Assessment of Vitamin D deficiency and COVID-19 diagnosis in patients with breast or prostate cancer using Electronic Medical Records

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BACKGROUND

- While patients with cancer are known to be at increased risk of infection in part due to the immunocompromising nature of cancer treatments, recent data indicate a particularly high risk for COVID-19 infection and poor outcomes.[1]
- Vitamin D may play an important role in COVID-19. A recent study demonstrated vitamin D deficiency may increase risk of COVID-19 infection, and a small randomized controlled trial in Spain reported significant improvement in mortality among hospitalized patients treated with calcifediol.[2,3]
- Vitamin D deficiency has been previously reported in two leading causes of cancer deaths: breast and prostate.[4]
- In this study, we performed a retrospective cohort analysis on nationally representative electronic medical records (EMR) to assess whether vitamin D deficiency affects risk of COVID-19 among these patients.

METHODS

Figure 1. Study Timeline

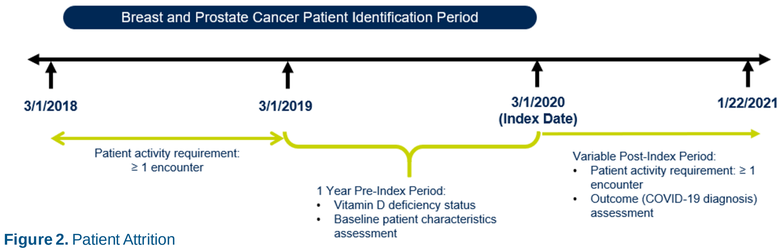
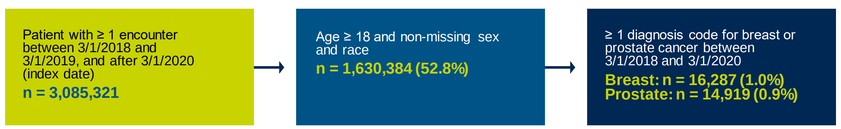


Figure 2. Patient Attrition



- Patients with breast (female) or prostate (male) cancer were identified between 3/1/2018 and 3/1/2020 from Healthjump EMR data provided pro-bono by the COVID-19 Research Database.[5]
- Patients with an ICD-10 code for vitamin D deficiency or <20ng/mL 20(OH)D laboratory results within 12 months prior to 3/1/2020 were classified as vitamin D deficient.
- COVID-19 diagnosis was defined using ICD-10 codes and laboratory results for COVID-19 at any time on or after 3/1/2020.
- Logistic regressions, adjusted for baseline demographic and clinical characteristics assessed in the 12 months prior to 3/1/2020, were conducted to estimate the effect of vitamin D deficiency on COVID-19 incidence in each cancer cohort. Confidence intervals were estimated using robust standard errors.
  - Adjusted characteristics include age categories (listed in **Table 1**), race, median Quan's Charlson Comorbidity Index categories (< 2 or ≥ 2), congestive heart failure, obesity, diabetes mellitus, liver disease, and chronic kidney disease.
- Analysis was also conducted on subgroups with incident cancer diagnosis, defined as patients whose first record of breast or prostate cancer diagnosis in the database was within 2 years prior to 3/1/2020. These patients were required to have an encounter ≥ 1 year prior to this diagnosis date.

References:

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CONCLUSIONS

- Our study suggests potentially vulnerable populations, such as breast and prostate cancer patients, may have an elevated risk of COVID-19 infection if vitamin D deficient.
- These results support previous findings demonstrating a relationship between vitamin D deficiency and COVID-19 infection.[2]
- Possible confounders include:
  - Patients who receive closer screening and follow up are more likely to be tested for and found to have vitamin D deficiency as well as more likely to be tested for and found to have COVID-19.
  - Patients with poorer physical performance status, due to certain comorbidities or treatments that are associated with higher risk of COVID-19, tend to have lower vitamin D levels.[6]
- Our study population consisted of older patients and a majority were White; it may therefore not be generalizable to the general breast and prostate cancer populations. However, these demographics were adjusted for in the models and results would be relevant to these select populations.
- While further study is warranted to confirm the role for vitamin D as a prophylaxis or treatment for as a prophylaxis or treatment for COVID-19, our study underscores the importance of monitoring vitamin D levels across and within cancer populations, particularly in the context of viral pandemics.

RESULTS

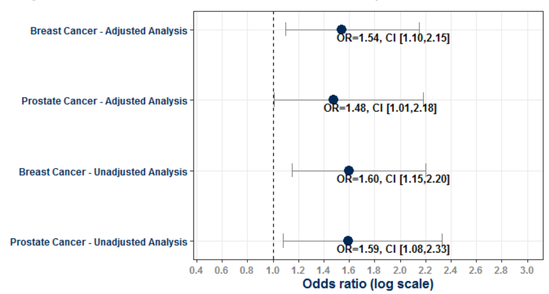
- A total of 16,287 breast cancer and 14,919 prostate cancer patients were included in the study. **(Figure 2)**

Table 1. Patient Demographic and Clinical Characteristics

		Breast Cancer TOTAL (N = 16,287)		Prostate Cancer TOTAL (N = 14,919)	
Patient Characteristics		**N/Mean**	**%/SD**	**N/Mean**	**%/SD**
Age (Mean, SD)		68.9	11.3	73.6	8.5
	<70 years (n, %)	7,962	48.9%	4,625	31.0%
	70-79 years (n, %)	5,368	33.0%	6,499	43.6%
	80+ years (n, %)	2,957	18.2%	3,795	25.4%
Sex (n, %)	Female	16,287	100.0%	0	0.0%
	Male	0	0.0%	14,919	100.0%
Race (n, %)	White	13,805	84.8%	12,390	83.1%
	Black	2,102	12.9%	2,405	16.1%
	Asian	305	1.9%	89	0.6%
	Native Hawaiian/Pacific Islander	16	0.1%	12	0.1%
	American Indian or Alaska Native	49	0.3%	22	0.1%
	Missing	10	0.1%	1	0.0%
Vitamin D deficient (n, %)		2,384	14.6%	1,318	8.8%
Comorbid Conditions	Quan Charlson Comorbidity Index (Mean, SD)	1.1	1.5	1.4	1.7
	Congestive heart failure (n, %)	1,075	6.60%	1,483	9.94%
	Obesity (n, %)	5,036	30.9%	4,627	31.0%
	Diabetes mellitus (n, %)	3,327	20.4%	3,897	26.1%
	Liver disease (n, %)	356	2.2%	303	2.0%
	Chronic kidney disease (n, %)	1,730	10.6%	2,371	15.9%

- The average age was 68.9 years in the breast cancer cohort and 73.6 years in the prostate cancer cohort. **(Table 1)**
- The breast cancer cohort consisted of 85% Whites, 13% Black or African Americans, and less than 5% of other races. A similar race distribution was observed in the prostate cancer cohort.
- Approximately 15% of the breast cancer cohort and 9% of the prostate cancer cohort had vitamin D deficiency.
- The most common comorbid conditions were obesity (approximately a third in both cohorts) and diabetes mellitus (20% in the breast cancer cohort and 26% in the prostate cancer cohort).

Figure 3. Odds Ratio Estimates: Vitamin D Deficiency and COVID-19 Infection



- Unadjusted and adjusted modelling results estimated the odds of COVID-19 infection was higher among vitamin D deficient patients compared to non-deficient patients in both cohorts, with statistical significance **(Figure 3)**
- In a subgroup of patients with incident breast cancer (n=5,973), vitamin D deficiency was not significantly associated with COVID-19 infection (adjusted OR=1.56 [95% CI: 0.89, 2.72], while in a subgroup of patients with incident prostate cancer (n=5,584), a significant association was found (adjusted OR=2.76 [95% CI: 1.53, 4.97]).
  - Estimates may be biased due very low counts of patients with the COVID-19 infection outcome in these subgroups

FUTURE DIRECTIONS FOR RESEARCH

- Prospective randomized controlled trials are needed to determine the role of vitamin D as a prophylaxis or treatment for COVID-19.
- Other cancer populations with reported vitamin D deficiency should be studied to evaluate their potential elevated risk for COVID-19 infection.
- Vitamin D might play a role in other viral illnesses and would be important to assess given the increased vulnerability of cancer populations to secondary infection.