SARS-CoV-2 Infection and Factors Associated with Mortality in Hospitalized Patients Aged 60 and Over at the Epidemic Treatment Center (ETC) of Saint-Louis (Senegal)

ABSTRACT

Background: SARS-CoV-2 infection typically causes severe pneumonia in elderly patients with high mortality rates.

Aim: This study aimed to describe the epidemiological, clinical, paraclinical and evolution profile of the SARS-CoV-2 infection in patients aged 60 years and over hospitalized at theEpidemic Treatment Center (ETC)of Saint-Louis "Senegal", and to identify the factors associated with death.

Methodology: This is a cross-sectional, retrospective, descriptive and analytical study conducted from March 2020 to August 2021. It includes all patients aged 60 years and older hospitalized at the ETC of Saint-Louis (Senegal) for SARS-CoV-2 infection**.** Microsoft Excel was used to enter data and then analysis was done using EPI INFO version 7 software.

Results: Of a total of 448 hospitalizations, 188 patient records aged 60 years and older was collected. The prevalence was 42%. The mean age was 70 years (±8 years). The sex ratio was 1.7 with a male predominance (62.8%). Hypertension was the most common co-morbidity (67%). Severe forms were predominant (64.4%). Dyspnea (60.3%), cough (56.5%) and ageusia (24.5%) were the most common symptoms on admission. Thoracic CT scans showed severe involvement in 51.7% of cases. Hydroxychloroquine-azithromycin combination was prescribed in 98.4% of cases. The mortality rate was 18.6%. The main factors associated with death were age (≤75 years) (p=0.014) [OR=0.488; 95% CI: 0.201-1.187]; critical forms (p=0.017) [OR=0.061; 95% CI: 0.006-0.601]; comorbidity (p=0. 031) [OR=1.647; 95% CI: 0.280-2.499]; occurrence of complications (p=0.009) [OR=1.212; 95% CI: 0.530-2.774]; and SpO2≤95% at admission (p=0.031) [OR=4.899; 95% CI: 0.752-8.797].

Conclusion: SARS-CoV-2 infection in the elderly is predominantly severe with high mortality. This high-risk group requires special attention.

keywords: *SARS-CoV-2; elderly patients; Saint-Louis; Senegal.*

1. INTRODUCTION

COVID-19 (coronavirus disease 19), caused by SARS-CoV-2(Severe Acute Respiratory Syndrome Coronavirus 2), is a respiratory illness that often results in respiratory failure [1,2]. The World Health Organization declared the pandemic on March 11, 2020, following its fast global expansion [1]. As of September 27, 2020, there were approximately 32,920,218 confirmed cases and nearly one million deaths worldwide. On the same date, Africa recorded 35,440 deaths from 1,459,714 confirmed cases [3]. Like other African countries, Senegal has not escaped the epidemic. Its first case was recorded on March 2, 2020. As of September 24, 2020, Senegal reported 14 816confirmed cases, with 11 818recovered and 304 deaths [4,5].

SARS-CoV-2 infection is typically mild in 80% of cases, with the most typical clinical presentation being acute respiratory infection with fever, dry cough, dyspnea, fatigue, myalgia and headache [6-9]. However, 15% of cases are severe and 5% are critical [6,7]. The mortality rate is very high in severe and critical cases, reaching up to 50% in some series [6]. Individuals with comorbidities such as advanced age, hypertension, diabetes mellitus, and chronic respiratory diseases are at a higher risk of developing severe forms of the disease or dying from it [9-11]. WHO confirmed that 40 years and above will face age-related risks.However, the Centers for Disease Control and Prevention (CDC) states that the risk of developing severe forms is observed in people aged 65 years and over [12]. In the population aged 60 years and older, the mortality rate associated with SARS-CoV-2 infection is estimated to be 6.38%. This is approximately 20 times higher than the mortality rate observed in persons under the age of 60 (0.32%) [12]. In Senegal, few studies have investigated SARS-CoV-2 infection in elderly people. This study aims to describe the epidemiological, clinical, paraclinical, therapeutic, and evolution profile of SARS-CoV-2 infection in patients aged 60 and over hospitalized at the ETC of Saint-Louis (Senegal), and to identify the factors associated with death.

2. MATERIALS AND METHODS

2.1. Type, Period of Study and study population

This was a cross-sectional, retrospective, descriptive and analytical study conducted from March 2020 to August 2021, carried out on patients aged 60 and over hospitalized at the Saint-Louis ETC (Senegal).

2.2 Inclusion criteria

It included all patients aged 60 years and older hospitalized at the ETC of Saint-Louis (Senegal) for SARS-CoV-2 infection, regardless of severity, during the three waves of COVID-19. In Senegal, the 1st wave ran from March 2020 to November 2020, the 2nd wave from December 2020 to May 2021 and the 3rd wave from June 2021 to September 2021.

2.3 Non-inclusion criteria

Patients whose medical records were incomplete(poorly filled out with many parameters missing) or could not be found were not included.

2.4 Diagnostic criteria

The diagnosis of SARS-CoV-2 infection was based on

a. RT-PCR obtained from nasopharyngeal swabs.
b. Positive Antigen rapid tests
c. Chest CT scan

2.5 Data collection

Datawascollected from medical records using a questionnaire covering the following parameters:

- Epidemiological data: age, gender, marital status, comorbidities, and COVID-19 vaccination status)
- Clinical data: the time between symptom onset and hospitalization, severity of clinical presentation(mild, moderate, severe, critical), peripheral oxygen saturation (SpO2) at admission, and symptoms at admission. The Ministry of Health and Social Action (MSAS) of Senegal classifies the different forms of SARS-CoV-2 infection according to severity:
    - Mild forms: no pneumonia, normal heart rate (HR), respiratory rate (RR): 12-20 cpm, SpO2≥95%, chest CT scan: 0 to 25% of lung parenchyma affected, Q-SOFA =0, no comorbidity

- Moderate forms: mild to moderate pneumonia, HR normal or >90 bpm, RR: 20-29 cpm, Sp02: 95%-90%, chest CT scan: 25%to 50% involvement of lung parenchyma, Q-SOFA<2, balanced comorbidities
- Severe forms: severe pneumonia, HR>100 bpm, RR≥30cpm, SpO2≥90%, chest CT scan: 50-75% lung parenchyma involvement, Q-SPFA≥2, unbalanced or unstable comorbidities
- Critical forms: hypoxemic pneumonia, HR >100 bpmor <50 bpm, RR>30 cpmor <10 cpm, SpO2≤90%, chest CT scan: involvement >75% of lung parenchyma, Q-SOFA≥2, unbalanced or unstablecomorbidities.

- Paraclinical data: hemogram, transaminases, creatinine, CRP, fasting blood glucose, blood electrolytes, lipids, troponin, prothrombin levels, and thoracic CT scan.
- Therapeutic data: molecules administered
- Evolution data: length of hospital stay and outcome.

2.6 Statistical analysis

The study included usage for microsoft excel with EPI INFO version 7 software.Statistical tools employed for calculating means and percentages are Chi2 and Fisher tests based on applicability.Statistical significance was defined as any difference below 0.05.

3. RESULTS

3.1 Epidemiological Aspects

Out of a total of 448 hospitalizations, 188 patient files of people aged 60 years and overwas collected, resulting in a prevalence of 42%. During the first wave, 66 cases out of 256 (25.8%)wasrecorded, 69 cases out of 102 (67.6%) during the second wave, and 53 cases out of 90 (59%) during the third wave (Fig. 1).

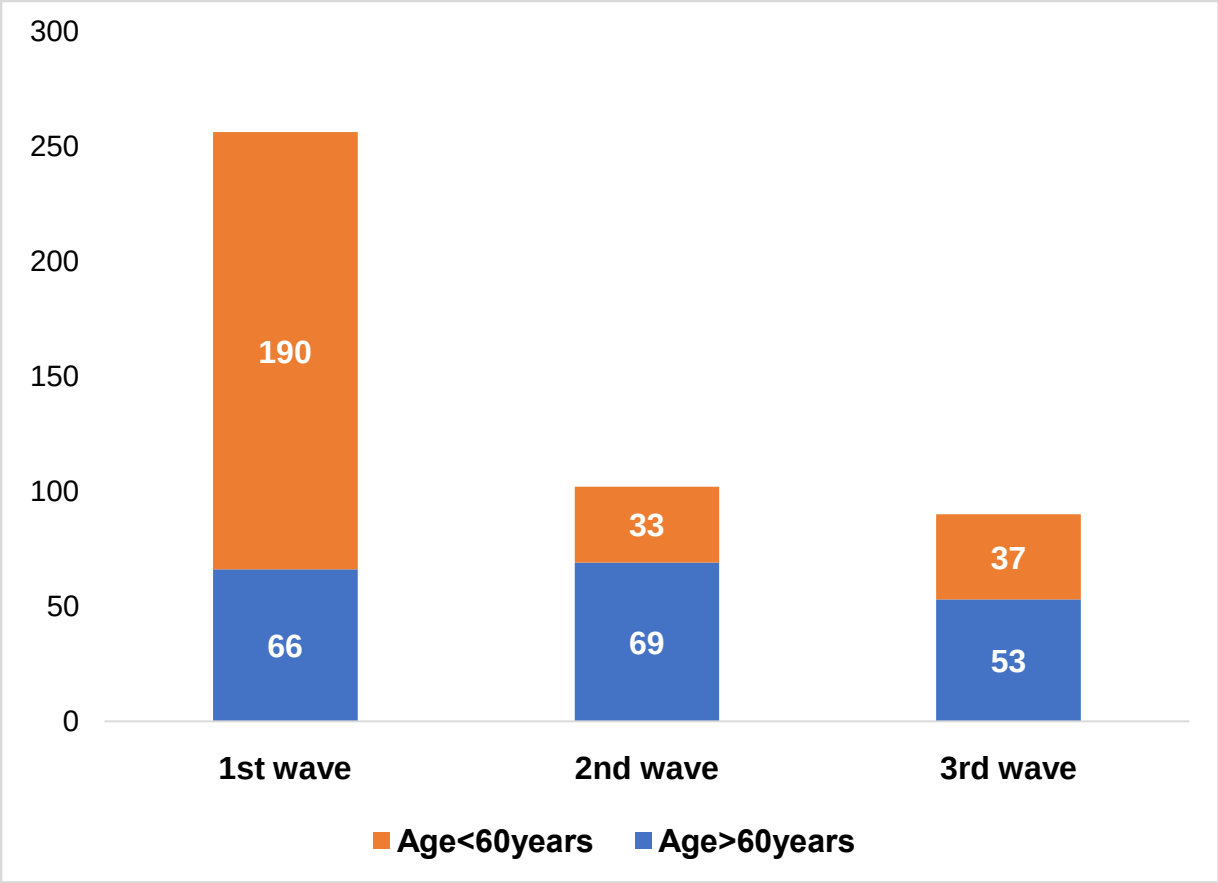

Fig. 1. Prevalence of patients aged 60+ hospitalized at Saint-Louis ETC during the first three waves of COVID-19

The mean age of the study population was 70 years (±0.8) with a male predominance of 118 (62.8%) compared to 70 females (37.2%), resulting in a sex ratio of 1.7. Comorbidities were present in 115 patients (61.2%) and were mainly hypertension (77 cases, 67%), followed by diabetes mellitus (54 cases, 47%) and asthma (7 cases, 6%). Only 4 patients (2.1%) had receivedSARS-CoV-2 vaccination(Table 1).

Table 1. Distribution of patients according to epidemiological data

Epidemiological data	Number	Percentage (%)
Age		
60-65 years	65	34.6
66-70 years	49	26.1
71-75 years	34	18.1
76-80 years	17	9

81-85 years	14	7.4
86-90 years	6	3.2
91-95 years	3	1.6
Sex		
Males	118	62.8
Females	70	37.2
Marital status (n=145)		
Married	124	85.5
Widowed	16	11
Single	5	3.4
Comorbidities (115)		
HTN	77	67
Diabetes mellitus	54	47
Asthma	7	6
Cardiopathy	6	5.2
Dyslipidemia	6	5.2
Chronic Kidney Disease	3	2.6
Gout	3	2.6
Obesity	2	1.7
Rheumatoid Arthritis	1	0.9
Scleroderma	1	0.9
Sickle Cell Disease	1	0.9
Dementia	1	0.9
SARS-CoV-2 vaccination (n=188)		
Yes	4	2.1
No	184	97.9
Type ofSARS-CoV-2 vaccine(n=04)		
Sinopharm	2	50
AstraZenecca	1	25
Johnson & Johnson	1	25

3.2 Clinical Aspects

The mean time from symptom onset to hospitalization was 9.6 days (±4.9). The mean SpO2 was 88.6 % (± 10.2 %). The majority of patients had severe forms of the

disease, with 121 cases (64.4%). Dyspnea was the most common symptom upon admission, with 111 cases (60.3%), followed by cough with 104 cases (56.5%) and ageusia with 45 cases (24.5%) (Table 2).

Table 2. Distribution of patients according to clinical data

Clinical data	Number	Percentage (%)
Severity (n=188)		
Mild form	36	19
Moderate form	26	13.8
Severe form	121	64.4
Critical form	5	2.7
Clinical symptoms		
Respiratory symptoms		
Dyspnea	111	60.3
Cough	104	56.5
Chest pain	29	15.2
Hemoptysis	1	0.5
Sneezing	1	0.5
Otorhinolaryngologicalsymptoms		
Agueusia	45	24.5
Anosmia	19	10.3
Rhinorrhea	18	9.8
Otalgia	1	0.5
Laryngeal crackles	1	0.5
Digestive symptoms		
Diarrhea	21	11.4
Vomiting	7	3.8
Odynophagia	6	3.3
Abdominal pain	4	2.2
Epigastric pain	3	1.6
Nausea	2	1.1
Hiccups	1	0.5

Constipation	1	0.5
Neurological symptoms		
Headache	44	24
Dizziness	3	1.6
Insomnia	1	0.5
Anxiety	1	0.5
Cardio-vascular symptoms		
Precordialgia	1	0.5
Generalsymptoms		
Fever	83	45.4
Asthenia	78	42.6
Arthralgia	59	32.2
Myalgia	54	29.5
Anorexia	54	29.5
Body aches	47	25.7
Lumbago	28	15.3
Chills	14	7.6
Sweat	10	5.5
Loss of weight	4	2.2
Lethargy	1	0.5

3.3 Paraclinical Aspects

The mean leukocyte count was 7898/uL (±4093). Leukocytosis (>10,000/uL) was found in 35 patients (18.6%). Lymphopenia (<1500/uL) was found in 108 patients (57.4%). The mean creatinine level was 14.5 mg/dL (±22.2). Renal failure with a creatinine level ≥14 mg/L was found in 34 patients (19.5%). The mean fasting glycaemia was 1.1 g/L (±0.5). Hyperglycemia ≥1.26 g/L was found in 32 patients (23%). All patients (100%) underwent a diagnostic PCR test. A chest CT scan was performed in 51 patients (27.1%). The extent of the lesions was specified in 29 cases, with severe involvement predominating in 15 cases (51.7%) (Table 3).

Table 3. Distribution of patients according to paraclinical data

Paraclinical data	Number	Percentage (%)
Hemogram (n=188)		
Leukocytosis (>10000/ul)	35	18.6
Lymphopenia (<1500/ul)	108	57.4
Neutropenia (<1500/ul)	7	3.7
Thrombocytopenia (<150000/ul)	9	4.8
Anemia (≤10 g/dl)	13	7
Transaminases (n=125)		
ALT (>70UI)	15	12
AST (>60UI)	21	16.8
Creatinine (>14mg/l) (n=174)	34	19.5
CRP (≥12mg/l) (n=38)	32	84.2
Hyperglycaemia (≥1,26g/l) (n=139)	32	23
Hemoglobin A1C (≥7%) (n=21)	8	38.1
Electrolyte profile (n=78)		
Hyponatremia (<130meq/l)	6	7.7
Hypochloremia(<98meq/l)	17	21.8
Hypokalemia (<3,5meq/l)	18	23.1
Lipid profile (n=106)		
Hypercholesterolemia (>2g/l)	31	29.2
Hypo-HDL-cholesterolemia (<0,4g/l)	35	33
Hyper-LDL-cholesterolemia (>1,6g/l)	18	17
Hypertriglyceridemia (>1,6g/l)	28	26.4
Hypertroponinemia (>0,4ng/ml) (n=80)	80	100
Decrease in prothrombin levels<70% (n=155)	18	11.6
SARS-CoV-2 PCR(n=188)	188	100
Thoracic CT scan lesion extent (n=29)		
0 to25%	3	10.3
25% to 50%	10	34.5
50% to 75%	15	51.7
>75%	1	3.4

3.4 Therapeutic Aspects

The hydroxychloroquine-azithromycin combination was prescribed in 185 cases (98.4%). Antibiotic treatment was initiated in 126 cases (67%). Oxygen therapy was administered in 128 cases (68%) (Table 4).

Table 4. Distribution of patients according to therapeutic data

Therapeutic data	Number	Percentage (%)
Hydroxychloroquine-azithromycin combination	185	98.4
Antibiotic therapy	126	67
Oxygen therapy	128	68.1
Non-invasive ventilation	5	2.6
Anticoagulation	179	95.2
Corticosteroid therapy	113	60.1
Analgesic/antipyretic	176	93.6
Vitamin C	181	96.3
Zinc	83	44.1

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Azithromycin was the most prescribed antibiotic with 187 cases (99.5%), followed by ceftriaxone with 122 cases (96.8%) and amoxicillin-clavulanate with 03 cases (2.4%) (Table 5).

Table 5. Breakdown of patients by antibiotics prescribed

Antibiotic molecules	Number	Percentage (%)
Azithromycin	187	99.5
Ceftriaxone	122	96.8
Amoxicillin-Clavulanate	3	2.4
Cefixime	2	1.6
Gentamicin	1	0.8
Metronidazole	1	0.8
Ciprofloxacin	1	0.8
Fucidic acid	1	0.8
Levofloxacin	1	0.8

anti-tuberculosis drugs	1	0.8

3.5 Evolutionary Aspects

The mean length of hospital stay was 12.6 days (±4.7). Just over half of the patients, 100 out of 181 (55.2%), had a hospital stay between 11 to 15 days (Fig. 2). Regarding outcome, there were 153 recoveries (81.4%) and 35 deaths (18.6%). The main factors associated with death were age (≤75 years) (p=0.014) [OR=0.488; 95% CI: 0.201-1.187]; critical forms (p=0.017) [OR=0.061; 95% CI:]; comorbidities (p=0.031) [OR=1.647; 95% CI: 0.280-2.499], complications (p=0.009) [OR=1.212; 95% CI: 0.530-2.774], and SpO2≤95% at admission (p=0.031) [OR=4.899; 95% CI: 0.752-8.797]

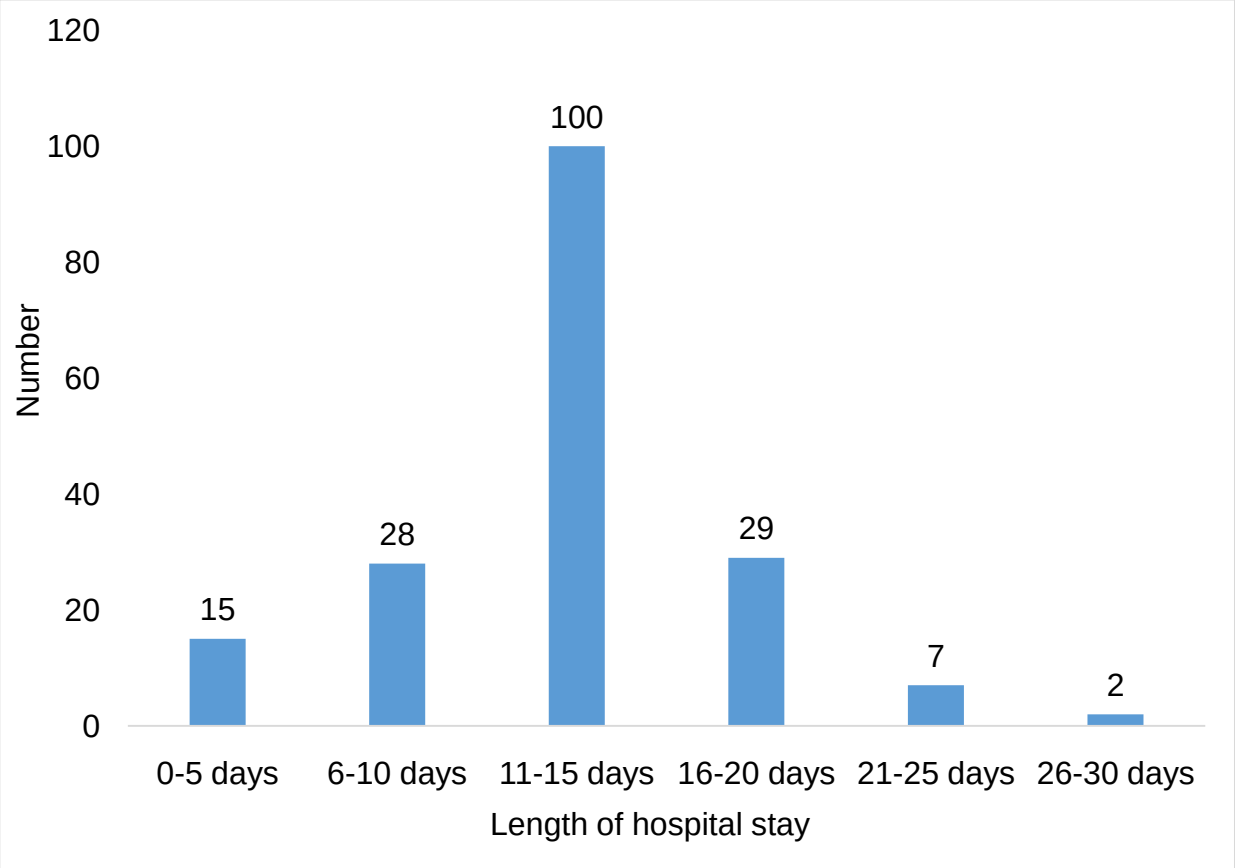

Fig. 2.Distribution of patients according to their length of hospital stay

4. DISCUSSION

In our series, the mean age was 70 years (±8 years). Similar results were found by **Wang et al.** (China) and **Touahri et al.** (Algeria) who reported mean ages of 71 and 74 years, respectively [13,14]. In the preliminary study by **Zulfiqar et al.** (France) on a series of elderly COVID-19 patients, the mean age was slightly higher at 83.97 years [15]. The difference in mean age could be explained by the fact that life expectancy is higher in France (85.4 years for women and 79.3 years for men) [16], whereas in Senegal it is 67.7 years [17].

Our series had a male predominance (62.8%) with a sex ratio of 1.7. The same trend was found by **Niu et al.** (China) and **Córdova et al.** (Peru), with 56.7% and 51.9% male predominance respectively [18,19]. This male predominance could be explained by the fact that men are more mobile, often finding themselves in gatherings and therefore more exposed to COVID-19.

In our study, co-morbidities were present in 61.2% of patients, with high blood pressure (67%) and diabetes mellitus (47%) being the most common. This is consistent with the results of **Wang et al.** (China) who found a predominance of hypertension (40.8%) and diabetes mellitus (16%) [13]. **Collarino et al.** (France) also found a predominance of hypertension (67%) and diabetes mellitus (23%) [20]. This predominance may be explained by the high prevalence of these comorbidities in the general Senegalese population, with rates of 29.8% and 3.4%, respectively [17]. In particular, the Saint-Louis region of Senegal has a high prevalence of hypertension (46%) and diabetes mellitus (10.4%) [17].

In our patients, the SARS-CoV-2 vaccinationcoverage rate was 2.1%. According to **Masresha B et al.**, in the first year after vaccine introduction, only 6.8% of the total population was fully vaccinated in the 47 countries of the WHO African Region [21]. Due to the high lethality rate of COVID-19 in the elderly population, they quickly became a priority target for vaccination, despite the evolving indications based on availability and knowledge [22]. This low prevalence of vaccination coverage can be explained by people's reluctance to receive the anti-COVID vaccine.

In our series, most patients had severe COVID-19 (64.4%). The prevalence of severe forms in elderly individuals was corroborated by **Mahiat C et al.** (Belgium) and **Chen et al.** (China), who reported 72% and 87.3%, respectively [23,24]. The fact that elderly subjects often have many comorbidities and a weakened immune system may explain this. Indeed, they are more prone to develop severe forms of COVID-19 [11,25] due to senility and decreased IFN-1 production.

In our study, the hydroxychloroquine-azithromycin combination was prescribed in 98.4% of cases. This contrasts with the Lydie C study (France), where only 3% of patients received this combination [26]. The World Health Organisation's decision to discourage the use of drugs such as hydroxychloroquine in COVID-19 patients [27] may explain these results. However, because of its proven results in reducing the median length of hospitalisation and the absence of serious side effects, this molecule was included in the Senegalese treatment protocol at the beginning of the pandemic [28].

In terms of evolution, the mortality rate in our series was 18.6%. A mortality rate of 16.8% was reported by **Tam EMYY and al.** (China) [29]. However, **Kone D et al.** (Ivory Coast) found a higher fatality rate of 23.7% [30]. This high fatality rate demonstrates the severity of COVID-19 in elderly individuals.

The main factors associated with death that we found were age, critical forms, comorbidities, the occurrence of complications, and SpO2 at admission. Many other factors associated with death have been reported in the literature. For instance, **Aw et al.**(England) found aging and male sex as factors of death [31]. Chen et al. found that factors associated with death were male sex, multiple comorbidities, dyspnea, high creatinine levels and high AST levels [24]. **Thiam et al.** found that delirium was the only factor associated with death [32].

5. CONCLUSION

In our series, hospital admissions of patients aged 60 and over infected with SARS-CoV-2 were higher during the 2nd and 3rd waves of COVID-19 at the Epidemic Treatment Center (ETC) of Saint-Louis (Senegal). Our study showed that these patients were mainly hypertensive men, very few of whom had been vaccinated against COVID-19. Symptoms such as dyspnea, cough and agueusia were the main reasons for admission to hospital. Case fatality was high and was associated with several factors. This study shows the need to step up COVID vaccination, to ensure that booster doses are taken, to raise awareness of the need to comply with barrier measures, to seek medical advice as soon as the first symptoms appear, and to ensure that co-morbidities are properly monitored, in order to reduce COVID-19-related mortality in the elderly population.

COMPETING INTERESTS

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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