

# Characteristics of Patients with COVID-19 at the Touba Ndamatou Public Health Hospital Establishment in the Medical Region of Diourbel

Ndeye Fatou Ngom<sup>1,2\*</sup>, Djiby Sow<sup>3,4</sup>, Fulgence Abdou Faye<sup>1,5</sup>, Alassane Ndiaye<sup>2</sup>, Modou Gueye<sup>3</sup>, Ousseynou Ka<sup>1,2</sup>

<sup>1</sup>Department of Medicine, UFRSDD, University Alioune Diop, Bambey, Senegal

<sup>2</sup>Outpatient Treatment Center, Fann Hospital, Dakar, Senegal

<sup>3</sup>Faculty of Medicine, Pharmacy and Odontology, University Cheikh Anta Diop, Dakar, Senegal.

<sup>4</sup>Internal Medicine Department, Abasse Ndao Hospital, Dakar, Senegal

<sup>5</sup>Hospital Heinrich Lucke, Diourbel, Senegal

Email: \*Ndeyefatou.ngom@uadb.edu.sn

**How to cite this paper:** Ngom, N.F., Sow, D., Faye, F.A., Ndiaye, A., Gueye, M. and Ka, O. (2024) Characteristics of Patients with COVID-19 at the Touba Ndamatou Public Health Hospital Establishment in the Medical Region of Diourbel. *Advances in Infectious Diseases*, 14, 670-681.

<https://doi.org/10.4236/aid.2024.144049>

**Received:** September 17, 2024

**Accepted:** November 10, 2024

**Published:** November 13, 2024

Copyright © 2024 by author(s) and Scientific Research Publishing Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

## Abstract

**Introduction:** Coronavirus disease is a pandemic discovered in December 2019. It is a polymorphic, systemic zoonosis caused by a virus with predominant respiratory tropism. This work aimed to evaluate the epidemiological, clinical, paraclinical, therapeutic, and evolutionary profile of patients with COVID-19 at Touba Ndamatou Public Hospital Hospital Establishment. **Materials and Methods:** This was a descriptive, retrospective, cross-sectional study of 114 cases hospitalized for COVID-19 at Touba Ndamatou Public Hospital Health Establishment, during the period from May 1, 2020, to September 30, 2021. Data were collected from patient medical records, entered using Epi Info Version 7 software, and analyzed using SPSS version 21.0 software. **Results:** The mean age of patients was  $65 \pm 14.5$  years, with extremes of 25 and 92 years. The predominant age group was [46 - 65 years] with 39%. Males predominated with 65% (n = 74). The peak occurred in August 2021 with 57.8% of cases (n = 66). 68.15% of patients had at least one comorbidity, with hypertension and diabetes the most frequent comorbidities at 35.9% and 15.7% respectively. Dyspnea was the most frequent reason for consultation (70%), while the most common physical signs were pulmonary condensation syndrome (94%), respiratory distress (77%), and hypoxia (65%). Severe forms accounted for 32%. The most common CT images were ground-glass areas, predominantly in the basithoracic region. Azithromycin was used in all patients, oxygen therapy was used in 93%, and corticosteroids were used in 90%.

---

although the average number of drugs taken per patient was eight (8). The average hospital stay was 4.54 days. The case fatality rate was 18.51% (n = 21). Advanced age (60 and over) and hypoxia were the main risk factors for mortality. **Conclusion:** The COVID-19 pandemic has been declared a global health emergency by the WHO. It has caused many deaths worldwide. Vaccination, the subject of much controversy in our context, would be the only means of preventing critical forms of the disease, especially among people at risk.

## Keywords

COVID-19, Morbi-Mortality, Ndamatou, Senegal

---

## 1. Introduction

COVID-19, short for “Coronavirus Disease 2019”, is caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), a member of the Coronaviridae family. This infectious disease is a zoonosis, the origin of which is still debated, emerged in December 2019. It spread rapidly, first reported in China, then abroad causing a pandemic [1].

This emerging disease, which has become a pandemic since its announcement by the World Health Organization (WHO) on March 11, 2020, has affected almost every country in the world, with over 2.6 million cases worldwide and 62,290 cases in Senegal as of July 2023 [2]. The unpredictable nature of the pandemic and the lack of global preparedness against infectious diseases led to business closures, widespread economic recession, and millions of lost jobs [3]. This has led to a funding gap of around US\$2.5 trillion in the space of a few months [4]. Yet access to healthcare remains an essential pillar in tackling the COVID-19 pandemic [4].

The Senegalese government responded swiftly by declaring its first COVID-19 case on March 2, 2020 [5], implementing health measures, and establishing Outbreak Care Centers (OCCs) across the country’s health facilities. Although advanced age over 65 years, concomitant or pre-existing cardiovascular or cerebrovascular disease, lymphopenia, and cardiac troponin above 0.05 ng/ml have been reported in several studies as risk factors for mortality in subjects with COVID-19 [6], it is crucial for our health authorities to know not only the clinical-biological characteristics of patients but also the mortality risk factors associated with this new infection, to better combat the epidemic. Our study aimed to investigate the epidemiological, clinical, paraclinical, therapeutic, and evolutionary aspects of patients with COVID-19 and factors associated with death at Touba Ndamatou Public Health Hospital Establishment, in the Diourbel medical region during the period from May 1, 2020, to September 30, 2021.

## 2. Patients and Method

### 2.1. Study Setting

First, confirm that you have the correct template for your paper size. This template

has been tailored for output on the custom paper size (21 cm × 28.5 cm).

The study took place at Touba Ndamatou Public Hospital Hospital Establishment (EPS), located in the Touba commune, 47 km away from the Diourbel department and 193 km away from Dakar. Touba's population, estimated at 1,500,000 in 2018, is growing exponentially due to migration encouraged by the city's religious character and the free land available for housing (83). The Touba Ndamatou EPS has various departments. The facility did not have an OCC. Patients with COVID-19 were admitted and treated on-site in the emergency, medical, and intensive care departments. Vaccination was available on site.

## **2.2. Type and Duration of the Study**

This was a descriptive retrospective cross-sectional analytical study of patients hospitalized at Touba Ndamatou EPS for COVID-19 from May 1, 2020, to September 30, 2021.

## **2.3. Study Population**

We performed exhaustive sampling. Any patient hospitalized at the Touba Ndamatou EPS during the study period and whose biological confirmation was obtained by a positive COVID-19 PCR and/or positive COVID-19 RDT was included in the study. Medical records of COVID-19 patients with incomplete data were not included.

## **2.4. Data Collection and Sources**

Data were collected from the medical records of patients with COVID-19 admitted to Touba Ndamatou EPS during the study period. A previously tested and validated pre-established form was used to collect the data.

## **2.5. Data Entry and Analysis**

Data were entered using Epi Info Version 7 software and analyzed using SPSS (Statistical Package for Social Sciences) version 21. In the descriptive analysis, qualitative variables were described by numbers and percentages, and quantitative variables by mean, standard deviation, extremes, and median. The analytical study included univariate and multivariate analysis. The univariate analysis consisted of a comparison between mortality and the other variables. The Chi2 test was used to compare proportions. The difference was statistically significant when the p-value was strictly less than 0.05. For multivariate analysis, we used the binary logistic regression method. All variables with a p-value  $\leq 0.25$  were used to model mortality. Bottom-up modeling was used. Adjusted ORs with their [95% CI] were determined for each variable retained in the final model. The goodness-of-fit of the model was investigated using the Hosmer and Lemeshow test to verify its adequacy.

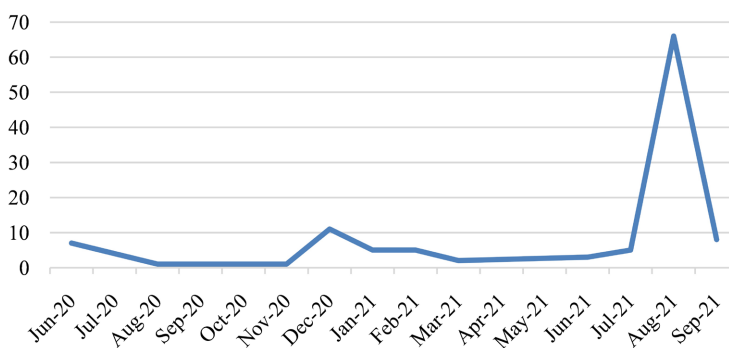
## **3. Results**

A total of 139 files on patients with COVID-19 (TDR positive or PCR positive)

were collected, 114 of which could be used. Among the 114 patients, the mean age was  $65 \pm 14.5$  years, with extremes of 25 and 92 years. The age group 46-65 years was predominant. The majority (65%) of our study population was male, standing for 74 patients with a sex ratio of 1.85. Among the 10% of patients who provided information on their professional activity, shopkeepers and housewives accounted for 3% each. Almost all (99.13%) patients had an unknown vaccination status. Only one (1) person out of 114 had been vaccinated against COVID-19 with the Astra Zeneca vaccine. Approximately two-thirds of individuals had at least one comorbidity (68.15%). The most frequent comorbidity was hypertension (35.9%,  $n = 41$ ), followed by diabetes (15.7%,  $n = 18$ ), pulmonary tuberculosis and renal disease. Pregnancy was found in 2 patients (**Table 1**).

**Table 1.** Socio demographic characteristics of patients with COVID-19, EPS of Ndamatou, from May 1, 2020, to September 30, 2021.

Variable	Workforce n = 69	Percentages %
Median age (years)	$65 \pm 14.5$ [25 - 92]	
Age group (years)	N = 114	
25 - 45	11	10
46 - 65	44	39
66 - 75	33	29
>75	26	23
Male	74	65
Comorbidities	N = 114	
Diabetes mellitus	18	15.7
Hypertension	41	35.9
Others (TB, Asthme, kidney diseases, cardiovascular diseases)	19	16.6
Consultation time (days)	17 [3 - 58]	
Hospitalisation stay (days)	4.54 [1 - 12]	



**Figure 1.** Distribution of COVID-19 cases monthly, from May 1, 2020, to September 30, 2021.

In this series, hospitalization peaked in August 2021, with 57.8% ( $n = 66$ ) of cases (**Figure 1**). The most frequent reasons for consultation were dyspnea (70%,

n = 80), followed by cough (40%, n = 46), fever (12%, n = 14), and diffuse wheezing (11%, n = 13). The most common symptoms were pulmonary condensation syndrome (97%, n = 11), respiratory distress (77%, n = 88) and room air hypoxia (65%, n = 74) (**Table 2**).

**Table 2.** Distribution of patients by motif of consultation and clinical signs.

	Abnormalities	Workforce	Percentage (%)
<b>Motif of consultation</b>	Dyspnea	80	70%
	Cough	46	40%
	Fever	14	12%
	Diffuse algia	13	11%
	Others	36	32%
<b>Clinical signs</b>	Pulmonary condensation syndrome	111	
	respiratory distress	88	77%
	Room air hypoxia	74	65%
	Fever	26	23%

Chest X-ray was performed in 35% of cases, chest CT in 11% and ECG in 6%. Chest X-ray findings were unspecific, generally presenting as unilateral, sometimes bilateral, diffuse alveolar condensations, predominantly basal with interstitial abnormalities. Chest CT scan showed mainly multifocal, bilateral, asymmetric ground-glass areas, with at least 50% of the lung parenchyma affected in almost all patients. The ECG showed indirect signs of pulmonary embolism and occasionally cardiac rhythm disturbances. COVID-19 RDT was performed in all patients, and was positive in 88% of cases, while 12% had positive COVID-19 PCR and negative RDT. We observed 32% of severe or critical cases.

Azithromycin was used in all patients, Ceftriaxone or Amoxicillin-Clavulanic Acid in 88%, anticoagulants mainly low molecular weight heparins (LMWH) 93%, corticosteroids 90%, paracetamol 84%, and Zinc 82%. Patients were dewormed in 81% of cases, and 75% were treated with polyvitamins (**Table 3**). The average hospital stay was 4.54 days, with extremes of 1 and 12 days. One patient refused hospitalization. Of the 113 patients hospitalized, 8.7% were transferred to other OCCs, and the case fatality rate was 18.53%. Risk factors for mortality (**Table 4**) were advanced age ( $p = 0.0132$ ) and hypoxia ( $P = 0.0045$ ).

**Table 3.** Treatment aspects.

Treatment	Yes	
	Workforce	Percentage (%)
Azithromycin	114	100%
O <sub>2</sub>	107	94%

**Continued**

Anticoagulant	106	93%
Corticosteroids	103	90%
Ceftriaxone	100	88%
Paracetamol	96	84%
Zinc	93	82%
Pest control	92	81%
Polyvitamins	86	75%
Proton pump inhibitor (PPI)	68	60%
Expectorant	30	26%
Antihypertensive	18	16%
Potassium	8	7%

**Table 4.** Risk factors of death.

Variables	Death		
	Table column subhead	AHR	P value
Age group (years)	60 - 79	0.237**	0.0132**
Sex		0.034	0.7206
Comorbidities	Diabetes melitus	0.032	0.7319
	Hypertension	0.050	0.5906
Hypoxie		0.266**	0.0045***
Hypokaliémie		0.046	0.6219
Traitements	Corticosteroids	0.009	0.9214
	Antihypertensive	-0.090	0.3375
	Oxygen	0.125	0.1817
	Anticoagulant	0.6717	-0.0397

**4. Discussion****4.1. Socio-Demographic Aspects**

The mean age of our study population was 65 years. Onder *G et al.*, in their study of the “Lethality rate and characteristics of patients who died of COVID-19 in Italy”, observed an average age of 52.5 years [7]. Male predominance (65%) was reported by Donamou J. *et al.*, Wu *et al.*, Guan *et al.* and Zhou *et al.*, respectively 82.3%, 63.7%, 58.1%, and 62% [8]-[11]. The higher frequency of risk factors for disease severity in the male population may explain this male predominance. Contrariwise, research by the Institut National de Santé Publique du Québec (INSPQ) has shown a predominance of women [12]. The most frequently encountered professions were tradesmen (3%) and religious leaders. These are at risk of being exposed to COVID-19 contamination since they are constantly in contact with people who are infected or whose COVID-19 serostatus is unknown. Touba is a deeply religious city, with many visits to religious leaders, and distancing is not

often respected. In their study, Lemke C *et al.* showed that high-exposure occupations were health workers often considered as contact cases [13].

#### 4.2. Vaccination Status

Only one subject out of one hundred and fourteen (114), representing 0.87%, was vaccinated with certainty. The vaccine received was Astra Zeneca. However, to obtain immunity through vaccination, good vaccine coverage is required to block transmission of the virus, combined with the application of social distancing measures. These results could be explained by the fact that people were reluctant to take part in the vaccination program because of rumors and false beliefs about vaccines. Awareness-raising sessions within and by communities are necessary to achieve the objective of vaccination at the local level [14].

#### 4.3. Clinical Aspects and Comorbidities

Our study showed that the most frequent reasons for consultation were respiratory difficulties (70%), cough (40%), fever (12%), and diffuse algia (11%). Among the most frequent physical signs, we found pulmonary condensation syndrome at 97%, followed by respiratory distress syndrome at 77%, room air hypoxia at 65%, and fever at 23%. In the work by Waechter C *et al.* [15], fever and cough were the main signs found. This difference could be explained by the population's recourse to self-medication before coming to hospital, as well as the almost systematic use of analgesics such as paracetamol, which also has antipyretic effects that can mask fever. More than two-thirds of individuals had at least one comorbidity, corresponding to 68.15% of cases. Hypertension and diabetes were the most frequent comorbidities, with 35.9% and 15.7% respectively. Ka *et al.* also found higher proportions, with hypertension and diabetes accounting for 43.7% and 42.7% of cases respectively [16]. This predominance of these two comorbidities has also been outlined by several authors [16]-[18]. Simple to moderate forms (68%) were more frequent. The same observation was made by Desvaux *et al.*, who found that asymptomatic forms, or those with moderate clinical signs, were the most frequent (80%) [19]. COVID-19 is often associated with biological disorders. Hyperleukocytosis was present in twenty-eight percent of patients (28%), and leukopenia in 3%. A study carried out at the OCC of FANN Teaching Hospital Center (CHNU FANN) found a predominantly neutrophilic hyperleukocytosis in 55.7% of cases [16]. Seven percent of patients had thrombocytosis. Ka *et al.* found a higher proportion, 24.4%, of thrombocytosis [16]. This difference may be explained by the fact that Ka *et al.*'s study was carried out in patients with pulmonary embolism. Dysnatremia accounted for 36%, 34% of whom had hyponatremia. In a review carried out at the Centre Medical Diamant in Lubumbashi, hypokalemia was by far the most frequent ionic disorder, accounting for 53.6% of cases [20]. A quarter of patients had impaired renal function. Studies carried out in intensive care units found up to 19% of acute kidney injury (AKI), the mechanism of which remains to be clarified [21]. A study by Zaidan *et al.* showed that 37.5% of cases

developed AKI [22]. However, there is a significant risk of these patients hospitalized for COVID-19 developing AKI, including those who had recovered “normal” function on discharge, underlining the value of renal assessment remote from COVID-19 [23]. On chest X-ray, the signs were unspecific, generally presenting as unilateral, sometimes bilateral, diffuse alveolar condensations predominantly basal with interstitial abnormalities. Chest CT scan revealed mainly multifocal, bilateral, asymmetric ground-glass areas, with at least 50% of the lung parenchyma affected in almost all patients. Guan *et al.* found similar results, with 56.4% of patients presenting with ground-glass images, unilateral alveolar condensation in 41.9% and bilateral condensation in 51.8%, with interstitial abnormalities in 14.7% [9] [24]. Treatment was recorded for all patients, and therapeutic management was based on Ministry of Health recommendations. As in every country in the world, patient management at the start of the pandemic was based on oxygen therapy, prevention of thromboembolic disease, and antibiotic therapy. However, the use of antibiotics has tended to decline, due to the rarity of bacterial superinfections of COVID-19 [19]. In our study, all patients (100%) received azithromycin. Almost all patients (94%) were on oxygen therapy to combat severe acute respiratory syndrome (SARS), the incidence of which is 15% in Covid-19 patients [25]. In addition, between 50 and 85% of patients admitted to emergency departments present with hypoxemia and/or respiratory exhaustion [2]. Consequently, rapid and effective respiratory support can help reduce complications and improve survival in these critically ill patients. Mechanical ventilation for patients with COVID-19 should be managed with lung-protective strategies to minimize lung injuries associated with the ventilator and improve survival. The anti-coagulant treatment and corticosteroid therapy were nearly systematic (93% and 90%, respectively). None of the patients in our study received hydroxychloroquine. There have been several controversies regarding the effectiveness of hydroxychloroquine [26]-[28]. The prophylactic use of hydroxychloroquine had little to no effect on preventing the disease, hospitalizations, or deaths related to COVID-19. Furthermore, the efficacy of hydroxychloroquine was not proven, and its use could lead to QT interval prolongation and an increased risk of cardiac arrest [29].

#### 4.4. Average Length of Hospital Stays

The average hospital stay was 4.54 days, with extremes of 1 and 12 days. A study in Algeria by Kefti *et al.* [30] found a longer hospital stay of 7.3 days. Another study by Touahri *et al.* [31] found results almost similar to those of Kefti *et al.*, with an average hospital stay of 7.6 days.

#### 4.5. Evolutionary Aspects and Death Risk Factors

A majority (71.9%) of patients had a favorable outcome. Death occurred in 19% of cases. The mortality rate reported by Taieb *et al.* [17] is slightly higher than ours, with a proportion of 23.04%. Mortality was statistically higher in subjects aged 60 and over, with a p-value of 0.0132. Muller M *et al.*, in their work on

“COVID-19 prognostic factors”, confirmed that patients aged 60 and over are more likely to be hospitalized and to die during the course of the disease [32]. Patients over 60 were found to have more severe forms and to die more than others. Several studies have reported that advanced age is the most important predictor of severity and death in patients with COVID-19. Indeed, advanced age can lead to immunodeficiency, as well as a predisposition to the onset of chronic non-communicable diseases (diabetes, hypertension, etc.). Hypoxia or desaturation was also a risk factor for mortality, accounting for 27% of deaths versus 5% in the non-hypoxia group ( $P = 0.0045$ ). However, in their series, Ouedraogo AR *et al.* asserted lower results, with desaturation-related mortality of 11.2% [33]. This difference may be linked to the technical resources available in the provinces. Thus, desaturation leads to a more restrictive treatment based on oxygen therapy, but also to longer hospitalization or eventual transfer to OCC. Other factors, such as gender, comorbidities, hypokalemia, and treatment received, were not significantly associated with mortality. However, in most studies advanced age and cardiovascular comorbidities are risk factors for severity and death. It’s important to strengthen the health system by integrating the management of these comorbidities and geriatric syndrome to better prepare providers during other epidemics. Every moment, there is the possibility and risk of exposure to a new pandemic. In addition, the correct filling of files must be reinforced to take advantage of and better understand these emerging transmissible diseases. A uniform computerized file would ensure better data collection.

## 5. Conclusion

The COVID-19 pandemic has been declared a global health emergency by the WHO. It has caused many deaths worldwide. In our study, risk factors for mortality were advanced age (60 years and over), hypoxia (desaturation). Vaccination is currently the only alternative that seems to present itself in preventive treatment of COVID-19, although it is the subject of a lot of controversies regarding its current effectiveness.

## Study Limitations

The limitation of our study was the problem of missing data in the patient files.

## Ethical Considerations

The hospital director gave their approval for this project. Confidentiality and anonymity were respected. Consent Confidentiality was ensured by the identification numbers used to ensure anonymity. Patients will not be identified in scientific publications and/or in various presentations related to this study.

## Authors’ Contributions

Ngom ndeye Fatou ueye ModouG, AN, Sow Djiby, Faye Fulgence Abdou and Ka Ousseynou: design, data collection, data curation, statical analysis; writing the

original draft and manuscript review and prepared the figures and tables. Ngom Ndeye Fatou, Ndiaye Alassane and Ka Ousseynou performed the literature review and improved the manuscript. All authors contributed to the article and approved the submitted version of the manuscript.

## Acknowledgements

The authors would like to thank all the staff of Touba Ndamatou Public Hospital Health Establishment in the medical region of Diourbel. We also acknowledge all patients whose data were used in this study.

## Conflicts of Interest

The authors declare that they have no conflict of interest. The authors did not receive any specific funding for this work.

## References

- [1] Kern, J. (2019) Définition COVID-19 (Coronavirus Disease 2019). National Library of Medicine. <https://medlineplus.gov/covid19coronavirusdisease2019.html>
- [2] Annweiler, C., Sacco, G., Salles, N., Aquino, J., Gautier, J., Berrut, G., *et al.* (2020) National French Survey of Coronavirus Disease (COVID-19) Symptoms in People Aged 70 and over. *Clinical Infectious Diseases*, **72**, 490-494. <https://doi.org/10.1093/cid/ciaa792>
- [3] Villa, S., Lombardi, A., Mangioni, D., Bozzi, G., Bandera, A., Gori, A., *et al.* (2020) The COVID-19 Pandemic Preparedness ... or Lack Thereof: From China to Italy. *Global Health & Medicine*, **2**, 73-77. <https://doi.org/10.35772/ghm.2020.01016>
- [4] Sutton, D., Fuchs, K., D'Alton, M. and Goffman, D. (2020) Universal Screening for Sars-Cov-2 in Women Admitted for Delivery. *New England Journal of Medicine*, **382**, 2163-2164. <https://doi.org/10.1056/nejmc2009316>
- [5] OMS Afrique (2023) Le Sénégal déclare le premier cas de COVID-19. Bureau régional pour l'Afrique. <https://www.afro.who.int/fr/news/le-senegal-declare-le-premier-cas-de-covid-19>
- [6] Du, R.H., Liang, L.R., Yang, C.Q., Wang, W., Cao, T.Z., Li, M., *et al.* (2020) Predictors of Mortality for Patients with COVID-19 Pneumonia Caused by SARS-CoV-2: A Prospective Cohort Study. *European Respiratory Journal*, **55**, Article ID: 2000524. <https://erj.ersjournals.com/content/55/5/2000524>
- [7] Onder, G., Rezza, G. and Brusaferro, S. (2020) Case-Fatality Rate and Characteristics of Patients Dying in Relation to COVID-19 in Italy. *JAMA*, **323**, 1775-1776. <https://doi.org/10.1001/jama.2020.4683>
- [8] Donamou, J., Bangoura, A., Camara, L.M., Camara, D., Traoré, D.A., Abékan, R.J.-, *et al.* (2021) Caractéristiques épidémiologiques et cliniques des patients COVID-19 admis en réanimation à l'hôpital Donka de Conakry, Guinée: Étude descriptive des 140 premiers cas hospitalisés. *Anesthésie & Réanimation*, **7**, 102-109. <https://doi.org/10.1016/j.anrea.2021.01.001>
- [9] Guan, W., Ni, Z., Hu, Y., Liang, W., Ou, C., He, J., *et al.* (2020) Clinical Characteristics of Coronavirus Disease 2019 in China. *New England Journal of Medicine*, **382**, 1708-1720. <https://doi.org/10.1056/nejmoa2002032>
- [10] Zhou, F., Yu, T., Du, R., Fan, G., Liu, Y., Liu, Z., *et al.* (2020) Clinical Course and Risk

- Factors for Mortality of Adult Inpatients with COVID-19 in Wuhan, China: A Retrospective Cohort Study. *The Lancet*, **395**, 1054-1062.  
[https://doi.org/10.1016/s0140-6736\(20\)30566-3](https://doi.org/10.1016/s0140-6736(20)30566-3)
- [11] Wu, C., Chen, X., Cai, Y., Xia, J., Zhou, X., Xu, S., *et al.* (2020) Risk Factors Associated with Acute Respiratory Distress Syndrome and Death in Patients with Coronavirus Disease 2019 Pneumonia in Wuhan, China. *JAMA Internal Medicine*, **180**, 934-943.  
<https://doi.org/10.1001/jamainternmed.2020.0994>
- [12] Institut National de Santé Public du Quebec: Données COVID-19 par vague selon l'âge et le sexe au Québec. <https://www.inspq.qc.ca/covid-19/donnees/age-sexe>
- [13] Lemke, C. (2020) COVID-19: Les métiers les plus à risque de contamination. Sciences et Avenir.  
[https://www.sciencesetavenir.fr/sante/covid-19-la-liste-des-metiers-les-plus-a-risque-de-contamination\\_149278](https://www.sciencesetavenir.fr/sante/covid-19-la-liste-des-metiers-les-plus-a-risque-de-contamination_149278)
- [14] Hogan, A., Winskill, P., Watson, O., *et al.* (2020) Report 33—Modelling the Allocation and Impact of a COVID-19 Vaccine Imperial College London.  
<https://spiral.imperial.ac.uk/handle/10044/1/82822>
- [15] Waechter, C. (2021) Manifestations cliniques et paracliniques de la COVID-19, diagnostic virologique. *NPG Neurologie—Psychiatrie—Gériatrie*, **21**, 297-303.  
<https://doi.org/10.1016/j.npg.2021.05.011>
- [16] Ka, T.N., Mbaye, F.B.R., Soumaré, P.M., Ndiaye, E.O., Sagna, A.L., Dia, Y., *et al.* (2023) Facteurs associés à l'embolie pulmonaire chez les patients COVID-19: Étude analytique à propos de 103 cas au centre de traitement des épidémies et au Service de pneumologie du Centre hospitalier universitaire de Fann. *Revue des Maladies Respiratoires Actualités*, **15**, 200-201. <https://doi.org/10.1016/j.rmra.2022.11.346>
- [17] Taieb, F., Mbaye, K.D., Tall, B., Lakhe, N.A., Talla, C., Thioub, D., *et al.* (2021) Hydroxychloroquine and Azithromycin Treatment of Hospitalized Patients Infected with SARS-CoV-2 in Senegal from March to October 2020. *Journal of Clinical Medicine*, **10**, Article 2954. <https://doi.org/10.3390/jcm10132954>
- [18] Gold, M.S., Sehayek, D., Gabrielli, S., Zhang, X., McCusker, C. and Ben-Shoshan, M. (2020) COVID-19 and Comorbidities: A Systematic Review and Meta-Analysis. *Postgraduate Medicine*, **132**, 749-755. <https://doi.org/10.1080/00325481.2020.1786964>
- [19] Desvaux, É. and Faucher, J. (2020) COVID-19: Aspects cliniques et principaux éléments de prise en charge. *Revue Francophone des Laboratoires*, **2020**, 40-47.  
[https://doi.org/10.1016/s1773-035x\(20\)30312-9](https://doi.org/10.1016/s1773-035x(20)30312-9)
- [20] Fr, I., Me, W and Ml, S. (2021) Troubles ioniques, gazométriques et spirométriques chez les patients atteints de la COVID-19 Au Centre Medical Diamant de Lubumbashi. *Revue Africaine de Médecine et de Santé Publique*, **4**, 38.  
<http://www.rams-journal.com/index.php/RAMS/article/view/39>
- [21] Arentz, M., Yim, E., Klaff, L., Lokhandwala, S., Riedo, F.X., Chong, M., *et al.* (2020) Characteristics and Outcomes of 21 Critically Ill Patients with COVID-19 in Washington State. *JAMA*, **323**, 1612-1614. <https://doi.org/10.1001/jama.2020.4326>
- [22] Zaidan, M., Gaillard, F., Barnoud, A., Darhi, Y., Samb, P. and Grimaldi, L. (2022) Conséquences à long terme de l'insuffisance rénale aiguë au cours de la COVID-19: Données de l'entrepôt de données de santé de l'AP-HP. *Néphrologie & Thérapeutique*, **18**, 315-316. <https://doi.org/10.1016/j.nephro.2022.07.253>
- [23] Hafi, K., Ben Salah, M.A.N.E.L., Manaa, R., Ben Mahmoud, N., Ben Salem, M., Letaief, A., *et al.* (2022) Maladie rénale chronique et COVID-19: Quelles particularités? *Néphrologie & Thérapeutique*, **18**, 406.  
<https://doi.org/10.1016/j.nephro.2022.07.351>

- [24] Plaçais, L. and Richier, Q. (2020) COVID-19: Caractéristiques cliniques, biologiques et radiologiques chez l'adulte, la femme enceinte et l'enfant. Une mise au point au cœur de la pandémie. *La Revue de Médecine Interne*, **41**, 308-318. <https://doi.org/10.1016/j.revmed.2020.04.004>
- [25] Pateron, D., Raphael, M. and Trinh-Duc, A. (2020) COVID-19 Diagnostic et Prise en charge thérapeutique. Elsevier Connect. <https://www.elsevier.com/fr-fr/connect/aru/covid-19-diagnostic-therapeutique-urgences>
- [26] Yao, X., Ye, F., Zhang, M., Cui, C., Huang, B., Niu, P., *et al.* (2020) *In Vitro* Antiviral Activity and Projection of Optimized Dosing Design of Hydroxychloroquine for the Treatment of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). *Clinical Infectious Diseases*, **71**, 732-739. <https://doi.org/10.1093/cid/ciaa237>
- [27] Wang, M., Cao, R., Zhang, L., Yang, X., Liu, J., Xu, M., *et al.* (2020) Remdesivir and Chloroquine Effectively Inhibit the Recently Emerged Novel Coronavirus (2019-Ncov) *in Vitro*. *Cell Research*, **30**, 269-271. <https://doi.org/10.1038/s41422-020-0282-0>
- [28] World Health Organization (2021) Drugs to Prevent COVID-19: A WHO Living Guideline.
- [29] Recovery Collaborative Group, Horby, P., Mafham, M., *et al.* (2020) Effect of Hydroxychloroquine in Hospitalized Patients with COVID-19. *New England Journal of Medicine*, **383**, 2030-2040. <https://doi.org/10.1056/nejmoa2022926>
- [30] Ketfi, A., Chabati, O., Chemali, S., Mahjoub, M., Gharnaout, M., Touahri, R., *et al.* (2020) Profil clinique, biologique et radiologique des patients Algériens hospitalisés pour COVID-19: Données préliminaires. *The Pan African Medical Journal*, **35**, Article 77. <https://doi.org/10.11604/pamj.suppl.2020.35.2.23807>
- [31] Touahri, R., Laouedj, I., Behbeh, S. and Ketfi, A. (2021) Étude clinique, biologique et radiologique des patients COVID-19: Expérience d'un service de pneumologie. *Revue des Maladies Respiratoires Actualités*, **13**, 114-115. <https://doi.org/10.1016/j.rmra.2020.11.238>
- [32] Muller, M., Bulubas, I. and Vogel, T. (2021) Les facteurs pronostiques dans la COVID-19. *NPG Neurologie—Psychiatrie—Gériatrie*, **21**, 304-312. <https://doi.org/10.1016/j.npg.2021.06.002>
- [33] Ouédraogo, A.R., Bougma, G., Baguiya, A., Sawadogo, A., Kaboré, P.R., Minougou, C.J., *et al.* (2021) Facteurs associés à la survenue de la détresse respiratoire aiguë et au décès chez des patients atteints de COVID-19 au Burkina Faso. *Revue des Maladies Respiratoires*, **38**, 240-248. <https://doi.org/10.1016/j.rmr.2021.02.001>