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Research Article

COVID-19 Outbreak in Burkina Faso: Epidemiological Surveillance among High Risk Population

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Abstract

Background: In Burkina Faso, the first suspected case of COVID-19 was reported on February 5, 2020. Three months later, few data were available to support public health decision making. This surveillance aimed to provide accurate data on the prevalence of SARS-CoV-2 among high risk population during the early days of the outbreak.

Method: From February 5 to April 4, 2020, we collected sociodemographic, medical history and behavioral characteristic of population with recent travel history from high risk countries, contact cases of COVID-19, clinically suspected cases and health care workers by a one-on-one person interview. Nasopharyngeal or oropharyngeal swabs were collected and shipped to the national influenza reference laboratory (NIRL) for molecular diagnosis. Real time RT-PCR assays using the Tib Molbiol protocol and reagents to detect SARS-CoV-2 E and RdRp genes was used. Infection case was defined by the detection of both E and RdRp genes.

Results: Of the 1062 persons examined, 51.2% had history of contact with confirmed cases. Male patients were predominant (62%) with a median age of 43 years (range, 2 - 80 years). Clinically, 71.09%, 57.63%, 37.5% and 1.3% of the study population had cough, fever, shortness of breath and chest pain respectively. By PCR tests, SARS-CoV-2 was detected in 42.4% (450/1,062) of patient and among them, both E and RdRp genes detected in 76.9% (346/450). The dual detection of E and RdRP gene were considered actual COVID-19 cases according to the WHO definition. Isolated detection of the E gene was considered indeterminate and required further testing. By multivariate logistic regression, the patient age (p = 0.006) and presence of fever (p = 0.002) were the factors positively associated with COVID-19.

Conclusion: PCR assay were effective for COVID-19 diagnostic and the contribution of the NIRL was critical during the early moments of the pandemic in Burkina Faso. The use of the Tib-Molbiol kits were useful for implementing specific COVID-19 control interventions.

Keywords: *SARS-CoV-2; COVID-19; Epidemiology; National Influenza Reference Laboratory; Burkina Faso*

Abbreviations

WHO: World Health Organization; COVID: Coronavirus Disease; IRSS: Institut de Recherche en Science de la Santé; SARS-CoV-2: Severe Acute Respiratory Syndrome, Coronavirus 2; NIRL: National Influenza Reference Laboratory; CDC: Center for Disease Control; INSD: National Institute of Statistics and Demography; RDRp: RNA-Dependent RNA-Polymerase; CI: Confident Interval; µL: Microliter

Introduction

Emerging infections are significant public health challenges worldwide [1]. Over the past twenty years, the world has faced several disease outbreaks with a massive global impact in terms of economic disruption, strain on global public health resources and, above all, on human health [2]. Indeed, several epidemic pathogens such as the SARS-CoV in 2002 to 2003 [3], the avian influenza H5N1 in 2006 [4], the H1N1 pandemic influenza virus in 2009 [5], the MERS-CoV in 2012 [6], the Ebola outbreak in west Africa in 2014 [7], and recently in the Democratic Republic of Congo [8] have been recorded in different regions of the world.

In late 2019, a cluster of pneumonia like syndrome of unknown etiology was reported in Wuhan, Hubei Province, China and the causative agent was ultimately identified as the novel coronavirus (2019-nCoV) by the Chinese Center for Disease Control, which is phylogenetically related to the SARS-CoV [9,10]. By the end of February 2020, several countries were experiencing sustained local transmission [11]. As the number of 2019-nCoV disease (COVID-19) cases outside China increased to reach 118,000 cases in 114 countries and over 4,000 deaths, WHO declared the COVID-19 a pandemic on march 11th, 2020 [12].

Before the 2019-nCoV, four human coronaviruses; 229E (alpha coronavirus), NL63 (alpha coronavirus), OC43 (beta coronavirus) and HKU1 (beta coronavirus) were classified as medically important [13]. Then in 2002-2003, the severe acute respiratory syndrome virus (SARS-CoV) was recording with 8,000 cases among which 800 fatalities [14] and in 2012, the Middle East Respiratory Syndrome virus (MERS-CoV) in Middle East countries [15].

The 2019-nCoV named SARS-CoV-2 is a positive-sense single stranded RNA virus of 30 kB long with a gene at the 5'end known as ORF1ab that encodes for all the polyprotein bearing all the non-structural proteins (nsp) [16]. The virus also possesses genes that code for structural proteins, namely spike (S), envelope (E), membrane (M) and nucleocapsid (N) [16]. The polyprotein arising from ORF1ab may undergo proteolytic processing to give rise to 16 proteins namely nsp 1-16 [17]. Among the cleaved products of the ORF1ab polyprotein, the proteins of known function include nsp3 which has an adenosine diphosphate-ribose 1"-phosphatase activity [16]. The protease activity that is responsible for the cleavage of the polyprotein is present in the nsp5 protein [18]. The nsp12 protein houses the RNA-dependent RNA- polymerases that is responsible for the duplication of the genome [18]. The RNA helicase activity that is critical for genome duplication is present in the nsp13 protein. Exoribonuclease (exoN) and N7-methyltransferase activities are present in the nsp14 protein [19]. The nsp15 protein houses a Nidoviral ribonuclease specific for U, and the nsp16 protein has a SAM-dependent O-methyltransferase activity [16]. Despite the good knowledge of the genetic structure of SARS-CoV-2, neither a vaccine nor a specific antiviral therapy was available to treat and prevent the COVID-19. The therapeutic strategies were mainly supportive, and prevention aimed at reducing transmission in the community. Prompt and accurate diagnosis, followed by aggressive isolation measures in China led to a progressive reduction of cases' number. Currently, vaccination is advocated to limit the expansion of the disease in combination with the behavioral practices. In addition, several rapid diagnostic tests are developed, but yet to be advocated. Therefore, the point of care real time RT-PCR is still the recommended approach and was required to control both nosocomial and community level transmission.

In Burkina Faso, The Ministry of Health set up an emergency response team to development specific activities that will help control the disease with the support of the National Influenza Reference Laboratory (NIRL) set up in 2009 with the support of the U.S. Centers for Disease Control and Prevention (CDC), the Government of Burkina Faso, and which was in charge of the COVID-19 laboratory diagnosis in

the country using the real time RT- PCR for nCoV-19 detection protocol [20]. However, accurate epidemiologic data were still missing to help rationalize the allocation of resources and to help in the development of more effective interventions. This study aimed to summarize data of the first patients of the COVID-19 outbreak in Burkina Faso and to provide useful information to the national health authorities that will help for public health decision making.

Materials and Methods

Outbreak history

The risk of an epidemic with COVID-19 remains non-negligible in Burkina Faso, due to: i) Burkina Faso its multiple borders (Figure 1). The climate is Sahelian where two seasons (a dry season, and a rainy season) alternate [21]. According to data from the National Institute of Statistics and Demography (INSD), the country population in 2020 was 21,478,529 inhabitants and the growth was rate of 3.1% (RGPH, 2006). The estimated crude general mortality rate was 11.8 per 1,000 inhabitants according to the Ministry of Health's 2018 statistical yearbook. This mortality is mainly due to endemic-epidemic diseases (such malaria, acute respiratory infectious diseases, diarrhea), chronic non-communicable diseases and nutritional deficiencies [22]. ii) In Burkina Faso, there is currently a surveillance system in place for 52 priority diseases and events. This system is mainly based on the monitoring of indicators and allows early detection of priority diseases (influenza, HIV, *Mycobacterium tuberculosis*, *Plasmodium* species, *Salmonella typhi*, *Vibrio cholerae*, dengue, yellow fever, measles, and *N. meningitis*). The assessment of the basic capacities required for the implementation of the IHR (2005), carried out in 2017, showed shortcomings in the surveillance of entry points. The COVID-19 fact sheets have been developed and disseminated, but there is a lack of health personnel training on this disease, especially as new information is constantly provided on the characteristics of the disease. This situation is detrimental to the management of international health events or emergencies including COVID-19 and may increase the risk of national and international spread. iii) the existence of factors such as free movement of people and goods through diplomatic and commercial relations with other countries, precarious socio-economic conditions characterized by great promiscuity, insufficient individual and collective hygiene, poor performance of the epidemiological surveillance system.

Since the COVID-19 outbreak was upgraded as a global pandemic, the WHO recommended all countries to take multilevel actions to prevent the spread of the disease within the population. Thus, Burkina Faso organized its response system. A national coordinator has been appointed and commissions have been set up: (i) the rapid response team commission; (ii) the laboratory commission; iii) the logistics commission; iv) infection prevention and control commission; v) the finances commission.

On February 5, 2020, Burkina Faso registered the first suspected cases of COVID-19 that were subsequently tested negative at the NIRL in Bobo-Dioulasso by two expert trainers from the regional reference center of Dakar (IPD) on February 9, 2020. This was a training opportunity for nationals. From then, surveillance at various entry points of the country. The country index case of COVID-19 was reported in patients with travel history from France where they participate to a mass gathering. The disease spread from this case in the country.

Study sites

The study was carried out countrywide where suspected cases of COVID-19 case were present (10 over 13 regions of the country). Nasopharyngeal or oropharyngeal swabs were collected by trained medical and paramedical staffs. Collected samples were shipped to the NIRL for molecular diagnosis. The laboratory was set-up in 2009 by the Ministry of Health following an evaluation of medical biology laboratories and biomedical research laboratories in Burkina Faso. Since then, the laboratory has played a key role in supporting ILI and SARI surveillance in Burkina Faso. Initially located in Bobo-Dioulasso, the second largest city in the western part of the country, the NIRL was subsequently transferred to Ouagadougou, the capital city, for security reasons and to better meet surveillance requirements and

specifications. The NIRL is in charge of the training of medical and nurses' staffs for clinical specimens sampling, management, and the analysis of all clinical specimens. Study participant were recruited mainly at the teaching hospital of Tengandogo in Ouagadougou and the teaching hospital Souro Sanou in Bobo-Dioulasso, two national hospitals.

Case definitions and variables collected

A suspected case of 2019-nCoV infection was defined as a patient presenting with a flu-like syndrome (fever higher than 37.8°C in the absence of antipyretics' treatment and/or cough or sore throat) associated with at least one of the following conditions: return from a trip to China, or to a country with a proven increase in the incidence of 2019-nCoV infections, or a close contact (sharing the same household, professional life, plane, etc.) with a person defined as a suspected or confirmed case; occurring in an establishment having received at least one case of suspected or confirmed 2019-nCoV infection case. A confirmed case of SARS-CoV-2 is defined as a suspected case for which a coronavirus or 2019-nCoV is identified in nasopharyngeal or oropharyngeal swabs by rRT-PCR. Variable collected included patient age, sex, travel history, history of recent contact with COVID-19 confirmed or suspected case, clinical symptoms (fever, cough, chest pain), history of kidney, heart, neurologic disease). PCR tests were conducted in all suspected cases.

Study design

This is part of routine viral pneumonia surveillance conducted by the NRIL. This study included all suspected cases of COVID-19 patients between February 05, 2020 and April 4th, 2020 and occurred countrywide.

Study participants

Suspected cases contacting the toll-free number for COVID-19 rapid responses were included if they were willing to be evaluated and have their nasopharyngeal (NP) or/and oropharyngeal (OP) specimens collected. Specimens were place into tubes of virus transport medium (Copan Diagnostics, Brescia, Italy) and subsequently transported on triple packaging with cold ice packs to the national influenza reference laboratory within 24 hours. Upon arrival at the national influenza reference laboratory, specimens were divided into three aliquots, from which one is used for the test and the two others were stored at minus 80 degrees Celsius in the freezer.

Molecular diagnosis

The molecular diagnosis was performed at the Influenza National Reference Laboratory, Institute of Research in Health Sciences, Bobo-Dioulasso, Burkina Faso.

Nucleic acid extraction

Viral RNAs were extracted from 200 µL of virus transport Medium containing NP and OP swabs by using a QIAamp viral RNA mini kit (QIAGEN, Hilden, Germany), and eluted into 60 µL, RNA extraction following the manufacturer's instructions. The eluted RNAs (templates for RT-PCR) were stored immediately at minus 80°C until use.

A control reaction consisting of 70 bp fragment from Equine Arteritis Virus (EAV) detected with an Atto 647 labeled is provided with the PCR kit Tib-Molbiol. After reconstitution with 1,200 µL RNase/DNase-free water, 10 µL de EAV is added to 200 µL of the sample to be extracted. An extraction control (EC) consisting of nuclease-free water is also used.

Real-time reverse-transcription PCR

SARS-CoV-2 RNA was assessed by real-time reverse transcription-PCR using a hydrolysis primer/probe-based system that targets the gene encoding the envelope (E) protein for screening and RNA-dependent RNA-polymerase (RdRp) gene for confirmation. All oli-

gonucleotides were synthesized and provided by Tib-Molbiol (Berlin, Germany). Table 1 presents the use primers and their optimized concentration.

Target gene	Oligonucleotide ID	Sequence (5'–3')	Comment
RdRP gene	RdRP_SARSr-F2	GTGARATGGTCATGTGTGGCGG	Use 600 nM per reaction
	RdRP_SARSr-R1	CARATGTTAAASACACTATTAGCATA	Use 800 nM per reaction
	RdRP_SARSr-P2 F	FAM-CAGGTGGAACCTCATCAGGAGATGC-BBQ	Specific for 2019-nCoV, will not detect SARSCoV use 100 nM per reaction and mix with P1
	RdRP_SARSr-P1	FAM-CCAGGTGGWACRTCATCMGGTGATGC-BBQ	Pan Sarbeco-Probe, will detect 2019-nCoV, SARS-CoV and bat-SARS-related CoVs use 100 nM per reaction and mix with P2
E gene	E_Sarbeco_F1	ACAGGTACGTTAATAGTTAATAGCGT	Use 400 nM per reaction
	E_Sarbeco_R2	ATATTGCAGCAGTACGCACACA	Use 400 nM per reaction
	E_Sarbeco_P1	FAM-ACACTAGCCATCCTTACTGCGCTTCG-BBQ	Use 200 nM per reaction

Table 1: *Primers and probes.*

(Ref: WHO, 2020 at https://www.who.int/docs/default-source/coronaviruse/protocol-v2-1.pdf).

Each reaction-mix for detection of E gene contained 5 µL of RNA, 4.1 µL of nuclease-free water 10 µL of 2 × reaction buffer provided with the Superscript III one step RT-PCR system with Platinum Taq Polymerase (Invitrogen, Darmstadt, Germany; containing 0.4 mM of each deoxyribonic triphosphates (dNTP) and 3.2 mM magnesium sulphate), 0.5 µL of reverse transcriptase/Taq mixture from the kit, 0.5 µL of primer and probe oligonucleotides mix of E gene plus EAV control. The E gene plus EAV control is a multiplex PCR. A negative control (nuclease-free water) extraction control and positive control were included for each reaction mix. The rRT-PCR testing was performed at a final volume of 20 µL on the Applied Biosystems 7500 Real-Time PCR instrument (ThermoFisher Scientific, Foster City, CA, USA) with the following cycling conditions: 50°C for 10 min for reverse transcription followed by 95°C for 03 min and 45 cycles of 95°C for 15s, 60°C for 60s. All positive specimens for the E gene will be confirmed in the second Real-time reverse-transcription PCR for gene RdRp detection in the same conditions.

Statistical methods

Statistical analyses were performed using STATA11.0 (Stata Corporation 12.1, MP. Parallel Edition, College station, TX, USA). Descriptive analyses comprised assessing frequency distributions for each variable category. Fisher's Exact-test or Chi-square test for categorical variables were used for group comparisons. Odds ratios (OR) and 95% confident intervals (95% CI) were calculated according to each participant characteristics (symptom, age-group) using univariate logistic regression. Adjusted odd ratios (aOR) and 95% CI were derived by a backward elimination regression of variables with a p-values < 0.20 and retention of variables with statistically significant p-values. A p-value < 0.05 was considered statistically significant.

Ethics approval, consent to participate

This was part of a routine surveillance data performed by the ministry of health in collaboration with the National Influenza reference laboratory (NLIR) and there is no requirement for ethical approval. However, all patient provided a written inform consent prior to participation to this evaluation. In addition, all data were fully anonymized to protect patients' identities and data usage was done in accordance ethical regulations.

Results

Background characteristics of study population and COVID-19 symptoms

From February 5 to April 4, 2020, Burkina Faso registered 1,062 suspected cases of COVID-19 and the males to females' ratio was 1.6:1 (61.8% males versus 38.2% of females). Median age of suspected case was 43 years (minimum of 2 years, maximum of 80 years). Suspected cases from the age-group 30 - 39 (24.9%), and those from the age-group 40 - 49 years old (24.7%) were the most numerous verus 9.3% from the age-group 60 - 69 years old. Majority of the participants (85.0%) were Burkina Faso nationals while 13.4% were internationals. None of the suspected cases was adequately vaccinated against influenza. Regarding main COVID-19 symptoms, cough and fever were the most frequent among suspected cases with 71.1% and 57.6% respectively, while shortness of breath and chest pain were observed in 37.5% and 21.3%, respectively. Table 2 presents the main characteristics of COVID-19 suspected cases.

Variable	Number (n)	Percentage (%)
Age (years)		
< 10	26	2.5
10 - 19	17	1.6
20 - 29	105	9.9
30 - 39	264	24.9
40 - 49	262	24.7
50 - 59	187	17.6
60 - 69	99	9.3
70 - 79	78	7.3
≥ 80	24	2.3
Sex		
Male	656	61.8
Female	406	38.2
Patients in contact with confirmed cases		
Yes	542	51.2
No	200	18.9
Missing	320	30.1
Fever		
Yes	612	57.6
No	210	19.8
Missing	240	22.6
Cough		
Yes	755	71.1
No	180	17.0
Missing	127	12.0
Shortness of breath		
Yes	398	37.5
No	424	39.9
Missing	240	22.6
Chest pain		
Yes	226	21.3
No	522	49.2
Missing	314	29.6

Table 2: *Main characteristics of COVID-19 suspected cases in Burkina Faso, February-April 2020.*
Abbreviations: n = The number of cases for each variable category.

Molecular test results

Of the 1,062 individuals tested, 346/1062 (32.6%, 95% CI: 29.78 - 35.50) cases were dually positive for the E gene and the RNA-dependant RNA-polymerase (RdRp) gene of SARS-CoV-2 by real time RT-PCR using Tib Molbiol protocol, reagents and probes. Based on the WHO recommendations, these 346 cases were the true positive for COVID-19 with active replication of the virus, a mean Ct-value of 25.2 ± 6.5 (Minimum Ct-value was 13 ± 6.5 and the maximum Ct-value was 36.9 ± 6.5). There were 450 (42.4%, 95% CI: 39.38 - 45.41) specimens positive for E gene of SARS-CoV-2, a mean Ct-value of 25.2 ± 6.5 (Minimum Ct-value was 13 ± 6.5 and the maximum Ct-value was 36.9 ± 6.5), with however 23.1% (104/450) of them negative for RdRp gene of SARS-CoV-2. The latter were considered indeterminate results for COVID-19 according to the WHO interpretation and thus needed a second sampling, 48 - 72 hours after. As of April 4, 2020, 10/13 regions were affected by COVID-19 (Figure 1). Unfortunately, a total of 36 deaths were recorded in the country, mean age 62.6 years (range, 26 - 80 years). The majority of deaths (59%) were observed among people over the age of 60 years (Figure 2).

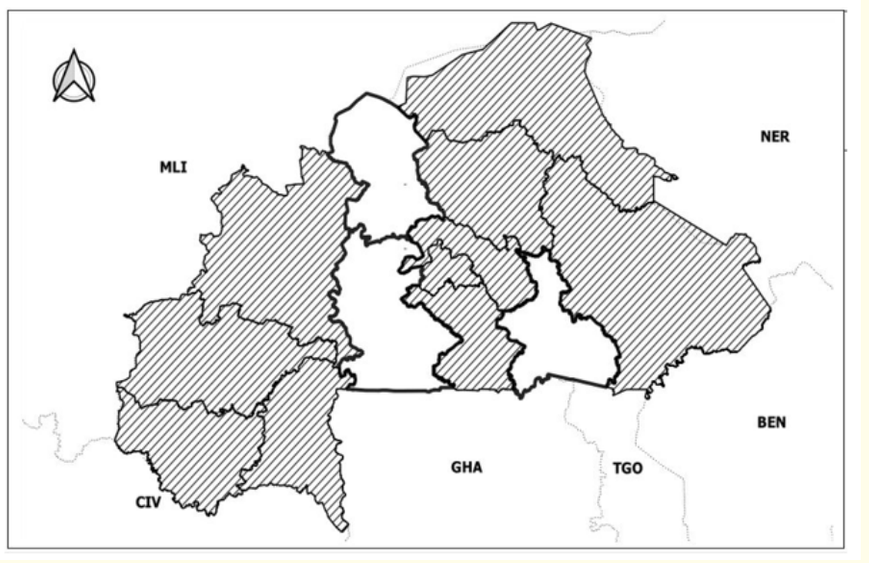

Figure 1: *Regions of Burkina Faso affected by COVID-19 by 4th of April 2020.*
Legend: Hatched areas are the regions where cases were reported. CIV: Côte d'Ivoire; GHA: Ghana; TGO: Togo; BEN: Benin; NER: Niger and MLI: Mali.

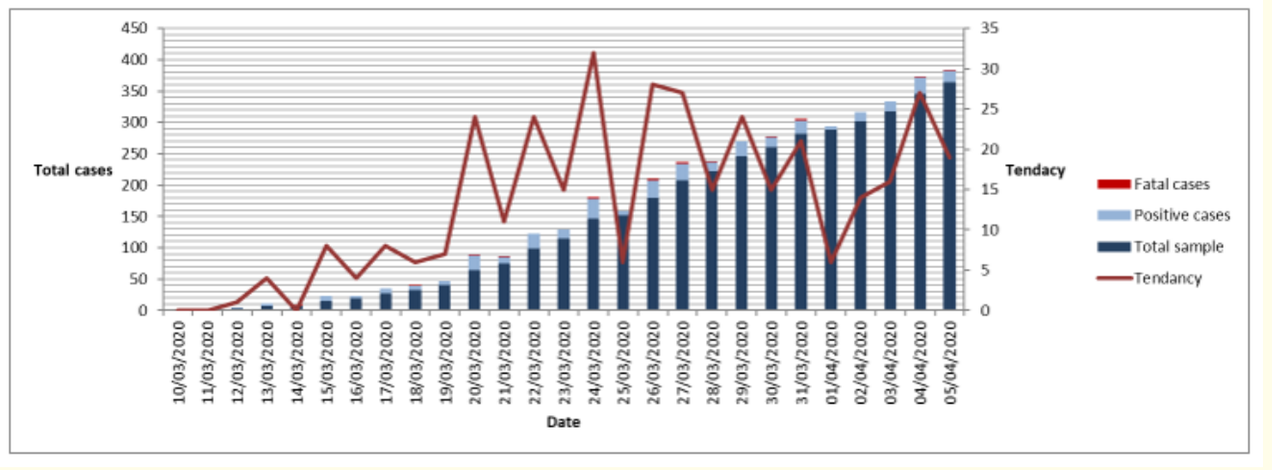

Figure 2: *COVID-19 progression data in Burkina Faso, March 9 - April 5, 2020.*
Caption: Evolution of COVID-19 cases and fatality, and overall trend from February 05, 2020 and April 4th, 2020.

Factor associated with a COVID-19 positive PCR test

Table 3 presents main symptoms and their association to a positive PCR test to E and RdRp genes. By univariate logistic regression, age (p = 0.002), the male sex (P = 0.03) were positively associated with positive PCR test results. By multivariate logistic regression age (p = 0.006) and fever (axillary temperature of 37.8^{0}C or above) (p = 0.02) were significantly associated with the presence of a positive COVID-19 test.

Characteristics	Total	% PCR positive	OR	95%CI	p. value	aOR	95%CI	p. value
Age group (years)								
[00-10]	26	5.3	0.1	0.1-0.9	0.002*	-	-	0.006
[10-20]	17	14.3	0.4	0.1-1.7		0.3	0.1-2.6	
[20-30]	105	31.4	Ref	-		Ref	-	
[30-40]	264	32.2	1.0	0.6-1.7		1.0	0.5-2.1	
[40-50]	262	39.9	1.5	0.8-2.5		1.5	0.7-3.1	
[50-60]	187	39.8	1.4	0.8-2.5		1.1	0.5-2.3	
[60-70]	99	41.9	1.6	0.8-2.9		1.4	0.6-3.1	
[70 -80]	78	32.4	1.0	0.5-2.1		0.6	0.2-1.5	
[80 and plus]	24	8.7	0.2	0.1-0.9		0.1	0.1-0.9	
Sex						-		
Male	647	34.5	Ref	-	0.030*		-	-
Female	383	27.9	0.7	0.4-0.9				
History of fever in the last 24h						-	-	
No	217	32.3	Ref	-	0.237			-
Yes	679	36.7	1.2	0.9-1.7				
Temperature								
< = 37.8	397	29.2	Ref	-	0.158	Ref		0.022*
>37.8	228	34.7	1.2	0.9-1.8		1.6	1.1-2.3	
Presence of neurologic condition								
No	214	11.7	Ref	-		-	-	-
Yes	69	14.5	1.3	0.6-2.8	0.537			
Cough								
No	180	36.1	Ref	-	0.506	-	-	-
Yes	773	33.5	0.9	0.6-1.3				
Kidney disease	232						-	
No	15	9.9	Ref	-		-		-
Yes		20.0	2.3	0.6-8.6	0.217			
Liver condition								
No	225	10.7	Ref	-	0.469	-	-	-
Yes	26	15.6	1.5	0.5-4.8				
Muscular ache								
No	490	41.2	Ref			-	-	-
Yes	280	38.2	0.9	0.7-1.2	0.412			

***Table 3**: Main characteristics, symptoms and their association to a positive COVID-19 test (n = 1,062).*

***Legend**: *: Statistically significant.*

***Abbreviations**. OR: Odd Ratio; aOR: Adjusted Odd Ratio; PCR: Polymerase Chain Reaction; Ref: Reference Category.*

Discussion

COVID-19 pandemic started in late December 2019 in China and spread worldwide, particularly in Asia and Europe, before reaching other regions of the world [23,24]. This can be explained by the fact that at the very beginning of the outbreak, there was a repatriation of nationals of European countries from China, where the virus was [25]. These early repatriations, without adequate prevention measures, and with limited knowledge regarding the epidemiologic characteristics of the virus may explain this rapid spread of the virus in Europe. For example, the incubation period initially thought to be short (3 - 7 days), has sometimes proved to be longer (7 - 14 days or even more than 20 days) particularly in elderly [26,27]. This misjudgment added to the high basic reproduction number of SARS-CoV-2 (mean R0 of 2.71) could explain the rapid spread of the disease in Europe through the early transport of returnees, some of whom being asymptomatic [28,29]. The low spread of the disease in Burkina Faso particularly and in Africa in general could be explain by the low availability of resource to repatriate their nationals during the early days of the outbreak. In Burkina Faso, screening of passengers at entry points in the country started earlier in January 2020 based on symptoms suggestive of COVID-19. The first suspect case of COVID-19 was recorded on February 5th, 2020, three months following the notification of the first cases in China and these were tested negative at the NIRL. There was a higher expectation of detecting SARS-CoV-2 in expatriate travelers, especially from airports across the country. However, this was not exactly the case as the index case in Burkina Faso was imported from Europe by asymptomatic national travelers, and diagnosis was only available 3 to 5 days after they presented symptoms. This was indicative of limited effect of the symptom-based screening [29,30]. Systematic molecular diagnosis could present more accurate result and prevent positive case from introducing the virus into the community.

The second source that introduced SARS-CoV-2 in Burkina Faso were expatriate mining workers that travelled between Burkina Faso and Europe. This source of contamination was more expected due multiple transmission epicenters in Europe and in the Americas which national are more involved in mining in the country [31].

The transmission accelerated and within two months, 1 062 suspected cases were recorded among them 450 positives for the virus structural envelop E gene (346 dually positive for both the E gene and the RdRp gene of the non-structural protein NSP-12 of ORF 1ab, i.e. 42.4% and 32.6% frequency of the E gene and the duality of the E gene plus the RdRp gene respectively. The mere presence of the E gene in a patient means that the patient is indeed infected with SARS-CoV-2, but the patient is not in full viral replication. However, the presence of both the E and RdRp genes not only means that the patient is infected with SARS- CoV-2, but also indicates that the virus is actively replicating in the host organism.

The male sex was found significantly associated with positive PCR test results by univariate analysis ($p = 0.03$). This could be due to the predominant presence of male outdoor for due to professional or cultural reasons in the African context, which would increase the risk of contamination of male subjects. This finding was not confirmed by the multivariate analysis after adjustment to socio-demographic characteristics of the suspected COVID-19 cases ($p = 0.18$). This analysis showed that there was no evidence of male vulnerability to COVID-19 compare to women. This is explained by the fact that in Burkina Faso, with some few exceptions, the majority of households are financially supported by men whose activities are mainly outdoor in contrast to the female population. If we consider the mode of transmission of SARS-CoV-2 by droplets from nasal secretions and through the air (7,11), it is clear that men who are most outdoors are most at risk of contamination. However, the male gender is described as an important risk factor for mortality among COVID-19 patient [32].

Fever (> 37.8°C), like the other symptoms used for the COVID-19 definition, is used for the identification of COVID-19 suspect cases. Univariate analysis showed a positive but not statistically significant association between fever and COVID-19 confirmed cases in rRT-PCR ($p = 0.15$). However, this association was statistically significant after adjustment for age ($p = 0.02$). The use of fever in symptom-based detection of patient suspected of COVID-19 is already described as an important public health approach particularly in screening at entry points [33].

In multivariate analysis, adults (20 - 80 years) with fever appeared to be at greater risk of having a positive rRT-PCR test than younger (under 10 years) and older (over 80 years) adults, p = 0.006. Even though we have no explanation for now, it could be used in combination with the fever symptoms for the symptom based screening at entry point for a further control of the spread of the SARS-CoV-2 infection [33]. This is particularly of interest when there is shortage of testing kits.

The use of the Tib-Molbiol kits for the PCR was useful for the detection of gene E and gene RdRp of the SARS-Cov 2. The detection of both gene in a patient prompted his transfer to the governmental designated site for COVID-19 care. Those positive to gene E only were considered positive with low viral replication and were therefore self-confined with PCR symptoms and molecular surveillance. The remaining negative to both gene were not confine. Thus, the use of this kit was useful in categorizing suspected case with allow definition of specifics public health intervention to limit the spread of the virus.

Conclusion

The COVID-19 outbreak is rapidly progressing in the country and PCR has been a crucial tool for the diagnosis of active cases and help implement action for the control of the disease. The use of the Tib-Molbiol kits were useful for implementing specific COVID-19 control interventions.

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Conflict of Interest

The authors declare that they have no competing interests.

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