



## ORIGINAL RESEARCH

# Comorbidities and vaccination status of 85 deceased patients with coronavirus disease 2019 in a Military Hospital in Greece

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### Abstract:

**Background:** The Covid-19 infection is an infectious disease that has plagued health care systems for over the past three years. Mortality from Covid-19 is reported to be associated with the presence of underlying diseases and older age. On the other hand, Covid-19 vaccines have been found to be effective in preventing severe disease. The aim of this study is to describe and assess the vaccination status and the comorbidities of patients who died, as a direct consequence of Covid-19 infection.

**Methods:** This is an observational retrospective study of adult patients admitted to a 26 bed internal medicine department and a 3 bed ICU of a military hospital of Athens from 26th of March 2020 to 31st of July 2022. The sample consisted of 52 unvaccinated patients (61.2%), 16 (18.8%) non-booster patients and 17 fully vaccinated patients (20.0%).

**Results:** The most common comorbidities were cardiovascular diseases (67.1%) and diabetes mellitus Type 2 (22.4%), followed by renal failure (15.3%), cancer (15.3%) and dementia (14.1%). 81.2% of patients who died, had at least one chronic underlying condition and 11.8% had more than 3 chronic medical problems.

**Conclusions:** Male patients, older patients and patients with comorbidities are at a greater risk of losing the battle against Covid-19. Cardiovascular disease was the most frequent comorbidity of deceased patients due to Covid-19. Vaccination against Covid-19 has been proven efficient and able to prevent mortality in patients with chronic medical conditions.

**Keywords:** SARS-CoV-2, COVID-19, mortality, vaccination, Greece

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## 1 | INTRODUCTION

Coronaviruses are a group of RNA viruses responsible for respiratory infections, mainly in humans, causing a variety of respiratory symptoms. During the last two decades, two highly pathogenic human coronaviruses have been reported, the Severe Acute Respiratory Syndrome Coronavirus (SARS-Cov) and the Middle East Respiratory Syndrome Coronavirus (MERS-Cov).<sup>1</sup> In January 9 2020, the strain of coronavirus (2019-nCoV) was isolated by the health authorities of China. The novel coronavirus emerged in the city of Wuhan, Hubei Province, China, where a flurry of pneumonia cases appeared.<sup>2</sup>

The Covid-19 infection is an infectious disease that has plagued health care systems for over the past two years. All scientific organizations were extensively preoccupied with the therapeutic and diagnostic course of the infection, due to the imperative need to entrench the pandemic. Undeniably, the extent in which the global population was infected or sickened by Covid-19, is beyond all reason. Numerous control measures such as social distancing, use of face masks and lockdowns have been used to slow down the progress of the pandemic.

On 6th August 2022 the global cumulative incidence reached 580.940.852 reported cases and 6.423.296 deaths due to Covid-19. Until 19th February 2023, the numbers have climbed to approximately 674.011.274 confirmed cases, 6.862.893 deaths and 13.307.915.519 total vaccine doses administered according to Johns Hopkins University and Medicine.<sup>3</sup> In Greece until 31st July 2022, there were 4.474.616 confirmed Covid-19 cases,<sup>4</sup> 31.377 deaths and 21.253.028 total vaccine doses administered.<sup>5</sup>

Although most patients had mild to moderate illness, a minority of them are at a higher risk of more serious complications, including death. Mortality from Covid-19 is reported to be associated with the presence of underlying diseases (hypertension, DM, obesity, COPD) and older age.<sup>6</sup> On the other hand, Covid-19 vaccines, that have been developed in record time, have been found to be effective in preventing severe disease. The aim of this study is to describe and assess the vaccination status and the comorbidities of patients who died, as a direct consequence of Covid-19 infection. Such information will allow us to have a better understanding of the disease and support policy decisions.

## 2 | METHODOLOGY

This is an observational retrospective study of adult patients admitted to a 26 bed internal medicine department and a 3 bed ICU of a military hospital of Athens. The study period started on the 26th of March 2020, date of admission of the first hospitalized positive case, to 31st of July 2022.

### *Patient population:*

All consecutive patients admitted to the unit were screened for eligibility. The study included all adult patients (18 years old or older). The study population was divided into three groups according to their vaccination status: fully vaccinated patients, vaccinated patients without a booster dose (nonbooster group) and unvaccinated patients. Fully vaccinated patients were considered participants that received one dose (Johnson) or two doses (Moderna, Pfizer, Astra) 14 days to 6 months prior to their admission or received the booster dose 14 days or more prior to their admission to the hospital. The non-booster group consisted of patients that had received only one dose (Johnson) or two doses (Moderna, Pfizer) more than 6 months prior to their admission or their booster dose was less than 14 days prior to their admission, so there was not enough time allowed for antibodies to build effectively. Unvaccinated patients were patients that either received no vaccine or had only one dose, of the two doses vaccines.

### *Statistical Analysis:*

Statistical analysis was performed using programs available in the SPSS statistical package (SPSS 20.0, Chicago, USA). All data were coded, validated and analyzed. The results were presented as frequencies in percentages (%), mean and median. The created sub-groups for the analysis of the data were according to vaccination status (fully vaccinated patients, non-booster patients, unvaccinated patients). Any value of P below 0.05 was considered statistically significant.

## 3 | RESULTS

### *Patient Characteristics:*

The study flowchart is depicted in Figure 1. Of the 85 deceased patients enrolled, 58 (68.2%) were male and 27 (31.8%) were female. Male to female ratio is 2.1 (p: 0.209). The average age was 85 years old (maximum 97 years, minimum 38 years).

Figure 2 shows the number of deaths chronologically in our hospital. Figure 3 shows the monthly number of deaths in Greece. During the first months of the Covid-19 pandemic there were very few deaths in Greece, and none in our hospital due to the strict lockdown. As expected, most deaths are registered during the winter months, when morbidity was at the highest level. The death rate in our hospital is generally consistent and comparable with the situation of the whole country.

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Table 1 shows the age and gender distribution of study participants.

**Table 1. Age and gender distribution of study participants**

		Gender				Total
		Male		Female		
		N	%	N	%	N
Age (years)	38-59	6	10.3	2	7.4	8
	60-74	10	17.2	2	7.4	12
	75-89	33	56.9	17	63	50
	>90	9	15.5	6	22.2	15
Total		58	100	27	100	85

The average hospital stay was 15 days (maximum 58 days and minimum 1 day). Table 2 shows where the patients were treated (hospital bed or ICU bed).

**Table 2. Bed type**

BED TYPE	Number of deceased patients
Hospital Bed	55
ICU Bed	30
Total	85

Sample comorbidities and underlying conditions are shown in Table 3. The most common were cardiovascular diseases (67.1%) and diabetes mellitus Type 2 (22.4%), followed by renal failure (15.3%), cancer (15.3%) and dementia (14.1%).

**Table 3. Comorbidities and underlying conditions**

Underlying Conditions	Frequency	Percent %
Cardiovascular disease*	57	67.1
Diabetes Mellitus Type 2**	19	22.4
Renal Failure	13	15.3
Cancer	13	15.3
Dementia	12	14.1
COPD ***	7	8.2
Obesity ****	6	7.1
Rheumatoid Arthritis	5	5.9
None	8	9.4

\* CVD includes Heart Failure, Hypertensive heart disease, Coronary artery disease, Abnormal heart rhythms, Pericarditis, Valvular disease.

\*\* Means HbA1c ≥ 7%

\*\*\* COPD:Chronic Obstructive Pulmonary Disease

\*\*\*\* Obesity is defined as BMI ≥ 30 kg/m<sup>2</sup> based on the international guidelines

The number of the sample's comorbidities and underlying conditions associated to gender are shown in Table 4 and associated to age are shown in Table 5. Overall, 81.2% of patients who died, had at least one chronic underlying condition and 11.8% had more than 3 chronic medical problems. Patients with comorbidities to patients without comorbidities ratio is 4.3 (p: 0.068).

**Table 4. Comorbidities and underlying conditions associated to gender**

			Comorbidities and underlying conditions				Total
			0	1	2	≥3	
Gender	MALE	Count	14	18	22	4	58
		% within Gender	24.1	31.0	37.9	6.8	100.0
	FEMALE	Count	2	8	11	6	27
		% within Gender	7.4	29.6	40.7	22.2	100.0
Total		Count	16	26	33	10	85
		% within Gender	18.8	30.6	38.8	11.8	100.0

**Table 5. Comorbidities and underlying conditions associated to age**

		Comorbidities and underlying conditions					
		None		1 or more		Total	
		N	%	N	%	N	%
Age (years)	38-59	3	3.5	5	5.9	8	9.4
	60-74	4	4.7	8	9.4	12	14.1
	75-89	7	8.2	43	50.5	50	58.8
	>90	2	2.3	13	15.2	15	17.6
Total		16	18.8	69	81.2	85	100

**Vaccination Status:**

The sample's vaccination status for Covid-19 is shown in Table 6. The sample consisted of 52 unvaccinated patients (61.2%), 16 (18.8%) non-booster patients and 17 fully vaccinated patients (20.0%).

**Table 6. Vaccination coverage**

VACCINATION COVERAGE		Frequency	%
	Vaccinated patients	17	20
	Non-booster patients	16	18,8
	Unvaccinated patients	52	61,2
	Total	85	100

Table 7 shows the vaccination status of patients according to their gender. It is important to take into account that the vaccine was not available for the public before March 2021. Moreover, the distribution of the vaccine was scheduled in three phases, and Covid-19 vaccine prioritization was based on age and high risk medical conditions. This explains the high proportion of unvaccinated patients, especially on the onset of the study.

**Table 7. Vaccination Status associated to gender**

			Vaccination Status			
			Vaccinated patients	Non-booster patients	Unvaccinated patients	Total
Sex	Male	Count	14	10	34	58
		% Male Sex	24.1	17.2	58.6	68.2
	Female	Count	3	6	18	27
		% Female Sex	11.1	22.2	66.7	31.7
Total		Count	17	16	52	85
		% Both of two sexes	20.0	18.8	61.2	100

Table 8 shows the vaccination status of patients according to their age. Apart from one, all patients up to 74 years old were unvaccinated (95%).

**Table 8. Vaccination Status associated to age**

			Vaccination Status			
			Vaccinated patients	Non-booster patients	Unvaccinated patients	Total
Age (years)	38-59	Count	0	0	8	8
		% within Age	0.0	0.0	100.0	100.0
	60-74	Count	1	0	11	12
		% within Age	8.3	0.0	91.7	100.0
	75-89	Count	13	12	25	50
		% within Age	26.0	24.0	50.0	100.0
	>90	Count	3	4	8	15
		% within Age	20.0	26.7	53.3	100.0
Total		Count	17	16	52	85
		% within Age	20.0	18.8	61.2	100.0

Table 9 shows the vaccination status of patients associated to their comorbidities and underlying conditions. The majority of deceased patients without any comorbidities (87.5%) chose not to be vaccinated, whereas the percentage of unvaccinated patients with one or more comorbidities was 55%.

**Table 9. Vaccination Status associated to Comorbidities**

		Vaccination Status			
		Vaccinated patients	Non-booster patients	Unvaccinated patients	Total
Comorbidities and underlying conditions	None	1	1	14	16
	1 or more	16	15	38	69
Total	Count	17	16	52	85
	% of Total	20.0	18.8	61.2	100

**4 | DISCUSSION**

Male sex may be more susceptible to Covid-19 as 68.2% of the deceased patients were male. This finding is in accordance with the findings of a study in China,<sup>7</sup> that analyzed the data of 113 deceased patients due to Covid-19 and showed that male sex was predominant in deceased patients (73%) and with a study in India<sup>8</sup> that analyzed 310 Covid-19 positive deaths (55.5% of the deceased patients were male). Furthermore, female deceased patients in our study seem to suffer from more chronic medical conditions. The percent of male participants that did not have any comorbidities was 24.1%, whereas only 7.4% of female participants had none chronic disease.

It is evident that comorbidities affect patients' ability to overcome Covid-19 disease. In other words, it was found in our study, that the majority of the deceased patients had at least one chronic condition (81.8%). As expected these patients with comorbidities were mainly (81%) older patients (≥ 75 years old). The most frequent comorbidity of the deceased patients due to Covid-19, found in our study, was cardiovascular disease; 67.1% of our sample had cardiovascular disease as an underline condition. This finding is in line with the results of Chen et al.<sup>7</sup> (48% of the study participants suffered from a heart condition) and Kompaniyets et al.<sup>9</sup> (Hypertension and disorders of lipid metabolism were the most frequent underlying conditions). On the contrary, a study in India<sup>8</sup> showed that diabetes was the most common comorbidity (17.1% of the deaths) and cardiovascular disease was only in 8.7% of the cases.

On the other hand, an Israeli study<sup>10</sup> showed that ischemic heart disease and chronic heart failure might not be confounding variables that had significant association with death due to Covid-19. The study of Kompaniyets et al.<sup>9</sup> also showed that risks are higher for patients suffering from complicated diabetes, obesity, and anxiety related disorders and less for patients with cardiovascular disease.

The study of Arbel et al.,<sup>10</sup> also showed that fully vaccinated participants (booster dose 5 months after the second dose) had 90% lower mortality due to Covid-19, than participants without booster dose. In an analysis of deaths due to Covid-19 by vaccination status in England,<sup>11</sup> it is shown that the percentage of deaths due to Covid-19 drops dramatically 21 days or more after the second vaccination. Unvaccinated patients and patients within 21 days of the first dose are 60,9% of total deaths due to Covid-19. In accordance with the previous findings, in our study only 20% of the deceased patients were fully vaccinated. (The percentage of vaccinated men was 24.1% while the percentage of vaccinated women was only 11.1%).The efficiency of vaccines is also shown in a study that examined deaths due to Covid-19, lockdowns, vaccinations and weather temperatures in Greece.<sup>12</sup> In the

present study only one vaccinated patient died under the age of 75. This patient however, had two underlying conditions (Cardiovascular disease and obesity).

In our study it is shown that older people are in higher risk as there were no deaths in ages younger than 38 years old, 20 participants were 38 - 74 years old (24 % of the sample) and 65 participants (76% of the sample) aged over 75. This finding is in line with the study of Pennington et al.<sup>13</sup> in USA, that used data from the Premier Healthcare Database and concluded that age has a negative impact on COVID-19 clinical severity.

**Limitations:**

There are limitations to the generalizability of the findings of the present study, because of the relatively small sample size. Furthermore more details were needed on the underlying conditions to draw safe conclusions. However it can be used as a starting point to continuous documentation that is needed in evidence based practice, in order to aid clinical decision making and health policy..

**5 | CONCLUSION**

The findings of the present study suggest that male patients, older patients and patients with comorbidities are at a greater risk of losing the battle against Covid-19. Cardiovascular disease in particular, was the most frequent comorbidity of deceased patients due to Covid-19. However, vaccination against Covid-19 has been proven efficient and able to prevent mortality in patients with chronic medical conditions.

**Declaration of non-conflict of interest:** The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

**Availability of data and materials:**

All data analyzed during this study are available from the corresponding author on reasonable request.

**Ethics approval:**

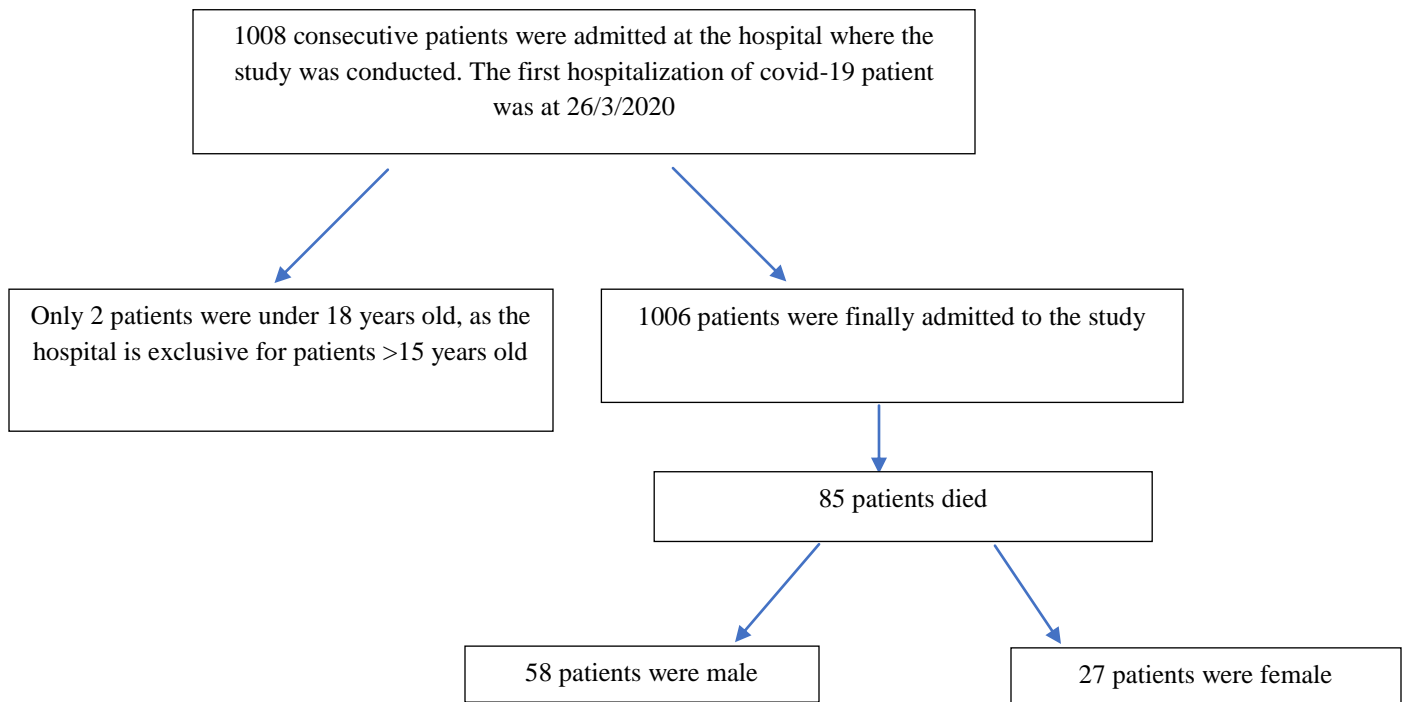
Confidentiality and anonymity were maintained. The protocol was approved by the Ethics Committee of the hospital.

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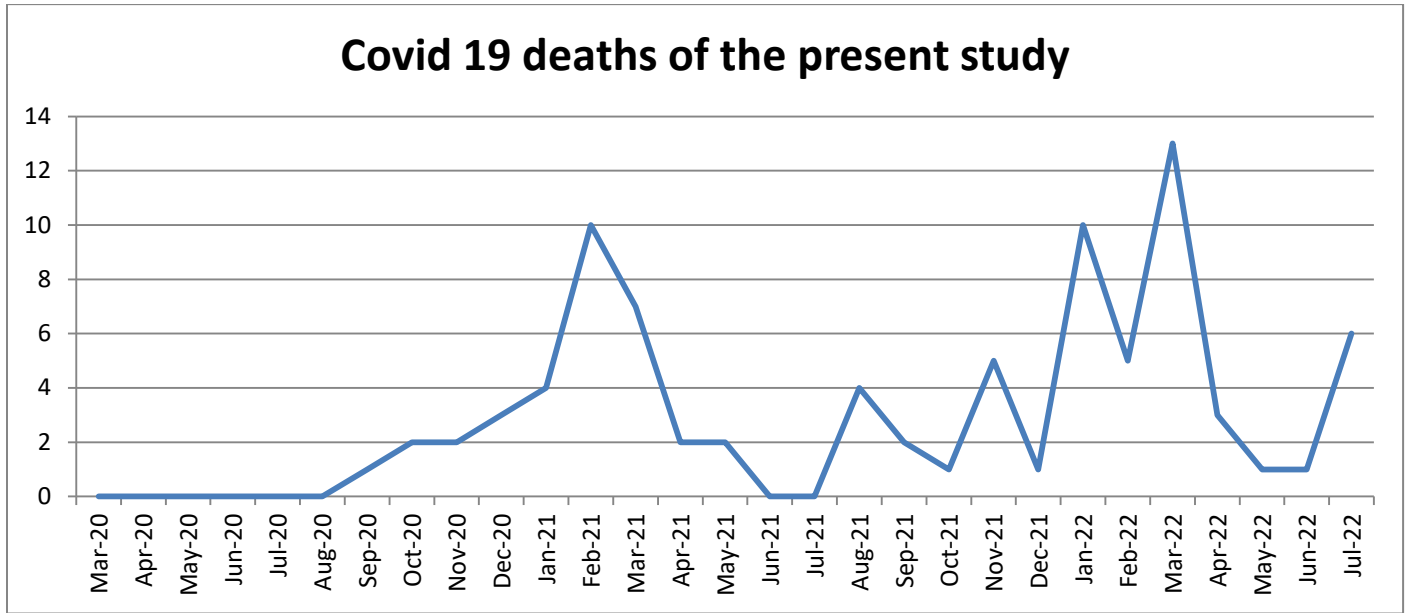
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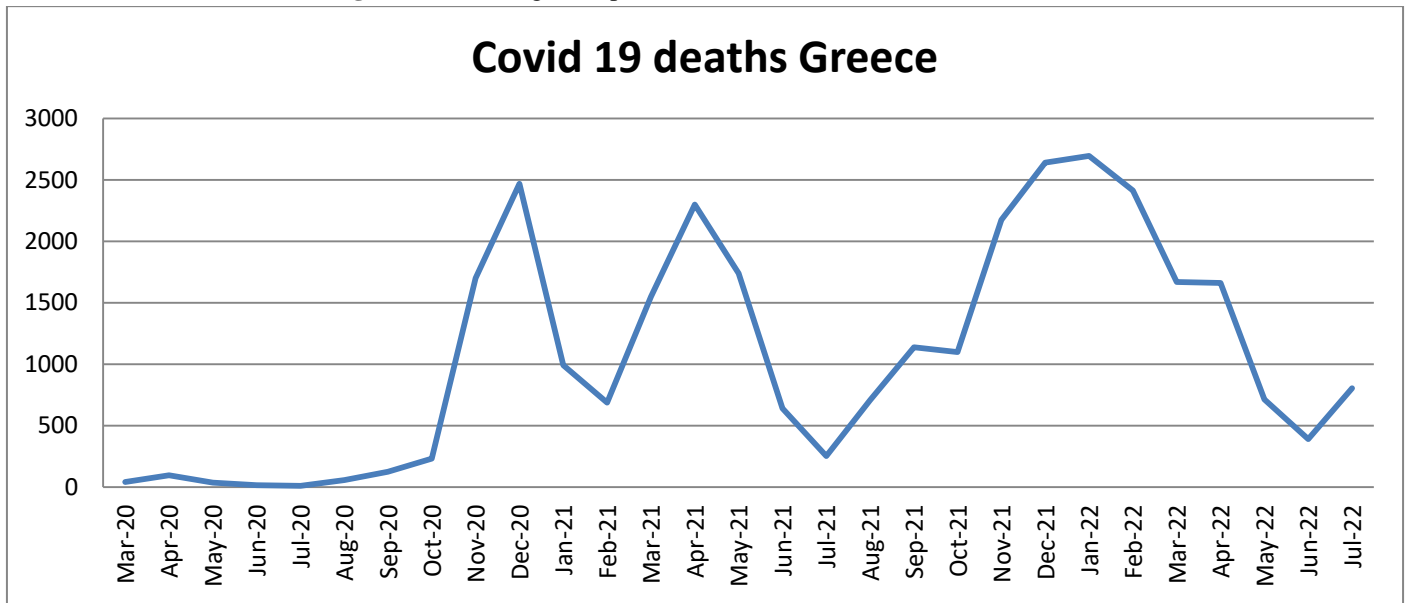
Figure 1. Study flowchart



**Figure 2.**Chronological representation of Deaths included in the present study



**Figure 3.**Chronological representation of Deaths in Greece



Data source: WHO

Download link: <https://covid19.who.int/WHO-COVID-19-global-data.csv>