RESEARCH

Race is Related with Increased COVID-19 Infection in Oncology Patients

John Nakayama*[a], Gino Cioffi[b,l], Sharanya Iyer[c], Ravi Kumar Kyasaram[d], John Shanahan[d], Paolo Caimi[e], Kristin A. Waite[b,l], Thomas A. Sellers[f], Jill S. Barnholtz-Sloan[b,g,h,i]

[a] Division of Gynecologic Oncology, Department of Obstetrics and Gynecology University Hospitals Cleveland Medical Center. Cleveland, Ohio. USA [b] Department of Population and Quantitative Health Sciences, Case Western Reserve University School of Medicine. Cleveland, Ohio. USA [c] Case Western Reserve University School of Medicine. Cleveland, Ohio. USA [d] Cancer Informatics, Seidman Cancer Center. Cleveland, Ohio. USA [e] Division of Hematology, Department of Medicine, University Hospitals Seidman Cancer Center. Cleveland, Ohio. USA [f] TAS Consulting. Tampa, Florida. USA [g] Case Comprehensive Cancer Center. Cleveland, Ohio. USA [h] Research and Education Division, University Hospitals of Cleveland. Cleveland, Ohio. USA [i] Cleveland Center for Health Outcomes Research (CCHOR). Cleveland, Ohio. USA

Corresponding author: John Nakayama. Email: john.nakayama@ahn.org

ABSTRACT

We seek to assess racial disparities in oncology patients with COVID19 compared to appropriately matched controls with and without COVID19. All patients treated at the Seidman Cancer Center with a diagnosis of COVID19 and cancer were identified from the electronic medical record using ICD9/ICD10 codes for cancer diagnoses and database of all patients diagnosed with COVID19. Two control groups, cancer patients without COVID19 and patients without cancer but with COVID19, were generated and matched 3:1 on age at date of data extraction, age at cancer diagnosis, and sex to COVID19 positive cancer cases. African Americans (AA) and Whites made up 8.6% vs. 76.9% of the baseline oncologic population without COVID19, respectively. AA representation (41.0%) was significantly increased in cancer patients positive for COVID19 compared to those negative for COVID19 ($p<0.001$). In the comparison of patients with COVID19 with or without cancer, the proportion of AA cases was greater in the non-oncologic population (41.0% vs. 47.6%, $p=0.014$). AA are disproportionately affected with COVID19 in oncologic and benign populations. Despite similar rates of adverse outcomes to COVID19 in cancer patients by race, we found a 32.4% increase in the AA proportion compared to those without COVID19. These findings suggest COVID19 prevention policies and future studies should account for racial differences in the oncology population.

KEYWORDS: COVID19, coronavirus 19, racial disparities, oncology,

Citation: Nakayama J et al (2021) Race is Related with Increased COVID-19 Infection in Oncology Patients. Cancer Health Disparities 5:e1-e8.doi:10.9777/chd.2021.1004

Introduction

The novel coronavirus SARS-CoV-2 (COVID19) pandemic led to radical shifts in oncology care. New reports indicate that cancer patients have increased morbidity and mortality from COVID19[1–4]. One study from New York, showed 40% of cancer patients with COVID19 required hospital admission. Older age (>65 years) and recent immunotherapy predicted admission and disease severity while chemotherapy or surgery did not[5]. These findings may not be generalizable given that the proportion of minority subjects was lower than other studies conducted in the same area[3,6]. In an attempt to overcome some of the limitations of prior studies,a case control study of Chinese COVID19 patients with and without cancer was performed. It showed oncology patients had a nearly significant increased risk of death (OR: 2.17, p= 0.06) and significantly more ICU admissions (OR: 3.13, p<0.01) or at least one severe symptom (OR: 1.99, p<0.01)[7].

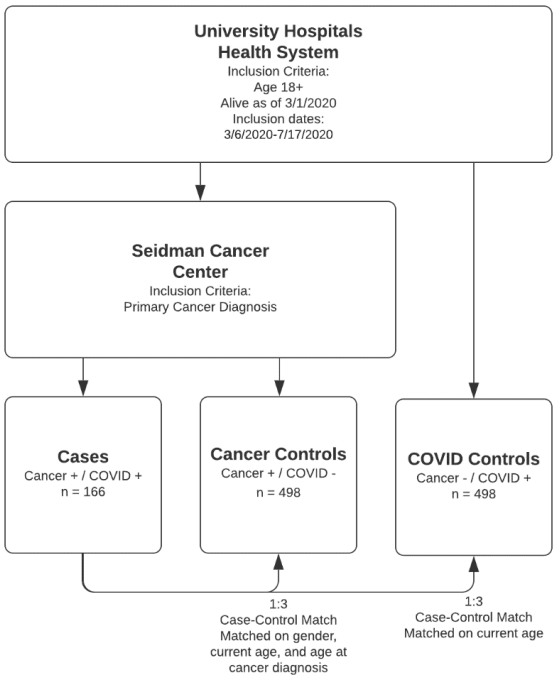
Cancer patients are often obliged to continue care. During the COVID19 pandemic this can be dangerous for patients who lack the resources or ability to limit their exposure. While higher COVID19 infection rates have been observed in minority communities through the lay press and editorials, a limited body of scientific literature is available[3,8]. A recent study using Veteran's Affairs (VA) data showed a higher prevalence of COVID19 infection and hospitalization, but not mortality, in African Americans (AA)[9]. This data may not be generalizable due to the unique VA population.

Given these realities and the racially diverse population of the University Hospitals Seidman Cancer Center (UHSCC), we investigated the dynamics of COVID19 infection in oncology patients in order to: (1) determine the demographic differences between cancer patients infected with COVID19 versus COVID19 infected patients without a cancer history, (2) compare the outcomes of cancer patients infected with COVID19 to patients without cancer who are infected with COVID19, and (3) compare characteristics and outcomes of cancer patients infected with COVID19 to cancer patients without COVID19 diagnosis.

Materials and Methods

After receiving approval by UHSCC institutional review board, a search from 3/16/2020 to 7/7/2020 was performed of all patients treated at the Seidman Cancer Center. A cancer diagnosis was determined by searching the electronic medical record for a cancer ICD9/10 code and then manually verifying the cancer diagnosis. COVID19 positive patients were identified using a database maintained by the hospital of all patients diagnosed with COVID19. Adult (≥18years old), COVID19 positive oncology patients were identified (CA+/COVID+). Two control groups, cancer patients without COVID19 (CA+/COVID-) and patients without cancer but with COVID19 (CA-/COVID+), were generated. The CA+/COVID- group was matched based upon age at date of data extraction, age at cancer diagnosis, and sex at 3:1, and the CA-/COVID+ group was matched for age at data extraction at 3:1 (Figure 1). The weighted Elixhauser-comorbidity score was used to quantify the rate of comorbid medical conditions present in each group[10,11]. Descriptive statistics were generated using R software (version 3.6.3) to assess demographic and treatment differences between Cases and each control group. T-tests were performed to compare differences in mean and Chi-square tests assess differences in proportion. A $p < 0.05$ was considered statistically significant.

Figure 1. Flow diagram of included patients



A total of 166 Cases were identified (Table 1). The median follow-up time was 53 days from COVID19 diagnosis. Distribution of cancer differed between the CA+/COVID+ and CA+/COVID- groups (p=0.026), with a notably higher proportion of oral cavity and pharynx cancers in the CA+/COVID- population (0.6% compared to 4.2%, p=0.045). Cancer related treatment in CA+/COVID+ patients was uncommon with 7.2% and 0.6% of patients receiving chemotherapy or radiation, respectively, within 30 days of their COVID19 diagnosis. Only 4 CA+/COVID+ patients (2.4%) had a surgery in the year prior to their COVID19 diagnosis.

Significant racial differences were identified between groups. The racial distribution of patients in the CA+/COVID- group was 8.6% AA vs. 76.9% White (Table 1). A significantly higher proportion of AA, 41.0%, was noted in patients with cancer and COVID19 (p<0.001). In the comparison of CA+/COVID+ to CA-/COVID+, the proportion of AA patients was greater in the non-oncologic population (41.0% vs. 47.6%, p=0.014).

Measures associated with COVID19 severity were examined. A weighted Elixhauser Comorbidity score $\geq$5 was present in 91.6% of CA+/COVID+ patients compared to 82.3% (p=0.003) of CA+/COVID- and 52.3% (p<0.001) of CA-/COVID+ patients. Over 1 in 5 (22.3%) of the CA+/COVID+ patients were admitted to the ICU. This was not significantly greater than the CA-/COVID+ (16.3%, p= 0.101). There was no difference in ventilator use (p=0.999). The death rate from COVID19 was 3.0% in the CA-/COVID+ group versus 4.8% in the CA+/COVID- group, which was not statistically significant (p=0.391).

The CA+/COVID+ group was further stratified by race (Table 2). There was no difference in types of cancer (p=0.394) and comorbidity score by race (p=.794). Outcomes were equivalent between racial groups in terms of ventilator use (94.7% vs. 95.6%, p=0.999), ICU admission (76.8% vs. 77.9%, p=0.999), and death (94.7% vs. 95.6%, p=0.999).

Table 1. Descriptive statistics of patients diagnosed with primary cancer and COVID19 with corresponding Cancer and COVID19 controls.

	Patients with cancer and COVID19 (Cancer+/COVID+)	Patients with cancer without COVID19 (Cancer+/COVID-)	P*	Patients with cancer without COVID19 (Cancer-/COVID+)	P*
Overall n	166	498		498	
Age at Cancer Diagnosis, Mean (SD)[Range]	63.5 (15.0) [19-91]	63.5 (15.0) [19-91]	0.99	--	--
Age at COVID Diagnosis, Mean (SD)[Range]	68.2 (15.1) [26-97]	--	--	68.2 (15.1) [26-97]	0.86
Gender, n (%)					
Female	97 (58.4%)	291 (58.4%)	0.999	303 (60.8%)	0.647
Male	69 (41.6%)	207 (41.6%)		195 (39.2%)	
Race, n (%)					
White	95 (57.2%)	383 (76.9%)	<0.001	218 (43.8%)	0.014
African American	68 (41.0%)	43 (8.6%)		237 (47.6%)	
Other	2 (1.2%)	39 (7.8%)		20 (4.0%)	
Unknown	1 (0.6%)	33 (6.6%)		23 (4.6%)	
Ethnicity, n (%)					
Hispanic	2 (1.2%)	5 (1.0%)	0.999	0 (0.0%)	0.137
Non-Hispanic	160 (96.4%)	453 (91.0%)		418 (83.9%)	
Unknown	4 (2.4%)	40 (8.0%)		80 (16.1%)	
First Cancer, n (%)					
Bones and Joints	3 (1.8%)	6 (1.2%)	0.026	--	--
Brain and Other Nervous System	3 (1.8%)	19 (3.8%)		--	
Breast	31 (18.7%)	96 (19.3%)		--	
Digestive System	20 (12.0%)	92 (18.5%)		--	
Endocrine System	8 (4.8%)	11 (2.2%)		--	
Female Genital System	11 (6.6%)	30 (6.0%)		--	
Leukemia	10 (6.0%)	18 (3.6%)		--	
Lymphoma	8 (4.8%)	18 (3.6%)		--	

Male Genital System	22 (13.3%)	52 (10.4%)		--	
Oral Cavity and Pharynx	1 (0.6%)	21 (4.2%)		--	
Respiratory System	14 (8.4%)	39 (7.8%)		--	
Skin	5 (3.0%)	39 (7.8%)		--	
Urinary System	11 (6.6%)	20 (4.0%)		--	
Other/Unspecified	19 (11.4%)	37 (7.4%)		--	
Weighted Elixhauser Comorbidity Score, n (%)					
<0	3 (1.8%)	16 (3.2%)	0.003	122 (26.2%)	<0.001
0	2 (1.2%)	48 (9.6%)		60 (12.9%)	
1-4	9 (5.4%)	24 (4.8%)		40 (8.6%)	
>=5	152 (91.6%)	410 (82.3%)		243 (52.3%)	
Ventilator Use, n (%)					
No	158 (95.2%)	--	--	476 (95.6%)	0.999
Yes	8 (4.8%)	--		22 (4.4%)	
Admitted to ICU, n (%)					
No	129 (77.7%)	--	--	417 (83.7%)	0.101
Yes	37 (22.3%)	--		81 (16.3%)	
Died within 30 Days of COVID Diagnosis					
No	158 (95.2%)	--	--	483 (97.0%)	0.391
Yes	8 (4.8%)	--		15 (3.0%)	

*: p considered significant if <0.05, SD: standard deviation

Table 2. Descriptive statistics of cases (Cancer+/COVID19+) stratified by Race.

	Study Population (Cancer+/COVID19+)		
	White	Black	P*
Overall n	95	68	
Age at Cancer Diagnosis, Mean (SD)	65.0 (13.7)	61.8 (15.5)	0.162
Age at COVID Diagnosis, Mean (SD)	69.4 (14.3)	66.8 (15.6)	0.276
Gender, n (%)			
Female	55 (57.9%)	40 (58.8%)	0.999
Male	40 (42.1%)	28 (41.2%)	
Ethnicity, n (%)			

Hispanic	2 (2.2%)	0 (0.0%)	0.609
Non-Hispanic	89 (97.8%)	68 (100.0%)	
Unknown	0 (0.0%)	4 (4.2%)	
First Cancer, n (%)			
Bones and Joints	1 (1.1%)	2 (2.9%)	0.394
Brain and Other Nervous System	2 (2.1%)	1 (1.5%)	
Breast	13 (13.7%)	17 (25.0%)	
Digestive System	13 (13.7%)	6 (8.8%)	
Endocrine System	3 (3.2%)	4 (5.9%)	
Female Genital System	8 (8.4%)	3 (4.4%)	
Leukemia	6 (6.3%)	4 (5.9%)	
Lymphoma	5 (5.3%)	3 (4.4%)	
Male Genital System	11 (11.6%)	11 (16.2%)	
Oral Cavity and Pharynx	1 (1.1%)	0 (0.0%)	
Respiratory System	10 (10.5%)	9 (13.2%)	
Skin	11 (11.6%)	3 (4.4%)	
Urinary System	5 (5.3%)	0 (0.0%)	
Other/Unspecified	6 (6.3%)	5 (7.4%)	
Weighted Elixhauser Comorbidity Score, n (%)			
<0	2 (2.1%)	1 (1.5%)	0.794
0	1 (1.1%)	0 (0.0%)	
1-4	4 (4.2%)	4 (5.9%)	
>=5	88 (92.6%)	63 (92.6%)	
Ventilator Use, n (%)			
No	90 (94.7%)	65 (95.6%)	0.999
Yes	5 (5.3%)	3 (4.4%)	
Admitted to ICU, n (%)			
No	73 (76.8%)	53 (77.9%)	0.999
Yes	22 (23.2%)	15 (22.1%)	
Died within 30 Days of COVID Diagnosis			
No	90 (94.7%)	65 (95.6%)	0.999
Yes	5 (5.3%)	3 (4.4%)	

*: p considered significant if <0.05

Discussion

This study reflects the disproportionate effect of COVID19 on AA with and without cancer. AA normally make up 8.6% of the oncology patients at UHSCC as shown in the CA+/COVID- group. However, this increases over 4.5 times to 41.0% of oncology patients with COVID19 infections. Further studies evaluating socioeconomic factors that limit the ability to social distance or work remotely as well as other social determinants of health are needed to determine why this disparity exists. Interestingly, the proportion of AA is even greater (47.6%) in non-oncologic patients (CA-/COVID19+) than oncology patients (CA+/COVID19+). To our knowledge, this has not been previously reported. Cancer patients may be taking additional precautions that ameliorate identified factors predisposing this community to COVID19[8,12]. Alternatively, the smaller proportion of AA among cancer patients could reflect impaired access to cancer care which would decrease the likelihood of COVID19 testing; such an investigation was beyond the scope of this report.

There was no difference in ventilator use, ICU admission, or death in cancer patients with COVID19 versus patients without cancer. This finding remained true when stratified by race. This absence of difference in COVID19 related complications occurred despite cancer patients having a greater proportion of patients with elevated comorbidity scores and could be related to the low percentage of patients receiving active treatment, a known risk factor for worse outcomes [4,7,13–15].

This study has several limitations. Given its retrospective nature, it was not possible to control for rapidly evolving COVID19 care, however, the limited time frame of interest minimizes the effects of cancer care specifics to mortality and morbidity. The study population was that of a large urban academic center and may not represent other patient groups.

This study illustrates the disproportionate effect of COVID19 on AA oncology patients. Despite similar rates of adverse outcomes to COVID19 amongst racial groups, the proportion of AA patients was significantly higher among cancer patients with COVID19 when compared with controls without COVID19. These findings suggest racial differences in COVID19 rates in the oncology population should inform infection control efforts like vaccination programs as well as future study designs to protect vulnerable populations.

Acknowledgement

None

Conflicts of interest

The authors declare no conflict of interest.

Authors' contributions

Design: Nakayama, Cioffi, Waite, Sellers, Barnholtz-Sloan, Caimi, Sellers

Data collection: Nakayama, Iyer, Kyasaram, Shanahan

Analysis: Nakayama, Cioffi, Iyer, Caimi, Waite, Sellers, Barnholtz-Sloan

Manuscript: Nakayama, Cioffi, Iyer, Caimi, Waite, Sellers, Barnholtz-Sloan

REFERENCES

1. Liang W, Guan W, Chen R, et al. Cancer patients in SARS-CoV-2 infection: a nationwide analysis in China. *Lancet Oncol*. 2020;21(3):335-337. doi:10.1016/S1470-2045(20)30096-6

2. Trapani D, Marra A, Curigliano G. The experience on coronavirus disease 2019 and cancer from an oncology hub institution in Milan, Lombardy Region. *Eur J Cancer*. 2020;132:199-206. doi:10.1016/j.ejca.2020.04.017

3. Mehta V, Goel S, Kabarriti R, et al. Case Fatality Rate of Cancer Patients with COVID-19 in a New York Hospital System. *Cancer Discov*. 2020;10(7):935-941. doi:10.1158/2159-8290.CD-20-0516

4. Rugge M, Zorzi M, Guzzinati S. SARS-CoV-2 infection in the Italian Veneto region: adverse outcomes in patients with cancer. *Nat Cancer*. 2020;1(8):784-788. doi:10.1038/s43018-020-0104-9

5. Robilotti E V., Babady NE, Mead PA, et al. Determinants of COVID-19 disease severity in patients with cancer. *Nat Med*. 2020;26(8):1218-1223. doi:10.1038/s41591-020-0979-0

6. Kabarriti R, Brodin NP, Maron MI, et al. Association of Race and Ethnicity With Comorbidities and Survival Among Patients With COVID-19 at an Urban Medical Center in New York. *JAMA Netw open*. 2020;3(9):e2019795. doi:10.1001/jamanetworkopen.2020.19795

7. Dai M, Liu D, Liu M, et al. Patients with cancer appear more vulnerable to SARS-CoV-2: A multicenter study during the COVID-19 outbreak. *Cancer Discov*. 2020;10(6):783. doi:10.1158/2159-8290.CD-20-0422

8. Balogun OD, Bea VJ, Phillips E. Disparities in cancer outcomes due to COVID-19 - A tale of 2 cities. *JAMA Oncol*. 2020;6(10):1531-1532. doi:10.1001/jamaoncol.2020.3327

9. Fillmore NR, La J, Szalat RE, et al. Prevalence and outcome of COVID-19 infection in cancer patients: a national Veterans Affairs study. *J Natl Cancer Inst*. 2020. doi:10.1093/jnci/djaa159

10. Thompson NR, Fan Y, Dalton JE, et al. A new elixhauser-based comorbidity summary measure to predict in-hospital mortality. *Med Care*. 2015;53(4):374-379. doi:10.1097/MLR.0000000000000326

11. Moore BJ, White S, Washington R, Coenen N, Elixhauser A. Identifying Increased Risk of Readmission and In-hospital Mortality Using Hospital Administrative Data. *Med Care*. 2017;55(7):698-705. doi:10.1097/MLR.0000000000000735

12. Newman L, Winn RA, Carethers JM. Similarities in Risk for COVID-19 and Cancer Disparities. *Clin Cancer Res*. October 2020:clincanres.3421.2020. doi:10.1158/1078-0432.CCR-20-3421

13. Nepogodiev D, Bhangu A, Glasbey JC, et al. Mortality and pulmonary complications in patients undergoing surgery with perioperative SARS-CoV-2 infection: an international cohort study. *Lancet*. 2020;396(10243):27-38. doi:10.1016/S0140-6736(20)31182-X

14. Kapteijn BA, Nieweg OE, Liem I, et al. Localizing the sentinel node in cutaneous melanoma: gamma probe detection versus blue dye. *Ann Surg Oncol*. 1997;4(2):156-160.

15. Albiges L, Foulon S, Bayle A, et al. Determinants of the outcomes of patients with cancer infected with SARS-CoV-2: results from the Gustave Roussy cohort. *Nat Cancer*. September 2020:1-11. doi:10.1038/s43018-020-00120-5