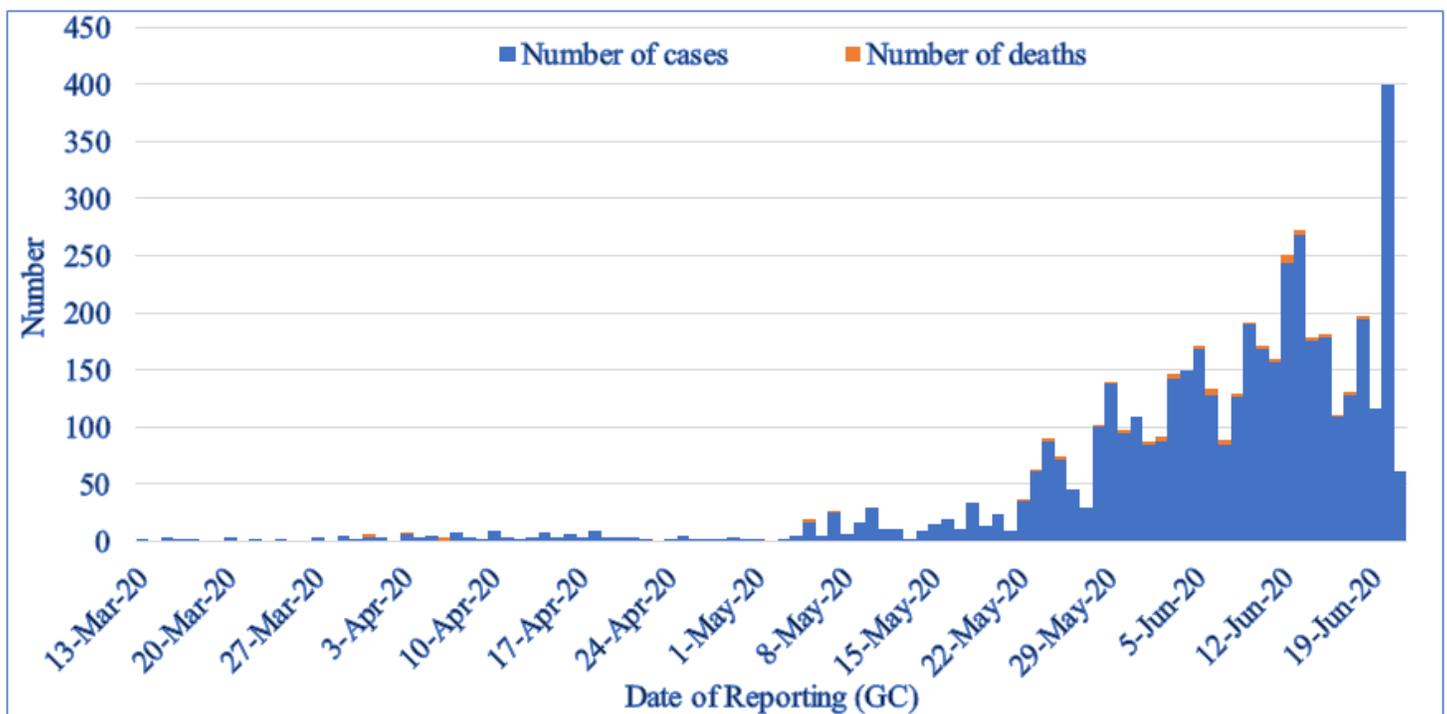


Figure 3

Epidemiological curve of COVID-19 confirmed cases, Ethiopia, 13 March -21 June, 2020

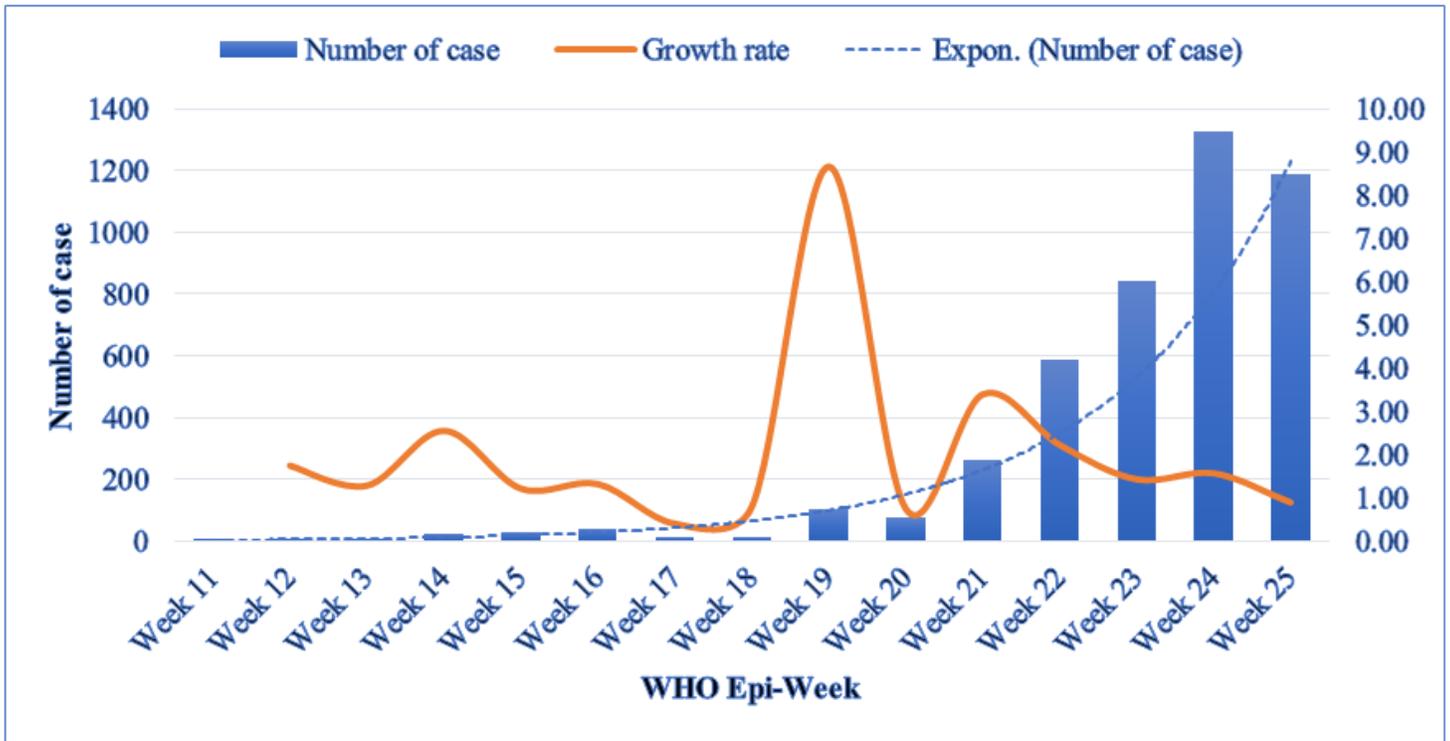
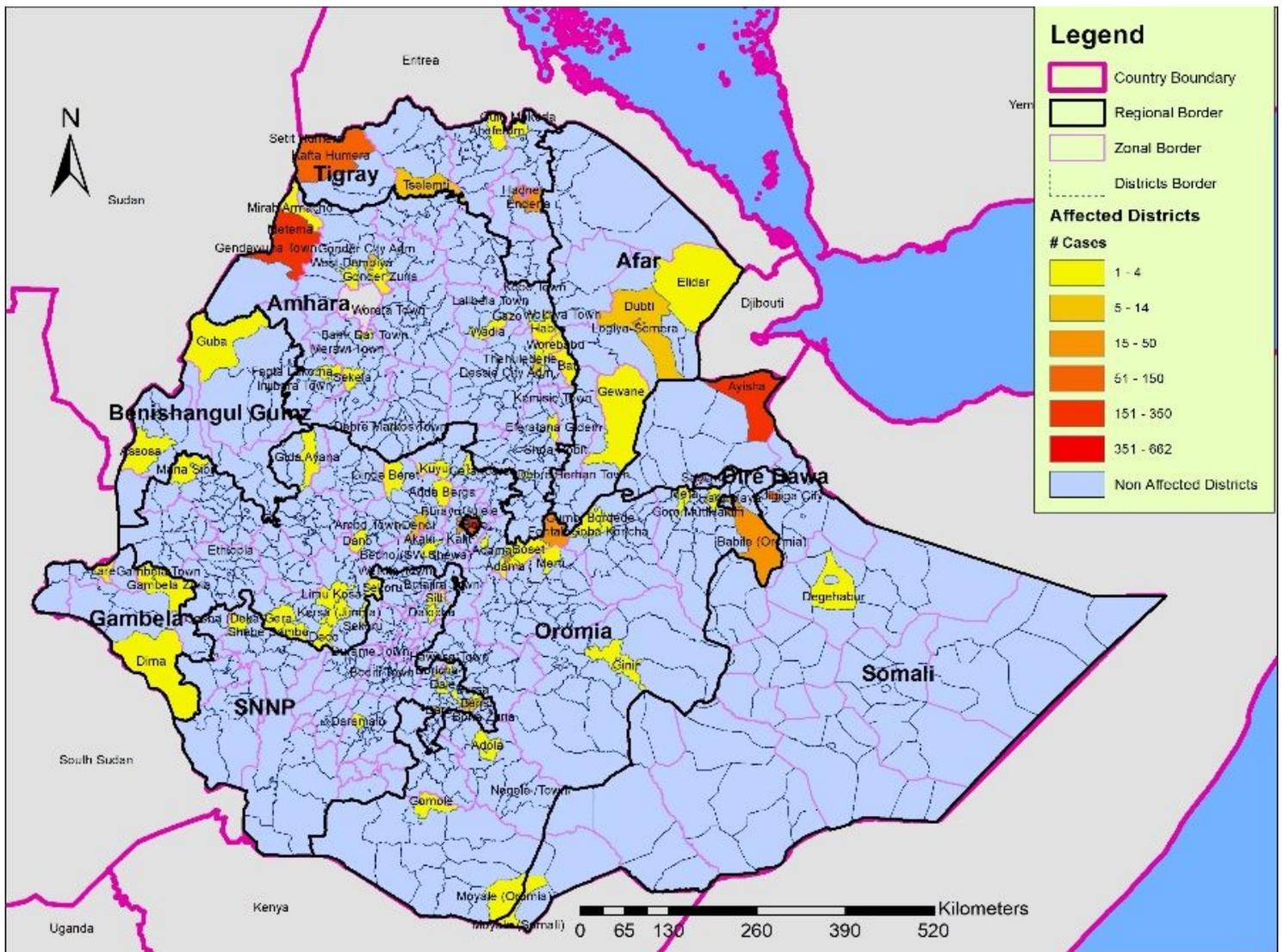


Figure 4

Distribution of COVID-19 confirmed cases by WHO Epi-Week, Ethiopia, 13 March -21 June, 2020



**Figure 5**

Geographical Distribution of COVID-19 Cases, Ethiopia, between 13 March, 2020 to 21 June, 2020