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Comparing Hospital Costs & Lengths of Stay for Cancer Patients in New York State Comprehensive Cancer Centers vs. Non-Designated Academic Centers & Community Hospitals

Ryan Fodero
Providence College

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Ryan Fodero, Providence College Department of Economics; Providence College Department of Biology

James Bailey, Ph.D., Providence College Department of Economics

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Objective: This paper explores differences in costs and lengths of stay for cancer patients admitted to National Cancer Institute-designated Comprehensive Cancer Centers, non-designated academic medical centers, and community hospitals in New York State.

Data Sources: We use patient-level data from the New York State Statewide Planning and Research Cooperative System Hospital Inpatient Discharges dataset for the years 2017-2019

Study Design: We employ ordinary least squares and Poisson regressions to compare hospital costs and length of stay for cancer patients, controlling for hospital type, patient demographics, and patient health.

Principal Findings: We determine that inpatient costs were 27% higher, but length of stay was 12% shorter, in comprehensive cancer centers relative to community hospitals.

Conclusions: The results imply that, in New York State, comprehensive cancer centers are a magnet for more complex oncology cases and administer more expensive treatments. That expertise, however, seems to be responsible for more efficient care delivery and thorough discharge planning, allowing for shorter average lengths of stay.

Keywords: National Cancer Institute; Comprehensive Cancer Center; Hospital Costs; Length of Stay; Hospital Inpatient Discharges dataset

What is known on this topic:

- Inpatient hospital care accounted for about 8% of New York State's 2020 real gross domestic product.
- Prior studies found that hospital costs for academic medical centers were higher than non-academic centers, but no study has considered cost differences by designated specialty centers, like Comprehensive Cancer Centers.

What this study adds:

- Cancer-related inpatient costs are significantly higher in National Cancer Institute-designated Comprehensive Cancer Centers than in academic medical centers and community hospitals.
- Length of stay for cancer-related admissions is significantly shorter in National Cancer Institute-designated Comprehensive Cancer Centers than in academic medical centers and community hospitals.
- There are racial disparities in both costs and length of stay, regardless of hospital type.

Introduction

According to the United States Centers for Medicare and Medicaid Services (CMS)[1], healthcare spending in 2020 accounted for 19.7% of gross domestic product, totaling $4.1 trillion, or $12,530 per person. In New York State (NYS) alone, hospital care for all conditions accounted for nearly $110 billion, or about 8% of NYS's 2020 real gross domestic product[2]. The Kaiser Family Foundation estimates that cancer care is the seventh most expensive condition to treat in America, accounting for 7% of all 2020 U.S. healthcare spending[3].

As cancer becomes more prevalent, focus on research and treatment is intensifying, with the National Cancer Institute (NCI) investing $1.8 billion over seven years to the Cancer Moonshot program, aimed at accelerating progress in cancer research[4]. Much of this money goes to NCI-designated Comprehensive Cancer Centers (NCICCC), which are academic hospitals designated by the NCI as having exceptional depth and breadth of basic, clinical, translational, and transdisciplinary research, as well as renowned leadership and resources dedicated to clinical cancer care[5]. These centers are magnets for cancer patients around the world, thanks to their extraordinary expertise and outcomes. Their expertise and reputation may give NCICCCs greater leverage when negotiating reimbursement rates, makes them better equipped to efficiently handle complex oncology patients, and puts them on the forefront of drug development, so providers may be more attuned to the cost-effectiveness of pricey new treatments. However, there is little research exploring the differences in costs and utilization between NCICCCs, non-NCI academic medical centers (AMC), and community hospitals.

Most of the relevant previous research has compared AMCs to community hospitals without considering NCICCC status. Burke et al. (2019)[6] find that among Medicare patients, the initial admission is more expensive for major teaching hospitals, but the reduction in post-acute costs after discharge from a major teaching hospital more than compensates for the higher cost for the index hospitalization. Everett et al. (2007)[7] use internal data from a single Florida-based hospital system to explore the inpatient costs and length of stay (LOS) differences between academic internists, private hospitalists, and community general internists. The study found that academic internists had the lowest cost and shortest LOS. Takvorian et al. (2021)[8] most closely relates to this paper. The researchers explore the differences in spending and care utilization for common cancer-related procedures between NCI-designated Comprehensive Cancer Institutes

and Community Hospitals. They use data from 2011 to 2014 using the Health Care Cost Institute's national multipayer commercial claims data set, which has healthcare utilization and cost data for patients covered by Aetna, Humana, and UnitedHealthcare. The study included 66,878 patients with private insurance who underwent surgery for breast, colon, or lung cancer in the United States. Using a multilevel generalized mixed-effects model, the study found that NCI hospitals had significantly higher surgery-specific spending ($18,526) than community hospitals ($14,772) ($p < 0.001$) and close to $6,000 more in 90-day post discharge payments ($p = 0.006$). Utilization, measured by LOS, ED use, or 90-day readmission rate, was not significantly different among hospital types.

In this paper, we explore whether differences in costs and length of stay exist between hospital types in New York State. New York State serves as an excellent model for comparison since it has four NCICCCs, the second most in a single state in the U.S., after California[5,] and has data readily accessible, which includes total costs to the hospital for an inpatient admission. We hypothesize that, given their expertise in complex care, NCI-designated Comprehensive Cancer Centers likely have lower costs, but shorter lengths of stay than community hospitals and non-NCI AMCs. We provide the first estimates using data from all payer types of how patient length of stay varies by NCICCC status, and the first estimates in any patient population of how hospital costs (as opposed to prices or charges) vary by NCICCC status.

Data

This paper uses de-identified discharge level data from the New York State (NYS) Statewide Planning and Research Cooperative System (SPARCS) Hospital Inpatient Discharges dataset, retrieved from the NYS Department of Health website[9]. All registered NYS hospitals and diagnosis and treatment centers (D&TC) are required to submit data on all inpatient

discharges each year. The dataset contains medical record information and is de-identified so as not to contain any data that qualifies as protected health information (PHI), protected by the Health Insurance Portability and Accountability Act (HIPAA). This dataset is unique in that it includes total costs incurred by the hospital for each discharge, and contains patient demographic information, the APR DRG code for the admission, discharge disposition, and length of stay.

We include discharge data from 2017 – 2019, which contains a cumulative 7,030,657 observations. After dropping observations with missing demographic, length of stay, facility, and/or APR DRG data, there are 6,706,643 observations (Table 1.1). We then generated a binary variable to identify whether a facility was a National Cancer Institute Designated Comprehensive Cancer Center (NCICCC), of which New York State has four: Memorial Sloan Kettering Cancer Center (New York, NY), Roswell Park Cancer Center (Buffalo, NY), Herbert Irving Comprehensive Cancer Center (New York, NY), and the Laura and Isaac Perlmutter Cancer Center at NYU Langone Health (New York, NY)[5]. We also specify whether a hospital is an academic center, using the Association of American Medical Colleges (AAMC) Hospital and Health System Members database, which includes hospitals who are affiliated with an AAMC Accredited Medical School[10]. There are 19 non-NCI AMCs in NYS (See appendix table 3).

Table 1.1: Summary Statistics of All Admissions for All Causes in NYS 2017-2019

Variable	Observations	Mean	Std. Dev.	Min	Max
Total Costs	6,706,643	$ 16,378.07	$ 33,479.41	$ 0.01	$ 8,868,613.00
Length of Stay	6,706,643	5.3012	7.2243	1	119
Academic Medical Center	6,706,643	0.4183	0.4933	0	1
Comp. Cancer Center	6,706,643	0.0881	0.2834	0	1
Cancer-Related Admission	6,706,643	0.0195	0.1382	0	1
Age 0-17	6,706,643	0.1413	0.3484	0	1
Age 18-29	6,706,643	0.0951	0.2933	0	1
Age 30-49	6,706,643	0.1891	0.3916	0	1
Age 50-69	6,706,643	0.2804	0.4492	0	1
Age 70+	6,706,643	0.2941	0.4556	0	1
Elective Admission	6,706,643	0.1779	0.3824	0	1
Emergency Admission	6,706,643	0.6500	0.4770	0	1
Urgent Admission	6,706,643	0.0758	0.2646	0	1
Trauma Admission	6,706,643	0.0041	0.0637	0	1
Newborn	6,706,643	0.0923	0.2894	0	1
Discharged Alive	6,706,643	0.9788	0.1442	0	1
Discharged as Expired	6,706,643	0.0212	0.1442	0	1
Minor Severity of Illness	6,706,628	0.3072	0.4613	0	1
Moderate Severity of Illness	6,706,628	0.3756	0.4843	0	1
Major Severity of Illness	6,706,628	0.2390	0.4265	0	1
Extreme Severity of Illness	6,706,628	0.0782	0.2685	0	1
Male	6,706,643	0.4482	0.4973	0	1
White	6,706,643	0.5606	0.4963	0	1
Black	6,706,643	0.1785	0.3829	0	1
Other Race	6,706,643	0.2510	0.4336	0	1
Hispanic	6,706,643	0.1359	0.3427	0	1

Note: This table contains data on all living-patient discharges from all NYS hospitals in 2017-2019. "Other Race" includes Native American and Asian/Pacific Islander. With the exceptions of "Total Costs" and "Length of Stay," the mean reports the % of the sample in each category.

Over the three years analyzed, NCICCCs had 679,114 discharges. To include only cancer-related admissions, we use APR DRG codes for malignancy. There are 16 malignancy-related APR DRG codes (see Appendix Table 1)[11]. After keeping only those discharges related to cancer and excluding newborn and trauma admissions, there are 130,364 discharges from all NYS hospitals included in the analysis (Table 1.2). 75,422 (58%) of included admissions are to non-NCI AMCs, 28,068 (22%) of included admissions are to NCICCC, and 26,874 (21%) are to community hospitals. We use demographic controls for race, ethnicity, sex, and age group, and

controls for the severity of illness, using the APR Severity of Illness Code and the type of admission (urgent, emergent, elective).

Table 1.2: Summary Statistics of All Admissions Relating to Cancer in NYS 2017-2019

Variable	Observations	Mean	Std. dev.	Min	Max
Total Costs	130,551	$ 24,653.25	$ 37,194.12	$ 20.72	$ 1,833,879.00
Length of Stay	130,551	8.0207	9.7328	1	119
Academic Medical Center	130,551	0.5786	0.4938	0	1
Comp. Cancer Center	130,551	0.2150	0.4108	0	1
Cancer-Related Admission	130,551	1.0000	0.0000	1	1
Age 0-17	130,551	0.0487	0.2152	0	1
Age 18-29	130,551	0.0278	0.1645	0	1
Age 30-49	130,551	0.1028	0.3036	0	1
Age 50-69	130,551	0.4175	0.4931	0	1
Age 70+	130,551	0.4033	0.4906	0	1
Elective Admission	130,551	0.2292	0.4203	0	1
Emergency Admission	130,551	0.6770	0.4676	0	1
Urgent Admission	130,551	0.0924	0.2895	0	1
Trauma Admission	130,551	0.0014	0.0377	0	1
Newborn	130,551	0.0000	0.0028	0	1
Discharged Alive	130,551	0.8919	0.3105	0	1
Discharged as Expired	130,551	0.1081	0.3105	0	1
Minor Severity of Illness	130,551	0.0456	0.2086	0	1
Moderate Severity of Illness	130,551	0.3068	0.4612	0	1
Major Severity of Illness	130,551	0.4689	0.4990	0	1
Extreme Severity of Illness	130,551	0.1787	0.3831	0	1
Male	130,551	0.5011	0.5000	0	1
White	130,551	0.5698	0.4951	0	1
Black	130,551	0.1795	0.3838	0	1
Other Race	130,551	0.2402	0.4272	0	1
Hispanic	130,551	0.1157	0.3199	0	1

Note: This table contains data on living-patient discharges from cancer-related admission from all NYS hospitals in 2017-2019. “Other Race” includes Native American and Asian/Pacific Islander. Only APR DRG codes related to malignancy are included. With the exception of “Total Costs” and “Length of Stay,” The mean reports the % of the sample in each category.

Methods

We estimate two separate regression equations, one exploring the effects of an admission to an NCICCC on total costs and one estimating the effects of an admission to an NCICCC on length of stay. The estimation of the effect on total costs is an ordinary least squares (OLS) regression in the form:

$$\text{(Eq. 1) } Total\ Costs_{it} = \beta_0 + \beta_1 * NCICCC_{it} + \beta_2 * Controls_{it} + \beta_3 Time + \varepsilon_{it}$$

To account for the skewed distribution of costs, we also log transformed the dependent variable:

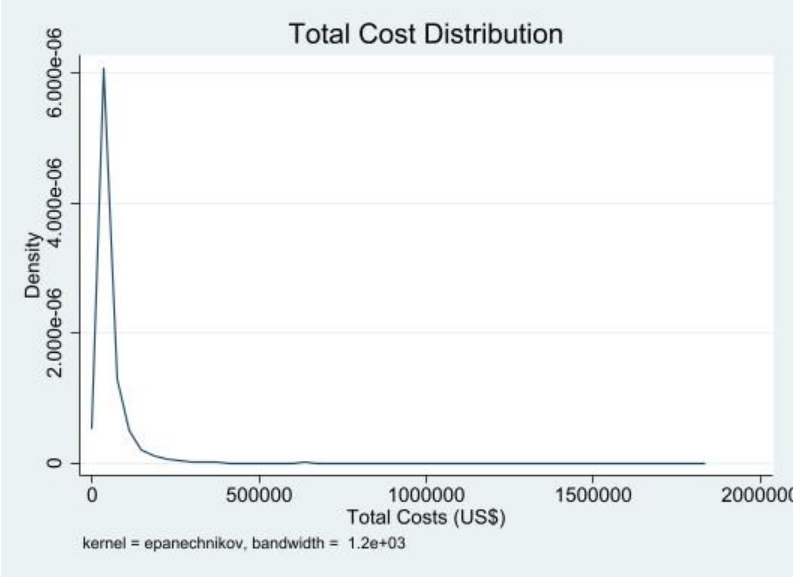
$$\text{(Eq. 2) } lnTotal\ Costs_{it} = \beta_0 + \beta_1 * NCICCC_{it} + \beta_2 * Controls_{it} + \beta_3 Time + \varepsilon_{it}$$

where $Total\ Costs_{it}$ is the total cost that the hospital incurs for admission *i* in year *t*, $lnTotal\ Costs_{it}$ is the natural log of total costs for admission *i* in year *t*, NCICCC represents whether the admission occurred at an NCI-designated Comprehensive Cancer Center, and controls represents the demographic and severity controls about each admission. After dropping newborn and trauma admissions, 130,364 admissions are included in the analysis (Table 2). A robustness check was performed by dropping all inpatients who died in the hospital and running the same regression models on the data, which included 116,277 discharges (Table 3).

Results

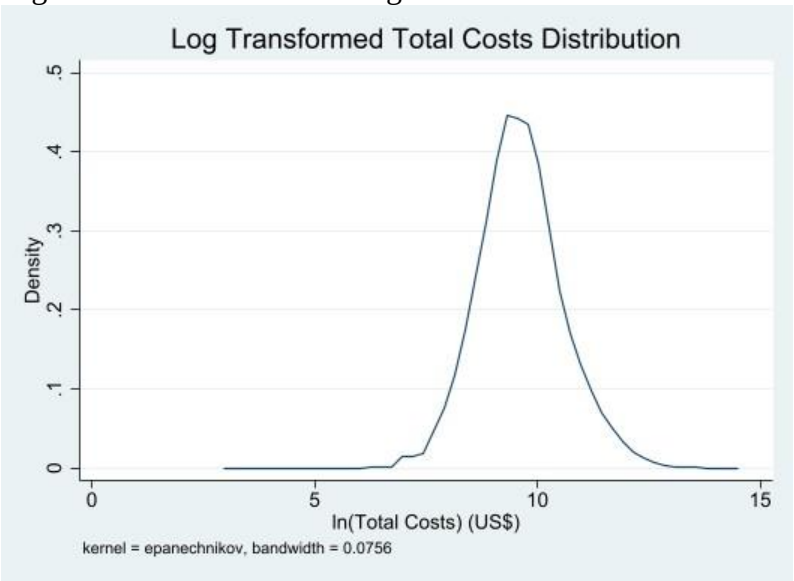
Our first regression on Total Costs (Eq. 1) (Column 1 in table 2) was an OLS regression without log transforming Total Costs. The results indicate that admission in a NCICCC increases the cost of care by $8,071 relative to community hospitals ($p < 0.01$). Costs, however, are distributed towards the left tail, so log transforming Total Costs provides a more normal distribution of the data (Figures 2.1 and 2.2). We took the natural log of Total Costs and ran an OLS regression (Eq. 2) (Column 3 on Table 4.1). The results can be interpreted by raising Euler's number to the power of the coefficient and subtracting 1, to give a percent change. As such, total costs of a cancer-related admission are, on average, 27% higher ($p<0.01$) than community hospitals. In non-NCI AMCs we find that costs are also significantly higher than community hospitals, though the difference is a smaller 23%. The analysis also finds that total costs tend to be higher with more severe illnesses and, interestingly, with younger age.

Figure 2.1: Distribution of Total Costs



Note: This graph displays the distribution of total costs, in US dollars, for all cancer-related admissions to all hospitals in NYS (n = 130,364).

Figure 2.2: Distribution of Log Transformed Total Costs



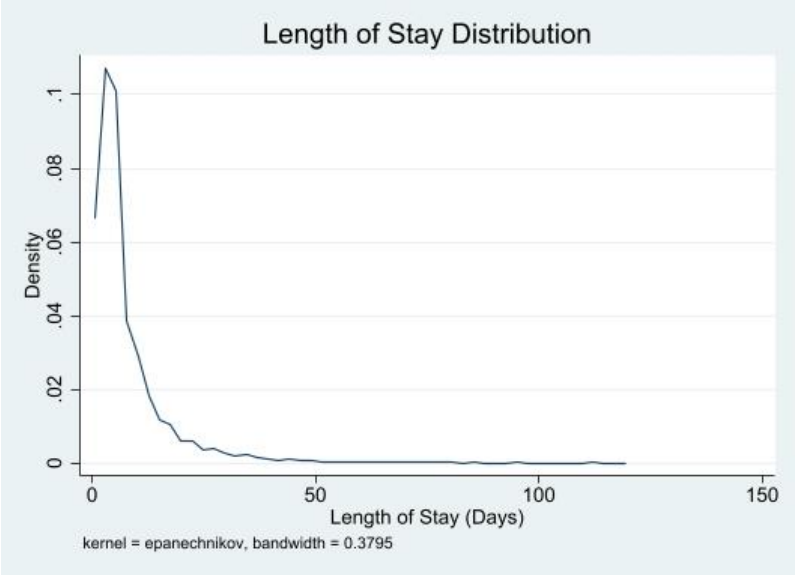
Note: This graph displays the distribution of the log transformed total costs, in US dollars, for all cancer-related admission to all hospitals in NYS (n = 130,364).

The impact of admission to a NCICCC on Length of Stay was estimated using an OLS regression and a Poisson regression, both in the form:

(Eq. 3) $Length\ of\ Stay_{it} = \beta_0 + \beta_1 * NCICCC_{it} + \beta_2 * Controls_{it} + \beta_3 Time + \varepsilon_{it}$

where Length of Stay is the number of days a patient spends in the hospital during admission *i* in year *t*, NCICCC represents whether the admission occurred at an NCI-designated Comprehensive Cancer Center, and controls represents the demographic and severity controls about each admission. Carter and Potts (2014)[12] describe the utility of Poisson Regression in LOS prediction due to its left skewed distribution (Figure 3).

Figure 3: Distribution of Length of Stay



Note: This graph displays the distribution of length of stay, in days, for all cancer-related admissions to all hospitals in NYS (n = 130,364).

Column 2 of table 2 contains the results of the OLS regression on LOS and shows that cancer-related admissions to NCICCC result in, on average, one day shorter LOS ($p < 0.01$) than in community hospitals. The Poisson regression results (Column 4 of table 2) can be interpreted by raising Euler's number to the power of the coefficient and subtracting 1, to give a percent change. The analysis shows that patients admitted to NCICCCs for cancer-related conditions on average have a 12% shorter LOS than community hospitals. Length of stay is not significantly different between non-NCI AMCs and community hospitals.

Table 2: Regression Results

VARIABLES	(1) Total Costs	(2) Length of Stay	(3) ln(Total Costs)	(4) Length of Stay
NCI-Designated Comp. Cancer Center	8,071***	-1.010***	0.238***	-0.123***
	(367.2)	(0.0738)	(0.00670)	(0.00899)
Academic Medical Center	4,211***	-0.0570	0.209***	-0.00531
	(208.2)	(0.0641)	(0.00570)	(0.00787)
White	2,176**	0.586***	0.0551**	0.0737**
	(1,067)	(0.226)	(0.0238)	(0.0290)
Black	4,303***	1.100***	0.163***	0.133***
	(1,076)	(0.233)	(0.0243)	(0.0296)
Other Race	3,550***	0.663***	0.101***	0.0831***
	(1,068)	(0.229)	(0.0241)	(0.0293)
Hispanic	32.32	-0.614***	0.0305***	-0.0745***
	(356.4)	(0.0872)	(0.00805)	(0.0110)
Male	1,015***	-0.0805	0.0293***	-0.00863
	(191.7)	(0.0505)	(0.00463)	(0.00627)
Age 18-29	-1,679	0.554***	3.45e-05	0.0654***
	(1,033)	(0.194)	(0.0184)	(0.0249)
Age 30-49	-8,788***	-0.369**	-0.165***	-0.0604***
	(743.0)	(0.145)	(0.0140)	(0.0194)
Age 50-69	-10,658***	-0.380***	-0.209***	-0.0609***
	(703.1)	(0.133)	(0.0128)	(0.0177)
Age 70+	-13,198***	-0.451***	-0.268***	-0.0707***
	(709.9)	(0.136)	(0.0130)	(0.0180)
Discharge Year	247.2**	-0.285***	0.00819***	-0.0347***
	(117.2)	(0.0313)	(0.00285)	(0.00391)
Emergency Admission	-2,070***	-2.067***	-0.00924	-0.265***
	(289.9)	(0.0855)	(0.00653)	(0.0101)
Urgent Admission	4,680***	-0.201*	0.111***	-0.0429***
	(443.8)	(0.110)	(0.00998)	(0.0129)
Moderate Severity of Illness	2,185***	1.120***	0.203***	0.250***
	(228.4)	(0.0850)	(0.0111)	(0.0219)
Major Severity of Illness	13,006***	4.998***	0.633***	0.852***
	(260.7)	(0.0917)	(0.0111)	(0.0217)
Extreme Severity of Illness	37,202***	11.23***	1.217***	1.430***
	(479.3)	(0.124)	(0.0124)	(0.0222)
Constant	-479,713**	580.9***	-7.397	71.53***
	(236,473)	(63.08)	(5.758)	(7.880)
Observations	130,364	130,364	130,364	130,364
R-squared	0.147	0.133	0.244	

Note: Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1. Analysis does not include newborn and trauma admissions (n=187).

Chastek et al. (2012)[13] calculated that cancer patients see a 223% increase in acute inpatient care costs between the second month before death and last month before death. To control for these dramatically increased costs, we repeated the regressions (Eqs. 1-3) on the same data but excluded any admission that resulted in the patient expiring in the hospital. There were 14,087 (10.8%) patients discharged as expired. The main regressions of interest (Columns 3 and 4 in Table 3) show that, on average, total costs are 24% higher for cancer-related admissions in NCICCCs, but LOS is, on average, 9% shorter than in community hospitals. In non-NCI AMCs total costs are also significantly higher than in community hospitals, though the increase is a smaller 19%. LOS in non-NCI AMCs is significantly higher than in community hospitals (by almost a full day), a major contrast to the NCICCCs which saw shorter LOS relative to community hospitals.

Table 3: Regression Results not including Patients Discharged as Expired

VARIABLES	(1) Total Costs	(2) Length of Stay	(3) ln(Total Costs)	(4) Length of Stay
NCI-Designated Comp. Cancer Center	7,015***	-0.645***	0.218***	-0.0851***
	(352.4)	(0.0710)	(0.00683)	(0.00908)
Academic Medical Center	4,130***	0.954***	0.175***	0.129***
	(207.6)	(0.0597)	(0.00582)	(0.00822)
White	1,639	0.251	0.0576**	0.0347
	(1,053)	(0.223)	(0.0245)	(0.0297)
Black	3,599***	0.896***	0.152***	0.118***
	(1,063)	(0.228)	(0.0249)	(0.0302)
Other Race	2,980***	0.443**	0.105***	0.0600**
	(1,053)	(0.225)	(0.0247)	(0.0299)
Hispanic	141.0	-0.171**	0.0171**	-0.0234**
	(353.6)	(0.0803)	(0.00812)	(0.0108)
Male	971.2***	0.0485	0.0328***	0.00737
	(191.9)	(0.0466)	(0.00469)	(0.00626)
Age 18-29	-2,435***	0.185	-0.00156	0.0157
	(936.0)	(0.183)	(0.0184)	(0.0240)
Age 30-49	-8,727***	-0.732***	-0.155***	-0.117***
	(709.1)	(0.139)	(0.0141)	(0.0190)
Age 50-69	-10,412***	-0.889***	-0.194***	-0.139***
	(675.4)	(0.127)	(0.0128)	(0.0172)
Age 70+	-12,734***	-1.076***	-0.236***	-0.164***
	(685.6)	(0.131)	(0.0131)	(0.0176)
Discharge Year	56.34	-0.311***	0.000799	-0.0412***
	(117.5)	(0.0288)	(0.00288)	(0.00389)
Emergency Admission	-1,913***	-0.0850	-0.0582***	-0.00866
	(320.0)	(0.0722)	(0.00660)	(0.0109)
Urgent Admission	4,537***	1.293***	0.0866***	0.164***
	(447.7)	(0.103)	(0.0100)	(0.0135)
Moderate Severity of Illness	2,044***	0.834***	0.197***	0.202***
	(228.2)	(0.0785)	(0.0110)	(0.0210)
Major Severity of Illness	12,924***	4.285***	0.639***	0.781***
	(266.0)	(0.0841)	(0.0110)	(0.0209)
Extreme Severity of Illness	37,705***	11.01***	1.245***	1.408***
	(534.1)	(0.130)	(0.0127)	(0.0217)
Constant	-94,374	631.1***	7.561	84.46***
	(237,141)	(58.16)	(5.820)	(7.850)
Observations	116,277	116,277	116,277	116,277
R-squared	0.149	0.157	0.250	

Note: Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1. Analysis does not include newborn and trauma admissions (n=187), or patients discharged as expired (n=14,087).

Discussion

Using patient-level data from the New York State Statewide Planning and Research Cooperative System (SPARCS) Hospital Inpatient Discharges dataset, we find that, contrary to our hypothesis, inpatient costs for cancer-related admissions are significantly higher in NCI-designated Comprehensive Cancer Centers than in community hospitals. However, the average length of stay for a cancer-related admission is significantly shorter in NCICCCs than in community hospitals. Ameri et al. (2022)[14] demonstrate that the main factors contributing to extended LOS for cancer patients were medical complications, post-discharge placement delays, and hospice arrangements. NCICCCs treat primarily cancer patients, so they have developed expertise in managing acute and post-acute medical needs as well as social needs. This expertise likely helps contribute to the shorter LOS seen in NCICCCs. However, since NCICCCs have such expertise in treating the most complex oncology patients, they tend to attract the most advanced cases of the disease. Therefore, the higher total costs could be due to performing a higher volume of complex procedures and administering more expensive treatments, like bone marrow transplants and chimeric antigen receptor (CAR) T-cell therapy.

Also important to note are the disparities in costs and LOS between races. For example, Black cancer patients have, on average three-times higher costs (18% vs. 6%, $p<0.01$) and nearly two times longer LOS (14% vs. 8%, $p<0.01$) than white cancer patients. Though it is impossible to determine the exact root cause of these racial disparities, it is reasonable to attribute them to the causes already described in the literature, including socioeconomic status and education level, poorer access to healthcare, lower prevalence of screening, and a lack of research focus on diverse groups, all of which can contribute to more advanced disease and increased mortality[15].

To our knowledge, ours is the first paper to use patient-level data from all payers to identify variation in total costs and length of stay for oncology care between hospital types. Previous work has focused on differences in spending among AMCs and community hospitals for all-cause admissions[6,7] or focused on commercial payor reimbursement difference for procedural costs related to cancer between NCI centers and non-NCI centers[8]. Our results are consistent with Takvorian et al. (2021)[8], who found that procedural prices are more expensive in NCICCs. They also found that commercial payors may be incentivized to steer patients away from NCICCCs, and that some are excluding physicians affiliated with the centers from narrow healthcare networks due to their higher costs.

This study identifies an important difference between hospital types and highlights important areas for further study. Though not possible with the dataset we use, it would be interesting to pair our results with overall outcomes for each center to determine if the higher costs in NCICCs are justified, and to determine the reasons for shorter LOS in the more expensive facilities. Moreover, total costs are not what the patient actually pays for their care episode, they are what it costs the hospital to care for a patient through his admission. The cost to the patient is determined by insurance coverage, and the effect of hospital type on patient charges likely differs by payer. Finally, our analysis identifies a deep disparity in costs and LOS between minority groups. Though our data does not allow for the determination of the root causes of these disparities, the identification of their existence is an important first step in making inpatient cancer care more equitable.

Limitations

This study has limitations, the greatest of which being that the data includes only New York State hospitals, so the results cannot necessarily be generalized to any other state or to the

whole United States. Second, this study does not include patient out-of-pocket spending or insurance coverage, so it is impossible to determine how patients are impacted by the total costs of their admissions. Third, the data does not allow for control of disease stage or type of treatment received during the admission, so patients receiving high-cost, intensive inpatient care, such as CAR-T cell therapy, are included with those admitted for a simple fever. We attempted to control for these variables by including the severity of illness code and admission type in our regression equations, and not including patients discharged as expired in a robustness check.

Conclusion

This study found that NCI-designated Comprehensive Cancer Centers have significantly higher costs, but shorter lengths of stays for admissions relating to a cancer diagnosis than non-NCI academic medical centers and community hospitals in New York State. More research must be done to identify the root causes of the differences in costs and LOS and pairing with outcomes measures to determine the level of cost-effectiveness for these admissions, and the extent to which the higher costs of Comprehensive Cancer Centers are necessary to achieve their shorter length of stay.

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Appendix

Appendix Table 1: APR DRG Code Descriptions

DRG Code	DRG Description
041	Nervous System Malignancy
110	Ear, Nose, Mouth, Throat, Cranial/Facial Malignancies
136	Respiratory Malignancy
240	Digestive Malignancy
281	Malignancy of Hepatobiliary System & Pancreas
343	Musculoskeletal Malignancy & Pathologic Fracture due to Musculoskeletal Malignancy
382	Malignant Breast Disorders
461	Kidney & Urinary Tract Malignancy
500	Malignancy, Male Reproductive System
530	Female Reproductive System Malignancy
690	Acute Leukemia
691	Lymphoma, Myeloma & Non-Acute Leukemia
692	Radiotherapy
694	Lymphatic & Other Malignancies & Neoplasms of Uncertain Behavior
695	Chemotherapy for Acute Leukemia
696	Other Chemotherapy

Note: This table includes the APR Diagnosis Related Groups included in our analysis and their descriptions

Appendix Table 2: NCI Cancer Centers

Operating Certificate Number	Hospital Name
7002020	Memorial Sloan Kettering Cancer Center
1401010	Roswell Park Cancer Institute
7002054	Columbia University Herbert Irving Comprehensive Cancer Center
7002053	NYU Langone Perlmutter Cancer Center

Note: This table includes the operating certificate numbers and names of NCI Cancer Centers in New York State

Appendix Table 3: Academic Medical Centers

Operating Certificate Number	Hospital Name
0101000	Albany Medical Center Hospital
3824000	Mary Imogene Bassett Hospital
7002017	Lenox Hill Hospital
7003004	Long Island Jewish Medical Center
7001020	Maimonides Medical Center
7000006	Montefiore Medical Center
7002002	Mount Sinai Beth Israel
7002032	Mount Sinai Morningside
7003010	NewYork-Presbyterian/Queens
7001021	NewYork-Presbyterian Brooklyn Methodist Hospital
2951001	North Shore University Hospital
7004003	Staten Island University Hospital
2701005	Strong Memorial Hospital
5151001	Stony Brook University Hospital
7002024	Mount Sinai Hospital
0303001	Binghamton General Hospital
7001037	University Hospital of Brooklyn
3301007	Upstate University Hospital at Community General
5957001	Westchester Medical Center

Note: This table includes the operating certificate numbers and names of all AMCs in NYS included in our analysis. It does not include NCICCCs