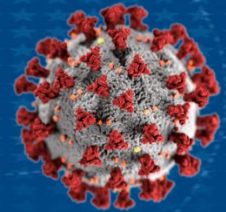


**Fact Sheet Supplement:**  
SARS-CoV-2 Infection in Veterans with Lung Cancer



Cooperative Studies Program Epidemiology Analytics Resource (CSPEAR)  
Cooperative Studies Program  
Office of Research and Development  
Department of Veterans Affairs

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**VA**



**U.S. Department of Veterans Affairs**

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## Contributions

This fact sheet is the result of a joint effort of CSPEAR and VA clinical partners.

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### About CSPEAR

CSPEAR translates VA electronic health record data into brief, scientifically-reliable reports on the health status of Veterans. CSPEAR is a collaborative effort of the Cooperative Studies Program’s national network of Epidemiology Centers.

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## 1 Background

Lung cancer patients may disproportionately suffer severe illness and death from coronavirus disease 2019 (COVID-19), caused by infection with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).<sup>1-3</sup> Susceptibility to more severe outcomes among lung cancer patients may be attributed to suppressed immune systems and chronic pulmonary inflammation.<sup>4</sup> Disease severity in lung cancer patients has been linked with comorbid chronic conditions and smoking status.<sup>2, 4-6</sup> Overall, there appears to be little evidence of an association between lung cancer treatment type and COVID-19 severity, although more research is needed to draw definitive conclusions.<sup>7,8</sup> However, reports show many lung cancer patients and their providers have elected to postpone or discontinue treatment during the pandemic, which may result in health consequences.<sup>2,4</sup>

## 2 Purpose

The purpose of the fact sheet is to provide VA leadership, clinicians, and investigators with crude epidemiologic data on Veterans with lung cancer who tested positive for SARS-CoV-2 infection. To provide context, data are also presented on patients with no lung cancer diagnosis on record who tested positive for SARS-CoV-2 infection.

## 3 Population

The population includes patients meeting the following criteria:

1. Age  $\geq 18$  and  $\leq 110$  years
2. Used Veterans Health Administration (VHA) health care services
3. Have a VA record of a positive test for SARS-CoV-2 infection
4. The first positive SARS-CoV-2 test or the inpatient admit date closest to first positive test in the 15 days prior fell between 03/01/2020 and 03/03/2021
5. Confirmed as Veterans with consistent Veteran statuses across and within the patient records
6. Assigned to 1 of the 8 VA priority groups
7. Records have consistent and complete numeric identifiers
8. Not labeled as a test patient

## 4 Data Source

Data are pulled from multiple domains within the VA Corporate Data Warehouse (CDW). Data on SARS-CoV-2 testing, COVID-19 treatment, comorbidities, and other COVID-19-related information originate from the VA COVID-19 Shared Data Resource, a data domain within CDW.

We use the VA COVID-19 Shared Data Resource definition of index date, i.e., the date in which patients meet the inclusion criteria (the start of follow-up):

- Index date: First positive SARS-CoV-2 test or the inpatient admit date closest to first positive test in the 15 days prior

Only a subset of patients in the population have lung cancer classification data recorded the oncology raw database. Information on these patients is reported in the [Appendix](#).

## 5 Classification of Phenotypes

### *Lung Cancer Diagnosis*

Veteran patients diagnosed with lung cancer are identified using 9th and 10th revisions of International Classification of Diseases (ICD-9 and ICD-10) diagnostic codes. Lung cancer cases include patients with a prior or current primary lung cancer diagnosis, defined as having  $\geq 1$  inpatient diagnosis code or  $\geq 2$  outpatient diagnosis codes in any position recorded since January 1, 2010. ICD codes indicative of lung cancer include:

- **ICD-9:** 162.0, 162.2, 162.3, 162.4, 162.5, 162.8, 162.9, 209.21, 231.2, 235.7
- **ICD-10:** C33.00, C34.00, C34.01, C34.02, C34.10, C34.11, C34.12, C34.2, C34.30, C34.31, C34.32, C34.80, C34.81, C34.82, C34.90, C34.91, C34.92, C7A.090, D02.20, D02.21, D02.22, D38.1

### *SARS-CoV-2 Infection*

SARS-CoV-2-positive patients include those with a positive laboratory test result for SARS-CoV-2 infection, as reported by the VA National Surveillance Tool.<sup>1</sup> These patients were identified through the VA COVID-19 Shared Data Resource.

### *Lung Cancer Classification*

Lung cancer histology reported in the [Appendix](#) is identified via ICD-O-3 codes recorded in the oncology raw data files and categorized into the following categories:

1. Small cell lung cancer
2. Non-small cell lung cancer
  - a. Non-small cell carcinoma, adenocarcinoma
  - b. Non-small cell squamous cell
  - c. Non-small cell large cell
  - d. Non-small cell, other / not otherwise specified (NOS)

The stage (I-IV) of lung cancer is identified via codes recorded in the oncology raw data files.

## 6 Project Approval

This work was conducted under the auspices of CSPEAR's operational access to VA data.

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<sup>1</sup> Adjudication SARS-CoV-2 status is performed by the [VA National Surveillance Tool](#), the authoritative data source for COVID-19 cases within the VHA.

## 7 Results

**Table 1.** Number of Veteran VHA users with a SARS-CoV-2 test on record and those who tested positive, by lung cancer diagnosis

SARS-CoV-2 Testing	Veteran VHA users		
	Total Veteran VHA users n	Lung cancer* n	No lung cancer n
Patients tested for SARS-CoV-2 infection	1,099,995	25,483	1,066,363
SARS-CoV-2-positive patients	209,682	2,857	205,822

\*Given the differences in etiology, patients with a recorded diagnosis of secondary lung cancer are not reported (n=1,003 SARS-CoV-2-positive Veterans with secondary lung cancer).

**Table 2.** Demographics of SARS-CoV-2-positive patients, by lung cancer diagnosis

Characteristic	SARS-CoV-2-positive Veteran patients	
	Lung cancer (n=2,857)	No lung cancer (n=205,822)
Age (years), n (%)		
18-34	<11*	17,384 (8.4%)
35-49	26 (0.9%)	36,373 (17.7%)
50-64	376 (13.2%)	56,600 (27.5%)
65-74	1,387 (48.5%)	56,761 (27.6%)
75-84	798 (27.9%)	26,248 (12.8%)
85+	265 (9.3%)	12,456 (6.1%)
Sex, n (%)		
Female	92 (3.2%)	21,118 (10.3%)
Male	2,765 (96.8%)	184,704 (89.7%)
Primary Race, n (%)		
American Indian/Alaska Native	13 (0.5%)	1,960 (1.0%)
Asian	11 (0.4%)	2,083 (1.0%)
Black or African American	536 (18.8%)	46,046 (22.4%)
Native Hawaiian/Pacific Islander	16 (0.6%)	1,952 (0.9%)
White	2,156 (75.5%)	137,443 (66.8%)
Ethnicity, n (%)		
Hispanic or Latino	118 (4.1%)	20,798 (10.1%)
Not Hispanic or Latino	2,656 (93.0%)	176,749 (85.9%)
Unknown	83 (2.9%)	8,275 (4.0%)
Region, n (%)		
Northeast	1,080 (37.8%)	63,549 (30.9%)
Southeast	965 (33.8%)	68,018 (33.0%)
Pacific	454 (15.9%)	39,789 (19.3%)
Continental	358 (12.5%)	34,461 (16.7%)

\*To protect patient privacy, all counts less than 11 have been reported as '<11'.

**Table 3.** Comorbid conditions among SARS-CoV-2-positive patients, by lung cancer diagnosis

Characteristic*	SARS-CoV-2-positive Veteran patients	
	Lung cancer (n=2,857)	No lung cancer (n=205,822)
CCI in the 2 years prior to index date		
Mean (SD)	5.06 (3.18)	1.66 (2.10)
Median (IQR) [Q1, Q3]	4 (5) [2,7]	1 (2) [0,2]
CCI categories, n(%)		
CCI = 0	119 (4.2%)	83,407 (40.5%)
CCI = 1-2	530 (18.6%)	71,374 (34.7%)
CCI = 3-4	780 (27.3%)	29,561 (14.4%)
CCI >4	1,428 (50.0%)	21,480 (10.4%)
Smoking status in the 2 years prior to index date, n(%)		
Current	536 (18.8%)	23,958 (11.6%)
Former	1,729 (60.5%)	84,937 (41.3%)
Never	475 (16.6%)	78,720 (38.2%)
Unknown	117 (4.1%)	18,207 (8.8%)
Comorbid conditions in the 2 years prior to index date, n(%)		
Asthma	177 (6.2%)	13,761 (6.7%)
Chronic kidney disease	715 (25.0%)	27,263 (13.2%)
Chronic liver disease	157 (5.5%)	6,592 (3.2%)
Chronic obstructive pulmonary disease	1,748 (61.2%)	29,777 (14.5%)
Diabetes (any)	1,276 (44.7%)	69,582 (33.8%)
Heart failure	616 (21.6%)	18,693 (9.1%)
History of prior lower respiratory infection	327 (11.4%)	18,193 (8.8%)
Hypertension	2,261 (79.1%)	119,838 (58.2%)
Ischemic heart disease	1,139 (39.9%)	38,425 (18.7%)
Obesity closest to index date (BMI ≥30 and ≤100)	890 (31.2%)	104,622 (50.8%)

\*Acronyms:

BMI: Body mass index

CCI: Charlson comorbidity index

IQR: Interquartile range

Q1: Quartile 1

Q3: Quartile 3

SD: Standard deviation

**Table 4.** Clinical characteristics of SARS-CoV-2-positive patients, by lung cancer diagnosis

Characteristic*	SARS-CoV-2-positive Veteran patients	
	Lung cancer (n=2,857) n(%)	No lung cancer (n=205,822) n(%)
Treatments in the 60 days post-index date		
ACE inhibitor	507 (17.7%)	28,810 (14.0%)
Anticoagulant	1,290 (45.2%)	43,262 (21.0%)
ARB	303 (10.6%)	19,041 (9.3%)
Azithromycin	420 (14.7%)	16,265 (7.9%)
Corticosteroid	1,116 (39.1%)	40,088 (19.5%)
Hydroxychloroquine	59 (2.1%)	2,160 (1.0%)
Remdesivir	466 (16.3%)	13,365 (6.5%)
Tocilizumab	14 (0.5%)	649 (0.3%)
Admitted as inpatients within 15 days of positive SARS-CoV-2 test**	922 (32.3%)	28,948 (14.1%)
Admitted as inpatients within 60 days of positive SARS-CoV-2 test**	1,032 (36.1%)	31,538 (15.3%)
Admitted to intensive care unit within 60 days of index date	419 (14.7%)	11,244 (5.5%)
Mechanical ventilation or intubation within 60 days of index date	155 (5.4%)	3,645 (1.8%)
Emergency department visit within 60 days of index date	1,236 (43.3%)	68,550 (33.3%)
In-hospital death within 30 days	179 (6.3%)	3,498 (1.7%)
All-cause death within 60 days of index date	544 (19.0%)	12,674 (6.2%)

\*Only a subset of patients in the population have lung cancer stage data recorded the oncology raw database. Information available on these patients is reported in the fact sheet supplement.

\*\*In some cases, COVID-19 may not be the primary reason for hospitalization.



**Table 5.** Death among SARS-CoV-2-positive Veteran lung cancer patients, by timing of index date

	SARS-CoV-2-positive Veteran patients With lung cancer				SARS-CoV-2-positive Veteran patients Without lung cancer			
	Timing of Index Date				Timing of Index Date			
	03/01/20 - 05/31/20 (n=270)	06/01/20 - 08/31/20 (n=395)	09/01/20 - 11/30/20 (n=742)	12/01/20 - 03/03/21 (n=1,450)	03/01/20 - 05/31/20 (n=14,642)	06/01/20 - 08/31/20 (n=32,511)	09/01/20 - 11/30/20 (n=53,814)	12/01/20 - 03/03/21 (n=104,855)
In-hospital death within 30 days	24 (8.9%)	31 (7.8%)	49 (6.6%)	75 (5.2%)	814 (5.6%)	522 (1.6%)	761 (1.4%)	1,401 (1.3%)
All-cause death within 60 days of index date	67 (24.8%)	74 (18.7%)	157 (21.2%)	246 (17.0%)	1,940 (13.2%)	1,909 (5.9%)	3,153 (5.9%)	5,672 (5.4%)

**Table 6.** Time from testing to admission and length of hospital stay among SARS-CoV-2-positive Veterans inpatients, by lung cancer diagnosis

Characteristic	SARS-CoV-2-positive Veterans admitted as inpatients within 60 days of positive test	
	Lung cancer (n=1,032)	No lung cancer (n=31,538)
Median time from SARS-CoV-2 test to admission among inpatients (days) (IQR) [Q1, Q3]	0 (2) [0,2]	0 (3) [0,3]
Median length of hospital stay (IQR) [Q1, Q3]	6 (9) [3,12]	5 (8) [3,11]

**Table 7.** Cancer-specific treatment received since March 1, 2018 (before and after index date)

Cancer treatment received	SARS-CoV-2-positive Veteran patients with lung cancer (n=2,857) n(%)		
	Before index date* (03/01/2018 – Index date)	After index date (Index date – 03/03/2021)	Total (03/01/2018 – 03/03/2021)
Lung cancer-related surgery	296 (10.4%)	70 (2.5%)	364 (12.7%)
Chemotherapy	498 (17.4%)	282 (9.9%)	615 (21.5%)
Radiation therapy	73 (2.6%)	24 (0.8%)	93 (3.3%)
Immunotherapy	538 (18.8%)	287 (10.0%)	652 (22.8%)

\*Index date varies for each individual patient



**Table 8.** Received COVID-19 vaccination under Emergency Use Authorization from December 11, 2020 to on or before May 2, 2021, by lung cancer diagnosis

<b>VA record of vaccination</b>	<b>Lung cancer</b> (n=2,857) n(%)	<b>No lung cancer</b> (n=205,822) n(%)
No record of vaccination	1,526 (53.4%)	121,191 (58.9%)
Partially vaccinated*	140 (4.9%)	10,886 (5.3%)
Fully vaccinated	1,163 (40.7%)	72,092 (35.0%)
Potentially erroneous**	28 (1.0%)	1,653 (0.8%)

\*Anyone who received a second dose of an applicable vaccine on 05/03/2021 or later is considered partially vaccinated (or Potentially erroneous)

\*\*Although Veterans have a record of vaccination, records were flagged as potentially erroneous for one of the following reasons: (1) Records indicate 2 vaccine doses were administered on the same day, (2) Records indicate doses were received within 14 days of one another, (3) Three or more immunization records present, (4) Multiple Series 1 or Series 2 records were present, (5) Records for more than 1 vaccine type (e.g., Pfizer and Moderna records), (6) Records indicate vaccination received outside of FDA EUA: Pfizer vaccination prior to 12/11/2020, Moderna vaccination prior to 12/18/2020, and Johnson & Johnson/Janssen vaccination prior to 02/27/2021, Novavax or AstraZeneca vaccination (any time), (7) Records indicate received Johnson & Johnson/Janssen vaccine between 04/13/2021 and 04/23/2021, the period in which vaccine administration was paused by FDA and CDC.

## 8 Limitations

Of the 2,857 SARS-CoV-2-positive Veterans with lung cancer in this cohort, only 795 (28.4%) had data available on stage and 1,275 (45.6%) had data available on histology due to a lag in reporting by the VA Cancer Registry to the VA oncology raw database. These and other factors can confound the summarized data whenever used to evaluate the health outcomes of this population.

Limitations inherent to the electronic health record data include variations in coding practices and diagnostic approaches, which may result in data discrepancies across facilities. The data do not capture diagnoses or events that do not result in VHA medical care, such as diagnoses of pre-existing conditions received at non-VA facilities and out-of-hospital deaths following discharge. Similarly, data do not capture vaccinations or treatments received outside of VHA health care. For example, patients are often referred to receive radiation therapy at a non-VA medical facility closer to a patient's home due to the limited number of radiation oncology departments in the VA.

The fact sheet presents information on Veterans using VHA health care services and are not generalizable to other US Veterans or lung cancer patients infected with SARS-CoV-2 more broadly.

## 9 Interpretation

The fact sheet is intended to provide a snapshot of VHA enrollees and to serve as a springboard for further discussion and research. No methods were applied to adjust for confounding or other biases. Therefore, no conclusions can be drawn from these results on the differences in risk factors and outcomes between SARS-CoV-2-positive patients with and without lung cancer. Gaining such insights requires research using appropriate methods to control for confounding and other biases.

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## Appendix

This appendix reports on the 1,311 SARS-CoV-2-positive Veterans diagnosed with primary lung cancer with data in the VA oncology raw database. Of these, 804 patients had data available on stage of lung cancer.

**Table A1.** SARS-CoV-2 infection among Veterans diagnosed with lung cancer, by histology and stage of lung cancer

Outcome	SARS-CoV-2-positive Veteran patients with lung cancer (n=1,311) n(%)
Histology	
Small cell lung cancer	60 (4.6%)
Non-small cell lung cancer	1,227 (93.6%)
Non-small cell carcinoma, adenocarcinoma	650 (49.6%)
Non-small cell squamous cell	391 (29.8%)
Non-small cell large cell	15 (1.1%)
Non-small cell, other / Not otherwise specified (NOS)	217 (16.6%)
Other	27 (2.1%)
Stage: Non-small cell lung cancer	1,227 (93.6%)
I	507 (38.7%)
II	116 (8.8%)
III	110 (8.4%)
IV	52 (4.0%)
Unknown	460 (35.1%)
Stage: small cell lung cancer	60 (4.6%)
I	<11*
II	<11*
III	15 (1.1%)
IV	<11*
Unknown	29 (2.2%)

\*To protect patient privacy, all counts less than 11 have been reported as '<11'.

Numbers do not add up to 100% as patients can have multiple categories of tumors and therefore be represented in multiple rows.