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Clinical Evolution and Risk Factors of Hospitalized Patients with COVID-19, Haiti, March-June 2020

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Abstract

In December 2019, a coronavirus epidemic emerged in China. Within months, the epidemic was considered a public health emergency of international concern. In Haiti, the first laboratory-confirmed cases of COVID-19 were reported on March 19, 2020, in a context where there was some limitations of knowledge on the modes of transmission, the severity, the clinical characteristics and the risk factors of the disease. This study has made it possible to characterize the epidemic and investigate the associations between the risk factors, co morbidities, and clinical evolution of the disease.

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To develop the epidemiological and clinical profile of patients with COVID-19 in Haiti, data were collected from the clinical records of patients hospitalized for COVID-19 from March 16 to June 16, 2020, in 22 healthcare facilities. Univariate, bivariate, and logistic regression model analyses were performed to describe and explore the risk factors, comorbidities, and treatments associated with patients' clinical evolution. Statistical significance was determined using a 95% confidence interval or p-value of ≤0.05. Diabetes and high blood pressure were the main comorbidities that had a statistically significant association with the severe form of the disease and the occurrence of death. The likelihood of dying increased with age, and patients in the severe form were almost four times more likely to die. The administration of ceftriaxone to patients was significantly related to recovery from the disease. Diabetes, high blood pressure, and age were the major risk factors for the severity and mortality of people infected with COVID19. Ceftriaxone administration was protective against recovery.

Keywords: Coronavirus; COVID-19; comorbidity; risk factors; clinical evolution; signs and symptoms; recovery; death severity.

1. Introduction

COVID-19, a disease caused by the novel coronavirus (SARS-COV-2), has been in the pandemic stage since its initial notification in Wuhan, China, in December 2019 [1]. The symptoms are flu-like and tend to be accompanied by a transient loss of taste and smell. The real surprise of this disease is its potential global spread and rapid international contagiousness and transmission, despite several preventive measures taken worldwide [2]. Clinically, covid19 manifests itself in three ways:80% of patients are asymptomatic or oligosymptomatic with mild symptoms without complications (fever, dry cough, fatigue, without pneumonia, or with mild pneumonia); 15% progress to hospitalization with moderate symptoms and need for oxygen therapy (tachypnea, decrease in oxygen saturation of the ambient air, and signs of respiratory distress); and 5% have severe forms, septic shock, and multiorgan dysfunction) with indications for treatment in the intensive care unit [2,3].

On March 19, 2020, the first laboratory-confirmed COVID-19 cases were identified in Haiti. Knowledge of the modes of transmission, severity, clinical characteristics, and risk factors of infections remains limited especially for COVID [4,5]. A more complete knowledge of the clinical characteristics and evolution of patients in the hospital environment could help care providers and managers to estimate the needs in terms of therapeutic regimen and medical inputs to adequately manage the crisis. The findings of this study have allowed for a better understanding of the epidemiology of this disease, better planning of care units, and help to stem the epidemic [6–8].

2. Methods

Place and period of the study

The study was conducted in Haiti across ten departments of the country from March 16 to June 16, 2020.

Type of study

This is a retrospective analytical study

Population of the study

It constituted all the cases hospitalized for COVID-19 in Haiti during the study period.

Sampling

It consisted of patients hospitalized for at least 24 h and confirmed for COVID-19 by an RT-PCR test from an accredited laboratory during the period from March 16 to June 16, 2020, in Haiti.

Data Collection

The primary source of data was the patient's medical record, whether electronic or paper, and included demographic and epidemiological information (age, sex, origin, level of education, comorbidities), clinical signs and symptoms, laboratory data (clinical signs and symptoms, radiological findings, and laboratory results (white blood cells, kidney function, CRP), and therapeutic and evolutionary data (although this is part of the clinical).

An electronic data collection sheet was developed using the Open Data Kit (ODK) platform.

Data Management

The collected data were synchronized on a database designed in Microsoft Excel 2019 and stored on a secure server owned by the DELR. Only authorized members of the technical coordination team had access to the data for cleaning and quality control purposes.

Ethical Considerations

Patient names were removed from the collection sheets. Patients were identified using chart numbers. Informed consent was not obtained from the patients, as this was a retrospective analytical study of their clinical records. An agreement between the MSPP and the relevant health institutions was established for data collection.

The data used has been anonymized. A series of case numbers was created and assigned according to the order of collection on ODK the Open Data Kit (ODK). However, the investigation team was sure to follow the procedures in force and obtain the required authorizations. The final validation of the results of this study will also have to be approved by the authorities before publication. The study protocol was submitted to the National Bioethics Committee of the MSPP of Haiti and ethical approval **n°1920-34 r** for this study was obtained on June 8, 2020. In addition, no team members declared any conflicts of interest in the context of this work.

3. Statistical Analysis

We followed a rigorous statistical analysis plan, including the description of the population studied by the absolute (n) and relative frequencies (percentage %) with measures of central tendency (mean, median, and

mode according to the types of variables) and dispersion (variance, standard deviation, and quantiles). Then, using a categorization tool for the level of severity of the disease (mild, moderate, and severe), we performed multiple component analyses (PCA), focusing primarily on the clinical findings. Pearson's chi-square test was used to compare proportions. Univariate, bivariate analyzes and logistic regression models were also performed to describe and explore risk and prognostic factors. Statistical significance was determined using a 95% confidence interval and p-value ≤ 0.05.Data management was performed using Excel 2019, and statistical analyses were performed using SPSS and Stata software.

4. Results

This study was conducted from March 16 to June 16, 2020, and initially recruited 1,066 records of people hospitalized at 22 COVID-19 treatment sites throughout the country. A total of 824 records of hospitalized patients were retained and included in the analysis.

Among the 824 hospitalized cases of COVID-19, 471 patients (57.2%) were confirmed by RT-PCR, 173 tested negative (21.0%), and 180 patients (21.8%) did not have their results at the time of our analysis. (Figure 1)

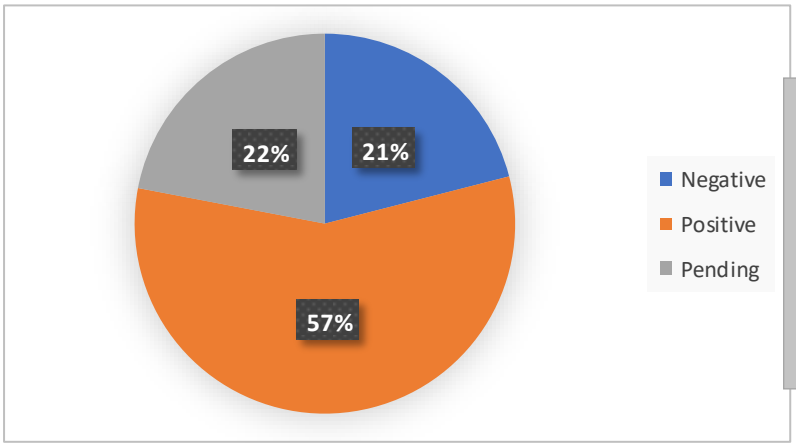

Figure 1: Percentage Distribution of Hospitalized Cases by Outcome

The following results are based on the 471 confirmed cases

The table below describes the sociodemographic and clinical characteristics of the cases from 22 COVID-19 health facilities in Haiti. Among the 471 patients analyzed, 170 were female (36.1%) and 301 were male (63.9%), with an average age of 52 years (Table 1). In addition, people aged between 50 and 59 years were the most affected. The predominant symptoms were fever (67.9%), cough (53.3%), and dyspnea (53.1%). The most common habits were alcohol consumption (29%) and smoking (26%), and 72.8% of the affected individuals had a moderate form of COVID-19. The most commonly administered drugs were ceftriaxone and azithromycin (AZM). (Tab 1)

Table 1: Sociodemographic and clinical characteristics of confirmed and hospitalized COVID-19 cases from March 16 to June 16, 2020, in Haiti.

Sociodemographic and clinical characteristics (n=471)	**n**	**%**	**Statistics**
GENDER			
Female	170	36.1	-
Male	301	63.9	-
Age Group (years)			-
0 to 9	5	1.1	-
10 to 19	8	1.7	-
20 to 29	37	7.9	-
30 to 39	84	17.8	-
40 to 49	79	16.8	-
50 to 59	93	19.7	-
60 to 69	79	7.8	-
70 and over	86	18.3	-
Age (years)			
Average	-	-	51,61 (49,96; 53,25)
Median	-	-	52,0
Standard deviation	-	-	18,2
Minimum	-	-	0
Maximum	-	-	104
Symptoms			
Fever	320	67.9	-
Cough	251	53.3	-
Dyspnea	250	53.1	-
Asthenia	84	17.8	-
Headache	75	15.9	-
Aches	67	14.2	-
Anosmia	45	9.6	-
Myalgia	42	8.9	-
Diarrhea	39	8.3	-
Dysgeusia	37	7.9	-
Sore throat	27	5.7	-
Expectoration	20	4.2	-
Nasal congestion	10	2.1	-
Habits			
Alcohol (n=324)	29	9.0	-
Smoking (n=325)	26	8.0	-
Drugs (n=316)	8	2.5	-
Severity according to clinical manifestations (n=471)			
Mild form	226	48	-
Moderate form	188	39.9	-
Severe form	57	12.1	
Comorbidity			
Other comorbidities	236	50.1	
High blood pressure	168	35.7	
Diabetes	104	22.1	

Medication		
Ceftriaxone	289	-
Azithromycin	273	-
Zinc	88	-
Chloroquine	79	-
Metronidazole	38	-
Gentamicin	13	-

The following analysis showed that among all the symptoms, fever was the most frequent in the 50-59 age group (20.3%). Second, cough in the 60-69 age group (19.1%). The last symptom was dyspnea in the age group of 70 years and over (21.6%) (Figure 2).

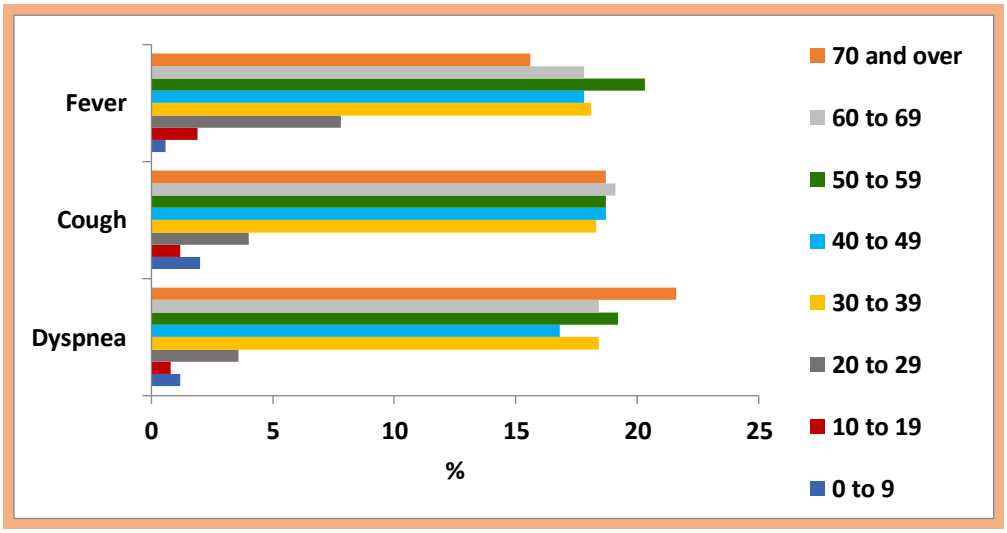

Figure 2: Distribution of confirmed cases by symptoms most frequently encountered in patients and by age group in Haiti

The use of the Principal Component Analysis (PCA) tool led to the classifications presented in Table 3.

It was observed that, first, the variables “symptom anosmia” and “symptom dysgeusia” were more correlated with the first axis. Thus, they form the first factor in the mild form. Second, the variables “symptom headache”, “symptom aches, and “symptom fatigue” are more correlated to the third axis and form the second factor of the moderate form. Third, the variables “symptom fever,” “symptom cough,” “symptom dyspnea” and “symptom sore throat” are more correlated to the second axis and form the third factor of severe form. (Tab 2)

The following table shows that most severe cases were in the age group of 40 years and above, which is 78.7% of this category. However, mild cases were concentrated more in the 20–39 age group (56%). (Tab 3)

Table 2: Classification of confirmed COVID-19 cases by multiple component analysis, March 19 - June 6, 2020, in Haiti

Symptoms	Size			
	1	**2**	**3**	**Average**
Fever	0.065	0.461	0.039	0.188
Cough	0.013	0.606	0.000	0.206
Dyspnea	0.079	0.141	0.128	0.116
Asthenia	0.066	0.050	0.192	0.103
Headache	0.079	0.019	0.424	0.174
Aches	0.114	0.000	0.159	0.091
Anosmia	0.657	0.004	0.111	0.258
Dysgeusia	0.635	0.004	0.154	0.264
Sore throat	0.000	0.015	0.002	0.006
Total active	1.709	1.299	1.210	1.406
% of variance	18.991	14.439	13.446	15.625

Table 3: Distribution of confirmed COVID-19 cases by age group according to severity level.

Age group	Severity		
	Mild form (%)	**Moderate form (%)**	**Severe form (%)**
0-9	0(0)	4(1.2)	1(1.0)
10-19	0(0)	7(2.0)	1(1.0)
20-29	3(12.0)	30(8.7)	4(3.9)
30-39	11(44.0)	57(16.6)	16(15.5)
40-49	4(16.0)	55(16.0)	20(19.4)
50-59	5(20.0)	70(20.4)	18(17.5)
60-69	1(4.0)	57(16.6)	21(20.4)
70 and over	1(4.0)	63(18.4)	22(21.4)
Total	**25 (100)**	**343 (100)**	**103 (100)**

The Table below presents the outcomes of patients in relation to their age group. According to the results obtained after the analyses, 65% of the patients who recovered were in the 40-49 age group, 62% were in the 50-59 and 20-29 age groups, and 60% were in the 0-9 age group (Table 4).

Table 4: Patients by Age Group

Age Group (years)	(%) of Patients				Total (%)
	Active (%)	Recovered (%)	Deaths (%)	Abandoned (%)	
0-9	1 (20)	3 (60)	0 (0)	1 (20)	**5 (100)**
10-19	2 (25)	3 (37.5)	1 (12.5)	2 (25)	**8 (100)**
20-29	11 (29.7)	23 (62.2)	2 (5.4)	1 (2.7)	**37 (100)**
30-39	30 (35.7)	48 (57.1)	5 (6)	1 (1.2)	**84 (100)**
40-49	11 (13.9)	51 (64.6)	12 (15.)	5 (6.33)	**79 (100)**
50-59	22 (23.7)	58 (62.4)	12 (12.)	1 (1.1)	**93 (100)**
60-69	15 ((19)	41 (51.9)	17 (21.)	6 (7.6)	**79 (100)**
70 and +	9 (10.5)	48 (55.8)	26 (30.)	3 (3.5)	**86 (100)**
Total	101 (21.4)	275 (58.4)	75 (15.9)	20 (4.2)	**471 (100)**

The following graph shows that patients with diabetes and arterial hypertension as comorbidities recovered less. (Figure 3)

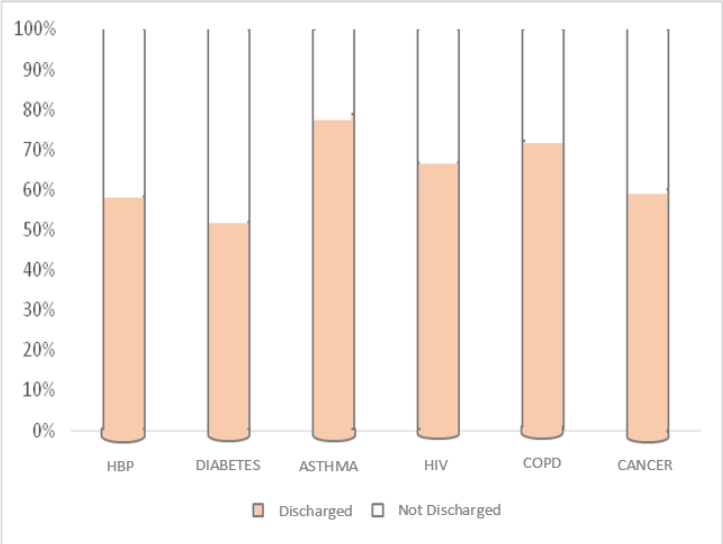

Figure 3: Distribution of COVID-19 patients who recovered according to their morbidity

The following analysis demonstrated a statistically significant association between diabetes and disease severity; therefore, diabetes was a risk factor (Table 5).

Table 5: Bivariate analysis of comorbidities and the severity of COVID 19

Comorbidity	Severity			
	Mild form (%)	Moderate form (%)	Severe form (%)	Pearson Chi-squared
HBP				
Yes	5 (3.0)	122 (72.6)	41 (24.4)	0.170
No	20 (6.8)	214 (72.5)	61 (20.7)	
Diabetes				
Yes	3 (2.9)	68 (65.4)	33 (31.4)	0.016
No	22 (6.1)	268 (74.7)	69 (19.0)	
HBP/ Diabetes				
Yes	1 (1.5)	47 (69.1)	20 (29.4)	0.112
No	24 (6.1)	289 (73.2)	82 (20.8)	
Cancer				
Yes	0 (0.0)	4 (80.0)	1 (20.0)	0.852
No	25 (5.5)	332 (72.5)	101 (22.1)	
Asthma				
Yes	0 (0.0)	15 (78.9)	4 (21.1)	0.552
No	25 (5.6)	321 (72.3)	98 (22.1)	

The following analysis demonstrated that hypertension and diabetes were significantly related to the risk of death in patients with COVID-19 (Table 6).

Table 6: Estimation of the risk of death linked to COVID-19 in individuals with Hypertension and/ or Diabetes by univariate analysis.

Comorbidity	Deaths:		
	N	RR	Value of P
HBP	**39**	**2.1**	**0.003**
Diabetes	**34**	**3.7**	**0.000**
HBP + Diabetes	**24**	**3.6**	**0.000**

This multivariate analysis showed that a person with diabetes has a greater chance of developing the severe form than the moderate form compared to a person without diabetes (Table 7).

Table 7: Statistical analysis of risk factors associated with disease severity

Severity Level		B	Standard error	Wald	ddl	ddl	Exp(B)	95%CI
Mild form	Constant	-0.989	0.266	13.797	1	0.000		
	HBP = Yes	-0.709	0.562	1.589	1	0.207	0.492	0.163; 1.482
	HBP = No	0[b]	-	-	0	-	-	-
	Diabetes = Yes	-1.005	0.677	2.204	1	0.138	0.366	0.097; 1.380
	Diabetes = No	0[b]	.	.	0	.	.	.
Moderate form	Constant	1.348	0.152	78.451	1	0.000		
	HBP = Yes	0.030	0.249	0.015	1	0.903	1.031	0.633; 1.679
	HBP = No	0[b]	.	.	0	.	.	.
	Diabetes = Yes	-0.645	0.268	5.790	1	0.016	0.525	0.310; 0.887
	Diabetes = No	0[b]	.	.	0	.	.	.

a. The reference category is the: Severe Form

b. This parameter is set to 0, as it is redundant

During this analysis, it was shown to be statistically significant that ceftriaxone administration to patients was a protective factor for their recovery (Table 8).

Table 8: Statistical analysis of patients who recovered based on the medications administered

Medication	Recovered cases			
	N	RR	Pearson Chi-square	95% CI
Ceftriaxone (N=289)	164	0.45	0.001	(0.27; 0.74)
Azithromycin (N=273)	166	1.16	0.513	(0.75; 1.80)
Gentamycin (N=13)	10	2.10	0.256	(0.57; 7.81)
Metronidazole (N=38)	21	0.78	0.46	(0.39; 1.54)
Zinc (N=88)	56	1.31	0.27	(0.81; 2.12)
Chloroquine (N=79)	54	1.46	0.17	(0.85; 2.53)

The following table shows that the probability of dying increases with age: a person with diabetes is almost three times more likely to die than a person without diabetes, and patients with the severe form are almost four times more likely to die than those with the mild form.(Tab 9)

Table 9: Multivariate analysis of risk factors for death among patients hospitalized during the period from March 16 to June 16 in Haiti. (Tab 9)

	Model						
	B	**E.S**	**Wald**	**ddl**	**Sig.**	**Exp(B)**	**CI (95%)**
Age	0.030	0.008	13.444	1	0.000	1.030	(1.01; 1.05)
Diabetes	1.080	0.278	15.128	1	0.000	2.943	(1.7; 5.07)
Severity Level			9.425	2	0.009		
Moderate	0.602	0.655	0.844	1	0.358	1.825	(0.50; 6.58)
Severe	1.345	0.631	4.544	1	0.033	3.839	(0.50; 6.58)
Constant	-4.582	0.728	39.653	1	0.000	0.010	

5. Discussions

This retrospective study identified the sociodemographic characteristics of the patients, the risk factors associated with the clinical course of the patients, and the impact of therapeutic regimens.

Among the COVID-19 patients admitted to hospitals in Haiti during the first three months of the epidemic, the majority was men (> 60%), with an average age of 52 years, and the predominant signs and symptoms were fever and dyspnea. Most cases were classified as moderate or severe, and the most frequent comorbidities were high blood pressure and diabetes. These findings are not different from those of studies performed in other countries, such as China and the United States [9–11].

Most patients with the severe form of the disease recovered, and the use of antibiotics such as ceftriaxone was associated with a favorable outcome for recovery from the disease. WHO has given guidelines for the management of COVID-19 but so far there is no specific treatment, which is why practitioners are advised to take responsibility if they prescribe drugs outside the protocols already used effectively by other countries in

clinical trials [12,14]. It is therefore recommended that Haitian prescribing physicians continue to follow the therapeutic regimens already tried with effectiveness in other regions of the world and ceftriaxone, since it was constituted as a protective factor in the recovery of patients in this study.

In this study, diabetes constituted a risk of aggravation of the disease, and the likelihood of dying increased with age, with the severe form and with diabetes and high blood pressure. These results do not disagree with the scientific literature since several other studies have already demonstrated statistically significant associations between the severity of COVID-19 and the occurrence of death with these previously mentioned factors [11, 15].

This is no different from a study carried out in France which showed an association between diabetes and the risk of admission to an Intensive Care Unit and also a relationship with severity [16].

Like this study, there are others that show that comorbidities such as high blood pressure were the leading causes of death among patients [17].

Like all observational studies, this study has certain limitations: certain variables of interest were not retained in the files of certain hospitalized patients, which led to missing data, and data on certain risk factors were not included. could be collected because it was not a patient survey.

The risk of contracting the disease was not assessed since the data collected was only data from patients hospitalized for covid19; we had not collected data from outpatients and neither from patients who tested negative.

All data was collected over the entire duration of the study, but difficulties due to the unavailability of certain laboratory results forced us to exclude certain data from the analysis.

In conclusion, COVID-19 in Haiti affects both sexes with a male predominance; it mainly affects people aged 30 years and older. Age, high blood pressure, and diabetes are the main risk factors for disease aggravation and death. The main therapeutic regimen used was hydroxychloroquine in combination with antibiotics, such as ceftriaxone, which is a protective factor for patient recovery.

6. Appendix

Case Definition

Confirmed case of COVID-19

Any suspected COVID-19 case tested positive by RT-PCR by LNSP or a laboratory equipped for COVID-19 testing.

Mild form

All patients had mild symptoms, such as anosmia, dysgeusia, simple fever, and dry cough.

Moderate form

Any patient with or without any of the above-mentioned mild signs and symptoms accompanied by impairment of general condition (aches, fatigue).

Severe form

Any patient with worsening of the above signs and symptoms accompanied by dyspnea

Hospitalized cases

Any suspected or confirmed COVID-19 case was admitted to a health facility providing COVID-19 care for at least 24 h.

Active cases

Any case that was still hospitalized at the time of data collection.

Abandoned cases

All cases for which a record of abandonment was signed in their clinical records

Recovered cases

All patients hospitalized for COVID-19 for whom a healthcare worker signed a discharge form.

Hospitalized Deaths:

All patients for whom a healthcare worker has declared death due to COVID-19.

7. Inclusion Criteria

All suspected or confirmed cases hospitalized in a COVID-19 care facility

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