Contribution of COVID Antigenic RDT to the Management Strategy of COVID-19 Pandemic in a Senegalese Company

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Objective: To describe the contribution of the rapid antigen diagnostic testing (RDT) to the management strategy of the COVID-19 pandemic. **Methodologies:** The protein chain reaction (PCR) and the RDT have been performed on each COVID-19 suspected workers from December 2020 to September 2021. **Results:** A total of 286 people tested. A positivity rate of 38.1% was recorded. The average time to obtain PCR results was 8.3 days. 54.8% ($n = 142$) of the RDT were followed by a PCR for confirmation or invalidation and 100% of positive cases with Ag-RDT were confirmed by the PCR. We have noticed a 58.3% reduction of lost work days due to COVID-19, since the use of the Ag-RDT. **Conclusion:** The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) rapid diagnostic tests are efficient. They have enabled early treatment of COVID-19 patients, helped hold back the spread of the disease in a high-risk professional environment, and reduced the impact of the pandemic on a vital sector in developing countries.

Keywords: Africa, antigen, COVID-19, diagnosis, management, PCR, Senegal

The COVID-19 and the restrictive measures undertaken to contain its spread have threatened food security.[1] In fact, high-density infrastructure workplaces are known to cause a high risk of coronavirus transmission[2] and have been severely affected by those restrictions. In this context, the management of the pandemic in companies, especially in the food processing industry has rapidly become a crucial challenge.[3] Early detection, isolation, and rapid treatment of positive cases seems to be not only the best means to protect workers and the operations,[4] but also to prevent the appearance of clusters within companies, as advised by the WHO.[5]

In our company, the gatherings of workers in the transportation cars and in workstations made of potential cases a threat for their colleagues and for the operations. To detect those cases, the Heath Emergency Operations Center of the Senegalese Ministry of Health and Social Affairs has provided dynamic definitions of basic concepts of suspect case, contact case, probable case, non-case, etc, in a handbook of procedures in response to COVID-19 pandemic. It stipulates that a suspect case refers to[6]:

A. A patient with an acute respiratory illness (fever and at least a sign/symptom of respiratory disease [eg, cough, breathlessness]), and who does not show any other etiology that fully explains the clinic presentation, and with a travel or residency history in a country, an area, or a territory with a local transmission of COVID-19, within the last 14 days of onset of symptoms;
Or

B. A patient with an acute respiratory illness, and who has been in contact with a confirmed or probable COVID-19 case within the last 14 days of the onset of symptoms;
Or

C. A patient with an acute respiratory infection (fever and at least a sign/symptom of respiratory disease [eg, cough, breathlessness]), and requiring hospitalization, and without any other etiology fully explaining this clinical presentation.

Prevention and response plans have been implemented to protect workers. At the heart of these plans is the ability to carry out a rapid diagnosis when there is a suspect case and to act accordingly. This capacity raised the inequality issue in the access to care, especially to the protein chain reaction (PCR) in the world[7] and has compelled companies to develop new efficient and accessible diagnostic methods.[8]

This study aims at describing the contribution of the antigenic RDT to the management strategy of the COVID-19 pandemic at the Société de Cultures Légumières.

MATERIAL AND METHOD

We conducted a descriptive and comparative study of the use of two COVID-19 diagnostic tools available to the company, from December 2020 to September 2021. The study was conducted at the Societe de Cultures Legumieres, an agribusiness company that produces and markets vegetables. It has about 6000 employees on its farms located in Saint-Louis, Senegal.

The diagnosis used packed nasopharyngeal swabs, which were then sent to a COVID laboratory, either in Richard Toll or in Touba, located respectively at 100 and 208 km away from the company, for RT-PCR.

As of March 2021, in addition to RT-PCR, we used WHO-approved Abbott PanbioTM COVID-19 rapid diagnostic tests to detect severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pro-nucleocapsid in nasopharyngeal samples.

During the 30-day launch phase, every completed TDR was followed by a sample sent for PCR. After the launch, all positive RDTs cases and highly suspected cases with negative RDTs were the only ones sent for PCR confirmation.

Indications for sampling followed national recommendations and testing was performed on any worker suspected of having COVID-19 as defined by the Ministry.

RESULTS

In total, 286 people were tested, of whom 162 received a PCR. The average time to obtain the PCR results was 8.3 days, with extremes ranging from 2 to 13 days. The result was given on a national common file. A patient's test result was assumed to be negative when their name was not on the list. The age of the tested workers ranged from 18 to 60 years with an average of 34.7 years. The sex ratio was 1.1. The number of tests performed varied according to the period, as shown in Fig. 1.
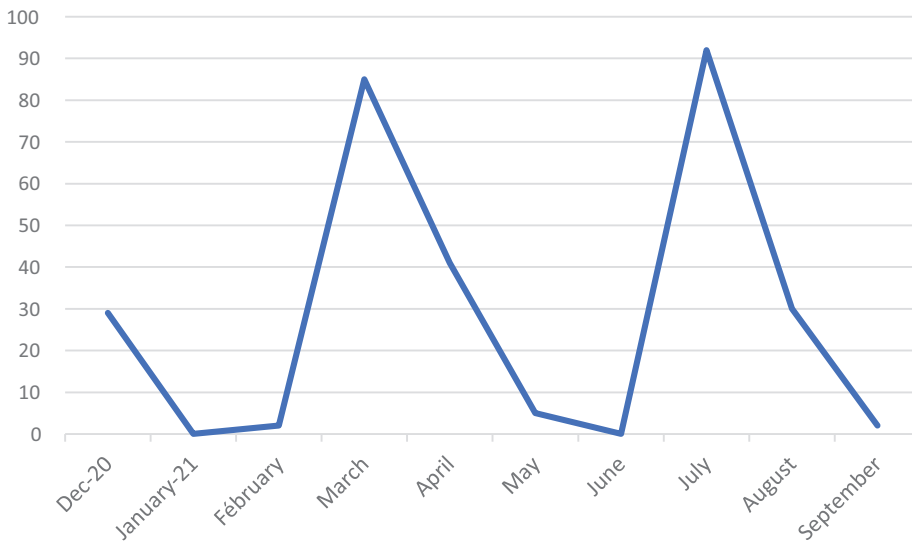
FIGURE 1. Trend of the number of monthly tests carried out at SCL, from December 2020 to September 2021.

We recorded 109 positive cases of COVID-19, that is, an overall positivity rate of 38.1%. A comorbidity was found in 11 COVID-19 infected workers, that is, a prevalence of 10% of comorbidity. These were mainly hypertension and diabetes, but also rheumatoid arthritis, HIV retrovirus, and two asthma cases. We recorded 0.9% ($n = 1$) of severe cases.

The evolution over time, illustrated in Fig. 2, is presented in three outbreaks with a maximum of cases in July ($n = 59$) and months without positive any cases—January, May, June. The test positivity rate varied according to the period (see Fig. 3).

The use of the COVID RDT started in March 2020. Apart from the first 30 suspected COVID cases at SCL, all other cases were subjected to RDT, for a total of 259 RDTs performed. Of all these RDTs, 54.8% ($n = 142$) were followed by PCR for confirmation or invalidation of the result.

Therefore, 93 of the 109 cases diagnosed were confirmed by RDT and by PCR, according to the requirements of the Ministry of Health, with a concordance of the positive 100% result. In four out of 49 cases, PCR corrected the RDT diagnosis, giving a false negative rate of 8.2%, (see cross-checks summary in Table 1).

Every COVID-suspected or COVID-positive worker was put off work without penalty until the diagnosis was overturned or until recovery. These non-working but paid days defined the number of working days lost due to COVID. Thus, there were 1505 lost working days due to COVID, with a 58.3% decrease in the number of lost days between the first and second COVID-19 outbreaks.

- 403 days lost, between December 2020 and February 2021 for 30 workers corresponding to an average of 13.4 days per suspected worker;
- 399 days lost, between March 2021 and June 2021 for 130 workers tested, that is, an average of 3 days lost per suspect case;
- 703 days lost, between July and November 2021 for 66 workers, that is, 3.4 days per suspect case.

DISCUSSION

At SCL, we have noticed three outbreaks of the COVID-19 pandemic with increasing severity. This evolution was based on what is called epidemic waves in Senegal and all around the world. The high positivity rate (38.1%) may be associated to the
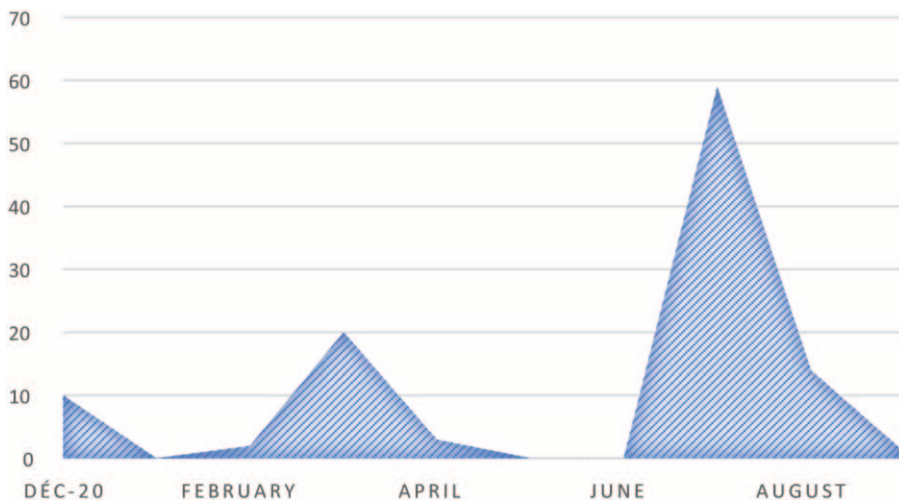

FIGURE 2. Trend of positive cases at SCL.

FIGURE 3. Positivity rates of the tests performed at SCL.

implemented strategy to fight the disease. Indeed, the testing strategy was targeting and restricted only to COVID-19 suspect and their asymptomatic cases, based on the definitions provided by the Ministry of Health and Social Affairs. This high rate is similar to the one found in other types of targeted high-risk people, notably health care personal in Paris where Greffe et al[9] has recorded 38%. In our case, this targeting was motivated by the limited diagnostic resources. Indeed, our RDTs were imported at a time when international traffic was considerably restricted on the one hand, and when strict restrictions on imports of equipment related to the pandemic were implemented on the other hand. Though approved by the WHO, the RDT used was not recognized by the Government of Senegal. Domestically, it allowed to have a rapid orientation, but a confirmation PCR Test was always performed as per the State's requirements.

During the first wave, the COVID-19 screening was carried out by the genome isolation via a RT-PCR. Besides, it was the only available option in developed countries as well as in developing countries.[4,10] Its accessibility to agricultural companies in rural areas was difficult. Consequently, for only 30 suspected cases, 403 work days were lost. In fact, during this period and as a precautionary measure, the COVID-19 suspect workers were isolated at home until the results are received. This was delaying the specific treatment of patients[11] and the identification of contact cases, and causing production loss. The delay in the transmission of the PCR test results was noted in many developing countries, including the Congo.[12]

Worse, the PCR required a heavy logistic including samples packing in bags for biological product shipment and the mobilizing a driver and a vehicle.

In our study, the rapid diagnostic tests have shown a great efficiency. Notwithstanding the limit relating to the small size of the sample, it was found that the PCR has confirmed all the positive screenings carried out with the RDT. We can therefore state that the RDTs have an excellent sensitivity. This has been shown in studies carried out in Central Africa (Kinshasa), in North Africa, and in the United States.[13–15] The noted variance, that is, the false negative rate (8.2%) was the same in a study that used the same test with a larger number of patients in Spain.[16] Over there, out of 412 patients, discordant results (RDT-/RT-PCR+) were obtained in 11 patients (2.7%).

Therefore, the advent of the rapid diagnostic tests has enabled to minimize the lost work days due to COVID-19 by 58.3%. The suspect and asymptomatic cases were able to know their status the same day and the duration of their work interruption depended on the RDT, which was obtained in the following 20 mn (3 or 5 days, if the RDT is negative). Therefore, the RDT has allowed to remove the extensive quarantine and guaranteed a prompt resumption of work for negative cases, and hence to maintain production ongoing. Moreover, it has allowed to undertake early treatment for positive cases thanks to the instantaneous results that could easily allowed therapeutic decision-making.[4,5,11]

This strategy has enabled the SCL to prevent the tragedy of clusters in companies that could lead to work stoppage. It has also allowed early treatment and prevented severe forms of the disease (only 0.9%), despite the 11 infected people with comorbidity, and the treatment at home by the occupational health care staff.

CONCLUSION

The SARS-COV-2 antigen detecting rapid diagnostic tests are efficient. They have enabled a rapid screening and early treatment of COVID-19 patients in our company, and have helped contain the spread of the disease in this high-risk professional workplace. They can be a safe alternative to the RT-PCR, whose accessibility, direct and indirect costs are complex. At the workplace, they allow to isolate earlier infected people from the group, to prevent an increase in cases in workstations, and to minimize the downtimes due the suspect COVID-19 cases. Ultimately, it allows a substantial reduction of the adverse impact of the pandemic on a vital sector in developing countries.

We believe that this method should be popularized in all occupational health care services in rural areas, to contribute to the fight against the pandemic and safeguard food security in developing countries. The State and its heath sector partners should resort to crowded workplaces as a lever in the fight against the pandemic, while preserving the economic activity, in a context of food insecurity.

TABLE 1. Cross-Checks Summary Between the RDT and the PCR

	PCR		
	Negative	**Positive**	**Total**
RDT			
Negative	45 (91.8%)	4 (8.2%)	49 (100%)
Positive	0 (00%)	93 (100%)	93 (100%)
Total	45 (31.9%)	97 (96.3%)	142 (100%)

RDT, rapid antigen diagnostic testing.

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