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Robin Arcani, Joris Weiland, Anais Courcier, Pierre Caunes, Priscilla  
Clot-Faybesse, Patrick Gil, et al.

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# Factors associated with COVID-19 hospitalizations and deaths in French nursing homes

**Running title:** COVID-19 in nursing homes

Anne-Laure Couderc<sup>1\*</sup>, MD, Florian Correard<sup>2\*</sup>, PharmD, PhD, Zeinab Hamidou<sup>3</sup>, PhD, Emilie Nouguerede<sup>1</sup>, PhD, Robin Arcani<sup>1</sup>, MD, Joris Weiland<sup>1</sup>, MD, Anais Courcier<sup>1</sup>, MD, Pierre Caunes<sup>1</sup>, MD, Priscilla Clot-Faybesse<sup>4</sup>, MD, Patrick Gil<sup>5</sup>, MD, Charlotte Berard<sup>2</sup>, PharmD, Charlène Miola<sup>1</sup>, MD, Julie Berbis<sup>3</sup>, MD PhD, Patrick Villani<sup>1\*</sup>, MD, PhD, Aurélie Daumas<sup>1\*</sup> MD PhD.

\*Contributed equally to the work

## Author Affiliations:

<sup>1</sup> Aix-Marseille Univ., Internal Medicine, Geriatrics and Therapeutic Department, Timone and Sainte Marguerite Hospital, AP-HM, Marseille, France

<sup>2</sup> Aix-Marseille Univ., Pharmaceutical Expertise And Clinical Research Unit, Pharmacy Department, Timone Hospital, AP-HM, Marseille, France

<sup>3</sup> Aix-Marseille Univ, School of Medicine - La Timone Medical Campus, EA 3279: CEReSS Health Service Research and Quality of Life Center, Marseille, France

<sup>4</sup> Korian nursing homes group, Marseille, France,

<sup>5</sup> MEDEOS nursing homes, Marseille, France

## Corresponding Author:

**Aurélie Daumas MD, PhD (aurelie.daumas@ap-hm.fr)**

Internal Medicine, Geriatrics and Therapeutic Department, Timone and Sainte Marguerite Hospital, AP-HM, Marseille, France.

Phone: 33 4.91.38.87.19 Fax: 33 4.91.38.87.17

**Keywords:** SARS-Cov-2; nursing home; older residents; mortality; outcomes

**Brief summary:**

Male gender, diabetes, an altered level of consciousness, and dyspnea were all associated with a greater risk of hospitalization. Male gender, thermal dysregulation, and being aged >85 years old were all associated with increased mortality risk.

**Abstract: 299 words****Main text: 3384 words****References: 40****Tables/figures: 4****Acknowledgments:**

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*Study concept and design:* Couderc, Correard, Villani and Daumas

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The data are available from the corresponding author upon reasonable request.

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1 **Abstract**

2 **Objectives:** To describe the clinical characteristics and management of residents in French  
3 nursing homes with suspected or confirmed coronavirus disease 2019 (COVID-19), and to  
4 determine the risk factors for COVID-19-related hospitalization and death in this population.

5 **Design:** A retrospective multicenter cohort study

6 **Setting and Participants:** Four hundred and eighty nursing home residents with suspected or  
7 confirmed COVID-19 between 1 March and 20 May 2020 were enrolled and followed until 2  
8 June 2020 in 15 nursing homes in Marseille's greater metropolitan area.

9 **Methods:** Demographic, clinical, laboratory, treatment type, and clinical outcome data were  
10 collected from patients' medical records. Multivariable analyses were used to determine  
11 factors associated with COVID-19-related hospitalization and death. For the former, the  
12 competing risk analysis - based on Fine and Gray's model - took death into account.

13 **Results:** 480 residents were included. Median age was 88 years (IQR 80-93), and 330  
14 residents were women. A total of 371 residents were symptomatic (77.3%), the most common  
15 symptoms being asthenia (47.9%), fever or hypothermia (48.1%), and dyspnea (35.6%). One  
16 hundred and twenty-three patients (25.6%) were hospitalized and 96 (20%) died. Male gender  
17 (sHR 1.63, 95% CI 1.12-2.35), diabetes (sHR 1.69, 95% CI 1.15-2.50), an altered level of  
18 consciousness (sHR 2.36, 95% CI 1.40-3.98), and dyspnea (sHR 1.69, 95% CI 1.09-2.62)  
19 were all associated with a greater risk of COVID-19-related hospitalization. Male gender (OR  
20 6.63, 95% CI 1.04-42.39), thermal dysregulation (OR 2.64, 95% CI 1.60-4.38), falls (2.21  
21 95% CI 1.02-4.75), and being aged >85 years old (OR 2.36 95% CI 1.32-4.24) were all  
22 associated with increased COVID-19-related mortality risk, whereas polymedication (OR  
23 0.46, 95% CI 0.27-0.77) and preventive anticoagulation (OR 0.46, 95% CI 0.27-0.79) were  
24 protective prognostic factors.

25 **Conclusions and Implications:** Male gender, being aged >85 years old, diabetes, dyspnea,  
26 thermal dysregulation, an altered level of consciousness, and falls, must all be considered  
27 when identifying and protecting nursing home residents who are at greatest risk of COVID-  
28 19-related hospitalization and death.

29

## 30 INTRODUCTION

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

40 In the context of the prevalence of COVID-19 in nursing home (NH) residents, research on  
41 clinical characteristics, care management, and disease-related outcomes is still scarce. A study  
42 in King county, Washington state, USA, reported that 54.5% of 101 NH residents infected  
43 over a period of three weeks were hospitalized for COVID-19, and that 33.7% subsequently  
44 died.<sup>10</sup> In a multicenter study in NH in Maryland, USA, residents with multiple symptoms had  
45 the highest risk of mortality and hospitalization. Interestingly, asymptomatic COVID-19 was  
46 also associated with higher mortality risk in that study (20.6%).<sup>11</sup> In France, between 1 March  
47 and 31 May 2020, of the 28 771 people who died from COVID-19, more than a third (10 327  
48 persons) were living in nursing homes.<sup>12</sup> International comparisons of data are difficult  
49 because of intra- and inter-country differences in NH in terms of organization, COVID-19  
50 testing policies, therapeutic management, and approaches to quantifying COVID-19-related  
51 deaths.<sup>13</sup> However, the general observation in NH literature is that COVID-19 increased  
52 mortality in NH residents in 2020.<sup>13-15</sup> Given the relatively small number of related studies to  
53 date, more research is needed on the clinical presentation and on risk factors for COVID-19-  
54 related hospitalization and death in this population. Accordingly, we implemented a

55 multicenter retrospective study to describe the clinical characteristics, biological  
56 characteristics, and healthcare management of a relatively large cohort of residents with  
57 suspected or confirmed COVID-19 living in NH located in the greater metropolitan area of  
58 Marseille. The secondary objectives were to determine the factors associated with COVID-  
59 19-related hospitalization and with death.

60

## 61 **METHODS**

62

### 63 *Study design and participants*

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

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

79



80 With regard to investigating risk factors for hospitalization, residents who had the possibility  
81 to be hospitalized from 21 March 2020 onwards – the date when French Public Health  
82 Authorities facilitated hospital admissions for the country’s NH residents - were included in  
83 the analysis. Prior to that date, only NH residents with few functional/cognitive impairments  
84 and no severe comorbidity who presented severe clinical symptoms could be hospitalized in  
85 France. With regard to investigating risk factors for death, all included residents (i.e., with  
86 suspected or confirmed COVID 19) for the enrollment period (i.e., 1 March and 20 May  
87 2020) were included.

88 The study was authorized by The National Institute for Health Data (number INDS- MR  
89 3109280520) and was conducted in accordance with the MR-004 study-type reference  
90 methodology approved by the National Commission for Information Technology and Civil  
91 Liberties (CNIL). In accordance with French legislation, formal approval from an ethics  
92 committee was not required for this type of retrospective non-interventional study based on  
93 the use of previously recorded data.

94

### 95 *Data collection*

96 Trained physicians (ALC, AD) used a standardized electronic form to collect COVID-19-  
97 specific data from clinical charts, laboratory findings, and chest computerized tomography  
98 (CT) scans, as well as data from NH records and treatments both for COVID-19 and for pre-  
99 existing comorbidities. They also collected the following data for each patient: demographic  
100 information (age, gender, body mass index (BMI), most recent iso-resource dependence group  
101 classification <sup>16</sup>), comorbidities, and flu and pneumococcus vaccination status.

102 To define their level of dependency, elderly people in France are divided into one of six iso-  
103 resource groups, which reflect different stages of loss of autonomy.<sup>16</sup> NH residents classified  
104 into iso-resource groups 1, 2 or 3 must be assisted in most or all their daily activities. We

105 defined cognitive impairment as a score of  $< 24$  according to Mini-Mental State  
106 Examination<sup>17</sup> (MMSE) test, or the presence of cognitive impairment symptoms (wandering,  
107 hallucinations, hostility/aggressiveness or history of cognitive disorder). Undernutrition and  
108 obesity were defined as a BMI of  $< 21$  and  $\geq 30$ , respectively.

109 The date of disease onset was defined as the day when COVID-19 symptoms were first  
110 noticed or, for asymptomatic patients, the day a patient had a positive RT-PCR test. The  
111 trained physicians collected data for the following symptoms suggestive of COVID-19 from  
112 the patients' medical records: general symptoms (sudden deterioration in general health  
113 condition or asthenia, anorexia, fever or hypothermia (thermal dysregulation), headaches,  
114 myalgia and/or arthralgia), respiratory symptoms, ear nose and throat (ENT) symptoms,  
115 gastrointestinal symptoms, worsening depression and geriatric-related syndromes (falls,  
116 delirium (acute confusional state), and altered level of consciousness (defined as a Glasgow  
117 coma score  $< 14$ )). Data on routine blood tests (blood count, renal and liver function, C-  
118 reactive protein, creatine phosphokinase and D-dimers) and on chest CT scan results were  
119 also collected. For all included patients, data on medications for pre-existing chronic  
120 pathologies, polymedication ( $\geq 5$  usual drugs per day), and management of COVID-19 were  
121 also recorded. Some patients were 'home hospitalized', that is to say they were provided some  
122 elements of hospital-type care for COVID-19 in their NH by an authorized external (i.e., not  
123 NH-based) team of specialists. These elements included hydroxychloroquine treatment,  
124 perfusions for hydration, and end-of-life care. Home hospitalization did not exclude potential  
125 subsequent normal hospitalization if symptoms deteriorated. The numbers of home  
126 hospitalized, hospitalized, and deceased patients were recorded. The reasons for home  
127 hospitalization (which reflected the availability of each of the three hospital-type care  
128 elements listed above), the reasons for hospitalization, and the causes of death were all

129 collected, as were symptom duration, time between disease onset and hospital admission, and  
130 the time between disease onset and death.

131

### 132 *Statistical analysis*

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

138 Our analysis aimed to explore the association between epidemiological/clinical characteristics  
139 and the risk of hospitalization/death in COVID-19 infected NH residents. Univariate and  
140 multivariate logistic regression models were used to analyze all the variables studied as  
141 potential factors of hospitalization/death (odds ratio; OR). Competing risk analysis based on  
142 Fine and Gray's model was used to measure the time from disease onset to hospitalization, in  
143 order to take into account the fact that patients who died could not have been hospitalized  
144 after their death. Cox proportional hazard regression models were used to estimate cause-  
145 specific hazard ratios (sHRs). The follow-up time was defined as the time between the date of  
146 disease onset and the date of hospitalization.

147 All variables with a  $p$ -value of less than 0.05 in the univariate logistic regression or Cox  
148 regression models were included in the multivariable analyses. Given the large number of  
149 variables with  $p < 0.05$ , we decided to select only those which were most clinically relevant  
150 and which had few missing data for the multivariable analysis, in order to respect the  
151 maximum authorized number of variables in each model (10 and 9 for the hospitalization and  
152 death models, respectively)<sup>18</sup>. For correlated variables, the variable selected was the greatest  
153 clinical relevance.

154 All statistical analyses were conducted using SPSS software. A p-value  $< 0.05$  was chosen for  
155 the statistical significance threshold.

156

157 **RESULTS**

158

159 *Patients' demographic and clinical characteristics (Table 1)*

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

163

164 Median age of the study sample was 88 years (IQR 80-93, range 65-105), and 330 patients  
165 (68.8%) were women. All patients had at least one comorbidity. Neurocognitive disorders  
166 were the most common comorbidity, affecting 406 (84.6%) patients, followed by  
167 hypertension (257, 53.5%), and depression (216, 45.0%). Eighty-six patients (17.9%) had  
168 diabetes and 51 (10.6%) had chronic pulmonary disease. With regard to weight status, 186  
169 (38.8%) were undernourished, and 43 (9.0%) were obese. The majority of residents (408,  
170 85.0%) were classified in iso-resource groups 1, 2, or 3.

171 Of the 480 patients included, 371 (77.3%) were symptomatic, the most common symptoms  
172 being thermal dysregulation (48.1%) and asthenia (47.9%), followed by dyspnea (35.6%), dry  
173 cough (27.7%), and anorexia (21.0%). Gastrointestinal symptoms and delirium were observed  
174 in 17.7 and 12.3% of the patients, respectively. ENT symptoms, falls and an altered level of  
175 consciousness were uncommon. The median duration of symptoms was 17.0 days (IQR 8.0-  
176 28.5; N=110). ~~Of the 480 patients, 370 had incomplete clinical data.~~

177

178 *Laboratory and imaging findings following COVID-19 diagnosis*

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

182 Lymphopenia, neutropenia and thrombocytopenia occurred in 109 (32.2%), 23 (6.8%) and 40  
183 (11.8%) patients, respectively. The median C-reactive protein was 26 mg/L (IQR 7-67).  
184 Of the 461 patients (96.0%) who had an RT-PCR test, 446 (92.9%) tested positive for  
185 COVID-19. Only 42 patients had chest CT scans during hospitalization. All the scans showed  
186 anomalies supporting the diagnosis of COVID-19.

187

### 188 *Treatments and clinical outcomes*

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

191 With regard to treatment for suspected or confirmed COVID-19, 375 patients (78.1%)  
192 received azithromycin. Of these, 117 (24.4%) also received hydroxychloroquine, and 346  
193 (72.1%) a second antibiotic (penicillin (7.9%) or ceftriaxone (59.4%)). No patient received  
194 antivirals or anti-inflammatory agents. Preventive anticoagulation was initiated in 203 patients  
195 (42.3%). Moreover, 163 patients (34.0%) received oxygen therapy, while 220 (45.8%)  
196 received intravenous or subcutaneous hydration.

197

198 One hundred and thirty-four residents (27.9%) were home hospitalized (Supplementary Table  
199 A1). The reasons for home hospitalization were to offer hydroxychloroquine treatment  
200 (79.9%), perfusion for hydration (11.2%) and end-of-life care (6.0%), provided by an external  
201 team of specialists in the 15 participating NH.

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

207 Ninety-six residents (20%) died over the study period: 42 in hospital and 54 in NH; 57  
208 (11.9%) received end-of-life care. Median time from symptom onset to death was 12.0 days  
209 (IQR 8.0-24.3). Death was attributed to COVID-19 in most cases (90.5%).

210

### 211 ***Factors associated with hospitalization and death***

212 Sixteen factors were associated with an increased risk of COVID-19-related hospitalization in  
213 the univariate analysis (Table 2 and supplementary Table A2). In multivariable and competing  
214 risk analyses, male gender (sHR 1.63, 95% CI 1.12-2.35;  $p=0.010$ ), diabetes (sHR 1.69, 95%  
215 CI 1.15-2.50;  $p=0.008$ ), an altered level of consciousness (sHR 2.36, 95% CI 1.40-3.98;  
216  $p=0.001$ ), and dyspnea (sHR 1.69, 95% CI 1.09-2.62;  $p=0.018$ ) all remained associated with  
217 an increased risk of hospitalization (Figure 1).

218 Twenty-two factors were associated with increased risk of mortality in univariate analysis  
219 (Table 3 and see Supplementary Table A3). In the multivariable model, male gender (OR  
220 6.63, 95% CI 1.04-42.39;  $p=0.001$ ), thermal dysregulation (OR 2.64, 95% CI 1.60-4.38;  
221  $p=0.0001$ ), falls (2.21 95% CI 1.02-4.75;  $p=0.043$ ), and being aged >85 years old (OR 2.36  
222 95% CI 1.32-4.24;  $p=0.004$ ) were all independently associated with an increased risk of  
223 mortality. Conversely, polymedication (OR 0.46, 95% CI 0.27-0.77) and preventive  
224 anticoagulation (OR 0.46, 95% CI 0.27-0.79) were protective prognostic factors (Figure 1).

225

226

## 227 **DISCUSSION**

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

235

236 In the literature, the number of deaths linked to COVID-19 in NH is unclear. In France, as of  
237 1 June 2020, the mortality among NH residents with diagnosed COVID-19 was 27.4%.<sup>19</sup>  
238 Sacco et al.<sup>14</sup> also found a 27% COVID-19 mortality diagnosed residents in their study of a  
239 middle-sized nursing home in Maine-et-Loire, in the west of France. In the USA, McMichael  
240 et al. found a mortality percentage of 33.7% in 101 residents in an NH in Washington,<sup>10</sup> while  
241 more recently, Tang et al.<sup>11</sup> reported 20.6% COVID-19 mortality - which is closer to that in  
242 our study- in 1970 residents in an NH in Maryland. With regard to hospitalization, 26.6% of  
243 our study sample were admitted to hospital. In the literature, this percentage varies between  
244 16 and 54.5%.<sup>10,11,14,20</sup>

245

246 To our knowledge, our cohort is the oldest (in terms of patients' age) described in the  
247 literature.<sup>7,8,11,21,22</sup> Unsurprisingly, all studies have shown that older patients have a poorer  
248 COVID-19 prognosis.<sup>1,8,23,24-27</sup> Furthermore, the present study is one of the first to investigate  
249 prognostic factors associated with the risk of hospitalization and death in NH residents.  
250 Unlike other French and international studies<sup>10,14</sup>, we did not consider staff members' or  
251 visitors' infectious status.



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

265

266 Most patients in our study sample were symptomatic, which reflects findings in the literature.  
267 <sup>8,21</sup> Having said that, some studies have reported a substantial proportion of asymptomatic  
268 patients.<sup>11,33</sup> We may have overestimated the proportion of symptomatic patients because we  
269 took into account symptomatic residents who tested negative for a RT-PCR test after being in  
270 contact with a confirmed COVID-19 case. Furthermore, the fact that France conducted  
271 systematic screening campaigns in NH, limited the number of asymptomatic people not  
272 screened. The most common COVID-19 symptoms in our study sample were thermal  
273 dysregulation and asthenia, followed by respiratory symptoms. These symptoms are  
274 consistent with previously reports. Anorexia, a common digestive symptom of many illnesses  
275 in older patients<sup>34</sup>, was present in 21% of residents in our study. ENT symptoms were present  
276 in less than 10% of the residents, which reflects findings in the literature that anosmia and

277 ageusia are more frequently found in young patients.<sup>5,35</sup> Atypical presentation in older adults  
278 may include gastrointestinal symptoms and geriatric syndromes complicating the diagnostic  
279 pathway. Surprisingly, delirium was less frequent in our study than in previous studies on NH  
280 adults<sup>7,36</sup>, perhaps due to the fact that 84.6% of our study sample were diagnosed with  
281 neurocognitive disorders and consequently, it may have been difficult to accurately attribute  
282 symptoms to delirium or to underlying dementia.

283

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

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

297

298 Our study has limitations. First, despite its multicenter design, it only included residents in the  
299 greater metropolitan area of one city - Marseille - and only from 15 out of 20 nursing homes  
300 which agreed to participate (as the other five had no suspected or confirmed COVID-19 case).  
301 Although relatively large, the size of the cohort might have prevented some specific clinical

302 symptoms from being highlighted and limited the identification of all prognostic factors.  
303 Furthermore, because of its retrospective design, the study had missing data. The missing data  
304 were primarily laboratory data, limiting the study's ability to draw conclusions about  
305 laboratory-base predictors of outcomes. We selected only variables which were most relevant,  
306 and which had few missing data for the multivariable analysis. In addition, only hospitalized  
307 patients had chest CT scans. With regard to the investigation of risk factors of hospitalization,  
308 we included only residents hospitalized from 21 March 2020 onwards (i.e., three weeks after  
309 the study start date), as this was the date that French Public Health Authorities facilitated  
310 hospitalization for NH residents throughout the country. Before this date, the advice given  
311 was to provide residents with care in their NH (NH-staff based care, and, when possible,  
312 home hospitalization), and to only transfer those with severe and critical forms of COVID-9  
313 to hospital. Home hospitalization in NH continued even after 21 March 2020.  
314 Finally, it is important to underline that our results reflect the specific French healthcare and  
315 NH context regarding COVID-19 management, and cannot be extrapolated to other countries.

316

### 317 **Conclusions and Implications**

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

326 While dyspnea is a precursor to hospitalization, in NH residents, the risk of COVID-19-  
327 related mortality was linked to demographic data and the occurrence of falls, and these factors

328 should be considered when caring for COVID-19-diagnosed NH residents in order to improve  
329 prognosis.

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479 **Appendix 1**

480 **Table A1:** Characteristics of the 134 residents who benefited from ‘home hospitalization’

481 **Appendix 2**

482 **Table A2:** Variables not associated with an increased risk of hospitalization: univariate analysis of the  
483 123/463 persons hospitalized

484 **Appendix 3**

485 **Table A3:** Variables not associated with an increased risk of hospitalization: univariate analysis of the  
486 96/480 persons who died

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492 **Figure 1:** Multivariable analysis of hospitalizations with competing risk (463 residents) and deaths  
493 (480 residents)

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496 **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
<b>Age (years)</b>	88 (80-93)	[65-105]	-	<b>Symptoms</b>	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	-
<b>Gender</b>				Asthenia	230	47.9	-
Male	150	31.3	-	Anorexia	101	21.0	-
Female	330	68.8	-	Gastrointestinal symptoms	85	17.7	-
<b>Nutrition*</b> Undernutrition	186	38.8	-	Myalgia or arthralgia	14	2.9	-
<b>Status</b> Obesity	43	9.0	-	Headaches	8	1.7	-
<b>Polymedication</b> ≥5 drugs for pre-existing conditions	348	72.5	-	ENT symptoms	40	8.3	-
<b>Vaccinated</b> for Flu	379	79.0	-	Falls	39	8.1	-
Pneumococcus	188	39.2	-	Delirium	59	12.3	-
<b>Comorbidities</b>				Worsening depression	27	5.6	-
Cognitive impairment**	406	84.6	-	Altered level of consciousness	32	6.7	-
Hypertension	257	53.5	-	<b>Positive RT-PCR test result</b>	446	92.9	-
Dyslipidemia	31	6.5	-	<b>Laboratory findings</b>	339	70.6	-
Type 2 diabetes	86	17.9	-	Red blood cells (G/L) <sup>1</sup>	4 (4-5)	[2-6]	164
Cerebrovascular disease	95	19.8	-	White blood cells (G/L) <sup>2</sup>	6 (4-7)	[2-20]	162
Coronaropathy	70	14.6	-	Neutrophils (G/L) <sup>3</sup>	4 (3-5)	[1-21]	165
Congestive heart failure	71	14.8	1	<b>Neutropenia****</b>	23	6.8	165
Atrial fibrillation	91	19.0	-	Lymphocytes (G/L) <sup>4</sup>	1 (1-2)	[0-7]	164
Asthma	11	2.3	-	<b>Lymphopenia****</b>	109	32.2	164
Chronic obstructive pulmonary disease	51	10.6	-	<b>Thrombocytopenia****</b>	40	11.8	443
Chronic respiratory insufficiency	16	3.3	-	AST (UI/L) <sup>6</sup>	25 (20-36)	[11-147]	344
Depression	216	45.0	-	ALT (UI/L) <sup>7</sup>	14 (10-21)	[5-68]	344
Psychiatric disorders	51	10.6	-	AP (UI/L) <sup>8</sup>	76 (66-86)	[35-338]	410
Chronic kidney disease	69	14.4	-	GGT (UI/L) <sup>9</sup>	27 (15-39)	[6-313]	353
Cancer history	31	6.5	-	Bilirubin (µmol/L) <sup>10</sup>	6 (4-8)	[2-20]	413
<b>Iso-resource groups</b>			3	Creatinine (µmol/L) <sup>11</sup>	77 (64-107)	[64-107]	175
1	102	21.3		GFR (ml/min) <sup>12</sup>	41.1 (29.8-57.5)	[5.2-174.4]	178
2	228	47.5		Potassium (mmol/L) <sup>14</sup>	4 (4-4)	[2-7]	166
3	78	16.3		Sodium (mmol/L) <sup>13</sup>	140 (138-143)	[125-173]	168
4	61	12.7		D dimer (µg/L) <sup>15</sup>	911 (680-1476)	[215-32463]	381
5 and 6	8	1.7		CPK (UI/L) <sup>16</sup>	74 (42.3-225.3)	[13-4036]	398
<b>Hospitalization***</b>							
In COVID-19 unit	123	26.6	-				
<b>Home hospitalization</b>	134	27.9	-				
<b>End-of-life care</b>	57	11.9	-				
<b>Death</b>							
In COVID-19 unit	42	8.5	-				



In nursing home	54	11.3	CRP (mg/L) <sup>5</sup>	26 (7-67)	[0-350]	169
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<sup>1</sup> (normal range: 4.4-5.7), <sup>2</sup> (normal range: 3.9-10.9), <sup>3</sup> (normal range: 1.7-7.1), <sup>4</sup> (normal range: 1.1-3.2), <sup>5</sup> (normal range: 0-10), <sup>6</sup> (normal range: 0-50), <sup>7</sup> (normal range: 0-50), <sup>8</sup> (normal range: 35-130), <sup>9</sup> (normal range: 0-60), <sup>10</sup> (normal range: 0-21), <sup>11</sup> (normal range: 60-104), <sup>12</sup> (normal range: >60), <sup>13</sup> (normal range: 136-145), <sup>14</sup> (normal range : 3.4-4.5), <sup>15</sup> (normal range: 0-500), <sup>16</sup> (normal range: 10-200)

N = number, IQR = interquartile range

- = 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) test or the presence of cognitive impairment symptoms (wandering, hallucination, hostility/aggressiveness or cognitive disorder history)

\*\*\*of the 463 residents still alive on 21 March, 2020 (17 patients died between 1 March and 21 March 2020)

\*\*\*\* Neutropenia was defined as a neutrophil level <1.5 G/L; lymphopenia was defined as a lymphocyte level <1.0 G/L, and

thrombocytopenia was defined as a platelet level < 150 G/L

ENT = ear, nose and throat; CRP = C-reactive protein; AST = aspartate aminotransferase; ALT = alanine aminotransferase; AP = alkaline phosphatase; GGT = gamma glutamyl transferase; GFR = glomerular filtration rate; CPK = creatine phosphokinase; RT-PCR = reverse transcriptase-polymerase chain reaction

547 **Table 2.** Variables associated with an increased risk of hospitalization: univariate analysis of 123  
 548 hospitalizations in 463 residents  
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Variables	Total N=463 (%)	Not hospitalized N=340 (%)	Hospitalized N=123 (%)	sHR	CI 95%	p
Gender (male)	318 (68.7)	248 (72.9)	70 (56.9)	1.77	[1.25-2.52]	0.001
<b>Comorbidities</b>						
Cognitive impairment*	391 (84.4)	280 (82.4)	111 (90.2)	1.81	[1.00-3.29]	0.050
Type 2 diabetes	84 (18.1)	48 (14.1)	36 (29.3)	2.03	[1.39-2.95]	<0.0001
Congestive heart failure	70 (15.1)	42 (12.4)	28 (22.8)	1.88	[1.23-2.87]	0.003
Atrial fibrillation	88 (19.0)	57 (16.8)	31 (25.2)	1.55	[1.03-2.32]	0.034
<b>Symptoms</b>	365 (78.8)	252 (74.1)	113 (91.9)	3.38	[1.77-6.43]	<0.0001
Dyspnea	163 (35.2)	96 (28.2)	67 (54.5)	2.51	[1.77-3.57]	<0.0001
Thermal dysregulation	222 (47.9)	147 (43.2)	75 (61.0)	1.83	[1.28-2.62]	0.001
Gastrointestinal symptoms	82 (17.7)	52 (15.3)	30 (24.4)	1.61	[1.07-2.42]	0.021
Altered level of consciousness	32 (10.9)	12 (3.5)	20 (16.3)	3.34	[2.12-5.26]	<0.0001
<b>Biology</b>						
CRP (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]	<0.0001
High CPK level	21 (4.5)	8 (2.4)	13 (10.6)	1.98	[1.00-3.88]	0.050
AST (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]	<0.0001
<b>Treatment</b>						
Antibiotics (except azithromycin)	329 (71.1)	227 (66.8)	102 (82.9)	2.09	[1.30-3.37]	0.002
Hydration	210 (45.4)	140 (11.8)	70 (56.9)	1.67	[1.17-2.38]	0.004
Oxygen therapy	153 (33.0)	83 (24.4)	70 (56.9)	3.13	[2.20-4.46]	<0.0001
Aerosol	11 (2.4)	5 (1.5)	6 (4.9)	2.03	[1.07-3.83]	0.029
<b>Contraindications</b>	46 (9.9)	27 (7.9)	19 (15.4)	1.81	[1.12-2.92]	0.014

550 sHR = specific hazard ratio  
 551 \*Cognitive impairment was defined as a score < 24 according to the Mini-Mental State Examination (MMSE) test, or the presence of  
 552 cognitive impairment symptoms (wandering, hallucination, hostility/aggressiveness or cognitive disorder history)  
 553 N = number, IQR = interquartile range  
 554 High CPK level was defined as CPK > 200 UI/L  
 555 CRP = C-reactive protein; AST = aspartate aminotransferase; CPK = creatine phosphokinase  
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570 **Table 3.** Variables associated with an increased risk of mortality: univariate analysis of 96 deaths in  
 571 480 residents  
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Variables	Total N=480 (%)	Survived N=384 (%)	Deceased N=96 (%)	OR	CI 95%	p
Age > 85 years	301 (62.7)	228 (59.4)	73 (76.0)	2.17	[1.30-3.62]	0.003
Gender (male)	145 (31.3)	92 (27.1)	53 (43.1)	2.04	[1.33-3.14]	0.001
Polymedication ≥5 drugs for pre- existing comorbidities	348 (72.5)	291(75.8)	57 (59.4)	0.47	[0.29-0.75]	0.001
<b>Comorbidities</b>						
Dyslipidemia	31 (6.5)	19 (4.9)	12 (12.5)	2.74	[1.28-5.87]	0.009
Atrial fibrillation	91 (19.0)	66 (17.2)	25 (26.0)	1.70	[1.00-2.88]	0.049
Psychiatric disorders	51 (10.6)	47 (12.2)	4 (4.2)	0.31	[0.11-0.89]	0.029
Chronic kidney disease	69 (14.4)	48 (12.5)	21 (21.9)	1.96	[1.11-3.47]	0.021
<b>Symptoms</b>	371 (77.3)	280 (72.7)	91 (95.8)	15.89	[3.84-65.68]	<0.0001
Dyspnea	171 (35.6)	110 (28.4)	62 (64.6)	4.60	[2.87-7.9]	<0.0001
Thermal dysregulation	231 (48.1)	167 (43.5)	64 (66.7)	2.6	[1.62-4.16]	<0.0001
Falls	39 (8.1)	26 (6.8)	13 (13.5)	2.16	[1.06-4.38]	0.033
Altered level of consciousness	32 (6.7)	20 (5.2)	12 (12.5)	2.60	[1.22-5.53]	0.013
<b>Biology</b>						
GFR (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]	0.004
CRP (IQR)	26.0 (7.0-67.0)	18 (5.0-53.3)	80 (31.0-150.0)	1.02	[1.01-1.02]	<0.0001
High CPK level	22 (26.8)	8 (14.8)	14 (50.0)	5.75	[2.00-16.51]	0.001
AST (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]	0.002
<b>Treatment</b>						
Azithromycin	375 (78.1)	308 (80.2)	67 (69.8)	0.57	[0.35-0.94]	0.028
Hydration	220 (45.8)	154 (40.1)	66 (68.8)	3.29	[2.04-5.30]	<0.0001
Preventive anticoagulation	203 (42.3)	175 (45.6)	28 (29.2)	0.49	[0.30-0.80]	0.004
Oxygen therapy	163 (34.0)	94 (24.5)	69 (71.9)	7.88	[4.77-13.03]	<0.0001
<b>Hospitalization</b>	128 (26.7)	84 (21.9)	44 (45.8)	3.02	[1.89-4.83]	<0.0001

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574 OR = odds ratio

575 N = number, IQR = interquartile range

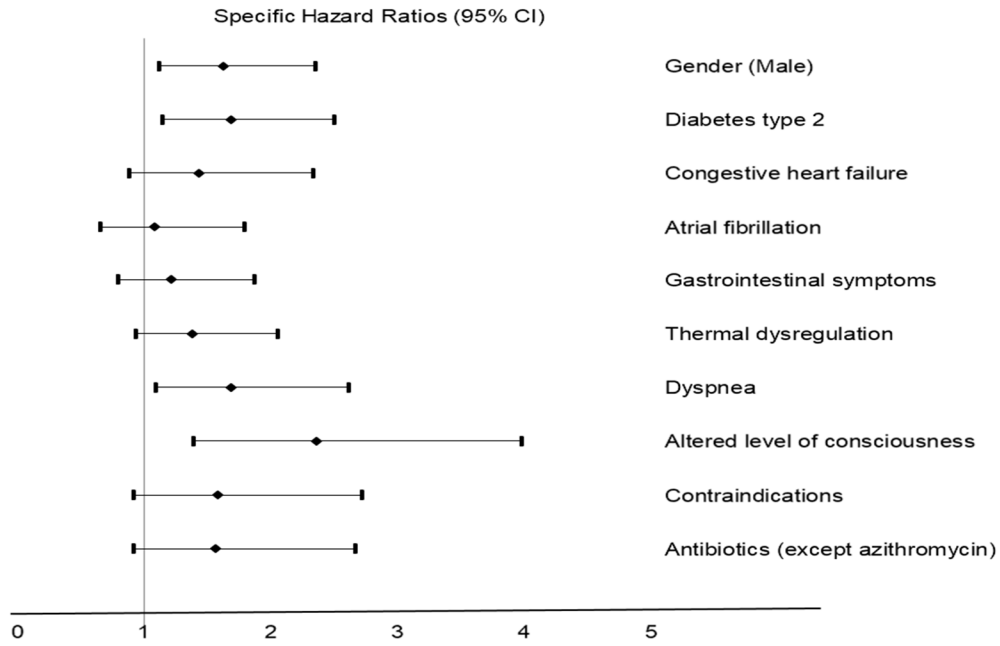
576 High CPK level was defined as CPK > 200 UI/

577 CRP = C-reactive protein; AST = aspartate aminotransferase; GFR = glomerular filtration rate

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**Multivariate analysis of factors associated with time to hospitalization with death as competitive risk**



**Multivariate analysis of factors associated with death**

