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Brief communication

Coronavirus disease 2019 in veterans receiving care at veterans health administration facilities

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ABSTRACT

Purpose: Veterans represent a significant proportion of the U.S. population (7%), and the impact of the coronavirus disease 2019 (COVID-19) in this group of vulnerable patients has been largely overlooked. This analysis reports COVID-19 patient demographics, infection, mortality, and case-fatality rates in the veteran population.

Methods: This is a cross-sectional analysis using the Veterans Affairs informatics and computing infrastructure tool to assess the veterans' COVID-19 infections at the Veterans Affairs facilities from March 4th to June 23rd, 2020.

Results: Of the 10,621,580 veterans in this analysis, 59.7% were ≥65 yo, 92.5% were men, 68.7% were white, and 14.2% were black. Veterans ≥65 yo comprised 52.1% of cases and 89.9% of deaths. The relative mortality and case-fatality rates of black veterans, when compared with white veterans, were 2.83 (CI 2.56–3.14; $P < .001$) and 0.75 (CI 0.68–0.82; $P < .001$), respectively. Among the veterans who died from COVID-19, 87.4% had a history of cardiovascular disease, 56.5% had a history of diabetes, and 33.6% were obese.

Conclusions: Elderly veterans (≥65yo) and veterans with a history of cardiovascular disease represent a large proportion of the VA COVID-19 cases and deaths. Black veterans had higher mortality rates but lower case fatality rates when than white veterans.

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Introduction

The first U.S. coronavirus disease 2019 (COVID-19) case was reported in the state of Washington on January 20th, 2020 [1]. Since then, the virus, designated severe acute respiratory syndrome coronavirus 2, quickly spread across all 50 states and U.S. territories. As of June 2020, the United States encompassed a quarter of the world's COVID-19 cases and deaths [2]. Observations of the general population suggest advanced age, minority races, male gender, and having pre-existing medical conditions are associated with higher rates of infection and more severe disease [3,4].

The United States Department of Veterans Affairs (VA) is a federal agency that provides benefits, health care, and cemetery services to veterans who served in the active military, naval, or air service without a dishonorable discharge [5]. The Veterans Health Administration (VHA) is a branch of the VA that implements programs providing health services and is the largest integrated health care system in the United States. There are 170 VA medical centers and 1074 outpatient sites, totaling 1255 VA health care facilities across the United States. Nine million veterans (42% of all U.S. veterans) are enrolled, and over six million veterans receive care through this hospital system each year [6].

Veterans are considered a vulnerable population, which the National Collaborating Center for Determinants of Health defines as "groups and communities at a higher risk of poor health as a result of the barriers they experience to social, economic, political, and environmental resources, as well as limitation due to illness or disability." [7] Veterans are more vulnerable and differ from the general public in several ways. First, veterans are older, with 50.0% of U.S. veterans ≥65 years, in contrast to 18.5% of civilians [8]. Second, veterans are 14.7 times more likely to be of poor health status and 14 times more likely to have ≥5 medical conditions than the general population [9]. Finally, there are also higher rates of

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mental health issues among veterans, such as substance use disorder, post-traumatic stress disorder, traumatic brain injuries, depression, suicide, and homelessness [10]. Moreover, there are also notable differences between veterans who utilize the VA health care system and the veterans who receive care elsewhere. The VA utilizers are more likely to be from a minority group, less educated, unmarried, and have a lower household income, with a higher prevalence of chronic medical conditions [11–13].

The veterans susceptible to physical, mental, and social issues are at a high risk of COVID-19 infection. The objective of this publication is to report COVID-19 patient demographics, the infection, mortality, and case-fatality rates within the U.S. veteran population that received care at VA facilities.

Methods

The electronic health records of each veteran encounter at VA facilities nationwide are uploaded nightly to one centralized database called the Corporate Data Warehouse (CDW). The CDW was created in 2006 and has stored over 20 years of patient information [14]. The National Surveillance Tool tracks COVID-19 cases across the country and feeds the data into the VA COVID-19 Shared Data Resource domain that was created to follow COVID-19 infections in the VHA facilities. The domain then collects specific veteran data points from the CDW database that houses the electronic health records of veteran encounters. The VA data are accessible for researchers through the VA informatics and computing infrastructure server that ensures veterans' privacy and data security (accessed: June 23rd, 2020) [15].

This study was approved by the University of Utah and local VA Institutional Review Boards (#00133238). The overall veteran demographics were derived from all VHA encounters for the last ten years. VHA patients with laboratory-confirmed or presumptive COVID-19 infection between March 4th and June 23rd, 2020, were included in this cross-sectional analysis. International Classification of Diseases, 10th edition (ICD-10) procedural code U07.1 and U07.2 identified patients with COVID-19 infections. The appropriate second codes for associated comorbidities were used to identify COVID-19 patients with comorbidities. Deidentified aggregate data of eligible patient demographic details were extracted (age, gender, body mass index, race, and presence of comorbidities).

Univariable binary Poisson regression with robust standard errors was used to perform comparisons of unadjusted infection, mortality, and case-fatality rates [16]. A multivariable regression was not possible with aggregate data. The infection rate (%) is calculated by dividing the number of individuals diagnosed with COVID-19 by the population at risk (i.e., incidence of infection) and then multiplying by 100. The mortality rate (per 100,000) is calculated by dividing the number of deaths by the population at risk (i.e., incidence of death) and then multiplying by 100,000. The

Table 1
Patient demographics

Patient variables	VA patient cohort (n = 10,621,580)	COVID-19 infection (n = 14,259)		Deaths due to COVID-19 infection (x = 1703)		
	N (% of N)	Total cases n (% of n)	Infection rate* % (95% CI)	Total death x (% of x)	Mortality rate per 100,000 patients† (95% CI)	Case fatality rate‡ % (95% CI)
Age						
18-29	305,838 (2.9)	293 (2.1)	0.10 (0.09–0.11)	0 (0)	0.0 (0.0–1.2)	0 (0–0)
30-39	1,028,072 (9.7)	1245 (8.7)	0.12 (0.11–0.13)	2 (0.1)	0.20 (0.0–0.7)	0.2 (0.0–0.6)
40-49	890,016 (8.4)	1235 (8.7)	0.14 (0.13–0.15)	9 (0.4)	1.0 (0.5–1.9)	0.7 (0.3–1.4)
50-64	2,047,694 (19.3)	4053 (28.4)	0.20 (0.19–0.20)	161 (9.5)	7.8 (6.7–9.2)	4.0 (3.4–4.6)
65-74	2,730,411 (25.7)	3969 (27.8)	0.15 (0.14–0.15)	545 (32.0)	20.0 (18.3–21.7)	13.7 (12.7–14.8)
75-85	1,660,328 (15.6)	1981 (13.9)	0.12 (0.11–0.12)	426 (25.0)	25.7 (23.3–28.2)	21.5 (19.7–2.4)
85+	1,958,553 (18.4)	1483 (10.4)	0.08 (0.07–0.08)	560 (32.9)	28.6 (26.3–31.1)	37.8 (35.3–40.3)
Unknown	663 (0.0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0–0)
Gender						
Female	801,095 (7.5)	1299 (9.1)	0.16 (0.15–0.17)	38 (2.2)	4.7 (3.4–6.5)	2.9 (2.1–4.0)
Male	9,819,970 (92.5)	12,959 (90.9)	0.13 (0.13–0.13)	1665 (97.8)	17.0 (16.2–17.8)	12.8 (12.3–13.4)
Unknown	515 (0.0)	1 (0.0)	0.19 (0.01–1.10)	0 (0)	0 (0–0)	0 (0–0)
Race						
White	7,300,959 (68.7)	7244 (50.8)	0.10 (0.10–0.10)	989 (58.1)	13.6 (12.7–14.4)	13.7 (12.9–14.5)
Black or African American	1,512,197 (14.2)	5685 (39.9)	0.38 (0.37–0.39)	580 (34.1)	38.4 (35.3–41.6)	10.2 (9.4–11.0)
Asian	110,180 (1.0)	120 (0.8)	0.11 (0.09–0.13)	9 (0.5)	8.2 (3.8–15.5)	7.5 (3.5–13.8)
NHPI	80,975 (0.8)	107 (0.8)	0.13 (0.11–0.16)	9 (0.5)	11.1 (5.1–21.1)	8.4 (3.9–15.4)
AIAN	74,964 (0.7)	112 (0.8)	0.15 (0.12–0.18)	16 (0.9)	21.4 (12.2–34.7)	14.3 (8.4–22.2)
Other§	1,542,305 (14.5)	991 (7.0)	0.06 (0.06–0.07)	100 (5.9)	6.5 (5.3–7.9)	10.1 (8.3–12.1)
Comorbidities‖						
Cardiovascular disease	5,353,190 (50.4)	9499 (66.6)	0.18 (0.17–0.18)	1489 (87.4)	27.8 (26.4–29.3)	15.7 (16.0–16.4)
Obesity	3,541,221 (33.3)	6344 (44.5)	0.18 (0.17–0.18)	572 (33.6)	16.2 (14.9–17.5)	9.0 (8.3–9.7)
Diabetes	2,703,880 (25.5)	6186 (43.4)	0.23 (0.22–0.23)	963 (56.6)	36.6 (33.4–37.9)	15.6 (14.7–16.5)

Table 1 shows the distributions of VA population, reported infection and death cases, and infection, mortality, and case-fatality rates by age, gender, race, and comorbidities. NHPI = Native Hawaiian or Other Pacific Islander; AIAN = American Indian or Alaska Native.

* The infection rate is calculated by dividing the number of COVID-19 cases by the population at risk between March 4th and June 23rd, 2020, and expressing it as a percentage.

† The mortality rate estimates the risk of dying from COVID-19 and is calculated by dividing the number of deaths by the population at risk between March 4th and June 23rd, 2020 and then multiply by 100,000.

‡ The case fatality rate refers to the proportion, expressed as a percentage, of veterans who died from the COVID-19 among all COVID-19 positive veterans between March 4th and June 23rd, 2020, which a measure of COVID-19 severity.

§ Other includes Hispanic and multirace patients who did not identify themselves as one of the listed race categories or who refused to provide their race.

‖ An individual with multiple underlying medical conditions contributed to the case counts of multiple comorbidities. The cardiovascular disease (CVD) category includes hypertension diagnosis. Obesity was defined as BMI ≥30 kg per m^2.

case fatality rate (%), which is a measure of the severity of disease, is calculated by dividing the number of deaths from the number of individuals diagnosed with COVID-19 and then multiplying by 100.

Results

Patient demographics

Over the last decade, 10,621,508 veterans received care at least once at VA facilities. Among those, 21.0% were aged 18–49 years, 19.3% were aged 50–64 years, and 59.7% were aged ≥65 years. There were 7.5% female and 92.5% male veterans. White and black veterans make up 68.7% and 14.2% of the population, respectively. Among the veterans who sought care in the VHA within the last ten years, 50.4% had a history of cardiovascular disease (CVD), 33.3% were obese, and 25.5% had a history of diabetes (Table 1).

COVID-19 case characteristics

From March 4th to June 23rd, the VHA identified 14,259 COVID-19 cases. The proportion of COVID-19 cases in the age groups 18–49, 50–64, and ≥65 years were 19.5%, 28.4%, and 52.1%, respectively. There were 9.1% of women and 90.8% of men with COVID-19 disease. The distribution of COVID-19 cases by race included 50.8% white and 39.9% black. Among the patients with COVID-19 disease, 66.6% had a history of CVD, 44.5% were obese, and 43.4% had a history of diabetes (Table 1).

COVID-19 infection, mortality, and case fatality rates

The percent of deaths in the age groups 18–49, 50–64, and ≥65 years were 0.5%, 9.5%, and 89.9%, respectively. The COVID-19 infection rates for white and black veterans were 0.10% and 0.38%, respectively; the mortality rates per 100,000 were 13.6 and 38.4, respectively; and the case fatality rates were 13.7% and 10.2%, respectively; The relative infection rate for black veterans was 3.79 times higher than for white veterans; the relative mortality rate was 2.83 times higher, and the relative case fatality rate was 0.75 times that of white veterans. Among all veterans who died from COVID-19, 87.4% had a history of CVD, 33.6% were obese, and 56.5% had a history of diabetes (Tables 1 and 2).

Discussion

Our study is the first to analyze the impact of COVID-19 infections and deaths in veterans who have received care at the VA facilities. In this analysis, the highest proportion of veterans with COVID-19 disease was ≥65 year old (52.1%) (Fig. 1). This is in contrast to the general population (GP), where the highest proportion with COVID-19 disease is seen in persons 18–49 year old (50.0%) [2]. Possible explanations for this finding are (1): individuals ≤49 year old constitute a smaller proportion of the total VHA population (21.0%) than in the GP (39.5%) [2], younger veterans are more likely to be covered by private insurance and obtain care at other health care facilities [13], (3) higher rates of testing in the younger civilian population [2], and (4) the ≤49 age group represents a substantial proportion of the U.S. work force [17], with a limited ability to stay home and more likely to be exposed to the virus. Nevertheless, persons ≥65 years still comprise the majority of COVID-19 deaths in the VHA (89.9%) and the GP (78.6%) (Fig. 1) [2].

Interestingly, the relative mortality rate of black veterans was 2.83 times ($P < .001$) higher, but case fatality was 0.75 times ($P < .001$) that of white veterans (Table 2). One possible explanation could be that the black veteran VA utilizers are younger and healthier than white veteran VA-utilizers because the overall U.S. median age for black veterans is a decade younger than white veterans (55.3 year old vs. 65 year old) [18]. Interestingly, Price-Haywood and her coworkers also reported a similar unadjusted case-fatality ratio (0.72) of black Americans in Louisiana's largest health system [19], which supports our finding. Further analyses are needed to elucidate why black veterans have a higher rate of COVID-19 infections but experience a lower disease severity. It is also worth noting that the relative case fatality rates for Asian (0.55) and NHPI (0.62) are even lower than for black (0.75) veterans than white veterans; this was not statistically significant, likely due to the much smaller sample size (Table 2).

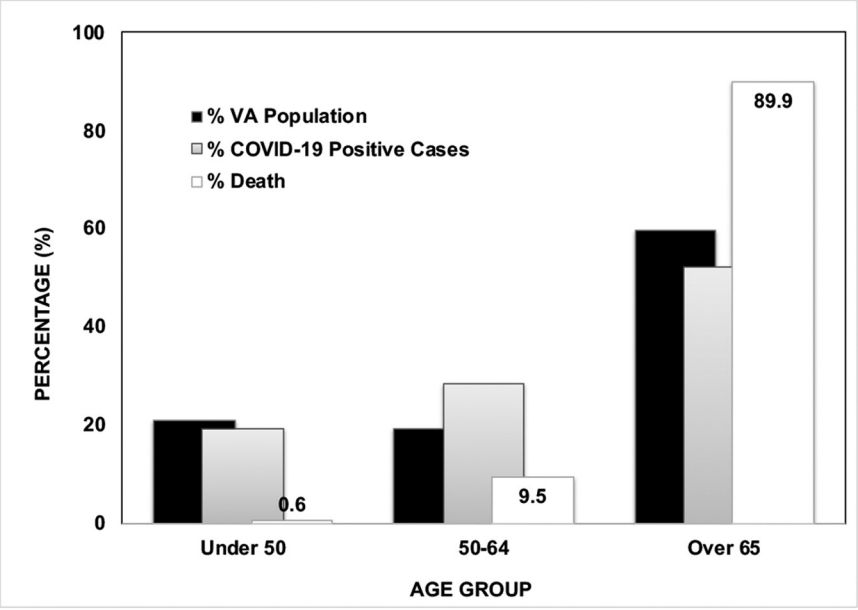

Fig. 1. COVID-19 cases and deaths by age in the VA.

Table 2
COVID-19 infection, mortality, and case-fatality rates by race

Race	Infection		Mortality		Case fatality	
	Relative infection rate[a] (95% CI)	*P*-value	Relative mortality rate[a] (95% CI)	*P*-value	Relative case fatality rate[a] (95% CI)	*P*-value
White	1(Referent)		1(Referent)		1(Referent)	
Black or African American	3.79 (3.66–3.92)	**<.001**	2.83 (2.56–3.14)	**<.001**	0.75 (0.68–0.82)	**<.001**
Asian	1.10 (0.92–1.31)	.31	0.60 (0.31–1.16)	.13	0.55 (0.29–1.03)	.06
NHPI	1.33 (1.10–1.61)	**.003**	0.82 (0.43–1.58)	.56	0.62 (0.33–1.15)	.13
AIAN	1.51 (1.25–1.81)	**<.001**	1.58 (0.96–2.58)	.07	1.05 (0.66–1.65)	.85
Other[b]	0.64 (0.61–0.69)	**<.001**	0.48 (0.39–0.59)	**<.001**	0.73 (0.61–0.90)	**.002**

AIAN = American Indian or Alaska Native; NHPI = Native Hawaiian or other Pacific Islander.
Table 2 shows relative COVID-19 disease infection, case fatality, and mortality rates by race within the VA population.
Bolded values have a significance of <.05.
[a] Relative rate is calculated from univariable binary Poisson regression with robust standard error.
[b] Other includes Hispanic, multirace, and all other patients who did not identify themselves as one of the listed race categories or who refused to provide their race.

Generally, the risk of severe COVID-19 disease is higher in patients with underlying medical conditions [20]. Underlying diseases are prevalent in patients with COVID-19 infections and deaths in both the veteran population and hospitalized patients in the GP. Depending on the study, comorbidities ranged from 8% to 43% for CVD (4, 21–24), 5%–58% for diabetes [4,21,22], and 13%–48% for obesity[4,22]. The presence of pre-existing CVD or the development of acute cardiac injury has been associated with significantly worse outcomes [21,23,24]. CVD was the most common comorbid condition seen in both COVID-19 cases (66.6%) and deaths (87.4%) in our cohort.

Of those who tested positive for the COVID-19 disease, the percent of reported deaths in the veteran population is higher than the GP (11.9% vs. 5.2%), as of June 23, 2020 (2). This disparity may be attributed to veterans being older and having a higher prevalence of comorbidities.

There are several limitations to this study. Because this study is an overall bigger picture of COVID-19 events in the VHA, the COVID-19 infection and deaths of each race were not adjusted for age, race, and comorbidities, which are planned for future analyses. Another limitation is that there are demographic differences between the VA utilizers and non-VA utilizers, and it is uncertain whether the COVID-19 disparities in this study are also seen in non-VA utilizers. Finally, these analyses represent a snapshot view of current COVID-19 events, and the data are changing daily.

CRediT authorship contribution statement

Jessica Luo: Investigation, Writing - original draft, Writing - review & editing. **Sujee Jeyapalina:** Conceptualization, Methodology, Validation, Investigation, Data curation, Writing - review & editing. **Gregory J. Stoddard:** Validation, Formal analysis, Data curation, Writing - review & editing. **Alvin C. Kwok:** Conceptualization, Methodology, Supervision, Writing - review & editing. **Jayant P. Agarwal:** Conceptualization, Methodology, Investigation, Supervision, Project administration, Writing - review & editing.

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