

**C2M2 Project- Africa Hub
Baseline Assessment Report, January 2021**



January 11, 2021

By Dr. Gaston Mbonglou (Hub Lead)
Prof Alex Lina (Lead Bukavu)
Erica Hagen (Nairobi)
Dr. Bianca Gerente (Pemba)

Table of Content

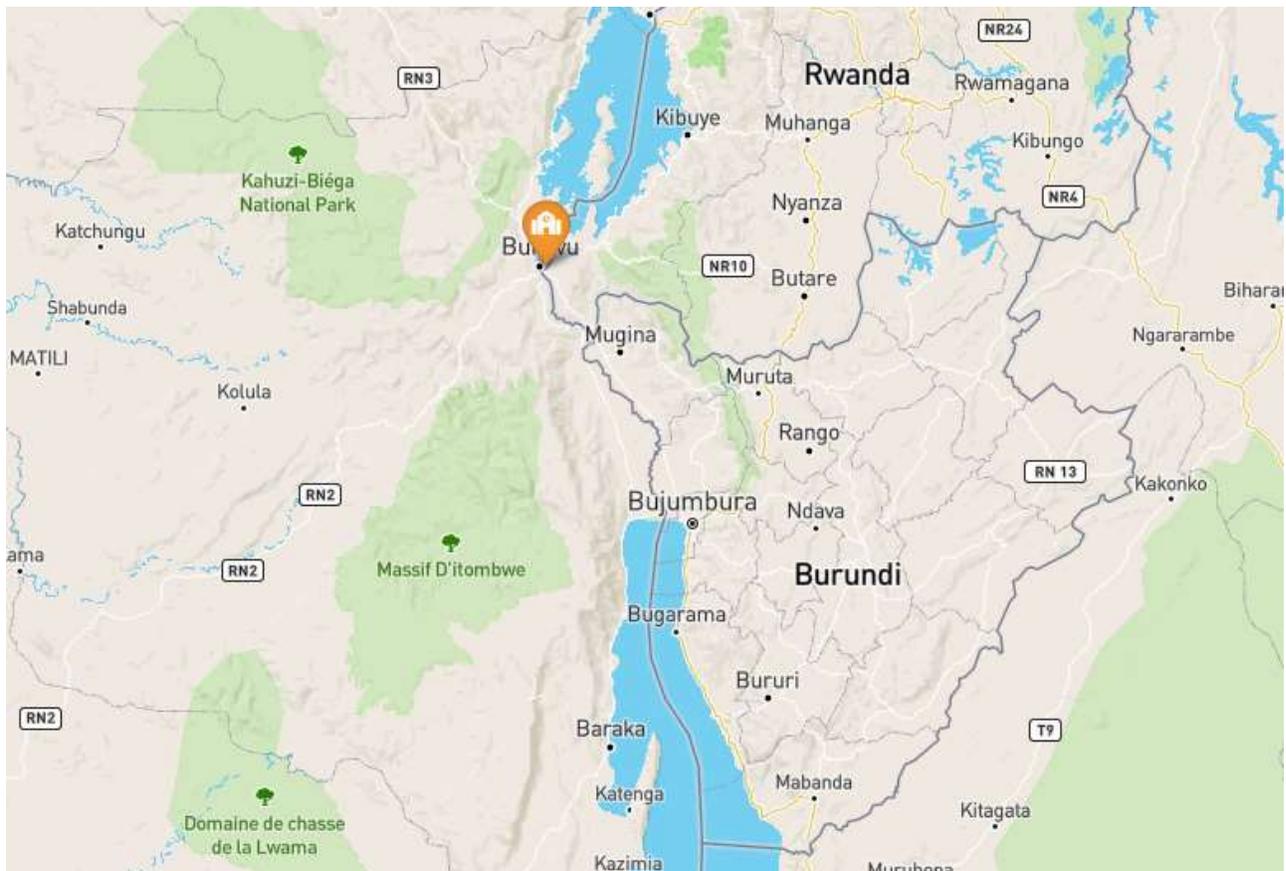
Bukavu City Project	4
1. Executive Summary	5
2. Current Status of COVID-19 Pandemic	7
3. Description of the Economy	9
4. Vulnerable Populations	11
5. Project Focus	12
6. C2M2 Metrics (based on analytic framework)	14
7. Tools for Data Collection	14
8. Data Management	15
9. Platform for Data Sharing	15
10. Software for Data Analysis	15
Nairobi City Project	16
1. Executive Summary	17
2. Current Status of COVID-19 Pandemic	17
3. Description of the economy	18
2. Define vulnerable populations	18
3. Project focus	18
4. C2M2 metrics	19
5. Tools for Data Collection	20
6. Data Management	20
7. Platform for Data Sharing	20
8. Software for Data Analysis	20
Pemba City Project	21
1. Executive Summary	22
2. Current Status of COVID-19 Pandemic	22
3. Description of the Economy	23
4. Define Vulnerable Populations	23
5. Project Focus	24
6. C2M2 metrics	25
7. Tools for Data Collection	25
8. Data Management	26
9. Platform for Data Sharing	26
10. Software for Data Analysis	26

Table of Figures

Table 1: Casualties by care location in Bukavu (Nov 2020)	7
Table 2: Number of positive cases (Covid-19) in Bukavu City (Dec 2020).....	8
Table 3: Emerging vulnerable groups	11
Table 4: Healthcare facilities in Bukavu	12
Table 5: Schools in Bukavu.....	13

Bukavu City Project

Country	Democratic Republic of Congo	City	Bukavu
Month	November	Year	2020
Focus	Healthcare, Education, Economy		



1. Executive Summary

The Democratic Republic of Congo (DRC) has faced multiple pandemics during the last 10 years including Ebola that caused many fatalities. Building from that experience, many mayors have established programs to improve the resiliency of their cities. The goal is to be better prepared to manage first and second order impacts of pandemics like COVID-19. Since March 2020, the country has experienced a rise in COVID-19 cases. Given the limited resources on both the national and local levels, the DRC has not been able to build the necessary screening capacity to better identify and report on COVID-19 cases and December 2020 has only made that a more pressing issue.

Both the central and local governments in the DRC have set policies relating to preventive measures to reduce the spread of COVID-19 early into the pandemic. Now as Bukavu approaches its second wave, the city has registered 391 positive cases from which 73 % are males, 27 % females and 0% children, whereas a total of 21 deaths were registered. The most vulnerable population groups in the city include:

- Patients with chronic and metabolic diseases
- Elderly people
- Medical and paramedical staff incl. nurses and doctors
- Pharmacists and laboratory technicians
- Travelers and people working in highly frequented public places
- Rural communities in areas surrounding the city
-

The effect that daily commutes to and from rural areas into the city have already shown their consequences as in December 2020 alone, four (4) positive cases have resulted in two different health zones.

The imposed lockdown early in March had a significant impact on education and the local economy. The implemented closure of schools for more than 5 months to reduce the spread of COVID-19 impacted the education sector in different ways including:

- Lack of motivation in teachers and learners
- Inability or inaccessibility to distance learning for the majority of the population due to limited finances
- Lack of access to power making it difficult to take advantage of implemented distance learning solutions in some schools
- Loss of jobs for many teachers

As a result of the COVID-19 pandemic, Bukavu has seen significant impacts in terms of economic development and social relations between the urban and surrounding population including limited mobility that led to a spike in food prices. Furthermore, the closure of the DRC borders to neighboring countries (Burundi, Uganda, Tanzania, and Rwanda) increased the unemployment rate for women and young adults. As a result of these shortfalls, psychological stress due to COVID-19 preventive measures is believed to be among other factors that triggered the increment of registered deaths during the lockdown period.

Despite the lockdown and other preventive regulations put in place, the President and Head of State issued an additional thirteen (13) measures on December 14, 2020 in order to mitigate the effects of the oncoming second COVID-19 wave. As a result, the

local economy, education, and health of the population are expected to only face more negative impacts in addition to the ones they are already experiencing.

The coming months and funding from the American Association of Geographers through the C2M2 Bukavu Project will enable the project team to gather more qualitative and quantitative data pertaining to second order impacts and build the causal loops necessary to visualize the impacts and suggest mitigation strategies.

2. Current Status of COVID-19 Pandemic

COVID-19 Cases

The figures below reflect the number of COVID-19 cases registered across the nation and in the City of Bukavu as of the beginning of the pandemic on March 10, 2020 to December 2020. The infection rate percentage in Bukavu is 73 % males vs 28 % females and 0% children.

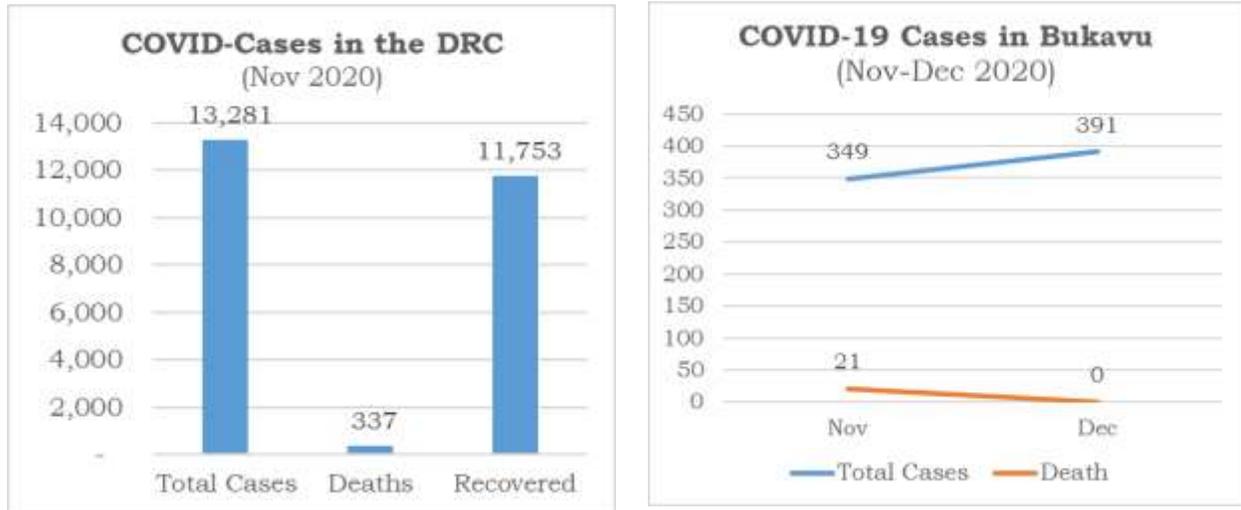


Figure 1: COVID-19 cases in the DRC and Bukavu (Dec 2020)

COVID-19 Casualties

The table below reflects the breakdown of casualties by care location.

Health facility	Deaths
Dead from homes	7
PANZI General Referral Hospital	4
BUKAVU General Referral Hospital	3
University Clinics (UOB)	1
During sensitization for testing	6
Total	21

Table 1: Casualties by care location in Bukavu (Nov 2020)

The table below showcases the breakdown of positive COVID-19 cases by health zones in Bukavu for December 2020.

Health Zone	Males	Females	Children	TOTAL
IBANDA	32	8	0	40
KADUTU	2	0	0	2
BAGIRA	0	0	0	0
TOTAL	34	8	0	42
Percentage	81%	19%	0%	100%

Table 2: Number of positive cases (Covid-19) in Bukavu City (Dec 2020)

Government Policies to Reduce the Spread

Policies determined as the initial response were defined at the provincial and national levels including:

1. Presidential decision that provides general guidelines to cope with COVID-19.
2. Decree signed by the governor of the South-Kivu province that included guidelines on implementing preventive measures while acknowledging the specificity needed at the local level.

As of December 14, 2020, the President of the Democratic Republic of Congo and the Head of State issued new preventive regulations to fight the second wave of COVID-19 in the DRC. Outlined below are the thirteen (13) new measures:

1. Curfew from 9 PM to 5 AM
2. Strict application of barrier gestures, such as mask wearing, social distancing, hand washing, and temperature measuring
3. Prohibition of public demonstrations, artistic productions, fairs, etc.
4. Banning of festive ceremonies and meetings of over 10 people
5. No pursuit of sports events behind closed doors
6. Transportation of the deceased directly to burial places, without ceremony
7. Church activities must uphold barrier gestures
8. Bars/bistros before curfew and all public and private places, namely vehicles, trains, planes, etc. at all times must uphold barrier gestures
9. Higher education activities and courses postponed until further notice
10. School holiday set to start on Friday, December 18, 2020
11. Continued testing for internal travelers and those abroad
12. Circulation during curfew of persons with special authorization from the provincial authority, except in cases of emergency
13. Strict control of the application of these preventive measures by the Congolese National Police

Note: The measures outlined above came into force starting on December 18, 2020 throughout the national territory after its announcement on December 14, 2020. Although the new issued regulations are useful and important; they are likely to increase the already negative impacts on the local economy, education and health of the population. More specially, youths (young girls and boys) will lack the opportunity to go to school, thereby will spend days in the city, which will expose them in the idleness with subsequent risks of unwanted pregnancies for young girls and hooliganism for the young boys with all related consequences.

In support of the new regulations, the Provincial Health Division has been popularizing the following recommendations to the public:

- Frequent hand washing and use of the hydroalcoholic solution
- Covering one's mouth and nose with the bend of their elbow when coughing or sneezing and immediately disposing of the tissue and washing one's hands
- Respect physical distancing by avoiding close contact with individuals with a fever or cough and direct unprotected contact with live animals
- Always wear a mask in public, no kisses, stay home and greet without shaking hands
- Consulting a health center if experiencing a cough, fever, or difficulty breathing
- Avoiding the consumption of raw or undercooked animal products, but handle with care (food biosecurity) if choosing to do so to avoid cross-contamination with raw food.

3. Description of the Economy

Impact on Trade

The COVID-19 pandemic in the South Kivu province and implemented restrictive mobility measures have impacted the economic development and the social relations between the urban population and residents of the surrounding counties. In fact, the limitation of mass population movement from surrounding counties to the cities where they earn most of their income through petty trade has impacted the food supply and led to a spike in the cost of commodities. The newly implemented measures put in



place to cope with the second wave on December 14th have only caused further strain on the local economy. Below are illustrative facts:

Before the COVID-19 Pandemic

South Kivu had:

- Free movement of the population and goods
- NGOs and other help organizations could operate freely and bring resources into the region
- The majority of the Bukavu population had a purchasing power that made it possible to eat at least twice a day

Since the COVID-19 Pandemic

South Kivu had:

- Implemented measures and limitations to reduce the spread of COVID-19 have halted the flow of goods and resources from rural areas to the city and within the region
- Borders' closure between the DRC and many of its neighboring countries (Burundi, Uganda, Tanzania, and Rwanda) have led to a spike in food prices up to a 3x factor. In addition, many carriers and border operators had to close their businesses or reduce staff thus increasing the local unemployment rate
- Additionally, since inter-provincial and inter-border trade facilitated the circulation of currency and other goods, implemented restrictions i.e., on inter-provincial water transportation during lockdown on Lake Kivu and Lake Tanganyika have resulted in unemployment

Other COVID-19 second order impact thus far include:

- An unemployment crisis mainly for women and young adults as many households live off of small shops and the pandemic has stopped this activity
- Social distancing chips away at African solidarity
- Youth income-generating activities like taxi operators, carriers, dockers, baggage handlers, etc. that ran 24/7 prior to the pandemic have been shut down. As a result, many young adults are unemployed and their motorcycles/car and taxis had to go out of business due to the prolonged periods of inactivity

The pandemic has also created a psychosis that has reduced the productive capacity of the urban population and created certain levels of discouragement. The psychological stress alone due to the COVID-19 measures has been identified among other factors that have triggered the increment of registered deaths during the lockdown.

Impact on Education

COVID-19 and its implemented measures have impacted the cities' ability to keep schools open. As a result, this has impacted all key players along the value chain including students (K-12 and college), parents, teachers and school owners. Additionally, the newly implemented postponing of school reopening is expected to only exacerbate similar issues teachers and higher education providers and institutions experienced during the lockdown. Below are illustrative facts:



Before the Covid-19 Pandemic

Teaching programs in Bukavu have been well respected and parents were able to send their children to school without fear. In addition, there were no hand washing requirements, hydro-alcoholic solutions, masks, or social distancing required.

Since the COVID-19 Pandemic

The lockdown that resulted in over 5-months of school closures has negatively impacted the education system including:

- No pay for teachers in most private and public schools
- Demotivated teachers and learners

Although most institutions have tried to find methods and means to deliver remote education, there are many challenges that have made it almost impossible i.e.:

- Many households' inability to acquire TV sets due to their limited income
- Many households' inability to afford monthly TV subscription fees in order to access TV based educational programs
- Scarcity of energy; In fact, most households do not have continued/have limited access to energy or electricity.

Although we have not yet seen the extent the school closings starting on the 18th will have on education and the population's health, there is growing fear that it will drive more youth into the cities as they are not accustomed to idleness and unfortunately raise the number of positive cases.

4. Vulnerable Populations

Existing Vulnerable Population

The most vulnerable population groups in Bukavu include:

- - Patients with chronic and metabolic diseases
- - Elderly people
- - Medical and paramedical staff incl. nurses and doctors
- - Pharmacists and laboratory technicians
- - Travelers and people working in highly frequented public places
- - Rural communities in areas surrounding the city

Emerging Vulnerable Groups

The emerging vulnerable population group includes the rural communities surrounding the city of Bukavu. This is due in part to the fact that most day time workers in Bukavu are from the surrounding rural areas. Their daily commute to the city and back has been identified as a major way of spreading the pandemic.

Health Zone	Male	Female	Children	TOTAL
KABARE	2	1	0	3
KALEHE	1	0	0	1
TOTAL	3	1	0	4
Percentage	75%	15%	0%	100%

Table 3: Emerging vulnerable groups

The effects of these commutes have already been seen as four (4) positive cases were found in two different rural health zones surrounding Bukavu just during the month of December 2020. The table below provides a breakdown of the two affected zones. It is important to note that urban areas are the most affected.

Table 3: Number of positive cases (COVID-19) in rural health zones surrounding Bukavu City, in December 2020

5. Project Focus

The focus in Bukavu is on the second order impacts of COVID-19 from a healthcare, education/social and depending on data availability, economic perspective. The goal is to provide best practices and tools to government agencies and healthcare and social services officials that enable them to better understand the second order impacts of COVID-19. Below is a current state summary for in scope areas.

Healthcare

The city of Bukavu has three (3) health zones corresponding to three (3) urban municipalities. These include: Ibanda, Kadutu and Bagira. In each health zone, many levels/categories of health facilities coexist including:

1. Health posts
Health facility level I: Smallest health facility that can be led by a nurse
2. Health centers: Health facility level II & III
3. Hospitals
4. Health formation (FOSA): An area within which the above-mentioned health facilities are located

The table below provides a breakdown of health facilities by location, category, as well as an estimation of the population in each health zone (municipality).

Health Zone	# of Health Centers	# of Hospital	# of Health Posts	# Health Formations (FOSA*)	Village/ Avenue	Population
Bagira	8	2	20	30	74	148,135
Ibanda	17	24	7	48	207	481,107
Kadutu	13	10	10	33	79	392,298
Total	38	36	37	111	360	1,021,540

FOSA*: Health Formations (Health Facility)

Table 4: Healthcare facilities in Bukavu

Education/Social

There are three (3) urban municipalities in Bukavu including Ibanda, Kadutu, and Bagira. The table below provides an overview on the number of schools in the city by municipality.

Health zone	Nursery	Primary	Secondary	ITM/IEM*	HEIs	TOTAL
-------------	---------	---------	-----------	----------	------	-------

Bagira	16	108	72	0	2	198
Ibanda	110	270	194	4	11	589
Kadutu	28	62	52	2	8	152
Total	154	440	316	6	21	939

ITM*: Institute of Medical Techniques | IEM*: Institute of Medical Education

Table 5: Schools in Bukavu

Note: Starting early January 2021, with funding from The American Association of Geographers through the C2M2 Project, data will be collected on health and education facilities to bring more light to newer and more accurate information.

Data Gaps

As we prepare for data collection, it is important to provide some insight on identified data gaps and challenges.

A. Education

- Geospatial data on schools
- Limited information on the number of trained professionals for surveillance, response, and management of the pandemic
- Lack and use of preventive equipment
- Availability of health services within schools like a nurse
- Statistics on the sanitation facilities in schools, school attendance, dropout rate,
- ... and the use of remote learning methods

B. Health

- Geospatial data on healthcare facilities
- Information on how health facilities and schools are coping with the pandemic
- Availability of preventive equipment in healthcare facilities
- Availability of COVID-19 and non-COVID medicine at hospitals, health centers, and pharmacies
- Types of sanitation facilities and medical services available in private hospitals and health centers

C. Social

From a social perspective, there is limited information on how households are managing second order impacts including the ability to mitigate both short- and long-term consequences of the pandemic.

Working with the different stakeholders, the team will look at available solutions to close these gaps as much as possible.

6. C2M2 Metrics

The table below provides an overview of metrics that will be collected in Bukavu given the focus on healthcare and education/social realms.

Perspective	Strategic Objectives	Measurement objectives (metrics)	In scope
Pandemic	Understand the current state of the pandemic	COVID-19	√
Health	Conclude impact of water borne diseases	Access to drinking water	√
		Access to care	√
	Mitigate the impact on care and access to care	Reduce the impact of pandemics	√
		Improve preventive care	√
Education	Mitigate the impact on education	Mental health	√
		Access to education	√
Economy	Mitigate the economic impact	Quality Of education	√
		Impact on local economy	
		Mobility	
		Economic health	
Social	Mitigate the impact on relevant SDG	Personal finances	
		Safe and affordable housing	
		Access to public transport systems	
		Inclusive and sustainable urbanization	
		Access to food	

Table 4: Summary of C2M2 metrics for Bukavu

7. Tools for Data Collection

Category	Type of tools used	Computer lab utilized? (Y/N)	Internet connectivity (speed)	Internet reliability (G, F, P)
Data Capture	Tablets	NA	NA	Poor to Fair
	GPS	NA	NA	Poor to Fair

Notes:	As data collection becomes increasingly important in remote areas so does internet connectivity. The team aims to find an appropriate source to aid in their collection, but until then, the team will rely on Kobo Collect, which will enable the researchers to collect data offline
---------------	--

	to then upload it to the data repository once the data collection device is connected to the internet.
--	--

8. Data Management

The team will use QGIS and the Cities Navigator application (given its OSM backend) hence making data easily accessible through open-source platforms. To ensure quality control during data collection and data management, the team will make sure all data providers understand how that data will be used and ensure that collected data is stored in open-source platforms.

Note: Although available, the team will not be able to use ArcGIS since the current license has expired.

9. Platform for Data Sharing

QGIS and Cities Navigator allow users to easily export data into multiple formats (CSV, excel and PDF) for additional processing or reporting hence making data sharing easy.

10. Software for Data Analysis

The team will use SPSS, Statistica and R for data analysis and visualization however, access to reports will be limited to few users given the number of currently available licenses. To mitigate that issue, the team will also leverage the Cities Navigator data visualization and analytics capabilities hence enabling an unlimited number of users to view the project results.

Nairobi City Project

Country	Kenya	City	Nairobi
Month	November	Year	2020
Focus	Education, Economy		



1. Executive Summary

Nairobi has been the epicenter for Kenya's Covid-19 outbreak during the global pandemic. In the early days of the pandemic, the Kenyan government imposed a fairly drastic lockdown, including closing in-country travel. This resulted in a massive economic impact. Some trade was allowed to continue, but most individuals were impacted. Schools were also ordered shut.

In September, certain grades were reopened, only the testing grades 4, 8, and 12. Most schoolteachers in private, informal schools were without pay, or with severely lower pay since schools depend on fees.

Many individuals were forced to quarantine in hotels by the government, at their own expense, if they were found to be exposed or test positive. This also disrupted the economy, as many were providers. Other impacts included increased inter-familial problems, domestic violence and divorce.

Additionally, curfews were put in place and gatherings were limited in size. Many bars and restaurants were forced to close. Tourist dollars dried up. Tourism accounts for 8.8% of GDP, and 8.3% of jobs in Kenya¹. In slums, police enforced curfews and mask wearing, sometimes violently.

From the Center for Strategic and International Studies: "Starting on March 25, the government closed airports, schools, churches and mosques; tightened border controls; restricted public gatherings; imposed severe limitations on movement around the country; and imposed curfews in urban areas. This may have helped slow the spread of the virus but at a cost. For millions who live in urban slums or rural poverty, social distancing is not an option. Their livelihoods depend on daily face-to-face interactions. Many Kenyan commentators on social media have denounced harsh and chaotic police enforcement of public health directives.

2. Current Status of COVID-19 Pandemic

Below is a current state of the pandemic in Nairobi

a. Number of cases

Nairobi has registered 16,923 COVID-19 cases to date (January 7, 2021). This number is reported by the Ministry of Health; however, there is widespread concern that we do not have comprehensive accurate figures, because many illnesses may not be reported or COVID-19 may not be tested for. Additionally, death records are not comprehensively collected so it is difficult to compare typical mortality with current.

b. Number of deaths:

There are 1,702 deaths so far country wide. There is no Nairobi specific number, but we can assume the majority of the deaths took place in Nairobi given its outsize proportion of overall cases.

c. Government COVID-19 Policies

- There is currently a curfew in effect from 10 pm to 4 am.
- Most other restrictions have either been lifted or are not enforced

¹ <https://voyagesafriq.com/2019/03/13/kenyas-travel-and-tourism-sector-surpasses-regional-and-global-growth/>

- Children have all returned to public schools as of January 4. Prior to that only very few children were in school (grades 4,8 began in September). For most children, there were no options for virtual school, due to lack of access to internet or to televisions (the government did provide some e-learning and TV learning).

3. Description of the economy

Specific sub-projects of hub

- a. The Nairobi team will be working on Education as a sub-specialty focus area.
- b. Impact on education in the informal sector is expected to show that closing schools has created major economic and learning challenges. Many parents rely on schools for feeding their children. School fees have gone unpaid, causing job and income loss for school leaders and teachers, however, when schools reopened even for very few grades, it's possible that this reversed some of that trend. This will be further investigated. Also unknown is how many schools may remain closed simply because their owners have made other arrangements, left the city, failed to pay rent, etc. Meanwhile, children have suffered from lack of learning during nearly an entire school year.

Informal economy sector

- a. Many businesses were closed, bars, restaurants and gathering places. The informal economy suffered from major job losses as well. Many people lost access to food and relied on distributions and other handouts. Transportation sector was also impacted, many workers reside in slums. Overall, the shutdown may have impacted the slums more than anywhere else. We will use the schools as a proxy for understanding the general downturn, to the extent possible.

2. Define vulnerable populations

Existing Vulnerable population

- a. The informal settlements of Nairobi are key vulnerable parts of the city. An estimated 2.5 million people live in Nairobi's slums, which is more than half the city population. This project will focus on the largest slums, Kibera and Mathare, as well as others.

Newly emerging vulnerable population

- a. Older people and those with chronic illness are being made more vulnerable than previously.

3. Project focus

Existing data

- a. OpenStreetMap data on school locations and many data points related to schools
- b. OpenStreetMap base data on locations and data around many types of social infrastructure in the informal areas, such as: health facilities, water points, public toilets, waste and dump sites, vendors and shops, bars and kiosks, and security features.
- c. The CDC may also have specific data around Kibera COVID-19 cases and their approximate locations.

Surrogate data

a. Unsure

Data gaps

- a. We do not have data around the current status of small private schools serving the slums, and their operating and financial status following closures. We also do not have details of numbers of students and information about the impacts of those closures on the economy and families.
- b. The informal economy will be addressed by focus on the informal settlements, and the economic impact on individuals associated with schools of their closure. That includes private school owners, teachers, and parents of children attending closed schools. This data is not yet available.
- c. Other baseline data from informal areas will likely be collected as well, for instance on water and sanitation availability in slums for sanitation, to compare to before the pandemic.
- d. We will also look into other key indicators that may arise during our mapping work in the slums.

4. C2M2 metrics

Perspective	Strategic Objectives	Measurement definition	In scope
Pandemic	Understand the current state of the pandemic	COVID-19	√
Health	Mitigate the impact on care and access to care	Impact of water borne diseases	√
		Access to drinking water	√
		Access to care	
		Reduce the impact of pandemics	
		Improve preventive care	
Education	Mitigate the impact on education	Mental health	
		Access to education	√
Economy	Mitigate the economic impact	Quality Of education	√
		Impact on local economy	√
		Mobility	
		Economic health	
		Access to food	
Social	Mitigate the impact on relevant SDG	Personal finances	√
		Safe and affordable housing	?

	Access to public transport systems	
	Inclusive and sustainable urbanization	√
	Access to food	

5. Tools for Data Collection

Category	Type of tools used	Computer lab utilized?	Internet connectivity (speed)	Internet reliability (G, F, P)
Data Capture	Smartphones (Android phones)	Y	Good	Good
	GPS (Garmin navigation device)	Y	NA	NA

Notes:	The team will use Kobo Collect, which it typically uses to gather OSM data. The team will also be using individual interviews.
---------------	--

6. Data Management

The team will use OSM, Kobo's cloud database, and local CSV exported files as primary data repositories. The following data management process will be implemented to ensure data quality: After collection, the lead mapper will check the data carefully prior to submission and import into OSM. OpenStreetMap also has its own built in quality check process as part of the open nature of the system.

In addition, the team will use the following processes to enforce ethics (i.e., making sure all data providers understand how that data will be used, make sure collected data is stored in open-source platforms): Any surveyed households or individuals will confirm consent and will be disidentified in any public, open system. OSM will not permit any PII. Individual data will be stored safely on local servers and Kobo's secure humanitarian server only. The project also shares back to respondents with results.

7. Platform for Data Sharing

In addition to using OSM, the team will tentatively also use the Map Kibera website to share data with all key stakeholders with the ability to export the information into Excel CV files. The project will also share relevant data on the Open Schools Kenya website. If possible, the team will create a basic website to share the data, likely a page of Open Schools Kenya.

8. Software for Data Analysis

The team will use QGIS, Excel/Google Sheets for data analysis. There is a possibility of using Microsoft BI and Mapbox as well.

Pemba City Project

Country	Mozambique	City	Pemba
Month	November	Year	2020
Focus	Education, Economy		



- Suspension of religious services
- Visa suspension
- Closure of schools
- Closure of entertainment establishments
- Closure of borders
- Advice against crowding

In August 2020, the government defined a three-phase strategy to reduce the impact of restrictive measures.

- **Phase 1: Implemented on August 18**

It allowed low-risk activities to resume including the reopening of universities and colleges, the Defense and Security Force's academy, teacher's training institutions, and public health and vocational training centers. It also expanded the number of participants in funeral ceremonies to a maximum of 50 people, except for deaths due to COVID-19 where the limit was set to 10. The opening of religious services was also allowed for a maximum of 50 people.

- **Phase 2: Implemented on September 1st**

Focusing on medium-risk activities, it allowed specific businesses to reopen including technical and professional establishments, cinemas, theaters, and casinos.

- **Phase 3: Since October 1st**

This phase allowed high-risk activities/environments to re-open i.e., secondary schools.

3. Description of the Economy

Pertaining to the economy, the Pemba Project will focus on the second order impact of COVID-19 on the tourism sector (specifically entertainment and lodging), retail, productivity, labor costs, unemployment rate, and personal finances. According to the Confederation of Economic Associations of Mozambique at least 1175 companies have suspended their activity to date and more than 12,160 jobs have been affected. This is mainly in the hotel and restaurant sector. The state of emergency that was implemented in April has significantly reduced the pace of business resulting in a 6.1 billion meticaais (~\$82.4Million) loss in economic activity.

According to the National Institute of Statistics in Mozambique (INE), restrictions on the movement of people and the sudden paralysis and the severe reduction in economic activities have impacted 90% of the informal sector and 10% of the formal sector. This situation has resulted in the loss of jobs for many informal sector workers, increasing poverty and vulnerability.

4. Define Vulnerable Populations

In the context of Pemba, the vulnerable population primarily includes people that are unable to remain safe and reduce their risk of contamination without external support and people with limited resources to mitigate second order impacts of COVID-19. Below are identified groups:

- Children, women, and the elderly population
- People with handicaps as they traditionally depend on others to perform basic daily tasks and ensure their daily needs are met

- Homeless
- Domestic workers as many have lost their jobs
- Displaced military families living in refugee centers
- Population in informal settlements with inadequate housing often without minimum sanitation infrastructure

5. Project Focus

The goal of the Cities' COVID Mitigation Mapping (C2M2) in Pemba is to provide detailed and useful insight regarding the secondary impacts of COVID-19 embedded in the education and economic sectors.

Pemba collected a significant amount of geospatial data on schools, hotels, guest houses, and supermarkets during the secondary cities project. The team plans to leverage that data for the C2M2 project.

While government institutions have COVID-19 metrics on schools and the economy, most available information is reported at the national level. In fact, local governments have been collecting data and sending it to the central government for consolidation and reporting. A key challenge for the project is to work with local government agencies to gain access to metrics we need for the project.

6. C2M2 metrics

The table below provides an overview of metrics that will be collected in Pemba with focus on the economy and education.

Perspective	Strategic Objectives	Measurement objectives (metrics)	In scope
Pandemic	Understand the current state of the pandemic	COVID-19	√
Health	Impact of water borne diseases	Access to drinking water	√
	Mitigate the impact on care and access to care	Access to care	
		Reduce the impact of pandemics	
		Improve preventive care	
Education	Mitigate the impact on education	Mental health	
		Access to education	√
Economy	Mitigate the economic impact	Quality of education	√
		Impact on local economy	√
		Mobility	√
		Economic health	√
Social	Mitigate the impact on relevant SDG	Personal finances	√
		Safe and affordable housing	
		Access to public transport systems	
		Inclusive and sustainable urbanization	√
		Access to food	√

Table 5: Summary of C2M2 metrics for Pemba

7. Tools for Data Collection

Category	Type of tools used	Computer lab utilized? (Y/N)	Internet connectivity (speed)	Internet reliability (G, F, P)
Data Capture	Tablets	Y	1-4GB	Good to Fair
	Computer	Y	NA	NA
	GPS	Y	NA	NA

Notes:

	The team recently acquired a 4G LTE Mobile Hotspot that will provide a good to fairly reliable internet connectivity (5-10Mb/s) thus enabling data collection in the field. In addition, the team will also use the KoboCollect tool that provides offline data collection capabilities.
--	--

8. Data Management

ArcGIS and the Cities Navigator application will be used as primary data repository. In addition, the team will use the following processes to enforce ethics:

To ensure quality control during data collection, students will be trained and undergo a pilot phase to ensure that both data collectors and providers understand the intentions of the research. Regarding ethical issues for households, all participants must sign an informed consent which clearly states the project objectives, uses and procedures of and for the research, as well as its possible consequences, and that all participation is voluntary. All collected data will be published on open-source platforms and made available to all stakeholders to make sure that the information has not been tampered with.

9. Platform for Data Sharing

In addition to making the data available through ArcGIS and Cities Navigator, the team will launch a website and Adobe Dreamweaver to publish data. All platforms will allow users to export data into multiple formats for further processing to meet their specific needs.

10. Software for Data Analysis

The team will use STATA for data analysis and Cites Navigator for its data visualization and analytics capabilities.