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Original Study

Factors Associated With COVID-19 Hospitalizations and Deaths in French Nursing Homes

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A B S T R A C T

Objectives: To describe the clinical characteristics and management of residents in French nursing homes with suspected or confirmed coronavirus disease 2019 (COVID-19) and to determine the risk factors for COVID-19–related hospitalization and death in this population.
Design: A retrospective multicenter cohort study.
Setting and Participants: Four hundred eighty nursing home residents with suspected or confirmed COVID-19 between March 1 and May 20, 2020, were enrolled and followed until June 2, 2020, in 15 nursing homes in Marseille's greater metropolitan area.
Methods: Demographic, clinical, laboratory, treatment type, and clinical outcome data were collected from patients' medical records. Multivariable analysis was used to determine factors associated with COVID-19–related hospitalization and death. For the former, the competing risk analysis—based on Fine and Gray's model—took death into account.
Results: A total of 480 residents were included. Median age was 88 years (IQR 80-93), and 330 residents were women. A total of 371 residents were symptomatic (77.3%), the most common symptoms being asthenia (47.9%), fever or hypothermia (48.1%), and dyspnea (35.6%). One hundred twenty-three patients (25.6%) were hospitalized and 96 (20%) died. Male gender [specific hazard ratio (sHR) 1.63, 95% confidence interval (CI) 1.12-2.35], diabetes (sHR 1.69, 95% CI 1.15-2.50), an altered level of consciousness (sHR 2.36, 95% CI 1.40-3.98), and dyspnea (sHR 1.69, 95% CI 1.09-2.62) were all associated with a greater risk of COVID-19–related hospitalization. Male gender [odds ratio (OR) 6.63, 95% CI 1.04-42.39], thermal dysregulation (OR 2.64, 95% CI 1.60-4.38), falls (2.21 95% CI 1.02-4.75), and being aged >85 years (OR 2.36, 95% CI 1.32-4.24) were all associated with increased COVID-19–related mortality risk, whereas polymedication (OR 0.46, 95% CI 0.27-0.77) and preventive anticoagulation (OR 0.46, 95% CI 0.27-0.79) were protective prognostic factors.
Conclusions and Implications: Male gender, being aged >85 years old, diabetes, dyspnea, thermal dysregulation, an altered level of consciousness, and falls must all be considered when identifying and

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protecting nursing home residents who are at greatest risk of COVID-19–related hospitalization and death.

Since December 2019, the number of older, frailer patients infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has dramatically increased worldwide. Infection rates are higher in the very old than in younger populations, and health outcomes are poorer.[1,2] The literature on novel coronavirus disease 2019 (COVID-19), which is caused by SARS-CoV-2, indicates that older adults are at particular risk of developing severe forms of the disease,[3,4] particularly those with pre-existing comorbidities[5] and those who are frail (the result of cognitive[6] and functional[7] impairment). Early reports also suggested that older people may initially present more atypical COVID-19–related clinical manifestations and biological results than younger adults.[8,9]

In the context of the prevalence of COVID-19 in nursing home (NH) residents, research on clinical characteristics, care management, and disease-related outcomes is still scarce. A study in King County, Washington State, USA, reported that 54.5% of 101 NH residents infected over a period of 3 weeks were hospitalized for COVID-19, and that 33.7% subsequently died.[10] In a multicenter study in NH in Maryland, USA, residents with multiple symptoms had the highest risk of mortality and hospitalization. Interestingly, asymptomatic COVID-19 was also associated with higher mortality risk in that study (20.6%).[11] In France, between March 1 and May 31, 2020, of the 28,771 people who died from COVID-19, more than a third (10,327 persons) were living in nursing homes.[12] International comparisons of data are difficult because of intra- and intercountry differences in NHs in terms of organization, COVID-19 testing policies, therapeutic management, and approaches to quantifying COVID-19–related deaths.[13] However, the general observation in NH literature is that COVID-19 increased mortality in NH residents in 2020.[13–15] Given the relatively small number of related studies to date, more research is needed on the clinical presentation and on risk factors for COVID-19–related hospitalization and death in this population. Accordingly, we implemented a multicenter retrospective study to describe the clinical characteristics, biological characteristics, and healthcare management of a relatively large cohort of residents with suspected or confirmed COVID-19 living in NHs located in the greater metropolitan area of Marseille. The secondary objectives were to determine the factors associated with COVID-19–related hospitalization and with death.

Methods

Study Design and Participants

We invited all 39 NHs located in the greater metropolitan area of Marseille to participate in a 13-week retrospective observational cohort study. Of the 20 that agreed to participate, 15 had at least 1 resident with suspected or confirmed COVID-19 at the time of the study. The remaining 5 NHs were therefore secondarily excluded. All residents with suspected or confirmed COVID-19 between March 1 and May 20, 2020, were included. No patient or patient legal representative opposed the use of their medical data when asked.

A suspected case was defined as a patient with acute respiratory illness who had been in contact with a confirmed COVID-19 case in the 14 days before the onset of symptoms. A confirmed case was defined as a suspected case who had tested positive for SARS-CoV-2 nucleic acid using a real-time reverse transcriptase–polymerase chain reaction (RT-PCR) assay (nasal swabs). From the moment a first case was diagnosed in any given NH, screening was performed for all residents approximately every 15 days. We monitored clinical outcomes, including COVID-19–related hospitalization and death, until June 2, 2020, which was the study end date. This end date was chosen as lockdown relaxation rules were introduced facilitating greater NH access to relatives of residents.

With regard to investigating risk factors for hospitalization, residents who had the possibility to be hospitalized from March 21, 2020—the date when French Public Health Authorities facilitated hospital admissions for the country's NH residents—were included in the analysis. Prior to that date, only NH residents with few functional/cognitive impairments and no severe comorbidity who presented severe clinical symptoms could be hospitalized in France. With regard to investigating risk factors for death, all included residents (ie, with suspected or confirmed COVID-19) for the enrollment period (ie, March 1 and May 20, 2020) were included.

The study was authorized by the National Institute for Health Data (number INDS-MR 3109280520) and was conducted in accordance with the MR-004 study type reference methodology approved by the National Commission for Information Technology and Civil Liberties. In accordance with French legislation, formal approval from an ethics committee was not required for this type of retrospective noninterventional study based on the use of previously recorded data.

Data Collection

Trained physicians (A.L.C., A.D.) used a standardized electronic form to collect COVID-19–specific data from clinical charts, laboratory findings, and chest computed tomography (CT) scans, as well as data from NH records and treatments both for COVID-19 and for pre-existing comorbidities. They also collected the following data for each patient: demographic information (age, gender, body mass index, most recent iso-resource dependence group classification[16]), comorbidities, and flu and pneumococcus vaccination status.

To define their level of dependency, older people in France are divided into one of 6 iso-resource groups, which reflect different stages of loss of autonomy.[16] NH residents classified into iso-resource groups 1, 2, or 3 must be assisted in most or all of their daily activities. We defined cognitive impairment as a score of <24 in the Mini-Mental State Examination[17] or the presence of cognitive impairment symptoms (wandering, hallucinations, hostility and aggressiveness, or history of cognitive disorder). Undernutrition and obesity were defined as a body mass index of <21 and ≥ 30, respectively.

The date of disease onset was defined as the day when COVID-19 symptoms were first noticed or, for asymptomatic patients, the day a patient had a positive RT-PCR test. The trained physicians collected data for the following symptoms suggestive of COVID-19 from the patients' medical records: general symptoms [sudden deterioration in general health condition or asthenia, anorexia, fever or hypothermia (thermal dysregulation), headaches, myalgia and/or arthralgia]; respiratory symptoms; ear, nose, and throat (ENT) symptoms; gastrointestinal symptoms; and worsening depression and geriatric-related syndromes [falls, delirium (acute confusional state), and altered level of consciousness (defined as a Glasgow Coma Scale score <14)]. Data on routine blood tests (blood count, renal and liver function, C-reactive protein, creatine phosphokinase, and D-dimers) and on chest CT scan results were also collected. For all included patients, data on

Table 1
Characteristics of the Study Sample (n = 480)

Characteristics	N or Median (IQR)	% or Min-Max	Missing Data	Characteristics	N or Median (IQR)		% or Min-Max	Missing Data
Age (y)	88 (80-93)	65-105	—*	Symptoms	371		77.3	—
65-74	67	14.0		Dyspnea	171		35.6	—
75-84	112	23.3		Dry cough	133		27.7	—
85-94	213	44.4		Thermal dysregulation	231		48.1	—
95-105	88	18.3		Fever	217		45.2	—
Gender				Asthenia	230		47.9	—
Male	150	31.3	—					
Female	330	68.8		Anorexia	101		21.0	—
Nutrition status†				Gastrointestinal symptoms	85		17.7	—
Undernutrition	186	38.8	—					
Obesity	43	9.0	—	Myalgia or arthralgia	14		2.9	—
Polymedication: ≥5 drugs for pre-existing conditions	348	72.5	—	Headaches	8		1.7	—
Vaccinated for				ENT symptoms	40		8.3	—
Flu	379	79.0	—					
Pneumococcus	188	39.2	—	Falls	39		8.1	—
Comorbidities				Delirium	59		12.3	—
Cognitive impairment‡	406	84.6	—	Worsening depression	27		5.6	—
Hypertension	257	53.5	—					
Dyslipidemia	31	6.5	—	Altered level of consciousness	32		6.7	—
Type 2 diabetes	86	17.9	—	Positive RT-PCR test result	446		92.9	—
Cerebrovascular disease	95	19.8	—	Laboratory findings	339	Normal Range	70.6	—
Coronaropathy	70	14.6	—	Red blood cells (10_9/L)	4 (4-5)	4.4-5.7	2-6	164
Congestive heart failure	71	14.8	1	White blood cells (10_9/L)	6 (4-7)	3.9-10.9	2-20	162
Atrial fibrillation	91	19.0	—	Neutrophils (10_9/L)	4 (3-5)	1.7-7.1	1-21	165
Asthma	11	2.3	—	Neutropenia‖	23		6.8	165
Chronic obstructive pulmonary disease	51	10.6	—	Lymphocytes (10_9/L)	1 (1-2)	1.1-3.2	0-7	164
Chronic respiratory insufficiency	16	3.3	—	Lymphopenia‖	109		32.2	164
Depression	216	45.0	—	Thrombocytopenia‖	40		11.8	443
Psychiatric disorders	51	10.6	—					
Chronic kidney disease	69	14.4	—	AST (U/L)	25 (20-36)	0-50	11-147	344
Cancer history	31	6.5	—	ALT (U/L)	14 (10-21)	0-50	5-68	344
Iso-resource groups								
1	102	21.3	3	AP (U/L)	76 (66-86)	35-130	35-338	410
2	228	47.5		GGT (U/L)	27 (15-39)	0-60	6-313	353
3	78	16.3		Bilirubin (μmol/L)	6 (4-8)	0-21	2-20	413
4	61	12.7		Creatinine (μmol/L)	77 (64-107)	60-104	64-107	175
5 and 6	8	1.7		GFR (ml/min)	41.1 (29.8-57.5)	≥60	5.2-174.4	178
Hospitalization§	123	26.6	—	Potassium (mmol/L)	4 (4-4)	3.4-4.5	2-7	166
In COVID-19 unit								
Home hospitalization	134	27.9	—	Sodium (mmol/L)	140 (138-143)	136-145	125-173	168
End-of-life care	57	11.9	—	D-dimer (μg/L)	911 (680-1476)	0-500	215-32463	381
Death				CK (U/L)	74 (42.3-225.3)	10-200	13-4036	398
In COVID-19 unit	42	8.5	—					
In nursing home	54	11.3		CRP (mg/L)	26 (7-67)	0-10	0-350	169

ALT, alanine aminotransferase; AP, alkaline phosphatase; AST, aspartate aminotransferase; CK, creatine kinase; CRP, C-reactive protein; GFR, glomerular filtration rate; GGT, gamma glutamyl transferase.

*No missing data.

†Undernutrition was defined as body mass index <21; obesity was defined as body mass index ≥30.

‡Cognitive impairment was defined as a score of <24 for the Mini-Mental State Examination (MMSE) or the presence of cognitive impairment symptoms (wandering, hallucination, hostility and aggressiveness, or cognitive disorder history).

§Of the 463 residents still alive on March 21, 2020 (17 patients died between March 1 and March 21, 2020).

‖Neutropenia was defined as a neutrophil level <1.5 10_9/L; lymphopenia was defined as a lymphocyte level <1.0 10_9/L, and thrombocytopenia was defined as a platelet level <150 10_9/L.

medications for pre-existing chronic pathologies, polymedication (≥5 usual drugs per day), and management of COVID-19 were also recorded. Some patients were "home hospitalized," that is to say they were provided some elements of hospital-type care for COVID-19 in their NH by an authorized external (ie, not NH-based) team of specialists. These elements included hydroxychloroquine treatment, perfusions for hydration, and end-of-life care. Home hospitalization did not exclude potential subsequent normal hospitalization if symptoms deteriorated. The numbers of home hospitalized, hospitalized, and deceased patients were recorded. The reasons for home hospitalization (which reflected the availability of each of the 3 hospital-type care elements listed above), the reasons for hospitalization, and the causes of death were all collected, as were symptom duration, time between disease onset and hospital admission, and the time between disease onset and death.

Statistical Analysis

Because the study focused on all suspected or confirmed COVID-19 NH residents specifically during the enrolment period, no a priori power calculation was needed. Continuous variables were presented as the median and interquartile range (IQR) with 95% confidence interval (CI). Categorical variables were expressed as the number of patients (percentage) with 95% CI.

Our analysis aimed to explore the association between epidemiologic and clinical characteristics and the risk of hospitalization or

Table 2
Variables Associated With an Increased Risk of Hospitalization: Univariate Analysis of 123 Hospitalizations in 463 Residents

Variables	Total, n (%) or Median (IQR) (n = 463)	Not Hospitalized, n (%) or Median (IQR) (n = 340)	Hospitalized, n (%) or Median (IQR) (n = 123)	sHR	95% CI	*P*
Gender (male)	318 (68.7)	248 (72.9)	70 (56.9)	1.77	1.25-2.52	.001
Comorbidities						
Cognitive impairment*	391 (84.4)	280 (82.4)	111 (90.2)	1.81	1.00-3.29	.05
Type 2 diabetes	84 (18.1)	48 (14.1)	36 (29.3)	2.03	1.39-2.95	<.001
Congestive heart failure	70 (15.1)	42 (12.4)	28 (22.8)	1.88	1.23-2.87	.003
Atrial fibrillation	88 (19.0)	57 (16.8)	31 (25.2)	1.55	1.03-2.32	.034
Symptoms	365 (78.8)	252 (74.1)	113 (91.9)	3.38	1.77-6.43	<.001
Dyspnea	163 (35.2)	96 (28.2)	67 (54.5)	2.51	1.77-3.57	<.001
Thermal dysregulation	222 (47.9)	147 (43.2)	75 (61.0)	1.83	1.28-2.62	.001
Gastrointestinal symptoms	82 (17.7)	52 (15.3)	30 (24.4)	1.61	1.07-2.42	.021
Altered level of consciousness	32 (10.9)	12 (3.5)	20 (16.3)	3.34	2.12-5.26	<.001
Biology						
CRP, median (IQR)	26.0 (7.0-68.0)	18.0 (5.0-56.8)	35.0 (13.0-120.0)	1.01	1.00-1.01	<.001
High CPK level	21 (4.5)	8 (2.4)	13 (10.6)	1.98	1.00-3.88	.050
AST, median (IQR)	25.0 (20.0-36.0)	22.0 (18.0-29.0)	30.0 (23.0-55.8)	1.03	1.02-1.03	<.001
Treatment						
Antibiotics (except azithromycin)	329 (71.1)	227 (66.8)	102 (82.9)	2.09	1.30-3.37	.002
Hydration	210 (45.4)	140 (11.8)	70 (56.9)	1.67	1.17-2.38	.004
Oxygen therapy	153 (33.0)	83 (24.4)	70 (56.9)	3.13	2.20-4.46	<.001
Aerosol	11 (2.4)	5 (1.5)	6 (4.9)	2.03	1.07-3.83	.029
Contraindications	46 (9.9)	27 (7.9)	19 (15.4)	1.81	1.12-2.92	.014

AST, aspartate aminotransferase; CK = creatine kinase; CRP, C-reactive protein.
High CK level was defined as CK > 200 U/L.
*Cognitive impairment was defined as a score <24 in the Mini-Mental State Examination (MMSE), or the presence of cognitive impairment symptoms (wandering, hallucination, hostility and aggressiveness, or cognitive disorder history).

death in COVID-19–infected NH residents. Univariate and multivariate logistic regression models were used to analyze all the variables studied as potential factors of hospitalization and death [odds ratio (OR)]. Competing risk analysis based on Fine and Gray's model was used to measure the time from disease onset to hospitalization, in order to take into account the fact that patients who died could not have been hospitalized after their death. Cox proportional hazard regression models were used to estimate cause-specific hazard ratios (sHRs). The follow-up time was defined as the time between the date of disease onset and the date of hospitalization.

All variables with a *P* value of less than .05 in the univariate logistic regression or Cox regression models were included in the multivariable analysis. Given the large number of variables with $P < .05$, we decided to select only those that were most clinically relevant and which had few missing data for the multivariable analysis, in order to respect the maximum authorized number of variables in each model (10 and 9 for the hospitalization and death models, respectively).[18] For correlated variables, the variable selected was the greatest clinical relevance.

All statistical analysis was conducted using SPSS software. A *P* value <.05 was chosen for the statistical significance threshold.

Results

Patients' Demographic and Clinical Characteristics

Between March 1 and May 20, 2020, of the 1392 residents in the 15 participating NHs in the greater metropolitan area of Marseille, a total of 480 (34.5%) had suspected or confirmed COVID-19 and were included in the present study (Table 1).

Median age of the study sample was 88 years (IQR 80-93, range 65-105), and 330 patients (68.8%) were women. All patients had at least 1 comorbidity. Neurocognitive disorders were the most common comorbidity, affecting 406 (84.6%) patients, followed by hypertension (257, 53.5%) and depression (216, 45.0%). Eighty-six patients (17.9%) had diabetes, and 51 (10.6%) had chronic pulmonary disease. With regard to weight status, 186 (38.8%) were undernourished, and 43 (9.0%) were obese. The majority of residents (408, 85.0%) were classified in iso-resource groups 1, 2, or 3.

Of the 480 patients included, 371 (77.3%) were symptomatic, the most common symptoms being thermal dysregulation (48.1%) and asthenia (47.9%), followed by dyspnea (35.6%), dry cough (27.7%), and anorexia (21.0%). Gastrointestinal symptoms and delirium were observed in 17.7% and 12.3% of the patients, respectively. ENT symptoms, falls, and an altered level of consciousness were uncommon. The median duration of symptoms was 17.0 days (IQR 8.0-28.5; N = 110).

Laboratory and Imaging Findings Following COVID-19 Diagnosis

Table 1 shows the biological characteristics of 339 patients with many missing laboratory data. One hundred forty-one patients (29.4%) did not have a blood test at diagnosis of infection.

Lymphopenia, neutropenia, and thrombocytopenia occurred in 109 (32.2%), 23 (6.8%), and 40 (11.8%) patients, respectively. The median C-reactive protein was 26 mg/L (IQR 7-67).

Of the 461 patients (96.0%) who had an RT-PCR test, 446 (92.9%) tested positive for COVID-19. Only 42 patients had chest CT scans during hospitalization. All the scans showed anomalies supporting the diagnosis of COVID-19.

Treatments and Clinical Outcomes

The median number of medications for pre-existing chronic illnesses was 7 (IQR 4-9.2). Polymedication was present for 348 patients (72.5%).

With regard to treatment for suspected or confirmed COVID-19, 375 patients (78.1%) received azithromycin. Of these, 117 (24.4%) also received hydroxychloroquine, and 346 (72.1%) a second antibiotic [penicillin (7.9%) or ceftriaxone (59.4%)]. No patient received antivirals or anti-inflammatory agents. Preventive anticoagulation was initiated in 203 patients (42.3%). Moreover, 163 patients (34.0%) received oxygen therapy, whereas 220 (45.8%) received intravenous or subcutaneous hydration.

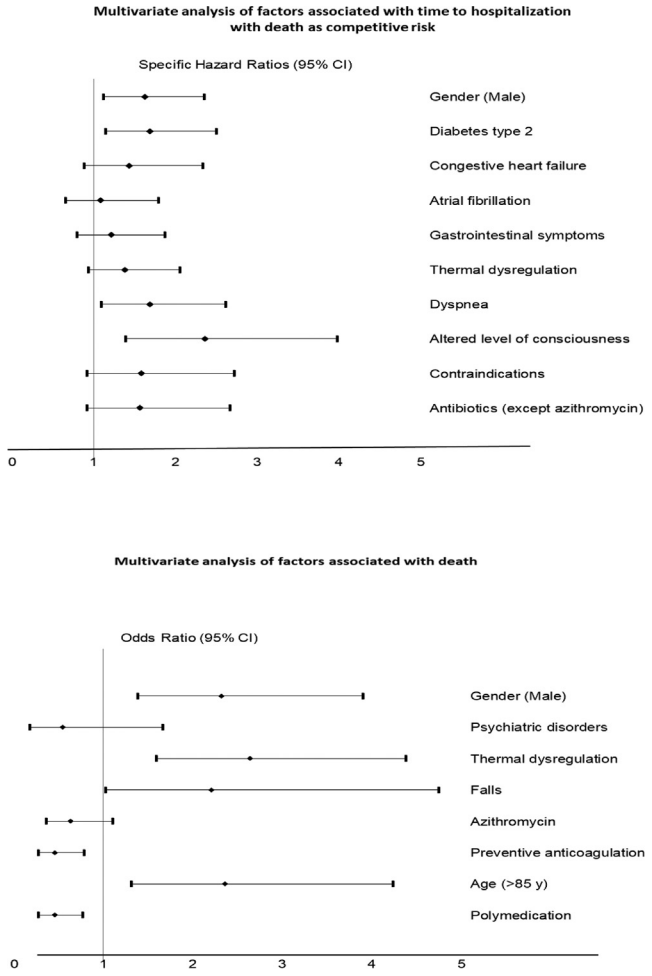

Fig. 1. Multivariable analysis of hospitalizations with competing risk (463 residents) and deaths (480 residents).

One hundred thirty-four residents (27.9%) were home hospitalized (Supplementary Table 1). The reasons for home hospitalization were to offer hydroxychloroquine treatment (79.9%), perfusion for hydration (11.2%), and end-of-life care (6.0%), provided by an external team of specialists.

Between March 21 and May 20, 2020, of the 463 (26.6%) patients still alive, 123 were hospitalized. Fifteen of the 134 residents who received home hospitalization were subsequently admitted to a hospital during this same period. The main cause for hospitalization was respiratory distress syndrome (45.5%). Median time from symptom onset to hospitalization was 5.0 days (IQR 2.0-10.0).

Ninety-six residents (20%) died over the study period: 42 in hospital and 54 in NH; 57 (11.9%) received end-of-life care. Median time from symptom onset to death was 12.0 days (IQR 8.0-24.3). Death was attributed to COVID-19 in most cases (90.5%).

Factors Associated With Hospitalization and Death

Sixteen factors were associated with an increased risk of COVID-19–related hospitalization in the univariate analysis (Table 2 and Supplementary Table 2). In multivariable and competing risk analysis, male gender (sHR 1.63, 95% CI 1.12-2.35; $P = .010$), diabetes (sHR 1.69, 95% CI 1.15-2.50; $P = .008$), an altered level of consciousness (sHR 2.36, 95% CI 1.40-3.98; $P = .001$), and dyspnea (sHR 1.69, 95% CI 1.09-2.62; $P = .018$) all remained associated with an increased risk of hospitalization (Figure 1).

Twenty-two factors were associated with increased risk of mortality in univariate analysis (Table 3 and Supplementary Table 3). In the multivariable model, male gender (OR 6.63, 95% CI 1.04-42.39; $P = .001$), thermal dysregulation (OR 2.64, 95% CI 1.60-4.38; $P = .001$), falls (2.21, 95% CI 1.02-4.75; $P = .043$), and being aged >85 years (OR 2.36, 95% CI 1.32-4.24; $P = .004$) were all independently associated with an increased risk of mortality. Conversely, polymedication (OR 0.46, 95% CI 0.27-0.77) and preventive anticoagulation (OR 0.46, 95% CI 0.27-0.79) were protective prognostic factors (Figure 1).

Discussion

To our knowledge, this is the first multicenter study in France to describe a relatively large cohort of older residents (mean age of 88 years) with suspected or confirmed COVID-19 in a large number of NHs. Among the 480 residents included, 77.3% were symptomatic, and 26.6% were hospitalized. Male gender, diabetes, an altered level of consciousness, and dyspnea were all associated with an increased risk of hospitalization. The overall mortality was 20% during the study period. Being >85 years old, male gender, thermal dysregulation, and falls were all associated with an increased risk of mortality.

In the literature, the number of deaths linked to COVID-19 in NH is unclear. In France, as of June 1, 2020, the mortality among NH residents with diagnosed COVID-19 was 27.4%.[19] Sacco et al[14] also found a 27% COVID-19 mortality–diagnosed residents in their study of a middle-sized NH in Maine-et-Loire, in the west of France. In the USA, McMichael et al[10] found a mortality percentage of 33.7% in 101 residents in an NH in Washington, while more recently, Tang et al[11] reported 20.6% COVID-19 mortality, which is closer to that in our study, in 1970 residents in an NH in Maryland. With regard to hospitalization, 26.6% of our study sample were admitted to hospital. In the literature, this percentage varies between 16% and 54.5%.[10,11,14,20]

To our knowledge, our cohort is the oldest (in terms of patients' age) described in the literature.[7,8,11,21,22] Unsurprisingly, all studies have shown that older patients have a poorer COVID-19 prognosis.[1,8,23–27] Furthermore, the present study is one of the first to investigate prognostic factors associated with the risk of hospitalization and death in NH residents. Unlike other French and international studies,[10,14] we did not consider staff members' or visitors' infectious status.

With regard to the factors listed above that were associated with hospitalization and death, different studies on COVID-19 have found that men are significantly more likely to get the disease than women[9,28] and that male gender is significantly associated with COVID-19–related mortality.[8,21] Comorbidities including hypertension, diabetes, and cardiovascular or respiratory diseases affect COVID-19 patient prognosis. In particular, diabetes is associated with a higher risk of developing a severe form of the disease and admission to an intensive care unit.[29,30] In Tang et al's study[11] in Maryland, renal disease, diabetes, and depression were associated with an increased risk of hospitalization. In line with the literature,[8,23,30] older age and comorbidities were significantly associated with death in our study. Falls are an atypical symptom of COVID-19,[14,31] and our study is the first to show an association between falls and hospitalization of NH residents with confirmed or suspected COVID-19. Unlike the literature,[32] we found that polymedication was a protective factor against death.

Most patients in our study sample were symptomatic, which reflects findings in the literature.[8,21] Having said that, some studies have reported a substantial proportion of asymptomatic patients.[11,33] We may have overestimated the proportion of symptomatic patients because we took into account symptomatic residents who tested negative for an RT-PCR test after being in contact with a confirmed COVID-19 case. Furthermore, the fact that France conducted

Table 3
Variables Associated With an Increased Risk of Mortality: Univariate Analysis of 96 Deaths in 480 Residents

Variables	Total, n (%) or Median (IQR) (n = 480)	Survived, n (%) or Median (IQR) (n = 384)	Deceased, n (%) or Median (IQR) (n = 96)	OR	95% CI	*P*
Age >85 y	301 (62.7)	228 (59.4)	73 (76.0)	2.17	1.30-3.62	.003
Gender (male)	145 (31.3)	92 (27.1)	53 (43.1)	2.04	1.33-3.14	.001
Polymedication, ≥5 drugs for pre-existing comorbidities	348 (72.5)	291 (75.8)	57 (59.4)	0.47	0.29-0.75	.001
Comorbidities						
Dyslipidemia	31 (6.5)	19 (4.9)	12 (12.5)	2.74	1.28-5.87	.009
Atrial fibrillation	91 (19.0)	66 (17.2)	25 (26.0)	1.70	1.00-2.88	.049
Psychiatric disorders	51 (10.6)	47 (12.2)	4 (4.2)	0.31	0.11-0.89	.029
Chronic kidney disease	69 (14.4)	48 (12.5)	21 (21.9)	1.96	1.11-3.47	.021
Symptoms	371 (77.3)	280 (72.7)	91 (95.8)	15.89	3.84-65.68	<.001
Dyspnea	171 (35.6)	110 (28.4)	62 (64.6)	4.60	2.87-7.9	<.001
Thermal dysregulation	231 (48.1)	167 (43.5)	64 (66.7)	2.6	1.62-4.16	<.001
Falls	39 (8.1)	26 (6.8)	13 (13.5)	2.16	1.06-4.38	.033
Altered level of consciousness	32 (6.7)	20 (5.2)	12 (12.5)	2.60	1.22-5.53	.013
Biology						
GFR, median (IQR)	41.1 (29.8-57.5)	43.2 (32.2-58.9)	32.0 (17.5-49.3)	0.98	0.97-0.99	.004
CRP, median (IQR)	26.0 (7.0-67.0)	18 (5.0-53.3)	80 (31.0-150.0)	1.02	1.01-1.02	<.001
High CK level	22 (26.8)	8 (14.8)	14 (50.0)	5.75	2.00-16.51	.001
AST, median (IQR)	25.0 (20.0-36.0)	23.0 (18.5-32.0)	35.0 (24.0-60.0)	1.03	1.01-1.05	.002
Treatment						
Azithromycin	375 (78.1)	308 (80.2)	67 (69.8)	0.57	0.35-0.94	.028
Hydration	220 (45.8)	154 (40.1)	66 (68.8)	3.29	2.04-5.30	<.001
Preventive anticoagulation	203 (42.3)	175 (45.6)	28 (29.2)	0.49	0.30-0.80	.004
Oxygen therapy	163 (34.0)	94 (24.5)	69 (71.9)	7.88	4.77-13.03	<.001
Hospitalization	128 (26.7)	84 (21.9)	44 (45.8)	3.02	1.89-4.83	<.001

AST, aspartate aminotransferase; CRP, C-reactive protein; GFR, glomerular filtration rate.
High CK level was defined as CK > 200 U/L.

systematic screening campaigns in NHs limited the number of asymptomatic people not screened. The most common COVID-19 symptoms in our study sample were thermal dysregulation and asthenia, followed by respiratory symptoms. These symptoms are consistent with previously reports. Anorexia, a common digestive symptom of many illnesses in older patients,[34] was present in 21% of residents in our study. ENT symptoms were present in less than 10% of the residents, which reflects findings in the literature that anosmia and ageusia are more frequently found in young patients.[5,35] Atypical presentation in older adults may include gastrointestinal symptoms and geriatric syndromes complicating the diagnostic pathway. Surprisingly, delirium was less frequent in our study than in previous studies on NH adults,[7,36] perhaps because 84.6% of our study sample were diagnosed with neurocognitive disorders and, consequently, it may have been difficult to accurately attribute symptoms to delirium or to underlying dementia.

With regard to COVID-19 management and treatment, 78.1% of our study sample received azithromycin whereas 72.1% also received another antibiotic. Less than a quarter were prescribed hydroxychloroquine. We found that azithromycin was independently associated with a reduced risk of death in univariate analysis. However, larger studies have shown no such benefit, and as of June 2020, this treatment was no longer recommended.[37,38] We found no association between hydroxychloroquine and hospitalization or mortality. Recent clinical data documented no benefit in patients treated with hydroxychloroquine, whether alone or in combination with azithromycin, and warned about potential adverse effects.[37,39]

Almost half of our patients received preventive anticoagulation. It is very likely that many of the others had previously had anticoagulation treatment. Preventive anticoagulation was recommended because of frequent thromboembolic events in cases of COVID-19.[40] Preventive anticoagulation was associated in our multivariable analysis with a reduced risk of death, which reflects previous findings.[22]

Our study has limitations. First, despite its multicenter design, it only included residents in the greater metropolitan area of 1 city, Marseille, and only from 15 of 20 nursing homes that agreed to participate (as the other 5 had no suspected or confirmed COVID-19 case). Although relatively large, the size of the cohort might have prevented some specific clinical symptoms from being highlighted and limited the identification of all prognostic factors. Furthermore, because of its retrospective design, the study had missing data. The missing data were primarily laboratory data, limiting the study's ability to draw conclusions about laboratory-base predictors of outcomes. We selected only variables that were most relevant, and which had few missing data for the multivariable analysis. In addition, only hospitalized patients had chest CT scans. With regard to the investigation of risk factors of hospitalization, we included only residents hospitalized from March 21, 2020, onward (ie, 3 weeks after the study start date), as this was the date that French Public Health Authorities facilitated hospitalization for NH residents throughout the country. Before this date, the advice given was to provide residents with care in their NH (NH-staff based care, and, when possible, home hospitalization), and to only transfer those with severe and critical forms of COVID-9 to hospital. Home hospitalization in NH continued even after March 21, 2020.

Finally, it is important to underline that our results reflect the specific French health care and NH context regarding COVID-19 management, and cannot be extrapolated to other countries.

Conclusions and Implications

This is the largest retrospective multicenter cohort study of NH residents with suspected or confirmed COVID-19 to date in France. Furthermore, our cohort is the oldest (in terms of residents' age) in the literature. A minority of older residents had uncommon, atypical symptoms of COVID-19. These were not associated with poor prognosis. Male gender, diabetes, an altered level of consciousness, and dyspnea were all associated with an increased risk of hospitalization in this frail population. Multivariable regression also showed that male gender, thermal dysregulation, falls, and being aged >85 years were all associated with an increased risk of death. Anticoagulation was a protective factor against death.

Although dyspnea is a precursor to hospitalization, in NH residents, the risk of COVID-19–related mortality was linked to

demographic data and the occurrence of falls, and these factors should be considered when caring for COVID-19–diagnosed NH residents in order to improve prognosis.

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References

1. Yang X, Yu Y, Xu J, et al. Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: A single-centered, retrospective, observational study. Lancet Respir Med 2020;8:475–481.
2. Aw D, Woodrow L, Ogliari G, et al. Association of frailty with mortality in older inpatients with Covid-19: A cohort study. Age Ageing 2020;49:915–922.
3. Liu W, Tao Z-W, Wang L, et al. Analysis of factors associated with disease outcomes in hospitalized patients with 2019 novel coronavirus disease. Chin Med J 2020;133:1032–1038.
4. D'Adamo H, Yoshikawa T, Ouslander JG. Coronavirus disease 2019 in geriatrics and long-term care: The ABCDs of COVID-19. J Am Geriatr Soc 2020;68:912–917.
5. Borges do Nascimento IJ, Cacic N, Abdulazeem HM, et al. Novel coronavirus infection (COVID-19) in humans: A scoping review and meta-analysis. J Clin Med 2020;9:941.
6. Wang H, Li T, Barbarino P, et al. Dementia care during COVID-19. Lancet 2020; 395:1190–1191.
7. Zerah L, Baudouin É, Pépin M, et al. Clinical characteristics and outcomes of 821 older patients with SARS-Cov-2 infection admitted to acute care geriatric wards. J Gerontol A Biol Sci Med Sci 2021;76:e4–e12.
8. Chen T, Dai Z, Mo P, et al. Clinical characteristics and outcomes of older patients with coronavirus disease 2019 (COVID-19) in Wuhan, China (2019): A single-centered, retrospective study. J Gerontol A Biol Sci Med Sci 2020;75:1788–1795.
9. Lithander FE, Neumann S, Tenison E, et al. COVID-19 in older people: A rapid clinical review. Age Ageing 2020;49:501–515.
10. McMichael TM, Currie DW, Clark S, et al. Epidemiology of Covid-19 in a long-term care facility in King County, Washington. N Engl J Med 2020;382:2005–2011.
11. Tang O, Bigelow BF, Sheikh F, et al. Outcomes of nursing home COVID-19 patients by initial symptoms and comorbidity: Results of universal testing of 1970 residents. J Am Med Dir Assoc 2020;21:1767–1773.e1.
12. Santé publique France. Coronavirus (COVID-19). https://www.santepubliquefrance.fr/dossiers/coronavirus-covid-19. Accessed July 15, 2020.
13. Comas-Herrera A, Zalakaín J, Lemmon E, et al. Mortality associated with COVID-19 outbreaks in care homes: Early international evidence. LTCcovid.org, International Long-Term Care Policy Network, CPEC-LSE; February 1, 2021.
14. Sacco G, Foucault G, Brière O, Annweiler C. COVID-19 in seniors: Findings and lessons from mass screening in a nursing home. Maturitas 2020;141:46–52.
15. Hollinghurst J, Lyons J, Fry R, et al. The impact of COVID-19 on adjusted mortality risk in care homes for older adults in Wales, UK: A retrospective population-based cohort study for mortality in 2016-2020. Age Ageing 2020;50:25–31.
16. Costa N, Hoogendijk EO, Mounié M, et al. Additional cost because of pneumonia in nursing home residents: Results from the incidence of pneumonia and related consequences in nursing home resident study. J Am Med Dir Assoc 2017;18:453.e7–453.e12.
17. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state": A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res 1975; 12:189–198.
18. Li G, Taljaard M, Van den Heuvel E, et al. An introduction to multiplicity issues in clinical trials: The what, why, when and how. Int J Epidemiol 2017;46: 746–755.
19. COVID-19 weekly epidemiological update of June 4, 2020. 2020. Available at: https://www.santepubliquefrance.fr/content/download/257630/2628879. Accessed July 15, 2020.
20. Patel MC, Chaisson LH, Borgetti S, et al. Asymptomatic SARS-CoV-2 infection and COVID-19 mortality during an outbreak investigation in a skilled nursing facility. Clin Infect Dis 2020;71:2920–2926.
21. Annweiler C, Sacco G, Salles N, et al. on behalf of the SFGG Covid-19 Study Group. National French survey of coronavirus disease (COVID-19) symptoms in people aged 70 and over. Clin Infect Dis 2020;72:490–494.
22. Bousquet G, Falgarone G, Deutsch D, et al. ADL-dependency, D-dimers, LDH and absence of anticoagulation are independently associated with one-month mortality in older inpatients with Covid-19. Aging (Albany NY) 2020;12: 11306–11313.
23. Zhou F, Yu T, Du R, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: A retrospective cohort study. Lancet 2020;395:1054–1062.
24. Liu Y, Yang Y, Zhang C, et al. Clinical and biochemical indexes from 2019-nCoV infected patients linked to viral loads and lung injury. Sci China Life Sci 2020; 63:364–374.
25. Chen R, Liang W, Jiang M, et al. Risk factors of fatal outcome in hospitalized subjects with coronavirus disease 2019 from a nationwide analysis in China. Chest 2020;158:97–105.
26. Guan WJ, Zhong NS. Clinical characteristics of Covid-19 in China. Reply. N Engl J Med 2020;382:1861–1862.
27. Onder G, Rezza G, Brusaferro S. Case-fatality rate and characteristics of patients dying in relation to COVID-19 in Italy. JAMA 2020;323:1775–1776.
28. Zheng Z, Peng F, Xu B, et al. Risk factors of critical & mortal COVID-19 cases: A systematic literature review and meta-analysis. J Infect 2020;81:e16–e25.
29. Li B, Yang J, Zhao F, et al. Prevalence and impact of cardiovascular metabolic diseases on COVID-19 in China. Clin Res Cardiol 2020;109:531–538.
30. Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: Summary of a report of 72 314 cases from the Chinese Center for Disease Control and Prevention. JAMA 2020;323:1239–1242.
31. Gawronska K, Lorkowski J. Falls as one of the atypical presentations of COVID-19 in older population. Geriatr Orthop Surg Rehabil 2021;12: 2151459321996619.
32. Corradini E, Ventura P, Ageno W, et al. Clinical factors associated with death in 3044 COVID-19 patients managed in internal medicine wards in Italy: Results from the SIMI-COVID-19 study of the Italian Society of Internal Medicine (SIMI). SIMI-COVID-19 Collaborators. Intern Emerg Med 2021;16: 1005–1015.
33. Blain H, Rolland Y, Tuaillon E, et al. Efficacy of a test-retest strategy in residents and health care personnel of a nursing home facing a COVID-19 outbreak. J Am Med Dir Assoc 2020;21:933–936.
34. Cheung KS, Hung IFN, Chan PPY, et al. Gastrointestinal manifestations of SARS-CoV-2 infection and virus load in fecal samples from a Hong Kong cohort: Systematic review and meta-analysis. Gastroenterology 2020;159: 81–95.
35. Lechien JR, Chiesa-Estomba CM, De Siati DR, et al. Olfactory and gustatory dysfunctions as a clinical presentation of mild-to-moderate forms of the coronavirus disease (COVID-19): A multicenter European study. Eur Arch Otorhinolaryngol 2020;277:2251–2261.
36. Zazzara MB, Penfold RS, Roberts AL, et al. Probable delirium is a presenting symptom of COVID-19 in frail, older adults: A cohort study of 322 hospitalised and 535 community-based older adults. Age Ageing 2021;50: 40–48.
37. Rosenberg ES, Dufort EM, Udo T, et al. Association of treatment with hydroxychloroquine or azithromycin with in-hospital mortality in patients with COVID-19 in New York State. JAMA 2020;323:2493–2502.
38. Sbidian E, Josse J, Lemaitre G, et al. Hydroxychloroquine with or without azithromycin and in-hospital mortality or discharge in patients hospitalized for COVID-19 infection: A cohort study of 4,642 in-patients in France. medRxiv; 2020.
39. Alvi MM, Sivasankaran S, Singh M. Pharmacological and non-pharmacological efforts at prevention, mitigation, and treatment for COVID-19. J Drug Target; 2020:1–46.
40. Wu T, Zhihong Z, Yang D, et al. Venous thromboembolic events in patients with COVID-19: A systematic review and meta-analysis. Age Ageing 2021;50: 284–293.

Supplementary Table 1
Characteristics of the 134 Residents Who Benefited From Home Hospitalization

Characteristics	N or Mean	%
Age (y)	86.9	
65-74	12	9.0
75-84	36	26.9
85-94	61	45.5
95-105	25	18.7
Sex		
Male	36	26.9
Female	98	73.1
Nutrition status*		
Undernutrition	58	43.3
Obesity	17	12.7
Polymedication ≥5 drugs for pre-existing conditions	103	76.9
Vaccinated for		
Flu	101	75.4
Pneumococcus	57	42.5
Comorbidities		
Cognition impairment†	115	85.8
Hypertension	71	53.0
Dyslipidemia	8	6.0
Type 2 diabetes	27	20.1
Cerebrovascular disease	31	23.1
Coronaropathy	13	9.7
Congestive heart failure	20	14.9
Atrial fibrillation	21	15.7
Asthma	3	2.2
Chronic obstructive pulmonary disease	16	11.9
Chronic respiratory insufficiency	2	1.5
Depression	68	50.7
Psychiatric disorders	9	6.7
Chronic kidney disease	19	14.2
Cancer history	8	6.0
Iso-resource groups (1 missing data)		
1	24	17.9
2	73	54.5
3	20	14.9
4	15	11.2
5 and 6	1	0.7
Hospitalization: in COVID-19 unit	15	11.2
Death		
In COVID-19 unit	7	5.2
In nursing home	24	17.9
Symptoms	113	84.3
Dyspnea	54	40.3
Dry cough	34	25.4
Thermal dysregulation	77	57.5
Fever	65	48.5
Asthenia	77	57.5
Anorexia	29	21.6
Gastrointestinal symptoms	17	12.7
Myalgia or arthralgia	4	3.0
Headaches	2	1.5
ENT symptoms	9	6.7
Falls	11	8.2
Delirium	17	12.7
Worsening depression	6	4.5
Altered level of consciousness	4	3.0
Positive RT-PCR test result	132	98.5

ENT, ear, nose, and throat.

*Undernutrition was defined as a body mass index <21; obesity was defined as a body mass index ≥30.

†Cognition impairment was defined as a score <24 in the Mini-Mental State Examination (MMSE) or the presence of cognitive symptoms (wandering, hallucination, hostility and aggressiveness, or cognitive disorder history).

Supplementary Table 2
Variables Not Associated With an Increased Risk of Hospitalization: Univariate Analysis of 123 Hospitalizations in 463 Residents

Variables	Total, n (%) or Median (IQR) (n = 463)	Not Hospitalized, n (%) or Median (IQR) (n = 340)	Hospitalized, n (%) or Median (IQR) (n = 123)	sHR	95% CI	*P*
Age >85 y	289 (62.4)	215 (63.2)	74 (60.2)	0.90	0.63-1.29	.58
Undernutrition*	179 (38.7)	138 (40.6)	41 (33.3)	0.76	0.53-1.10	.15
Obesity*	41 (8.9)	30 (8.8)	11 (8.9)	0.98	0.54-1.78	.94
Iso-resource group 1, 2, or 3	394 (85.1)	291 (85.6)	103 (83.7)	0.89	0.54-1.44	.63
Polymedication, ≥5 drugs for pre-existing conditions	333 (71.9)	240 (70.6)	93 (75.6)	1.21	0.80-1.83	.35
Vaccinated for						
Flu	365 (78.8)	265 (77.9)	100 (81.3)	1.17	0.74-1.85	.50
For pneumococcus	184 (39.7)	129 (37.9)	55 (44.7)	1.27	0.89-1.80	.19
Comorbidities						
Hypertension	247 (53.3)	173 (50.9)	74 (60.2)	1.37	0.96-1.96	.08
Dyslipidemia	30 (6.5)	18 (5.3)	12 (9.8)	1.63	0.93-2.88	.09
Cerebrovascular disease	94 (20.3)	71 (20.9)	23 (18.7)	0.91	0.58-1.44	.70
Coronaropathy	69 (14.9)	45 (13.2)	24 (19.5)	1.44	0.93-2.23	.10
Asthma	10 (2.2)	6 (1.8)	4 (3.3)	1.60	0.63-4.09	.33
Chronic obstructive pulmonary disease	50 (10.8)	37 (10.9)	13 (10.6)	0.93	0.54-1.62	.80
Chronic respiratory insufficiency	15 (3.2)	12 (3.5)	3 (2.4)	0.73	0.23-2.32	.59
Depression	213 (46.0)	160 (47.1)	53 (43.1)	0.89	0.63-1.28	.54
Psychiatric disorders	48 (10.4)	39 (11.5)	9 (7.3)	0.67	0.34-1.31	.24
Chronic kidney disease	67 (14.5)	49 (14.4)	18 (14.6)	1.05	0.63-1.75	.85
Cancer history	30 (10.5)	23 (6.8)	7 (5.7)	0.83	0.40-1.72	.61
Symptoms						
Dry cough	123 (26.6)	83 (24.4)	40 (32.5)	1.33	0.92-1.92	.12
Asthenia	220 (47.5)	153 (45.0)	67 (54.5)	1.38	0.97-1.96	.07
Anorexia	96 (20.6)	67 (19.7)	29 (23.6)	1.23	0.81-1.86	.33
Myalgia and/or arthralgia	14 (3.0)	12 (3.5)	2 (1.6)	0.48	0.12-1.91	.30
Headaches	7 (1.5)	4 (1.2)	3 (2.4)	1.66	0.58-4.71	.34
ENT symptoms	37 (8.0)	26 (7.6)	11 (8.9)	1.20	0.64-2.26	.57
Falls	34 (7.3)	20 (5.9)	14 (11.4)	1.64	0.98-2.73	.06
Delirium	41 (8.9)	29 (8.5)	12 (9.8)	1.34	0.83-2.16	.24
Worsening depression	26 (2.6)	18 (5.3)	8 (6.5)	1.23	0.60-2.56	.57
Biology†						
Lymphopenia	105 (22.7)	70 (20.6)	35 (28.5)	1.49	0.97-2.31	.07
Neutropenia	21 (4.5)	16 (4.7)	5 (4.0)	0.89	0.36-2.21	.80
Thrombocytopenia	39 (8.4)	29 (8.5)	10 (8.1)	0.91	0.49-1.67	.76
GFR, median (IQR)	41.0 (30.0-57.0)	41.0 (30.0-57.0)	42.0 (29.5-57.5)	1.00	0.99-1.01	.49
Hypokalemia	22 (4.8)	14 (4.1)	8 (6.5)	1.67	0.78-3.56	.19
Treatment						
Azithromycin	362 (78.2)	267 (78.5)	95 (77.2)	0.88	0.57-1.36	.57
Hydroxychloroquine	114 (24.6)	86 (25.3)	28 (22.8)	0.90	0.59-1.37	.63
Preventive anticoagulation	197 (42.5)	146 (42.9)	51 (41.5)	0.95	0.67-1.36	.80
DDI	227 (49.0)	168 (49.4)	59 (48.0)	0.92	0.65-1.31	.66
Adverse events	42 (9.1)	29 (8.5)	13 (10.6)	1.24	0.70-2.20	.47

AST, aspartate aminotransferase; CRP, C-reactive protein; DDI, drug-drug interaction; ENT, ear, nose, and throat; GFR, glomerular filtration rate; IQR, interquartile range; sHR, specific hazard ratio.

*Undernutrition was defined as a body mass index <21; obesity was defined as a body mass index ≥30.

†Neutropenia was defined as a neutrophil level <1.5 G/L, lymphopenia was defined as a lymphocyte level <1.0 G/L, thrombocytopenia was defined as a platelet level <150 G/L, hypokalemia was defined as a potassium level <3.4 mmol/L.

Supplementary Table 3
Variables Not Associated With an Increased Risk in Mortality: Univariate Analysis of 96 Deaths in 480 Residents

Variables	Total, n (%) (n = 480)	Survived, n (%) (n = 384)	Deceased, n (%) (n = 96)	OR	95% CI	*P*
Undernutrition*	186 (38.8)	144 (37.5)	42 (43.8)	1.30	0.82-2.04	.26
Obesity*	43 (9.0)	32 (8.3)	11 (11.5)	1.42	0.69-2.94	.34
Iso-resource group 1, 2, or 3	408 (85.5)	323 (84.8)	85 (88.5)	1.39	0.70-2.76	.35
Vaccinated for						
Flu	379 (79.0)	307 (79.9)	72 (75.0)	0.75	0.45-1.27	.29
Pneumococcus	188 (39.2)	147 (38.3)	41 (42.7)	1.20	0.76-1.89	.43
Comorbidities						
Cognitive impairment†	406 (84.6)	324 (84.2)	82 (86.3)	1.21	0.63-2.30	.57
Hypertension	257 (53.5)	202 (52.5)	55 (57.9)	1.27	0.81-2.00	.29
Type 2 diabetes	86 (17.9)	66 (16.9)	21 (21.9)	1.37	0.79-2.39	.26
Cerebrovascular disease	95 (19.8)	74 (19.3)	21 (21.9)	1.17	0.68-2.03	.57
Coronaropathy	70 (14.6)	53 (13.8)	17 (17.9)	1.34	0.74-2.45	.33
Congestive heart failure	71 (14.8)	53 (13.8)	18 (18.8)	1.44	0.80-2.59	.23
Asthma	11 (2.3)	9 (2.3)	2 (2.1)	0.89	0.19-4.17	.88
Chronic obstructive pulmonary disease	51 (10.6)	39 (10.2)	12 (12.5)	1.26	0.63-2.52	.51
Chronic respiratory insufficiency	16 (3.3)	11 (2.9)	5 (5.2)	1.86	0.63-5.50	.26
Depression	216 (45.0)	176 (45.8)	40 (41.7)	0.84	0.54-1.33	.46
Cancer history	31 (6.5)	22 (5.7)	9 (9.4)	1.70	0.76-3.83	.20
Symptoms						
Dry cough	133 (27.7)	102 (26.6)	31 (32.3)	1.32	0.81-2.14	.26
Anorexia	101 (21.0)	75 (19.5)	26 (27.1)	1.53	0.91-2.56	.11
Gastrointestinal symptoms	85 (17.7)	64 (16.4)	22 (22.9)	1.52	0.88-2.62	.14
Myalgia and/or arthralgia	14 (2.9)	11 (2.9)	3 (3.1)	1.09	0.30-4.00	.89
Headaches	8 (1.7)	7 (1.8)	1 (1.0)	0.57	0.07-4.66	.60
ENT symptoms	40 (8.3)	31 (8.1)	9 (9.4)	1.18	0.54-2.57	.68
Delirium	59 (12.3)	42 (10.9)	17 (17.7)	0.52	0.20-1.35	.18
Worsening depression	27 (5.6)	20 (5.2)	7 (7.3)	1.43	0.59-3.49	.43
Biology‡						
Neutropenia	23 (7.3)	18 (7.8)	5 (6.0)	1.17	0.02-1.25	.08
Lymphopenia	109 (34.5)	82 (32.5)	27 (42.2)	1.51	0.86-2.65	.15
Neutropenia	23 (7.3)	18 (7.8)	5 (6.0)	1.17	0.02-1.25	.08
Thrombocytopenia	40 (8.3)	30 (7.8)	10 (10.5)	1.37	0.65-2.92	.41
Hypokalemia	22 (7.0)	20 (7.9)	3 (3.2)	3.39	0.09-1.70	.21
Treatment						
Antibiotics (except azithromycin)	346 (72.1)	270 (70.3)	75 (79.2)	1.60	0.94-2.75	.09
Hydroxychloroquine	117 (24.4)	94 (24.5)	23 (24.0)	0.97	0.58-1.64	.92
Aerosol	13 (2.7)	10 (2.6)	3 (3.1)	1.21	0.33-4.47	.78
DDI	233 (48.6)	194 (50.7)	39 (41.6)	0.67	0.42-1.05	.08
Contraindications	47 (9.8)	34 (8.9)	13 (13.5)	1.61	0.82-3.19	.17
Adverse events	44 (9.2)	38 (9.9)	6 (6.3)	0.61	0.25-1.48	.27

DDI, drug-drug interaction; ENT, ear, nose, and throat; IQR, interquartile range; OR, odds ratio.

*Undernutrition was defined as a body mass index <21; obesity was defined as a body mass index ≥30.

†Cognitive impairment was defined as a score <24 in the Mini-Mental State Examination (MMSE) or the presence of cognitive symptoms (wandering, hallucination, hostility and aggressiveness, or cognitive disorder history).

‡Neutropenia was defined as a neutrophil level <1.5 G/L, Lymphopenia was defined as a lymphocyte level <1.0 G/L, thrombocytopenia was defined as a platelet level < 150 G/L, hypokalemia was defined as a potassium level < 3.4 mmol/L.