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

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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 [specification 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
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. 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, particularly those with pre-existing comorbidities and those who are frail (the result of cognitive and functional impairment). Early reports also suggested that older people may initially present more atypical COVID-19–related clinical manifestations and biological results than younger adults.

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. 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%). 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. 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. However, the general observation in NH literature is that COVID-19 increased mortality in NH residents in 2020. 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), 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. 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 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
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 1

| 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         | —           |                  |                  |              |              |
| **Nutrition status** | 406             | 84.6         | —           | Worsening depression | 27             | 5.6          | —           |
| **Comorbidities** | 257             | 53.5         | —           | Altered level of consciousness | 32            | 6.7          | —           |
| Cognitive impairment | 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 (109/L) | 4 (4-5)        | 4.4-5.7      | 2-6          |
| **Congestive heart failure** | 71            | 14.8         | —           | White blood cells (109/L) | 6 (4-7)       | 3.9-10.9    | 2-20         |
| **Atrial fibrillation** | 91             | 19.0         | —           | Neutrophils (109/L) | 4 (3-5)       | 1.7-7.1     | 1-21         |
| **Asthma**      | 11               | 2.3          | —           | Neutropenia     | 23              | 6.8          | 0-7          |
| **Chronic obstructive pulmonary disease** | 51             | 10.6         | —           | Lymphocytes (109/L) | 1 (1-2)       | 1.1-3.2     | 0-7          |
| **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         | —           |                  |                  |              |              |
| **Cancer history** | 31              | 6.5          | —           |                  |                  |              |              |
| **Iso-resource groups** |                  |              | —           |                  |                  |              |              |
| 1               | 102              | 21.3         | 3           |                  |                  |              |              |
| 2               | 228              | 47.5         | —           |                  |                  |              |              |
| 3               | 78               | 16.3         | —           |                  |                  |              |              |
| 4               | 61               | 12.7         | —           |                  |                  |              |              |
| 5 and 6        | 8                | 1.7          | —           |                  |                  |              |              |
| **Home hospitalization** | 123            | 26.6         | —           |                  |                  |              |              |
| **End-of-life care** | 134             | 27.9         | —           |                  |                  |              |              |
| **Death**       | 57               | 11.9         | —           |                  |                  |              |              |
| **In COVID-19 unit** | 42              | 8.5          | —           |                  |                  |              |              |
| **In nursing home** | 54              | 11.3         | —           |                  |                  |              |              |

**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 <1.0 109/L; lymphopenia was defined as a lymphocyte level <1.0 109/L, and thrombocytopenia was defined as a platelet level <150 109/L.**
In the present study, 371 (77.3%) were symptomatic, the most common symptoms being thermal dysregulation (48.1%), fever and asthenia (47.9%), followed by dry cough (35.6%), dyspnea (27.7%), and anoxia (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).

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.

| Comorbidities | Total, n (%) or Median (IQR) | Not Hospitalized, n (%) or Median (IQR) | Hospitalized, n (%) or Median (IQR) | HR or sHR | 95% CI |
|---------------|-----------------------------|-----------------------------------------|-------------------------------------|------------|--------|
| Gender (male) | 318 (68.7)                  | 248 (72.9)                              | 70 (56.9)                           | 1.77       | 1.25-2.52 | .001   |
| Physical activity | 243 (52.3)                  | 166 (49.0)                              | 77 (59.3)                           | 0.83       | 0.59-1.13 | .244   |
| Smoking status | 144 (31.5)                  | 99 (28.6)                               | 45 (34.7)                           | 1.67       | 1.03-2.72 | .036   |
| Alcohol abuse  | 81 (17.7)                   | 51 (15.0)                               | 30 (23.5)                           | 1.54       | 1.05-2.25 | .028   |
| Obesity       | 138 (30.3)                  | 101 (29.4)                              | 37 (29.4)                           | 1.05       | 0.70-1.60 | .824   |
| Hypertension  | 86 (18.7)                   | 57 (16.4)                               | 29 (22.6)                           | 1.68       | 1.04-2.72 | .034   |
| Diabetes      | 105 (22.7)                  | 72 (21.0)                               | 33 (26.2)                           | 1.57       | 1.02-2.43 | .040   |
| CHF           | 54 (11.8)                   | 34 (9.8)                                | 20 (15.4)                           | 2.32       | 1.27-4.23 | .009   |
| COPD          | 49 (10.7)                   | 34 (9.8)                                | 15 (11.9)                           | 1.82       | 1.02-3.25 | .044   |
| Asthma        | 31 (6.7)                    | 23 (6.6)                                | 8 (6.4)                             | 1.09       | 0.56-2.11 | .836   |
| COPD          | 31 (6.7)                    | 23 (6.6)                                | 8 (6.4)                             | 1.09       | 0.56-2.11 | .836   |

| Demographic and Clinical Characteristics | Total, n (%) or Median (IQR) | Not Hospitalized, n (%) or Median (IQR) | Hospitalized, n (%) or Median (IQR) | HR or sHR | 95% CI |
|------------------------------------------|-----------------------------|-----------------------------------------|-------------------------------------|------------|--------|
| Age                                       | 88 (19.0)                   | 57 (16.8)                               | 31 (25.2)                           | 1.55       | 1.03-2.32 | .034   |
| Gender (male)                             | 318 (68.7)                  | 248 (72.9)                              | 70 (56.9)                           | 1.77       | 1.25-2.52 | .001   |
| Physical activity | 243 (52.3)                  | 166 (49.0)                              | 77 (59.3)                           | 0.83       | 0.59-1.13 | .244   |
| Smoking status | 144 (31.5)                  | 99 (28.6)                               | 45 (34.7)                           | 1.67       | 1.03-2.72 | .036   |
| Alcohol abuse  | 81 (17.7)                   | 51 (15.0)                               | 30 (24.4)                           | 1.61       | 1.07-2.42 | .021   |
| Obesity       | 138 (30.3)                  | 101 (29.4)                              | 37 (29.4)                           | 1.05       | 0.70-1.60 | .824   |
| Hypertension  | 86 (18.7)                   | 57 (16.4)                               | 29 (22.6)                           | 1.68       | 1.04-2.72 | .034   |
| Diabetes      | 105 (22.7)                  | 72 (21.0)                               | 33 (26.2)                           | 1.57       | 1.02-2.43 | .040   |
| CHF           | 54 (11.8)                   | 34 (9.8)                                | 20 (15.4)                           | 2.32       | 1.27-4.23 | .009   |
| COPD          | 49 (10.7)                   | 34 (9.8)                                | 15 (11.9)                           | 1.82       | 1.02-3.25 | .044   |
| Asthma        | 31 (6.7)                    | 23 (6.6)                                | 8 (6.4)                             | 1.09       | 0.56-2.11 | .836   |
| COPD          | 31 (6.7)                    | 23 (6.6)                                | 8 (6.4)                             | 1.09       | 0.56-2.11 | .836   |

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 CRP 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 antiagulation was initiated in 203 patients (42.3%). Moreover, 163 patients (34.0%) received oxygen therapy, whereas 220 (45.8%) received intravenous or subcutaneous hydration.
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 hospitalization was 5.0 days (IQR 2.0–10.0).

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 5.63, 95% CI 1.04–23.9; 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%. Sacco et al 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 found a mortality percentage of 33.7% in 101 residents in an NH in Washington, while more recently, Tang et al 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%.

To our knowledge, our cohort is the oldest (in terms of patients’ age) described in the literature. Unsurprisingly, all studies have shown that older patients have a poorer COVID-19 prognosis. 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, we did not consider staff members’ or visitors’ infectious status.

With regard to the factors listed above that were associated with hospitalization and death, studies on COVID-19 have found that men are significantly more likely to get the disease than women and that male gender is significantly associated with COVID-19–related mortality. 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. In Tang et al’s study in Maryland, renal disease, diabetes, and depression were associated with an increased risk of hospitalization. In line with the literature, older age and comorbidities were significantly associated with death in our study. Falls are an atypical symptom of COVID-19 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, we found that polymedication was a protective factor against death.

Most patients in our study sample were symptomatic, which reflects findings in the literature. Having said that, some studies have reported a substantial proportion of asymptomatic patients. 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
and ageusia are more frequently found in young patients. Atypical clinical data documented no benefit between hydroxychloroquine and hospitalization or mortality. Recent studies on NH adults, perhaps because 84.6% of our study sample were diagnosed with neurocognitive disorders and, consequently, it is very likely that many of the others had previously had anti-coagulation treatment. Preventive anticoagulation was recommended for pre-existing comorbidities such as CK elevation, and as of June 2020, this is the largest retrospective multicenter cohort study of NH residents with suspected or confirmed COVID-19 to date in France.

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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### 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**                                          |           |
| 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   |
| **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 (45.1) 53 (43.1) 0.89 0.63-1.28 .54 | | | | | |
| Psychiatric disorders | 48 (10.4) 39 (11.5) 9 (7.3) 0.87 0.54-1.31 .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 | | | | | |
| Anorexia | 153 (40.6) 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 (5.6) 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) | 410 (30.5-57.0) 410 (30.5-57.0) 420 (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 0.39-1.37 .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 <0.5 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                             |                        |                           |                          |      |              |       |
| 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   |
| Coronaryopathy                                  | 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 | 0.39-4.17    | .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   |
| Anoxia                                          | 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 | 0.09-17.0    | .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 (42.0)                | 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                                             | 231 (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)                  | 8 (8.3)                  | 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.

1Cognitive 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).

1Neutropenia 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.