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An Appraisal of Water Availability, Infrastructures for Faecal Disposal and the Potential of Spread of Infectious Diseases in the Traveling Agencies and Motor Parks in the City of Yaounde (Cameroon)

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Abstract

The number of interurban and urban-rural travelers in the city of Yaounde has recently exceeded one hundred thousand per year, yet surprisingly few studies have assessed travelers' behavior, illness, and risk factors in a sanitary risks setting. Particularly scarce are surveys of data spanning travel, return, and follow-up of the same cohort in traveling agencies and parks. This study examines behavior and illness among travelers moving from Yaounde to other urban and rural areas of Cameroon and beyond. Patterns of behavior connected to a type of travel and illness are characterized in this study so as to identify risks factors and provide background data for pre-travel advice in our traveling agencies. Assessing the susceptibility that imported cases could pose to the national response to infectious diseases depends both on public health, health services and infrastructures. The six agencies assessed: Nvan, Mokolo, Tongolo, Biyem Assi, Mimbowman and Etoudi reveal that the sanitary infrastructures for faecal and urinary disposal are not sufficient and more so, some agencies do not keep enough cleanliness, let alone provide adequate hand washing material as prescribed by national and international concerns to combat the global health challenges. This could be an impediment to travellers going out or inside of the city, and could be a preponderant mechanism for the spread of infectious disease as presented by the infectious diseases isolated and identified in the health districts around the travelling agencies.

Keywords

Water Accessibility, Infrastructures for Faecal Disposal, Public Sanitation Infectious Diseases, Motor Parks, Yaounde

1. Introduction

This research is to provide governments, health authorities and relevant stakeholders with elements to consider in adjusting travel measures to the changing epidemiological situation of national public health and a contribution to mortality and morbidity. Each country should conduct a risk-benefit analysis and decide on its priorities. World Health Organisation (WHO) recommends that priority should be given to essential travel for emergencies, humanitarian actions (including emergency medical flights and medical evacuation), travel of essential personnel (including emergency responders and providers of public health technical support, critical personnel in transport sector such as seafarers and diplomatic officers and repatriation). Sick travellers and persons at risk including elderly travellers and people with chronic diseases or underlying health conditions, should delay or avoid travelling to and from areas with community transmission [1] [2]. There is no "zero risk" when considering the potential importation or exportation of cases in the context of international travel. Therefore, thorough and continuous risk assessment and management will help identify, reduce and mitigate those challenges, while balancing the socio-economic consequences of travel measures (or temporary restrictions) against potential adverse public health consequences.

The following factors should be considered: local epidemiology and transmission patterns, the national public health and social measures for controlling the outbreaks in both departure and in destination countries; public health and health service capacity at national and subnational levels to manage suspect and confirmed cases among travellers, including at points of entry (ports, airports, ground crossings) to mitigate and manage the risk of importation or exportation of the disease. Epidemiological situation and transmission patterns at origin and destination in the urban areas should be considered. It is a stunting reality that there is an imperative need to provide healthcare services to travelers worldwide. As a result a new branch of medicine was created, called travel medicine. According to the World Health Organisation (WHO), people who plan to travel need to contact a physician specialized in travel medicine, at least four to six weeks prior to departure. Unfortunately the majority of travelers do not consider the possibility to consult a medical service prior to the departure for an international trip [1].

A visit to the centers for disease prevention primarily aims to inform the traveler about potential health hazards of the destination, precautionary vaccinations, according to WHO guidelines and specific medication that might be required as you move in and out of the urban setting. Many infectious diseases are related with consumption of contaminated food and water. Diseases such as Brucellosis, Cholera, Listeriosis, Leptospirosis, Typhoid Fever and Hepatitis A and E and almost especially diarrheal disease are directly associated with the consumption of food and water [3]. It is estimated that over 40% of travelers would suffer from diarrhea known as "traveler's diarrhea". This is a mild self-limiting disease

with duration of less than five days and is caused by bacterial infection and intestinal parasites [4]. The incidence rate of malaria among travelers is estimated to be 30,000 annually. In most cases of malaria, transmission occurs through mosquito bites and infection by the Plasmodium of Malaria and could be incurred if the sanitary conditions in traveling agencies are daunting. The clinical symptoms include high fever, headaches, diarrhea, abdominal pain or cough are also linked to the traveling environment [5] [6].

The preparation of the travel should begin at least one month prior to the departure. Travelers must acquire essential information about hygiene conditions of the final destination, the climate and other special conditions [7]. A scheduled visit to a health professional is necessary, especially in the case of travelers suffering from chronic diseases or those taking chronic medication. In many cases vaccination is considered essential for specific destination countries. Consumption of food and-or beverage with caution is considered to be of major importance to protect the health of travelers. Travelers should eat in recommended places and they should under no circumstances buy food and beverage from street cantinas. Fruit and vegetables with thick shells (provided that are well washed), as well as well-cooked and canned foods may also be consumed. Hand hygiene (washing and using alcohol solution), is important before meals or after using the toilet. Partially cooked foods, shellfish, fresh salad, fresh milk and food exposed to ambient temperatures should be avoided. It is also recommended to use bottled, sealed or boiled water for drinking. In motor parks with poor sanitary living conditions there should be given special attention to the consumption of other beverages such as coffee, tea and mineral water, while beer and wine should be opened up in front of the client. Insects pose a risk factor for travelers' health. Flies, mosquitoes and ticks can become intermediate hosts of various diseases. Protective measures include appropriate clothing covering the limbs, use of closed shoes; and avoiding forests, lakes or still water. Use of insects' repellents can also be of help. Furthermore, research tends to focus on the effects that one or just a few specific factors have on travelers' behavior and illness: destination, length of journey, purpose of travel, gender, risk behavior, and particular diseases associated with diarrhea remained the most common cause for seeking health attention. It is in the context of health risks due to COVID -19 that our major objective is to determine the sanitary conditions of major travelling agencies in the city of Yaounde. The specific objectives are to determine the sanitary conditions of toiletry infrastructures, characterize the urinary infrastrucures, assess the level of hand washing equipment and evaluate the general nature of environmental cleanliness of the motor parks in Yaounde [8].

2. Materials and Methods

The city of Yaoundé is located on the western border of the South Cameroon Plateau at a latitude of 3˚52'N and a longitude of 11˚32'E (**Figure 1**). This plateau has an average altitude of 750 m [9] (Bachelier, 1959). The climate in

Yaoundé according to Suchel (1972) is of the equatorial type, it is hot and humid but attenuated by the altitude. This climate is characterised by moderate precipitations (annual pluviometry mean: 1576 mm) and temperature varies slowly with time from 22.4˚C to 27.4˚C. The highest daily thermal amplitude is 10.4˚C recorded in February, while the lowest value is 7.2˚C and is recorded in July. December, January, February, July and August are the sub-arid months, while April, May, September and October are the months with the highest rainfall. Four seasons can be distinguished in Yaoundé; a long dry season (from December to March), a short rainy season (from April to June), a short dry season (July and August) and a long rainy season (September to November). Yaounde consists of 20 quarters, but in this study only those with a population of more than 100,000 inhabitants were considered (Figure 1). The six motor parks chosen were finally enrolled because they are the major points of transit of travellers in and out of Yaounde. Motor parks to this prospective cohort study were identified at visits to all the travelling agencies. Data on the subjects' health and behavior were collected by questionnaires before and after journeys and over a three-week follow-up. In addition, the subjects were asked to fill in health diaries while traveling. Description of the study site per sampling station was confined in a Table 1 as presented below.

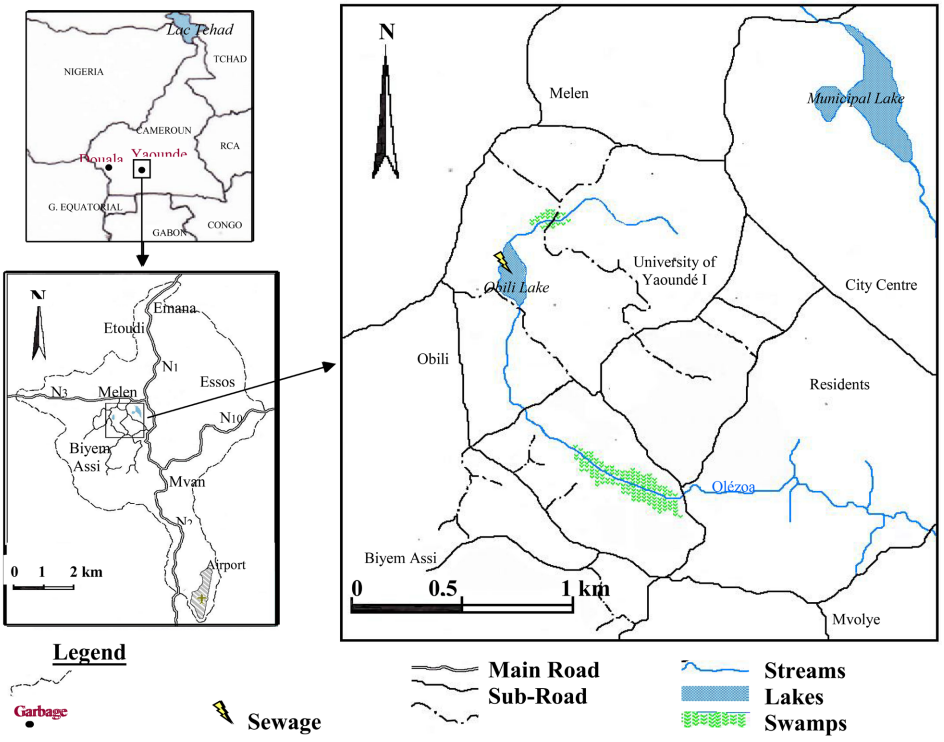

Figure 1. Map of Yaounde, indicating the sampling quarters.

Table 1. Analytic criterium for the assessment of health infrastructures per motor park.

Type of Cars/ Number of passengers	Toilettes infrastructures	State of the infrastructures	State of Urinary	Dispositive to wash hands	Level of sanitation of the agency

3. Results and Discussion

The findings on the infrastructures and sanitation of the different parks in Yaounde is presented in Tables 2-7: The Nvan motor park (Table 2) is located in the Yaounde 4th district and regroups numerous agencies transporting passengers to the North, littoral, South, East regions and some divisions of the centre region. These agiencies mostly use buses, coasters and cars to transport thousands of passengers to the different parts of Cameroon. Of the ten agencies assessed in Nvan, toilet and urinary infrastructures are present in seven, they are very clean in three and six of the agencies are clean, while the others do not meet the adequate sanitation as presented in Table 2.

The Mimbowman motor (Table 3) park is located in the Yaounde 4th district, and regroups more than 10 agencies. The agencies transport passengers to the west, east south regions and some divisions of the centre regions. The cleaning of hands is present at the unique entry point, that is close to the police station. There exists a single toilette facility that is used by passengers of this motor park. The buses and cars are used to transport passengers all over the country. Of the nine agencies assessed in Mimbowman, toiletry and urinary infrastructures are absent, there are very few hand washing points, and the level of sanitation is good in two of the transport services as presented in Table 3.

The Tongolo Motor park (Table 4) is located in the Yaounde 1 district and regroups about 10 agencies that are located transport passengers to the west region and some localities such as Bafia and Ntui. There is an apparent space between the agencies, and the types of vehicles used are mostly buses, coasters and cars. There is a lot of sanitary promiscuity between the passengers who use the streams and bushes around as their main toiletry and urinary infrastructures. Of the nine agencies assessed, toilet infrastructures are present in four, urinaries are quasi absent and most of the agencies to not take to task the attributes of environmental cleanliness as presented in Table 4.

Table 2. The infrastructural and sanitary characteristics of the NVAM motor parks.

The NVAN motor park						
Agency	Type of Cars/Number of passengers	Toilettes infrastructures	State of the infrastructures	State of Urinary	Dispositive to wash hands	Level of sanitation of the agency
A	Bus (350)	Present	Very clean	Very clean	Present	Clean
B	Coster (150)	Present	Dirty	Dirty	Absent	Dirty
C	Coster (180)	Present	Dirty	Dirty	Absent	Dirty
D	Coster (150)	absent	absent	absent	Absent	Dirty
E	Bus(250)	absent	absent	absent	Present	Clean
F	Bus (300)	Present	Clean	Clean	Present	Clean
G	Bus (400)	Present	Very clean	Very Clean	Present	Clean
H	Car (120)	absent	absent	absent	Absent	Dirty
I	Bus (350)	Present	Very clean	Very Clean	Present	Clean
J	Car (100)	Present	Clean	Clean	Absent	Clean

Table 3. The infrastructural and sanitary characteristics of the Mimbowman motor parks.

MIMBOMAN Motor park						
Agency	Type of Cars/Number of passengers	Toilettes infrastructures	State of the infrastructures	State of Urinary	Dispositive to wash hands	Level of sanitation of the agency
B	bus (420)	absent	absent	Absent	present	Clean
C	car (180)	absent	absent	Absent	absent	Dirty
D	car (180)	absent	absent	Absent	absent	Dirty
E	car (230)	absent	absent	Absent	absent	Dirty
F	Bus (260	absent	absent	Absent	absent	Dirty
G	Car (100)	absent	absent	Absent	absent	Dirty
H	Car (120)	absent	absent	Absent	absent	Dirty
I	Bus (300)	absent	absent	Absent	absent	clean
J	Bus (250)	absent	absent	Absent	absent	Dirty

Table 4. The infrastructural and sanitary characteristics of the Tongolo motor parks.

Gare routière de TONGOLO						
Travelling agency	Type of Cars/Number of passengers	Toilettes infrastructures	State of the infrastructures	State of Urinary	Dispositive to wash hands	Level of sanitation of the agency
B	Coster (180)	absent	absent	Absent	absent	Dirty
C	Bus (300)	absent	absent	Absent	absent	Dirty
D	Car (200)	present	sale	Absent	absent	Dirty
E	Car (150)	absent	absent	Absent	absent	Dirty
F	Car (90)	present	absent	Absent	absent	Dirty
G	Bus (200)	present	absent	Absent	absent	Dirty
H	Bus (200)	present	absent	Absent	absent	Dirty
I	Car (100)	absent	Very Clean	Very clean	present	Very clean
J	Car (100)	absent	absent	Absent	absent	Dirty

The Etoudi Motor park (Table 5) is located in the Yaounde district. It regroups more than 10 agencies that transport passengers to the centre, west and North West regions. This motor park under the direct tutelage of the council uses buses, touristic coasters to transport passengers all around the country. The sanitary infrastructures to clean the hand are lacking. Of the nine agencies assessed in the Etoudi motor parks, faecal disposal and urinaries are present in two, and there is no adequate upkeep of the level of sanitation as presented in Table 5.

The Biyem Assi motor park (Table 6) is located in the Yaounde 6th district. It regroups numerous agencies which transport passengers to the west, north west, south west regions. Each agency occupies a specific area of the motor parks. They mostly use big buses to transport the passengers to other places out of Yaounde. Of the nine traveling agencies investigated in the Biyam Assi park,

four present appropriate toilet and urinary infrastructures, but hand sanitation and water cleaning material is rare. Half of the agencies present an average level of environmental cleanliness (Table 6).

The Mokolo motor park (Table 7) is located in the Yaounde 2 district., it regroups numerous traditional car parks transporting passengers to the periphery of Yaounde which is Ekekam, Bissoko, Ekol, Evodoula, Nkolbizi, Nkol-Pobla, Mbamze, Elig-doum, Etok, Elat-Meyong, Nloudou, Nkol-Meyos, Miwoho. Water cleaning material is present at one of the entry points of the motor park. There is a double toiletry infrastructure that is used by passengers using this motor park. The major transportation facilities are small cars of 4 places transformed to 6 places by the car owners. Of the nine agencies analysed in the Mokolo motor parks, toilets and urinary infrastructures are completely absent, and there is a very low level of environmental sanitation and waste disposal as presented in Table 7.

Table 5. The infrastructural and sanitary characteristics of the Etoudi motor parks.

	ETOUDI Motor Parks					
	Type of Cars/Number of passengers	Toilettes infrastructures	State of the infrastructures	State of Urinary	Dispositive to wash hands	Level of sanitation of the agency
B	Car (100)	absent	absent	Absent	absent	Dirty
C	Bus (120)	present	propre	Propre	present	Clean
D	Car (170)	absent	absent	Absent	absent	Dirty
E	Car (100)	present	propre	Propre	absent	Dirty
F	Car (200)	absent	absent	Absent	present	Clean
G	Car (200)	absent	absent	Absent	absent	Dirty
H	Car (100)	absent	absent	Absent	absent	Dirty
I	Tourism cars (50)	absent	absent	Absent	absent	Dirty
J	Tourism cars (50)	absent	absent	Absent	absent	Dirty

Table 6. The infrastructural and sanitary characteristics of the Biyem-Assi motor parks.

	BIYEM-ASSI Motor Park					
Travelling agency	Type of Cars/Number of passengers	Toilettes infrastructures	State of the infrastructures	State of Urinary	Dispositive to wash hands	Level of sanitation of the agency
B	Bus (300)	present	very clean	Very clean	absent	clean
C	Bus (200)	absent	absent	absent	absent	clean
D	Bus (250)	present	clean	clean	absent	clean
E	Bus (200)	absent	absent	absent	absent	Dirty
F	Bus (270)	absent	absent	absent	absent	Dirty
G	Bus (270)	present	Clean	clean	absent	Clean
H	Bus (180)	present	clean	clean	absent	Clean
I	Bus (200)	absent	absent	absent	absent	Dirty
J	Bus (250)	absent	absent	absent	absent	Dirty

Table 7. The infrastructural and sanitary characteristics of the Mokolo motor parks.

MOKOLO Motor parks						
A	Type of Cars/Number of passengers	Toilettes infrastructures	State of the infrastructures	State of Urinary	Dispositive to wash hands	Level of sanitation of the agency
B	Tourism cars (30)	absent	absent	absent	absent	Dirty
C	Tourism cars (30)	absent	absent	absent	absent	Dirty
D	Tourism cars (30)	absent	absent	absent	absent	Dirty
E	Tourism cars (30)	absent	absent	absent	absent	Dirty
F	Tourism cars (30)	absent	absent	absent	absent	Dirty
G	Tourism cars (30)	absent	absent	absent	absent	Dirty
H	Tourism cars (30)	absent	absent	absent	absent	Dirty
I	Tourism cars (30)	absent	absent	absent	absent	Dirty
J	Tourism cars (30)	absent	absent	absent	absent	Dirty

The sanitary conditions reveal that most of the diseases around the health infrastructures in motor parks are malaria, amibiasis, ascadiasis and other intestinal diseases, urinary diseases and also breathing diseases and skin illnesses as presented in Table 8. Some of the prominent infectious disease agents are presented in Figure 2.

The travel measures (or temporary restrictions) should be based on a thorough risk assessment, taking into account country context, the local epidemiology and transmission patterns, the national health and social measures to control the outbreak, and the capacities of health systems in both departure and destination countries, including at points of entry. Since travel medical services are constantly expanding, the number of people who use these services is expected to further increase. Interventions at an individual level and the contribution to protect public health put the issue in a high priority in both medical and the nursing science. Travel medicine professionals should be well prepared and provide specialized knowledge in infectious diseases. Continuous professional training and education is required to maintain the health level of travelers, and assess their needs to protect them from potential health risks as presented in Tables 2-7. Awareness for prevention measures and the appropriate preparation to encounter a potential health problem is expected to surpass undesirable conditions affecting both the safety and the health status as well as the mental and physical well-being of travelers as some are unable to use good toilets, urinaries either during departure from Tongolo, Mokolo, Mimbowmam, Mvan, Biyem Assi and Etoudi or during arrivals into the city as presented in Tables 2-7. Additionally is equally important to secure compliance of travelers with regulations to provide a healthy trip so as to avoid diseases (Table 8).

Information from trusted internet resources contributes to an updated and accessible information, while the expanding services of travel medicine should be supported by the state policies and regulations. In our case, there is less or no

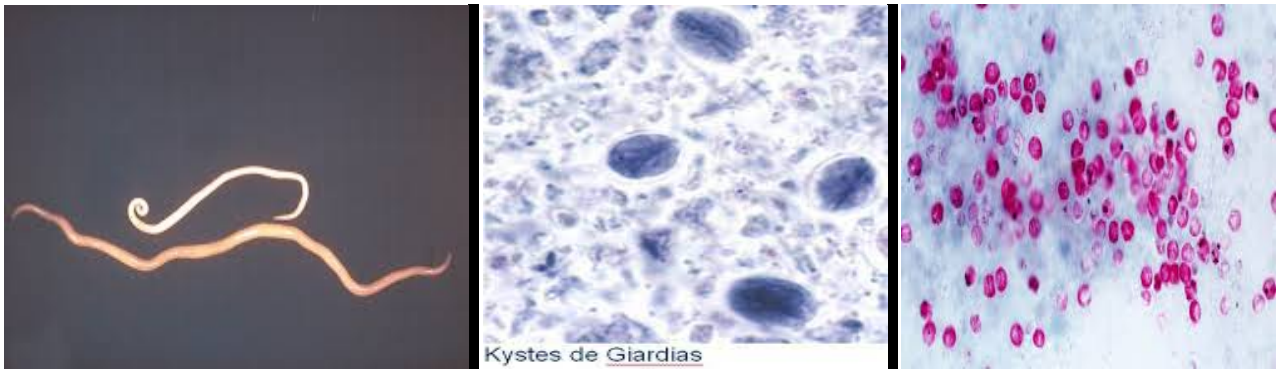

Figure 2. Prominent infectious diseases assessed in study area (*Ascaris*, *Giardia* and *Cryptosporidium*).

Table 8. An assessment of the different diseases in the health installations near travelling agencies.

Name of travelling agency	MIMBOMAN	MVAN	MOKOLO	ETOUDI	TONGOLO	BIYEM-ASSI
Health installation	Minbomam Dispensary	Mvan health center	Cité verte hospial	marie rêne d'Etoudi health centre	La gloire-Tongolo, Health district	Biyem-Assi Clinic
Malaria	Malaria (Very frequent)	Malaria and Gale (frequent)	Malaria (Very frequent)	Malaria (frequent)	Malaria(frequent)	Malaria (Very frequent)
Parasitoses intestinales	Amibiases Ascaridioses and other worms intestinal (very frequent)	Giardiose Oxyrose, Ascaridiose, (very frequent)	Amibiasis intestinales, Filarioses Vers intestinaux, (frequent)	Amibiase, Intestinal worms, (Frequent)	Amibiase (very frequent), Other parasits (frequent)	Intestinales amibiasis, and helminthiasis (Very frequent)
Bacterial diseases	Urinary Infections, (very frequent)	Sore throat, otite, sinusite, brochitis, pneumonia (meningitis, tuberculosis), (very frequent)	Skin Infections, pneumonia, tuberculosis (very frequent)	RAS	RAS	Pneumonia and tuberculosis (very frequent)
Peril fecal diseases	Urinar Bilharzia urinaire, typhoïde (very frequent)	Cholera, typhoïde, (very frequent)	Typhoïde, coliformes fecal coliforms (very frequent)	*Fecal coliforms* fecal, Salmonellosis (Very frequent)	*E. coli*, coliforms, fecal and total coliforms, Aeromonas (very frequent)	Typhoïde, coliformes (very frequent)

internet services giving travellers adequarte logistical information on their travel to and out of the city. To get a comprehensive view of travel-associated health problems, prospective study designs should be employed for collecting data on illness, after return, and at follow-up. It is essential to proactively communicate to the public through traditional media, social media and other channels about the rationale for gradually resuming international travels, the potential risk of travel and the measures required to ensure safe travel for all. By including a post-travel follow-up, we extended the research to symptoms not developing un-

til after return. Destination, gender, age, and duration of travel were shown by multivariable analysis to be factors predisposing to illness (**Tables 2-8**) [10].

Despite efficient preventive measures like vaccinations, malaria prophylaxis, and travel advice, the majority fall ill during or after travel. Diarhoea is the most common disease while abroad, followed by skin problems and fever. After travel, the most frequent complaints are fever, respiratory tract infections, and skin problems. Symptoms generally remain mild, not requiring medical care [11]. The proportion of newly onset illness among returning travelers is considerable: one-third get health problems after their journeys. Advice regarding this should be given already at pre-travel appointments [7]. These, include capacities for entry/exit screening; early detection through active case finding, isolation and testing of ill passengers (including supply of personal protective equipment at PoE); cleaning and disinfection; case management, including any necessary transportation to a medical facility; identification of contacts for contact-tracing; public information sharing on local policies for adequate hygiene and sanitation measures; physical distancing and wearing of masks; sharing of emergency phone numbers; and risk communication and education on responsible travel behavior [12]. Adapted procedures for handling baggage, cargo, containers, conveyances, goods and postal parcels should be available and clearly communicated to passengers leaving or entering Yaounde as presented by [13]. WHO recommends a comprehensive approach to supporting and managing travellers before departure and on arrival, which includes a combination of measures for consideration before departure and on arrival. General advice for travellers includes personal and hand hygiene, respiratory etiquette, maintaining physical distance of at least one metre from others and use of a mask as appropriate. Sick travellers and persons at risk, including elderly travellers and people with serious chronic diseases or underlying health conditions, should postpone travel internationally to and from areas with community transmission. Crowd control should be put in place to prevent transmission in areas where travellers gather before departure or on arrival from the city as recommended by [14]. Beyond the scientific considerations, there are ethical, legal and human rights aspects related to privacy of personal data, medical confidentiality, potential risk of falsification or engagement in risky behavior, stigma and discrimination. Travellers should self-monitor for the potential onset of symptoms on arrival for 14 days, report symptoms and travel history to local health facilities and follow national protocols [15]. Countries shall not charge travellers for measures required for the protection of health, including 1) examinations to ascertain their health status; 2) vaccination or prophylaxis on arrival (not published 10 days earlier); 3) appropriate isolation or quarantine; 4) certificates specifying the measures applied; or 5) applied to baggage accompanying them. Countries should regularly reiterate the risk assessment process and review the capacity of their public health and other relevant sectors while gradually resuming international travels. In this process countries should also consider new knowledge about travelers

disease and its epidemiology by consulting updated WHO scientific briefs [10] [16] [17] [18].

4. Conclusion

The decision-making process to safeguard passengers in and out of the city of Yaounde in particular and other major African cities in general should be multisectoral and ensure coordination of the measures implemented by national and international transport authorities. The other relevant sectors should be aligned with the overall national strategies for adjusting public health and social measures. Any subsequent measure must be proportionate to public health risks and should be adjusted based on a risk assessment, conducted regularly and systematically as the infectious disease situation evolves and communicated regularly to the public. Despite proper preventive measures like vaccinations, malaria prophylaxis, and travel advice, the majority of our subjects fell ill during or after travel and present intestinal, skin, urinary and respiratory diseases. As the symptoms mostly remained mild, health care services are seldomly questioned. Typical profiles of traveling agencies and motor parks reveal a lot of amateurism in the transport sectors, as most toilets were not well cared for if at all they existed, the urinary was inexistent and the sanitary status was deplorable. This essential analytic data thereby provide an essential working tool for pre-travel advice. The Mokolo, Tongolo, Mombowman, Nvan, Biyem-Assi and Etoudi and other moto parks around Yaounde, need to modify their environmental sanitation architecture in order to safeguard the health and wellbeing of travellers in and of the city, especially as the global network is undergoing an unprecedented health challenge.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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