

## Original article

### COVID-19 community transmission and clustering in Addis Ababa; what does this entail to the country's pandemic response?

Alemnesh H. Mirkuzie<sup>\*1,2,3</sup>, Abduilhafiz A. Endris<sup>1</sup>, Adane Woldeab Doyamo<sup>1</sup>, Enyew Birru Tadese<sup>1</sup>, Gizaw Teka Nibzene<sup>1</sup>, Mikias Alayu Alemu<sup>1</sup>, Mesfin Wossen Getaneh<sup>1</sup>, Shambel Habebe<sup>1</sup>, Habtamu Yimer Nega<sup>1</sup>, Zewdu Assefa Edea<sup>1</sup>, Mulatu Mekonen<sup>1</sup>, Abdilkarim Sultan<sup>1</sup> and Aschalew Abayneh<sup>1</sup>

<sup>1</sup>Ethiopian Public Health Institute, Addis Ababa, Ethiopia

<sup>2</sup>University of Washington, Institute for Health Metrics and Evaluation, Seattle, United States of America

<sup>3</sup>University of Bergen, Center for International Health, Norway

\*Corresponding author: [alemmirkuzie@yahoo.com](mailto:alemmirkuzie@yahoo.com),

Cell phone: +251 929 376 628

P.o.Box 1242

#### Abstract

**Background:** The early phase of the COVID 19 response in Ethiopia focuses primarily on containment of transmission linked to foreign travels and has significantly contributed to flatten the epidemic curve for about two months. From mid-May, the number of cases reported daily has seen a dramatic increase especially in the capital, Addis Ababa.

**Objective:** To describe how community and cluster transmission grows exponentially and the trends and what the country should do differently to control the epidemic.

**Methods:** Secondary data were abstracted from Ethiopian Public Health Institute, Emergency Operating Center and Incident Management reports, situation updates, from Health Minister's daily epidemic updates, and detailed epidemiologic investigation reports. A narrative and descriptive analysis were used.

**Results:** Primary case C1 had 67 contacts. Of these, five close contacts have become secondary cases. Of the 96 contact identified with the secondary cases, 16 become tertiary cases. From the 75 contacts identified with the tertiary cases, seven become quaternary cases and three quinary cases. One of the secondary cases was a super spreader, which infected 9 people. Most of these cases were clustered in one area of the city. Primary case C2 had 50 contacts. Of which four of his close family members have become positive for COVID-19. Except for the primary cases, all subsequent cases were asymptomatic. The number of positive cases identified in the community has been growing fast. End of April, 63% of the cumulative cases were among people who had travel history; while in mid-June 83% of the cumulative cases were identified in the community. From mid-May, the epidemic has shown exponential growth.

**Conclusions:** Exponential growth of the COVID-19 outbreak has followed the occurrence of community and cluster transmissions and is likely to overwhelm the country's emergency response facilities and the health care system in the near future. Tailored containment and mitigation strategies and responses that match the magnitude of the problem is needed. Comprehensive surveillance, increasing testing capacity; self/home isolation of cases and quarantining of contacts; implementation of non-pharmacological public health interventions; increasing awareness and community engagement, and ensuring compliance through law enforcement are important aspects to be strengthened.

**Keywords:** Addis Ababa, case, cluster transmission, community transmission, contact, COVID-19, Ethiopia, intervention, isolation, quarantine, preparedness, primary case, response, surveillance

#### Introduction

Ethiopia is a continental hub for air travel through the Addis Ababa, Bole international airport, and sits for the African Union and headquarters of many international organizations. The country is surrounded by fragile states and has porous borders with over 13 land crossing sites. All these expose the country to trans-boundary public health threats (1). According to the WHO, Ethiopia is one of the 13 high-risk African countries for COVID-19 (WHO 2020). Health security is a serious issue for Ethiopia for the aforementioned reasons. Under the Health minister,

there is a Public Health Emergency Management (PHEM) unit lead by the Ethiopia Public Health Institute (EPHI) responsible for managing public health emergencies and health security concerns. Both the institute and the Public Health Emergency Management (PHEM) have good track records to effectively and timely respond to public health emergencies of global concern such as Ebola. The systems established for Ebola have been used to kick-start point of entry screening at Bole international airport and at land crossings for COVID-19 (WHO 2015). Body temperature checking of travellers

coming from Ebola affected countries has been extended to those coming from COVID-19 affected countries; isolation, quarantine, and treatment facilities dedicated to Ebola have been used for COVID-19.

On March 13, Ethiopia reported its first COVID-19 case; a male non-Ethiopian traveller entered the country through Bole International airport from Burkina Faso. This was long before the country enforced mandatory quarantine of travellers at the point of entries. Later five of his close contacts were found to be positive. Until mid-May there was a gradual increase in the number of new cases, where most of the cases were having either travel history or contacts with known cases. COVID-19 cases among travellers entering the country through ground crossings have been increasing according to reports from mandatory quarantine sites located at the sub-national states (Federal Ministry of Health /FMOHa 2020). With strong point of entry surveillance, quarantine, contact tracing and case isolation, Ethiopia has succeeded in containing imported COVID 19 infections. This remarkable achievement spared the country from uncontrolled epidemic that would have devastating consequences to the already constrained health system.

Ethiopia has seen fast growth in the numbers of new cases and deaths seen mid-May, 2020. Just in a week time, the cumulative cases have increased by 32% jumping from 2,670 on June 11, to 3,954 on June 18. The deaths have increased by 38% from 40 deaths on June 11, to 65 on June 18, 2020. The number of recoveries has shown a 53% increase. The total number of tests stands at 202, 214. Addis Ababa the capital has carried the brunt of the pandemic, reporting about 75% of the total COVID-19 cases and the majority of the deaths in the country as of Mid-June (FMOHa 2020). The second on the line in reporting the highest cases is the Amhara sub-national state where most of the cases are travellers from mandatory quarantines at Ethiopia-Sudan border. This is inline with the accelerated growth in the COVID-19 pandemic in neighbouring countries. The numbers of new cases in Sudan have increased to 7,435, in Kenya to 3,860, in Djibouti 4,505 and Somalia 2, 642 as of June 16, 2020 (FMOHa 2020). Although tightening border control, enhancing point of entry screening and mandatory quarantine are the most important measures the sub-national states have been implementing, they should prepare themselves for the eventual community/ cluster transmission.

WHO has classified COVID-19 transmission in countries/territories as 1) no case 2) Sporadic cases, where countries with one or more cases, imported or locally detected; 3) Clusters of case, where countries

experience cases, clustered in time, geographic location and/or by common exposures, and 4) Community transmission, where countries experience larger outbreaks of local transmission with large numbers of cases not linkable to transmission chains or large numbers of cases from sentinel lab surveillance or multiple unrelated clusters in several areas of the country (WHO 2020). Understanding these outbreak classifications is important to implement tailored emergency preparedness and response actions and public health interventions to contain and mitigate the epidemic. Using two index cases and their contacts, this paper describes how the community and cluster transmission in Addis Ababa grows exponentially and what the country should do differently to control the pandemic. Moreover, the paper presents trends in epidemic progression in Addis Ababa since March 13.

## **Materials and Methods**

Ethiopia activated its national Incident Management (IM) for COVID-19 end of February. The IM and the national public health emergency operation centre have different layers of coordination platforms revitalized for COVID-19 preparedness and response activities. As per the WHO recommendations, the IM has a surveillance section, responsible for undertaking and overseeing national and sub-national surveillance activities (FMOHb 2020). Surveillance data are collected from rumours, telephone hotline, health facility, and community, point of entry, hotels, investment areas, closed facilities and quarantine centres. Case definitions have been continuously updated to match transmission scenarios.

Rumours coming from all sources including the hotline will further be investigated by a rapid response team (RRT), which is organized based on WHO recommendations. The RRT team have clinicians, epidemiologists, infection prevention experts and laboratory professions (WHO 2020, FMOH 2020). This team is expected to evaluate rumours and classify them as suspects, who will be admitted to isolation centres eventually or not a suspect. The RRT is also expected to investigate solitary cases if the confirmed case has no travel history in the two weeks prior to areas where there is wide spread community transmission or has no known contact history. This investigation will be done once the person is found to be positive with RT-PCR. This is different from the routine rumour investigation and will require detailed information of the patient in the two weeks prior from date of symptom onset or date of confirmation if the patient is asymptomatic. The information obtained from these will help to map the activity of the patient in that period and aims to find the possible index case,

find more cases around the confirmed case and test all identified contacts in that period. A team of contact tracers do contact tracing for the patient to find forward transmission of the virus from the confirmed case. Their role is to do contact tracing & listing starting two days prior to symptom onset or date of confirmation if asymptomatic until the date the cases are isolated. Contacts are kept in quarantine for 14 days after the last possible exposure to a confirmed COVID-19 case then get tested before discharge. The positive cases are admitted to treatment centres for care and close follow up irrespective of symptomatology. Laboratory testing is done between 7-10 days of admission to treatment centre if the case is symptom free for the last three consecutive days. COVID-19 cases who tested negative are discharged after a repeat test within 24 hours.

The IM produces reports, situation updates, briefings and dashboard for monitoring and tracking the epidemic at national, local and sub-national levels. The present study used secondary data abstracted from reports, daily briefings and daily situation updates and ethical approval was obtained from EPHI-IRB. Index cases data were abstracted from the narrative of IM report submitted to the FMOH and from detailed epidemiologic investigation reports for the cases. Two index community cases having extensive data on the cases and their contacts have been examined in this paper. Data showing the epidemic trajectory were abstracted from the daily briefings made by the health minister and from the daily situation updates on the epidemic shared by the IM. Study findings have been presented in narrative description. Each index case was linked to subsequent cases and contacts. The number of cases and contacts linked to each case has been presented. Descriptive statistics were used for trend analysis. Daily cases were aggregated on weekly basis and presented as cumulative cases. The study has given focus to Addis Ababa, as it was the first location in Ethiopia that experienced community and cluster COVID-19 transmission.

## Results

**Primary Case -C1 (ET-COVID-19-143):** A 75-year-old female chronic diabetic patient from Addis Ababa was admitted to hospital for her chronic condition on May 02, 2020. She had visited a private clinic a week before her admission to the hospital. She neither had travel history nor contact with suspected or confirmed COVID-19 cases. She was confined to home for a long time except for a church visit on April 26, 2020. Due to her poor health, she was frequently visited by her children, close friends, neighbours and relatives. On admission she was pre-screened for COVID-19 and

she did not fulfil the case definition to undertake testing. Then decision was made to treat the patient for her diabetes mellitus. On the next day, May 03, the patient suddenly started exhibiting respiratory distress. She was then transferred to Intensive Care Unit. Meanwhile, swab sample was taken for COVID-19 test. The patient passed away the same day. The sample result returned to the hospital on May 04 showed positive for COVID-19. She has become the primary case and the first community case (Figure 1). In connection with this primary case ET-COVID-19-143, 67 contacts were identified including family members. Twenty-seven were offered testing immediately following contact investigation. Of which, four of her children and one close neighbour who were having very close contact with the deceased, while providing care at home and in hospital were found positive, i.e ET-COVID-19-201-205. All of them were asymptomatic and have become secondary cases. The other contacts who were kept in mandatory quarantine for 14 days found to be negative (Figure 1).

From the five secondary cases, a total of 75 contacts were identified and followed up. Sixteen of the contact were tested positive and became tertiary cases. Of these, nine of the transmissions were from a single secondary case (ET-COVID-19-201) and considered as a super spreader. There were seven quaternary cases and three quinary cases. Three of the tertiary cases, half of the quaternary cases and three out to the four quinary cases were identified and early isolated and did not make contacts with people and hence further transmission did not happen. Except the primary case, all of them were asymptomatic. This has become the first evidence of community transmission. Moreover, the primary and the great majority of the secondary and tertiary cases were living in close proximity and formed a cluster in one of the busiest and overcrowded district of Addis Ababa (Figure 1).

**Primary case C2 (ET-COVID-19-169):** On April 28, a 65 years old man sought care in a private hospital for epigastria burning pain, intermittent high grade fever, chills and rigors that lasted for three days. Later he visited another private hospital three times between April 30 and May 03, 2020 as he did not get better. When the patient failed to respond to routine treatment, the hospital reported the patient as a COVID-19 suspect. The patient was then transferred to St. Peter hospital COVID-19 isolation centre. Sample taken from the patient tested positive on May 04. Following the result, the patient was transferred to Eka Kotebe, another hospital designated for critical COVID-19 cases on May 7, 2020. He passed away on May 08, 2020 and he has become the primary case. With the primary case ET-COVID-19-169, a total of 50 contacts were identified. Of which 10 of them were

family members who had been living together with the deceased. They were tested on May 07 and four of his children were found to be positive i.e ET-COVID-19-195, 196, 197 and 232 and have become secondary cases. The rest of contacts linked to the primary case have completed their 14 days quarantine and all of them

have tested negative. All of the secondary cases were asymptomatic. This primary case neither had travel history nor contact with suspected or confirmed COVID 19 case.

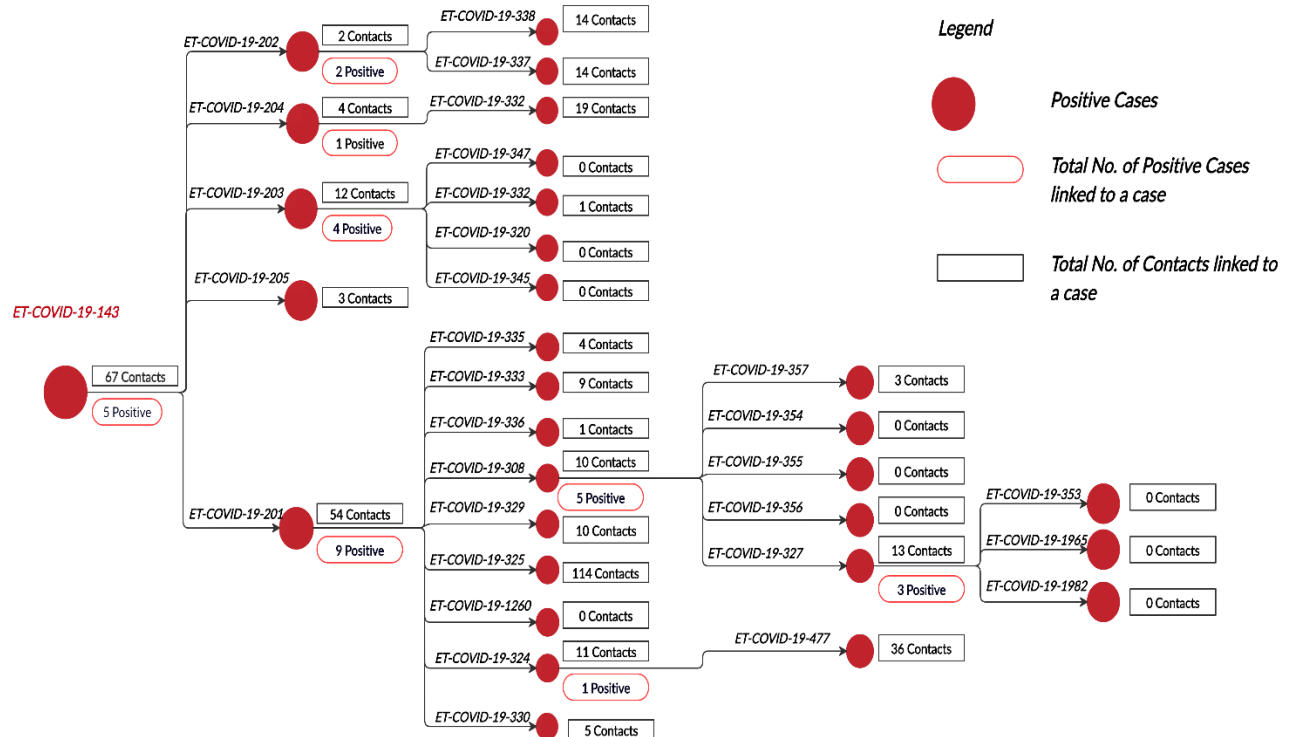


**Figure 1: Chain of transmission linked to the first index community case**

On June 18, 2020 Addis Ababa reported 144 new cases, which made the cumulative number 2,887 since the first COVID-19 case report on March 13. In total 53 COVID-19 related deaths reported as of June

18, 2020. The age range of the affected individuals was between <1 and 115 years. The great majority of the cases were male.

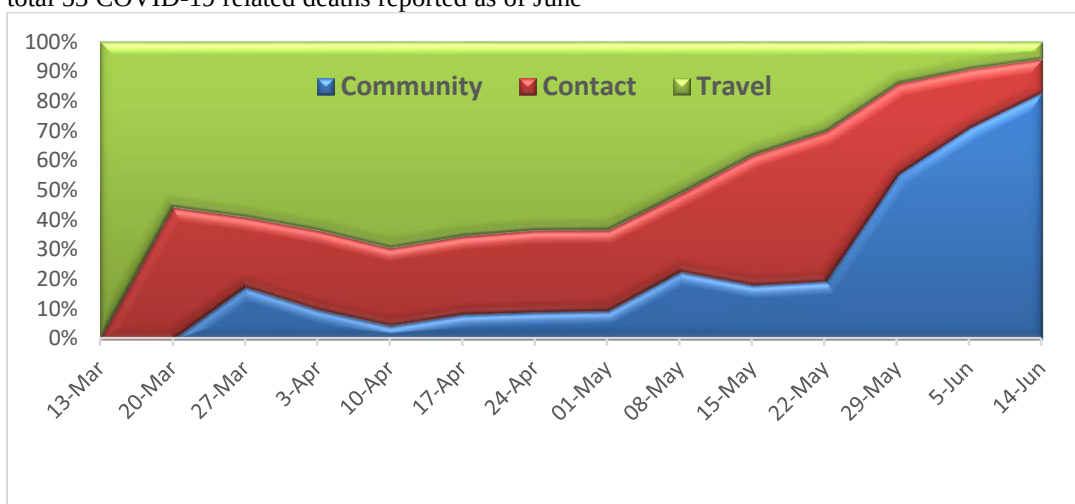


**Figure 2: Proportions of COVID-19 cases with source of infection in Addis Ababa from the week of March 13 to June 14, 2020**

As shown in figure 2, from mid-May, 2020, the number of cases having neither travel no history or

contact with known COVID-19 cases has been increasing exponentially, indicating the country is

entering into a phase of cluster and/or community transmission (Fig 2). The data has shown exponential

growth of the epidemic in Addis Ababa (Fig 3).

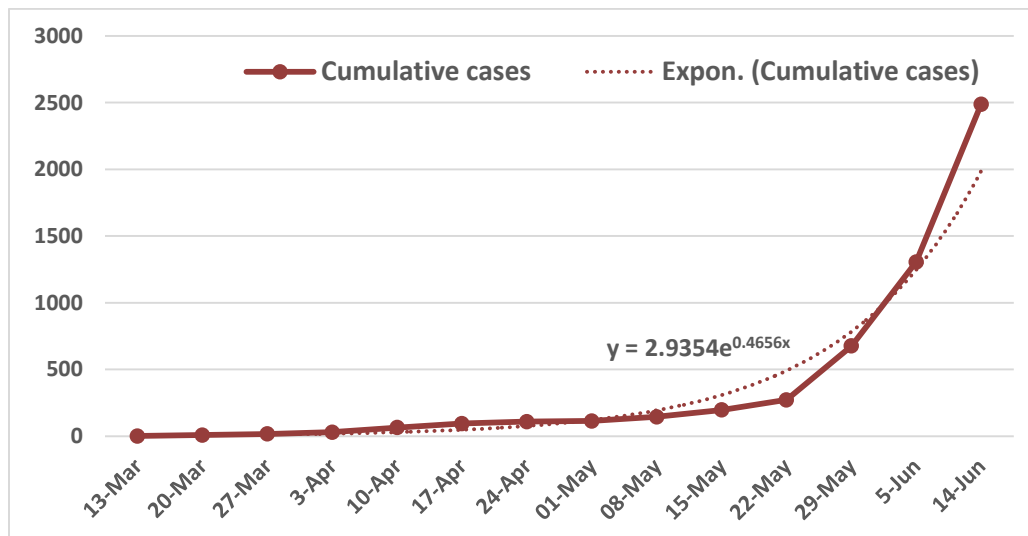


Figure 3: Cumulative COVID-19 cases fitted with exponential trend line in Addis Ababa, Ethiopia, 2020

## Discussion

The cases have demonstrated the silent exponential growth of the epidemic in the community following the two incident cases. The first index case was also responsible for the first geographic clustering of COVID-19 in one of the busiest district of Addis Ababa. This happened in one of the busiest and overcrowded area of the city. The chain of transmission data for the first linked to the first index case has shown the effectiveness of early detection and isolation of cases and quarantining of contacts as evidenced by transmission interruption for tertiary and subsequent cases. Following evidence of community transmission, the proportion of cases reportedly linked to travel and known contact have reduced significantly. On March and April, almost all the COVID-19 cases reported in the city were among travellers, while from May 20, the trend has reversed with most of the cases being linked with community transmission.

The present evidence on the community transmission is an indication that Ethiopia is having multiple COVID -19 transmission phases simultaneously. The cluster and community transmission is happening in Addis Ababa while, the sub-national states still having sporadic and cluster of cases among travellers. This require a shift in public health emergency preparedness and response actions including intensifying tailored screening and case identification, contact tracing and follow up, case isolation and quarantining of contacts.

Galvanizing the health systems response to match the enormous demand for health care services and to

minimize negative impact of the pandemic on the people and the health system at large accrue community transmission is imperative.

Intensifying surveillance, screening and case detection activities to capture community and cluster cases is necessary. Comprehensive surveillance through strengthening of existing systems to include COVID-19 as mandatory and immediately notifiable case, routine screening for Severe Acute Respiratory Infection (SARI) and pneumonia at the health care facility, strengthening the existing SARI sentinel surveillance sites, community surveillance, and enhanced surveillance from congregate settings is required (WHOc 2020). Community based morbidity surveillance of symptomatic cases and mortality surveillance through collection of data from cemeteries using COVID-19 death notification tool and verbal autopsy could complement the routine surveillance approach. The later approach could help to estimate the burden of COVID-19 in the community, where most deaths are happening and for tracing back those who had close contacts with the deceased.

Contact tracing and tracking require active community engagement especially in settings where widespread COVID-19 community transmissions occur. Contact tracing and tracking Apps that have shown promises for early case detection in many high resourced settings as part of easing lockdown measures could be tried in cities having high phone penetration as in Addis Ababa (Mark 2020). All these surveillance systems need to be integrated with testing and the DHIS 2 electronic platforms

developed for COVID-19 to ensure data integration, real time tracking, reporting, fast response and accountability.

The community transmission has triggered exponential growth of COVID-19 cases unlike the gradual epidemic growth linked to travel and known contacts seen in earlier months. Such case growth could easily overwhelm the existing health care systems unless strategies are designed to screen out those who need treatment and care and those who do not. This requires revisiting the current strategies, which promotes admission of all positive individuals to isolation/treatment centres. A study has shown that about 80% of COVID-19 cases in Africa are asymptomatic and 8% have mild symptoms (Cabore et al. 2020). These groups do not need treatment and close follow up but can transmit the virus although they are generally less infectious than symptomatic cases. Our result also showed that except the two index cases, all the subsequent cases were asymptomatic. One of the cases was a super spreader who infected nine contacts. Super spreaders are people who infect more than 8 individuals and have significant contributions in driving epidemic (Yunjun et al. 2020). This could explain the silent and fast growth of cases observed in Addis Ababa. Home or self-isolation of asymptomatic and mild cases is a response action highly recommended to contain community transmissions (Bondy et al. 2020, Cabore et al. 2020). Once community transmission has established there will be large number of COVID 19 cases to be identified. It is neither necessary nor practical to isolate all of them in treatment centres. Evidence suggests that only 30% of the COVID-19 patients require hospitalization (Cabore et al. 2020). Home isolation helps to relief the strain from the health care system. But require high level compliance by the affected individuals. This can be ensured through close follow up, active community engagement and putting in place some legal enforcement strategies and accountability mechanisms for those who breach the rules. Many people who experienced isolation have expressed their psychosocial challenges and frustrations towards isolation procedures and facilities and hence, encouraging home isolation could also help to address such grievances (Hossain et al. 2020).

On March 24, Ethiopia enforced mandatory quarantine for foreign travellers in designated places, as most of the COVID-19 cases in the country were among travellers and their contacts. This has contributed significantly to slows down the transmission to a manageable size, flatten the curve for about two months and has given more time for the government and the systems to prepare. However,

this approach would have little practical value once community transmission has established. Due to the large number of cases to be identified in the community, the number of close contacts for each case will be remarkably large. Therefore, considering home quarantine with strict government control is a practical and cost effective approach to contain transmission (Ngonghala et al. 2020, Bondy et al. 2020). This approach could also help to alleviate the psychosocial impact of quarantine to the individuals and their families (Hossain et al. 2020).

Complementing the emergency responses through implementation of non-pharmacological public health interventions are deemed necessary for epidemic containment and mitigation. Social distancing is one of the best interventions proved to break transmission cycle. China, the first country hit by the pandemic followed by Europe and the USA practiced lockdowns to ensure social distancing and have managed to reduce the transmission (Ngonghala et al. 2020; Bondy et al. 2020). However, the economic and social tolls of lockdown measures have devastating consequences to the majority of the people and to the country's economy. Counter measures to lockdown restrictions as riot and demonstration seen in some resource poor settings in Asia and Africa have caused more devastation than the epidemic itself. Hence, it is crucial to understand the local contexts to best implement social distancing measures and ensuring high level community engagement is important to its success.

Ethiopia has been implementing social distancing measures since mid-March through closing of schools and universities; closing of non-essential services; banning of gatherings more than four people; closing of religious facilities; banning of gathering at social events as in wedding and funeral; cutting carrying capacity of public and private transportation services by half and reducing the number of public service employee coming to office and encouraging working from home. In recent days complacency and non-compliance have been observed among the general public to the social distancing recommendations. Increasing public awareness and engagement and law enforcement need to be revitalized for the city to succeed in the containment of community and cluster transmission.

The other non-pharmacologic public health intervention showing promise in cutting COVID-19 transmission is mouth and nose cover (face mask). A study reported that the N95 mask reduces respiratory disease transmission by 90%, surgical mask by 80% and cloth mask by 20-80% (Ngonghala et al. 2020). Face mask have dual advantages, i.e to prevent

people from getting infection and to prevent them passing infection to others. High level coverage and compliance is required especially for cloth mask to have impact in cutting the transmission. It is one of the easiest, affordable and non-disruptive preventive interventions that the government should capitalize on. Mandatory face-mask use irrespective of the type of the mask is one of the landmark measures imposed by Ethiopian government in Addis Ababa requiring all people to wear outside their home. Though improper use of this masks continued to be a challenge, their values in slowing the transmission is undeniable. Due attention should be given to enforce routine and persistent use of it to ensure effectiveness.

Frequent hand washing is another non-pharmacological intervention recommended for the prevention of COVID-19 transmission. A study reported that hand washing can prevent the transmission of virus infections by 50% (Brauer et al. 2020). In Ethiopia, particularly in the capital Addis Ababa hand washing has been promoted as important public health prevention measure to reduce COVID-19 transmission. Efforts have been made to increase population level awareness about the benefit and to encourage consistent practice through media, short plays and by prominent public figures. This effort has improved awareness and compliance. However, poor access to clean water and sanitation facilities are challenging the effectiveness of this interventions especially in rural areas and need thorough consideration (Brauer et al. 2020, Mirkuzie et al. 2020). One fourth of the global population and over 50% of the Ethiopian population do not have access to hand washing (Brauer et al. 2020).

## Conclusion

The early phase of the COVID 19 response in Ethiopia focuses on containment of transmission linked to foreign travels. That has helped to flatten the epidemic curve for about two months. As the country enters in to a phase of community and cluster transmissions, tailored emergency containment responses are required to match the magnitude of the problem and its coverage as recommended by the WHO.

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