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Chemical implications and environmental impacts of COVID-19 pandemic in Burkina Faso

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Abstract

The study was focused on chemical implications and environmental impacts of corona virus pandemic in Burkina Faso. The objective was to describe the contribution of chemists, plant users and assess the disadvantages of covid-19 in the environment. Qualitative and quantitative data were collected and treated using Active Method of Research and Participative Planning. Results showed the increase of positive cases up to September 2020 with the increase of cured capacity. Plant users and scientists proposed some medicines such as Apivirine, chloroquine, artemisinin and others. Environment pollution (air, water, life medium, etc.) by wastes, plastics, masks and others.

1. Introduction

Pandemics in general are not merely serious public health concern, rather these trigger disastrous socio-economic and political crises in the infected countries. COVID-19, apart from becoming the greatest threat to global public health of the century, is being considered as an indicator of inequity and deficiency of social advancement. Coronavirus is a single stranded RNA virus with a diameter ranging from 80 to 120 nm. The first modern COVID-19 pandemic was reported in December 2019, in Wuhan, Hubei province, China and most initial cases were related to source infection from a seafood wholesale market [1]. Since then, the disease rapidly circled the globe and has eventually affected every continent except Antarctica. In less than four months, it has spread to more than 210 countries around the world. Africa got his first case of COVID-19 the 14th of February in Egypt and the first confirmed case in sub-Saharan Africa was in Nigeria. In Burkina Faso, the first cases appear the 9th of March. It has been categorized as a pandemic by the World Health Organization [2]. International Committee on Taxonomy of Viruses (ICTV) named the virus as severe acute respiratory syndrome coronavirus 2 noted SARS-CoV-2 [3]. Coronaviruses belong to a large diverse family of viruses. These can be categorized into four genera namely, α-, β-, γ-, and δ. All the previously discussed coronaviruses responsible for worldwide spread of pandemic, namely SARS, MERS-CoV and SARS-CoV-2 are β-coronaviruses. As of April 2020, some 93% of the global population (about 7.2 billion people) live in countries with some form of movement restrictions in place [4]. A new coronavirus disease, officially named COVID-19 by the World Health Organization (WHO), has caused a global pandemic with profound impacts on many aspects of human life [5].

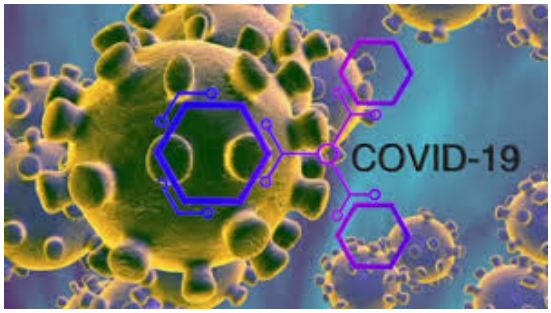


Figure 1: Image of corona virus

On 11 February 2020, the International Committee on Taxonomy of Viruses announced severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) as the name of the new virus [6]. Unlike all previous pandemics in modern history, COVID-19 is truly a global crisis. Never before have we seen the health care systems of some of the world's most industrialized nations on the verge of collapse [7]. Coronavirus disease 2019 (COVID-19) is an infectious disease caused by a new virus that has never been identified in humans before. This virus causes respiratory illness with symptoms like cough, fever and, in the most severe cases, pneumonia. The new COVID-19 is mainly spread through contact with an infected person, when they cough or sneeze, or through droplets of saliva or nasal secretions.

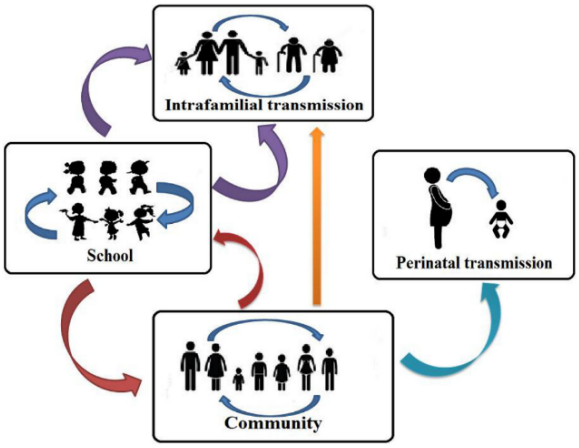


Fig. 2. Transmission dynamics of SARS-CoV-2 infection in People

2. Material and Methods

2.1. Description of study area

Burkina Faso (13°00' N, 2°00' W) is located in West Africa (Figure 3) with an estimated population of 21,510,181 [8]. It covers an area of 274,200 km^2 with a density of 76 inhabitants/km^2. Located in Sub-Saharan Africa, Burkina Faso's political capital is Ouagadougou (12°22′ N, 1°31′ W). Apart from the north, Sahelian, the country belongs to the so-called Sudanese zone, which is tropical. Having a tropical climate, the country has only two seasons, a dry season and a rainy season. A dry season, from mid-October to mid-June, and a rainy season, which has its peak in August. The harmattan, a dry wind, blows from November to February, the temperatures are then mild (25°C - 30°C) and the period favorable for travel. March, April and May are scorching hot.

2.2. Data collection and analysis

Qualitative and quantitative data were collected using literature review, key exchanges and discussions with people. Field surveys include physical observations in the field and interviews with local populations closed to the river. Quantitative survey was carried out with a focus group using Active Method of Research and Participative Planning.

Figure 3: Map of Burkina Faso

3. Results and discussion

3.1. Institutional management and measures in Burkina Faso

In Burkina Faso, there is a center of operations and response for health emergencies (CORUS). To mitigate the COVID-19 disease, authorities of Burkina Faso have adopted a number of measures. These include the creation of a disease management committee which includes a technical sub-committee headed by a coordinator and an administrative committee headed by the prime minister. The sub-technical committee works closely with CORUS to take in charge the contact and positive cases of corona virus in Burkina Faso and to take stock of the daily health situation. Regarding the negative consequences on various sectors of activity slowing down development, the government adopted a response plan to covid-19 with a budget valued at 177,900,426,041 F CFA [9]**.** This budget should make it possible to help the populations with the payment of electricity and water bills, to support bankrupt companies, market and yaar traders, cultural actors and road transporters. In addition, a humanitarian response plan has been adopted by the authorities of Burkina in conjunction with the United Nations Food and Agriculture Fund in order to manage internally displaced persons due to insecurity [10]**.** As part of adopted measures, the Burkina Faso government has proposed the compulsory wearing of masks to inhabitants of areas affected by the disease, the quarantine of affected towns, the closure of schools and universities, the social distancing, the screening test for contact cases, the isolation of positive cases and their immediate treatment by CORUS. In Burkina Faso, 11 regions are affected such as Cascades, Mouhoun Boucle, Haut-Bassins, South-West, Central Plateau, Central, Central-East, Sahel, North, Central-South and East as colored in Figure 4.

3.2. *Situation of Covid-19 in Burkina Faso*

Since the apparition of first cases of COVID-19 in Burkina Faso on March 9th, 2020 up to the date of 9 Avril, 2020, Burkina Faso was one of the West African countries most affected by the pandemic with 443 cases including 146 cured and 19 deaths. However, with the governmental measures and at the date of 7 October, 2020, it was noted 2167 positives cases, 1419 cured and unfortunately 59 deaths (See figure 5). One notices the decrease of deaths when the time increase indicating the control of the disease by the Burkina Faso authorities. They proposed preventive solutions such as: wearing of masks, social distancing of 1.5 m, restriction of movement, etc., and curative solutions such as: use of Apivirine, chloroquine, hydroxychloroquine, Azithromycin and some pharmacopoeia products (nime leaf, artemisia, covid-organics, etc.). In addition, other measures have been adopted such as hand washing with soap, disinfection of houses with bleach, use of alcohol or hydroalcoholic solution and management of biomedical waste, domestic waste and wastewater.

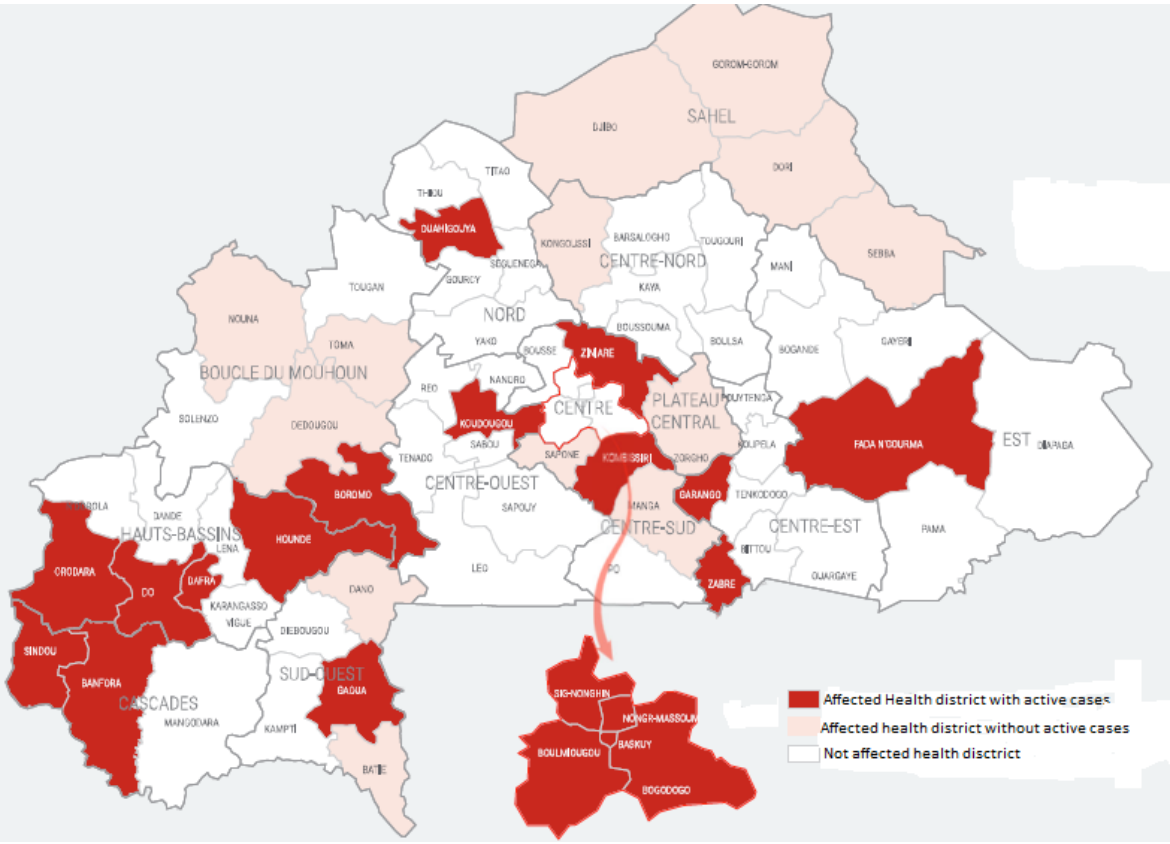


Figure 4: Cartography of contaminated areas in Burkina Faso [11]

In addition, we remark that the positive cases are mainly males with age between 15 and 59 years as indicated in Figure 6. That can be explained by mobility and more activities of male in Burkina Faso, combined to high content of this teenagers in the population indicating the young population in Burkina Faso.

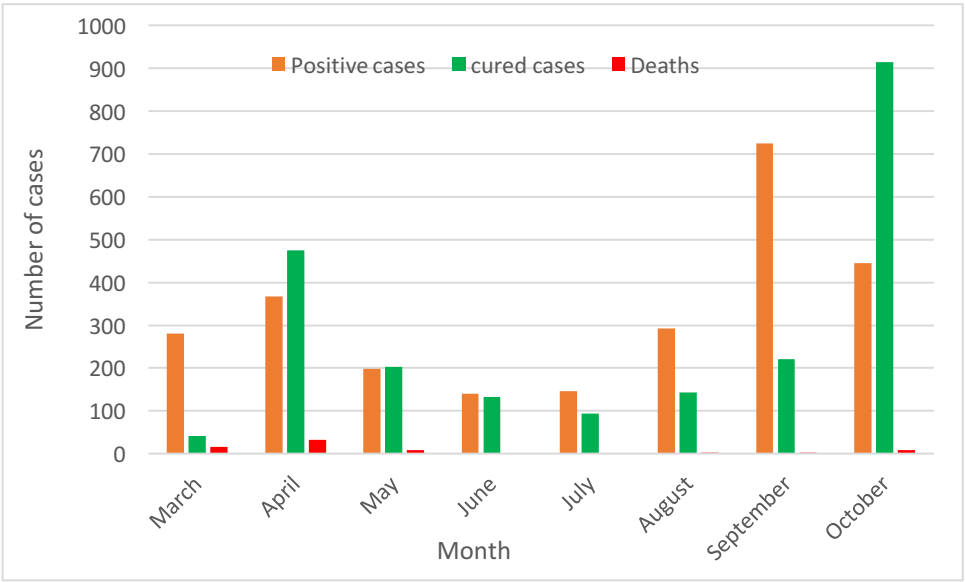


Figure 5: Coronavirus situation in Burkina Faso from March to October

3.3. Mitigation and adaptations measures

Human corona viruses (HCoV) are respiratory pathogens and their primary transmission mode is person-to-person contact through respiratory droplets generated by breathing, sneezing, coughing, etc., and contact (direct contact with an infected subject or indirect contact, trough hand-mediated transfer of the

virus from contaminated fomites to the mouth, nose, or eyes).Waterborne transmission has never been demonstrated in humans, however detection of HCoV in the feces of infected patients has been reported suggesting the fecal-oral route may contribute to HCoV transmission [12].

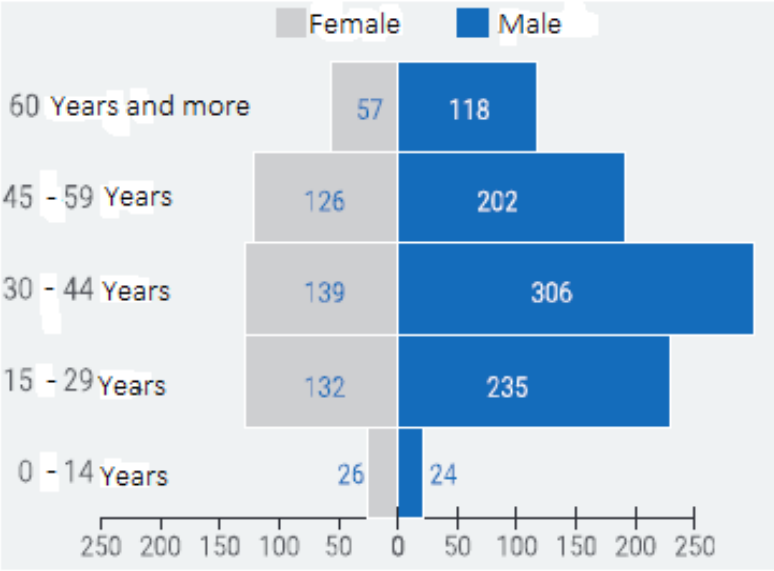


Figure 6: Distribution of number of cases per age and sex

Concerning the mitigation measures, the research showed that coronaviruses can be inactivated within one minute by disinfecting surfaces using 62-71% alcohol, or bleach 0.5% hydrogen peroxide or household bleach containing 0.1% sodium hypochlorite sodium. Some measures including hand washing with soap, disinfection of houses with bleach, alcohol or hydroalcoholic solutions, biomedical waste management, domestic waste management and wastewater management

For adaptation, there are the local production initiatives include innovators, inventors and volunteers for product preparation and making equipment. For the preparation of hydroalcolic gel and soap, there was important to know the composition and the production protocol, and to control the quality. In addition, the use of respirometer manufacturing, automatic pedal hand washer, mask making, fabric quality tests, and ABNORM standards that contribute to increase the resilience of populations in Burkina Faso.

3.4. Chemical implications

-The plant users (tradipracticiens, pharmacopeia) have contributed to the research of medicament au covid-19 and they proposed some plants which are effective against contagious diseases. We give some of which in Table 1 [13]:

Plant	Used part	Use
Cajanus indicus	Leaves	Boil, drink and wash
Scoparia dulcis	Leaves	Boil, drink and wash
Guiera Senegalensis	Leaves	Boil, wash and drink for the whole family just once
Balamites aegytiaca	Roots and bark	1 glass and rub with the cow cream

-Apivirine is extracted from a plant by decoction at 100 °C and which is used in the manufacture of an antiretroviral drug of immediate effectiveness as monotherapy on HIV / AIDS. The treatment offered by this medication consists in lowering the viral load (number of copies of viral RNA per milliliter of blood) to make it undetectable and to restore the immune system destroyed by HIV and therefore the patient regains his perfect health. . The natural origin of this active substance makes it a medication that escapes the possibility of resistance development on the part of HIV ... The technique consists of bathing the plant in water brought to the boil for 45 minutes and leaving for 6 hours. The liquid is filtered and a second extraction is carried out. After filtration, the process proceeds to dehydration and to obtaining "APIVIRINE". One hundred kilograms (100 kg) of treated plant yields 3100 grams of pure APIVIRINE with a pH between 3 and 4 and a moisture content of less than 10 % [14].

-Artemisinin (Figure 7): Faced with the increasing contamination of the coronavirus disease (COVID-19) initiatives are being developed to stem the evil. Madagascar officially launched on April 20, 2020 "Covid-Organics", a remedy based on local medicinal plants, capable of preventing and curing patients' sick with the new coronavirus. It is an organic decoction and herbal tea made from Artemisia and other Madagascan plants kept secret [15].

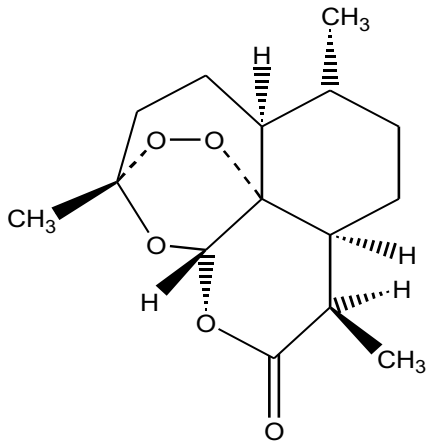
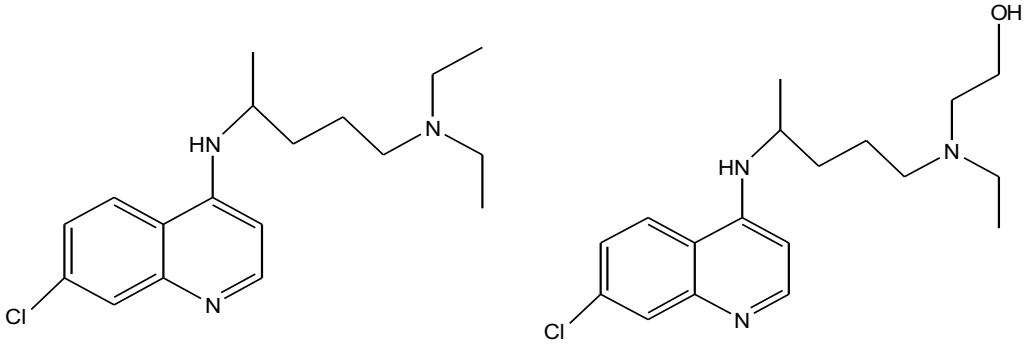


Figure 7: Chemical formula of the Artemisinin

-Chloroquine and hydroxychloroquine (Figure 8) are synthetic derivatives of quinine, isolated by French pharmacists at the beginning of the 19th century. Chloroquine has long been used as a treatment for malaria, but mutations in the disease have gradually made it resistant to this treatment in some areas. Chloroquine (nivaquine) and hydroxychloroquine are in fact particularly indicated for the treatment of rheumatoid arthritis, lupus, or the prevention of lucites [16].



Chloroquine

Hydroxychloroquine

Figure 8: Chemical formula of chloroquine (left) and hydroxychloroquine (right).

Those chemical compounds could be synthetized using the equation shown in Figure 9.

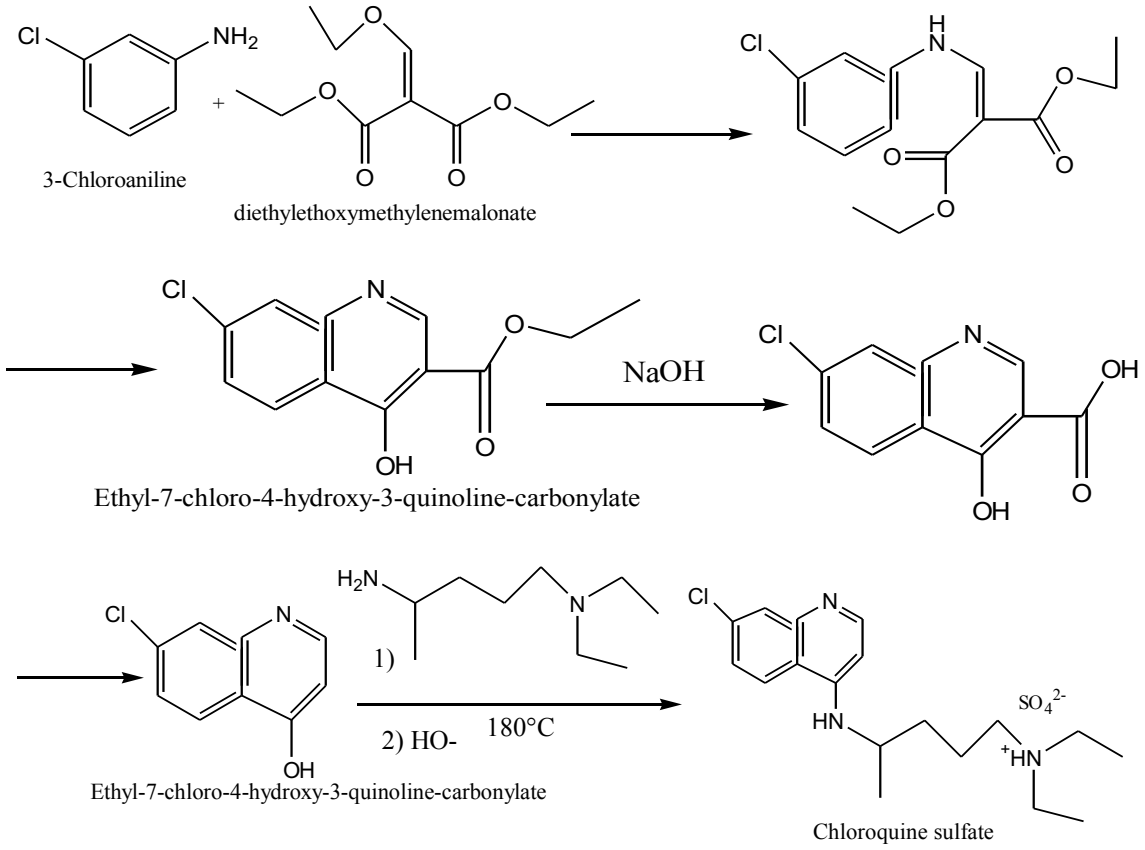


Figure 9: Equation of chloroquine synthesis

3.5. Environmental impacts

Faecal contamination of water supplies has been historically recognized as a risk for human health: water can provide a vehicle for pathogen spread, creating the conditions for outbreaks or sporadic cases of infection. Human pathogenic viruses are often detected in water environments and are deemed to be responsible for a considerable proportion of waterborne diseases [17-20]. Viruses of concern for their potential waterborne transmission belong mainly to the group of enteric viruses, a diverse group of non-enveloped viruses, which can multiply in the gastrointestinal tract of humans. They can be mostly responsible of gastrointestinal illness, but also of a wide spectrum of other diseases, such as conjunctivitis, respiratory symptoms, viral hepatitis, and infections of the central nervous system. Wastewater monitoring has been a successful strategy pursued to track chemical and biological markers of human activity including illicit drugs consumption, pharmaceuticals use/abuse, water pollution, and occurrence of antimicrobial resistance genes [21-24].

Viral diseases have been also surveilled by the detection of genetic material into wastewater as for enteric viruses [25, 26]. As SARS-CoV-2 virions are excreted in COVID-19 patients' faeces, sewage can also be an important point of surveillance for wastewater based epidemiology. Importantly, detection of SARS-CoV-2 RNAin wastewater does not imply that the virus is viable and able to infect humans. Coronavirus in wastewater is relatively short-lived, with 3-log10 reduction in virus titre reportedly occurring within 2–3 days [27]. With further development and using well-designed sampling campaigns with suitable spatio-temporal resolution, wastewater monitoring could well become a useful tool to monitor and assess the incidence of COVID-19 disease within populations to inform related public health policy.

Conclusion

This work revealed the situation of covid-19 in Burkina Faso where almost of regions (11 regions) have been contaminated by this pandemic. The main positive cases are male whose the age is ranged between 15 and 49 years. In addition, it is noted a low percentage of morbidity in Burkina Faso and that is due to climate. The resilience of populations were due to the barrier measures adopted by the government. The leaves, roots and bark of plants have been developed as medicine to treat the positive cases. Other medicines such as Apivirine, chloroquine, hydroxychloroquine, and Artemisinin have been used in Burkina Faso. As environmental impacts, we noted the pollution of wastewater, air and environment with many wastes.

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