



Strategies for Management of Certificates of Analysis of *Corona virus* Disease 2019 for Travellers in Times of Pandemic: Case of the Pasteur Institute of Côte d'Ivoire

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Authors' contributions

This work was carried out in collaboration among all authors. Author DTFB designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors AS and ABPAJC managed the analyses of the study. Author DTFB managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The *Corona virus* disease 2019 (COVID-19) health crisis has not spared any country in the world, from the most advanced to the poorest. COVID-19 pandemic has exposed much vulnerability in systems and societies. In all resource-constrained countries, the response has been very

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complicated. The pandemic had to be dealt with very quickly with limited health and economic resources to avoid the hecatomb already predicted for these countries. In Côte d'Ivoire in particular, health and government authorities worked with state or private structures with infrastructure and human resource capacities to develop a rapid and effective response plan. Several measures have been adopted to reduce the spread of COVID-19. As a result of all these strategies, the number of cases of infected persons has been gradually decreasing. This new situation has favored the revision of certain restrictive measures, in this case the closure of air borders, which have of course been eased under certain conditions. Travelers are required to have a paper attesting to their negativity in COVID-19 test. Thus, Pasteur Institute of Côte d'Ivoire (IPCI), the reference laboratory for carrying out COVID-19 tests, was responsible for supplying a certificate of analysis to travellers. The purpose of this article is to show the internal process developed and different strategies implemented by IPCI to establish and deliver this document in order to meet the demand in the context of a pandemic.

Keywords: *Corona virus disease 2019; travelers; Pasteur Institute of Côte d'Ivoire.*

1. INTRODUCTION

In December 2019, Chinese public health authorities reported several cases of acute respiratory syndrome in the city of Wuhan, Hubei Province, China. Chinese scientists quickly identified a novel *Corona virus* as the main causative agent. This was a new strain of *Corona virus* that had not previously been identified in humans. The virus was identified as belonging to the *Corona virus* and responsible for Severe Acute Respiratory Syndrome 2 (SARS-CoV-2). The disease caused by *Coronavirus* was named as "COVID-19" which refers the reported year of 2019 [1-3].

On March 11, 2020, a first case of COVID-19 was diagnosed in Côte d'Ivoire (CI). It was a forty-five (45) year old Ivorian who had returned from a stay in Italy. The information was given by the Ministry of Health and Public Hygiene (MHPH) in a press release. On March 12, 2020, 24 hours after the announcement of the first case of COVID-19 in Côte d'Ivoire, nine (9) people in the entourage of the contaminated man were quarantined. Following the confirmation of case of *Corona virus* in the country and in the absence of treatment, the health authorities recommended the adoption of a number of actions to reduce the risk of contamination by COVID-19 [4]. In order to do this, it was important to know the danger we were facing. Indeed, most infected people develop a mild to moderate form of the disease and recover without hospitalization. The most common symptoms are fever, dry cough and fatigue; least common are aches and pains, sore throat, diarrhea, conjunctivitis, headache, loss of smell or taste, and skin rash. Severe symptoms are difficulty breathing or shortness of breath, tightness or pain in chest, loss of speech or

motor skills that most often require hospitalization [5,6].

Unknown prior to the outbreak in December 2019, this new infection has spread around the world to become a pandemic. As a result, the World Health Organization (WHO) declared "a public health emergency of international concern in March 2020 [2,7]. Thus, as of June 24, 2020, two months after the start of the epidemic, Côte d'Ivoire has recorded 8,164 confirmed cases, 4,687 active cases, 3,419 cured and 58 deaths according to the Ivorian Ministry of Health [8]. Faced with the spread of disease and with main outbreak, the city of Abidjan, Ivorian authorities have adopted restrictive measures to reduce the spread. These included the adoption of martial measures, establishment of a curfew, closure of land, air, and sea borders, and a ban on unauthorized travel between Abidjan and cities in the interior of the country [4]. This strategy implemented since the end of March to contain COVID-19 emergency is extended until 30 June 2020 [9]. This has considerably contributed to reduction of population migration and trade flows with consequence of slowing down the progress of COVID-19 in Côte d'Ivoire (CI).

It was therefore decided during a National Security Council (CNS) chaired by Head of State, to reopen air borders from July 1st, 2020 while maintaining the state of emergency, closing land borders, isolating the greater Abidjan area until July 15, 2020 as well as closing bars and nightclubs during the same period [10]. This new measure obliged the government to ensure that anyone entering or leaving the territory by air is not COVID-19 positive. It was decided on August 5, 2020, by a memorandum from the Director of

Cabinet of the MPPH, to issue a certificate of analysis for travellers signed either by the Director of the Pasteur Institute of Côte d'Ivoire (PICI), or by the head of department of the Service of Infectious and Tropical Diseases (SITD) of the University Hospital Center (UHC) of Treichville (Abidjan) [11]. In this scenario, since August 16, 2020, the PICI has put in place a strategy for managing the issuance of certificates of analysis to travelers [12]. The purpose of this article is to analyze four fundamental strategies that have enabled the process to be carried out successfully, namely, organization of process, issuance of the certificate of analysis, distribution and management of data, all in a context of health crisis management.

1.1 Government Decisions Adopted In Côte D'ivoire

Several actions have been undertaken by the Government since the outbreak of COVID-19 health crisis in CI. These included : (i) setting up a crisis committee, (ii) raising awareness and disseminating preventive measures, (iii) developing an emergency response plan, (iv) systematic detection of suspected cases from travelers from countries affected by the pandemic, (v) quarantine or containment, and (vi) management of confirmed cases [13].

1.2 National Security Council (NSC)

On Monday, March 16, 2020, five (05) days after the announcement of the first case of COVID-19 in Côte d'Ivoire, an extraordinary meeting of the NSC was held, chaired by the President of the Republic and attended by Committee of Experts. The agenda focused on a single item, namely, the situation of COVID-19 pandemic in Côte d'Ivoire. It emerged that as of March 16, 2020, six (06) confirmed cases had been registered in Abidjan. All these cases, imported from France and Italy, including two (02) secondary cases in Abidjan have been taken care of by health services. It should be noted that the first case was cured and that the health status of others was not a cause for concern. After analysis of the situation and in view of evolution of the number of suspected cases, NSC adopted thirteen (13) measures aimed at stemming the spread of the epidemic on national territory [14].

These are:

1. A suspension for a period of 15 days, renewable, starting on March 16, 2020 at midnight, of the entry into Côte d'Ivoire of non-Ivorian travelers from countries with more than 100 confirmed cases of COVID-19. Ivorian nationals and non-Ivorian permanent residents were subjected to mandatory 14-day quarantine upon entry into Côte d'Ivoire in centers requisitioned by the State;
2. Strengthened health control at air, sea, and land borders;
3. Quarantine of suspected cases and contacts of patients in centers requisitioned by the State;
4. The closure of all preschool, primary, secondary and higher education institutions for a period of 30 days starting at midnight on March 16, 2020;
5. The respect of a distance of at least one (01) meter between people in supermarkets, scrubland, restaurants, businesses, airport area and public places;
6. The respect of personal, behavioral, water and food hygiene measures (hand washing with soap, application of hydro-alcoholic solutions, prohibition of manual greetings, hugs and kisses, strict prohibition of bush meat consumption);
7. The closure of nightclubs, cinemas and places of entertainment for a period of 15 days, renewable from 18 March 2020 at midnight;
8. A ban on population gatherings of more than 50 people for a period of 15 days renewable starting at midnight on March 18, 2020;
9. The suspension of all national and international sports and cultural events for a period of 15 days renewable starting from midnight on 18 March 2020.
10. The opening of additional sites equipped with care in Abidjan and in the cities of the interior of the country, namely, Abengourou, Aboisso, Bondoukou, Bouaké, Bouna, Daloa, Gagnoa, Korhogo, Man, Odienné, San Pédro and Yamoussoukro ;
11. Total free diagnosis and management of all suspected and confirmed cases of COVID-19;

12. Strengthening the health security of health workers, research personnel, defense and security forces, airport zone and port platform personnel in the prevention of COVID-19;
13. The reactivation of departmental epidemic control committees.

A Monitoring Committee has been set up by the NSC to monitor the implementation of these measures and their adaptation to the changing situation.

These new reforms made it possible to initiate the response plan against COVID-19 in Côte d'Ivoire.

2. METHODOLOGY

2.1 Intervention Strategies for the Response to Covid-19

More than a decade ago, the WHO Regional Office for Africa (WHO-AFRO), its members, and their technical partners adopted a strategy called Integrated Disease Surveillance and Response (IDSR). It aims to develop and implement integrated disease and response systems in African countries. This strategy promotes the rational use of resources by integrating and channeling routine surveillance activities. Surveillance includes the systematic and continuous collection of health data, their analysis and interpretation, and the dissemination of the information collected to those who need it to take the necessary health measures [15]. The success of these programs depends on the resources devoted to detecting the targeted diseases, obtaining laboratory confirmation of cases, and using national thresholds for interventions [16]. Thus, a national strategy has been defined: "detect, treat and track". Eight (08) strategic areas of intervention have been identified, namely : (i) epidemiological and biological surveillance; (ii) monitoring of contacts; (iii) patient management; (iv) response to the epidemic outbreak; (v) prevention of transmission of the disease to *Corona virus* (COVID-19), (vi) risk communication, social mobilization and community involvement; (vii) operational research and (viii) the creation at the Prime Minister's Office of a Framework for Emergency Management, monitoring and evaluation of the matrix of actions and prevention measures [13]. These various actions were carried out by public

structures according to their missions and capacities.

2.2 National Institute of Public Hygiene (NIPH)

In response strategies for response to COVID-19, the Center for Public Health Emergency Operations located at NIPH was activated under instructions from MHPH. NIPH was therefore in front line of response plan with the main missions of raising awareness of population about risks of contamination, communication on measures to prevent transmission of disease, social mobilization and community involvement.

The INHP was also in charge of carrying out nasopharyngeal swabs through sampling centers set up in all municipalities of Abidjan and in several towns in interior of the country, as well as mobile rapid response teams (RRTs). Each sample taken had a unique identification code and was accompanied by an epidemiological record. All samples were then sent to the various laboratories authorized to diagnose COVID-19 under biosafety and biosecurity conditions [13].

2.3 Organization of Laboratories

2.3.1 Pasteur Institute of Côte d'Ivoire (PICI)

The reference laboratory, authorized to carry out analyses on samples from COVID-19 suspects was PICI under supervision of Ministry of Higher Education and Scientific Research. All naso-pharyngeal samples taken from suspected COVID-19 cases by INHP, the network of COVID-19 centers and RRTs were sent to respiratory virus unit of PICI. The institution had an efficient and dynamic technical platform. Thus, ten (10) new generation Real Time Polymerase Chain Reaction (RT-PCR) machines with a total capacity of four hundred (400) samples every six (06) hours were dedicated for analyses. RT-PCR, only test authorized by WHO, was performed on each sample for the diagnosis of COVID-19 [17, 18]. However, the sharp increase in testing activities in the context of the health crisis led Minister of Health and Public Hygiene to opt for a policy of decentralizing RT-PCR to other equipped and authorized laboratories in Abidjan and various cities in interior of country.

2.3.2 Support laboratories

Laboratories of Retroviruses of Côte d'Ivoire (RETRO-CI), Centre for Diagnosis and Research on AIDS and other Infectious Diseases, Integrated Centre for Bioclinical Research in Abidjan, Abidjan Military Hospital, as well as those of Bouaké University Hospital and Regional Hospital Centres in six (06) cities in interior of the country: Abengourou, Daloa, Korhogo, Man, Odienné, San-Pedro have been identified and qualified for diagnosis of COVID-19 by RT-PCR [13,17].

All these laboratories, as well as those of IPCI, received samples from patients suspected of having COVID-19, in addition to other samples sent for disease surveillance within the framework of the national surveillance network. All results of the RT-PCR tests for COVID-19 are first validated by different laboratories and then reported on a publication platform. It has enabled all the screening centers to have access to the available results within 48 to 72 hours. All of these systems have enabled the entire country to be covered in terms of COVID-19 sampling and diagnosis.

2.4 Management of COVID-19 Patients

In terms of health infrastructure, Côte d'Ivoire has an Infectious and Tropical Diseases Service (ITDS) housed at the Treichville University Hospital (Abidjan), which is one of the country's five university hospitals. In addition, the country has 88 General Hospitals (HG); 03 specialized hospitals; 12 denominational General Hospitals; 17 Regional Hospitals; 2501 Public, denominational and community Primary Health Care Institutions. In addition, there is a vast and growing private care network that could be exploited 13. The ITDS was required from the very first days to receive the first confirmed cases and manage patients according to the symptoms they presented. A neighborhood and traceability survey was carried out by INHP agents to identify the so-called "contact" cases of contaminated persons for immediate care. Other sites have been identified throughout the country for the care of patients suffering from COVID-19. These sites have been fitted out and rehabilitated with a total capacity of 500 beds for the gradual management of serious cases [12].

All of these concerted actions have led to a reduction in transmission with a gradual

reduction in the number of (positive) cases of COVID-19 in Côte d'Ivoire. In this context, the easing of certain restrictive measures was announced, in particular the reopening of air borders with the obligation for all travellers to have a certificate of negative COVID-19 test results.

3. RESULTS AND DISCUSSION

3.1 Strategies for Managing Certificates of Analysis

3.1.1 Setting up the process

As a first step, the process for managing the COVID-19 certificates of analysis at the PICI was developed step by step. The work was structured from the moment travellers were received until after their departure by means of a flow chart (Fig. 1).

3.2 Internal Reorganization of the Workspace

Two areas have been set up within the PICI, one to welcome travelers and the second to serve as a base for operations. Strict measures to ensure compliance with safety regulations have been put in place through explicit displays, namely:

- The social distance of at least one meter between travelers
- The wearing of masks is compulsory for all staff and travelers.
- A hand washing device with soap and drinking water
- The presence in both spaces of several gel or hydro-alcoholic solution dispensing devices.

Also, two working groups composed of five members each were set up. Each working group is made up of at least two researchers (doctors, scientists, biologists, and pharmacists), a reception secretary and a voluntary data entry operator, all of whom are IPCI agents. Teams worked from Monday to Saturday from 7.30 am to 8 pm to ensure the permanence of the work. The role of each member of the working group was defined as follows:

- The reception secretary is in charge of welcoming travellers, giving them information on the process for acquiring

the certificate of analysis and guiding them.

- Two (02) researchers are in charge of searching for the patient's result in a daily national database on the platform for online publication of results. The two agents verified the traveler's result based on the information contained in the required documents. Once the information has been validated, authorization is given to draw up the certificate of analysis.
- The data entry operator is responsible for writing analysis certificates according to a predefined data entry model.
- One (01) researcher in traveller reception area is responsible for distributing certificates of analysis and ensuring that forms are correctly filled in.

Depending on the number of travellers, additional staff was required at the rate of four (4) other agents per shift.

3.3 Establishment of Certificates of Analysis

In order to obtain a certificate of analysis, a form was drawn up with information to be filled in: surname and first names, unique identification bar code, date of sampling, date and time of travel, destination and finally telephone contact of traveller. The form is attached to the photocopy of page 2 of passport bearing traveller's photo and identity information. Both documents are sent by the reception secretary to operations room. The traveller's information is checked and result of the test, whether positive or negative, is confirmed in daily national summary database. It is also necessary to check validity periods for the test certificate imposed by various recipient countries (48 to 72 hours). Certificate of analysis is issued on date of day with full name of traveller (surname and first

Flowchart of the process of management of COVID-19 analysis certificates for travelers at the Pasteur Institute of Côte d'Ivoire

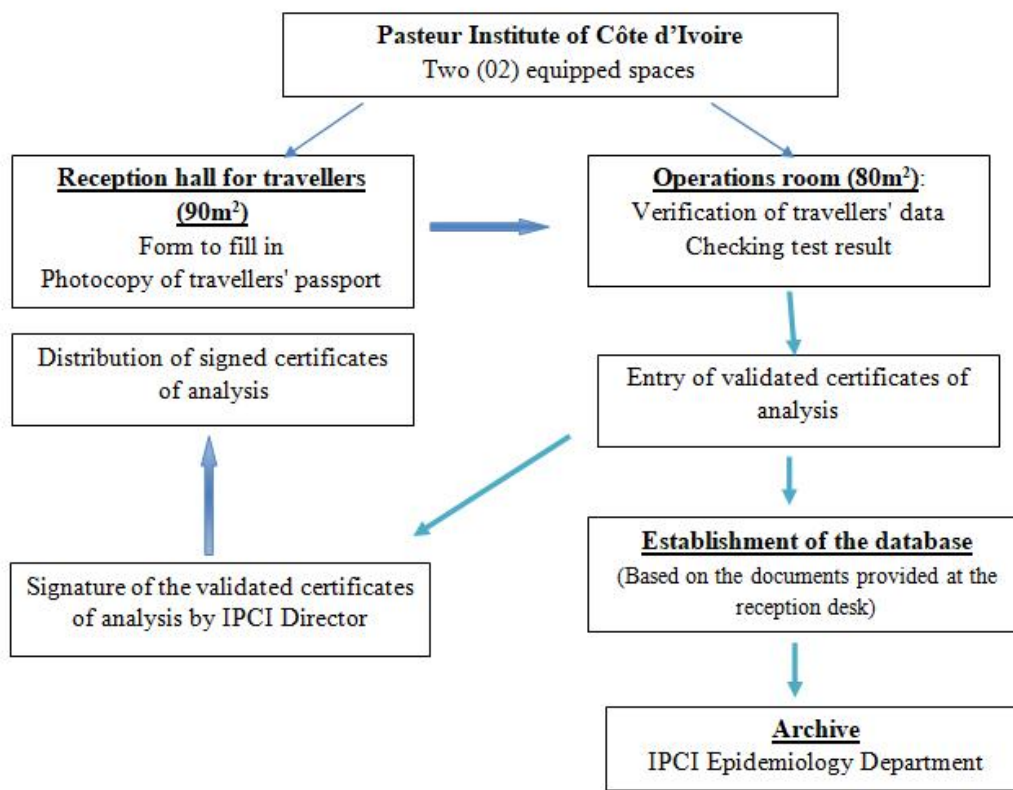


Fig. 1. Process for managing COVID-19 certificates of analysis at PICI

names according to the spelling on passport) and unique identification code. Finally, certificates of analysis are sent to Director of PCI for signing.

3.4 Distribution of Certificates of Analysis

Signed certificates of analysis are sent to the travellers' reception area for distribution, which is done by calling out the surname and first names on the document. Traveller is required to sign a form provided for this purpose once in possession of certificate of analysis. At end of the day, forms and documents used to draw up certificate of analysis are stored and archived. Number of certificates of analysis issued is determined on a daily basis.

3.5 Data Management

It was issued between 700 and 1100 certificates per day over a period of six (06) weeks (from 16 August to 27 September 2020) until implementation of an online certificate of analysis generation site. Destination of travellers was very varied, from sub-region to rest of African continent, in several countries in Europe, Asia and America. Daily data are recorded in a database and documents provided are archived by PCI epidemiological department.

4. CONCLUSION

When COVID-19 first appeared, African countries presented themselves as vulnerable territories with regard to the fragility of their health and economic systems. They had to use specific strategies adapted to their context, each at its own level and according to its means, to fight against the pandemic and thus thwart all the predictions that had been made. For Côte d'Ivoire, all institutions that can contribute to the fight have been mobilized. Participation in fight was carried out at different levels and PCI was pillar in terms of laboratory analysis. Moreover, management of COVID-19 certificates of analysis at PCI enabled staff to discover a formidable capacity to adapt to a new situation, personal commitment from researchers and adaptability to the workload. This experience also revealed a potential other than that of PCI's "laboratory". The lessons learned from this health crisis are that management must be comprehensive and inclusive by involving all levels of society and be able to adapt control strategies to different facets of disease. At this stage, it is far too early to know the exact extent of the impact of COVID-19 on our country. In

absence of treatment and vaccine, preventive measures (social distancing, barrier measures, containment) seem to be the most effective means of reducing the spread of COVID-19. This article is written to assist in response to possible further epidemics.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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