Appendix A. Methodological details

We evaluated whether hospitals' advertising spending was associated with long-term survival among cancer patients treated in those centers. For both measures, we applied previously described methods.[1,2] We captured hospital advertising spending for cancer services in 2014 using data from the media-monitoring agency Kantar Media (New York, New York). We included advertising by centers with the terms "cancer," "oncology," "radiation," or another cancer therapy (e.g., proton therapy) in their name or advertisement.[2] Free-standing clinics and solo outpatient centers were excluded.

Medicare Fee-for-Service (FFS) 100% Research Identifiable Files were used to determine hospital risk-adjusted five-year mortality ratios, including cases from 2011-12. Each case had new claims for cancer care after a year (or more) without a claim for a cancer diagnosis, and mortality data through 2017.[1] When multiple hospitals were involved under one advertising campaign, we pooled their outcomes weighted by the number of patients treated at each hospital. We included the top 50 hospitals (or sets of hospitals) in terms of their advertising spending, accounting for over 89% of the 173 million dollars spent on advertising in 2014.

Statistical analysis

The primary test of association was a linear regression, with advertising spending as the predictor. The outcome was a risk-adjusted mortality ratio which was determined by dividing the observed number of deaths by an expected number. In brief, the 3M Clinical Risk Group (CRG) risk adjustment model in combination with adjustments for age and median income level of the zip code of residence serve to adjust for differences in patient severity and population demographics. A risk-adjusted mortality ratio below one indicates that a hospital performed better than expected, where a ratio greater than one means a hospital had higher mortality than what was expected. The R-squared from the regression model was used to see how well advertising spending explained outcomes. We conducted additional analyses that included a log transformation of the x variable (i.e., spending) and weighting of the outcome (y) variable (i.e.,

risk- adjusted five-year mortality) by the volume of patients at the hospital. In total, there were four models used to assess the relationship between advertising spending and risk-adjusted mortality. This study was deemed exempt research by the institutional review board of Memorial Sloan Kettering Cancer Center. The Centers for Medicare & Medicaid Services and Kantar Media granted data use approvals.

References:

1.   Pfister DG, Rubin DM, Elkin EB, et al. Risk Adjusting Survival Outcomes in Hospitals That Treat Patients With Cancer Without Information on Cancer Stage. *JAMA oncology* 2015; **1**(9): 1303-10.

2.   Vater LB, Donohue JM, Park SY, Schenker Y. Trends in Cancer-Center Spending on Advertising in the United States, 2005 to 2014. *JAMA Intern Med* 2016; **176**(8): 1214-6.

Appendix B. Advertising spend and risk-adjusted five-year mortality for top 50 hospital advertisers

Rank by advertising spend	Hospital advertiser[1]	State(s)[2]	Advertising spend ($) in thousands[3]	Total number of FFS Medicare patients[4]	Five-year risk-standardized mortality ratio[5]
1	Cancer Treatment Centers of America	AZ, GA, IL, OK, PA	101741	506	1.13
2	MD Anderson Cancer Center	AZ, NJ, TX	15155	7587	0.90
3	Memorial Sloan Kettering Cancer Center	NY	9086	5945	0.83
4	Fox Chase Cancer Center	PA	3520	1233	0.90
5	Huntsman Cancer Institute	UT	2178	901	1.03
6	Sutter Cancer Center	CA	2089	2026	0.97
7	Dana-Farber Cancer Institute	MA	1836	2993	0.94
8	Seattle Cancer Care Alliance	WA	1821	1591	0.97
9	Winthrop NYCyberKnife Center	NY	1336	1162	0.98
10	CDH Proton Center	IL	1256	1910	0.89
11	H Lee Moffitt Cancer Center	FL	1113	2794	0.87
12	University of Florida	FL	1113	1839	0.94
13	James Cancer Hospital	OH	962	1646	0.96
14	Edward Cancer Center	IL	864	720	1.01
15	Swedish Cancer Institute	WA	663	1818	0.96
16	Smilow Cancer Hospital	CT	573	2235	0.97
17	Siteman Cancer Center	MO	486	2844	0.97
18	University of MD Greenebaum Cancer Center	MD	396	817	1.02
19	Karmanos Cancer Institute	MI	386	971	0.96
20	Scripps Proton Therapy Center	CA	363	1965	0.97
21	Northside Hospital Cancer Institute	GA	340	1712	1.03
22	Cancer Institute of NJ	NJ	338	171	1.01
23	Morristown Medical Center	NJ	332	1325	0.98
24	Houston Methodist Cancer Center	TX	322	93	1.04
25	NYU Cancer Institute	NY	306	1630	0.87
26	HealthEast CyberKnife Center	MN	305	151	1.07
27	University of Chicago Medicine Comprehensive Cancer Center	IL	303	1351	0.93
28	Hartford HealthCare Cancer Institute	CT	266	2514	0.99
29	Abramson Cancer Center	PA	264	3047	0.92
30	Memorial Cancer Institute	FL	255	433	0.97
31	City of Hope Cancer Center	CA	241	1178	0.87
32	University of KS Cancer Center	KS	224	1851	1.01
33	Christus Schumpert Cancer Treatment Center	LA	218	559	1.02
34	Sylvester Comprehensive Cancer Center	FL	197	659	0.93
35	University Hospitals Seidman Cancer Center	OH	194	1414	0.93
36	UPMC Cancer Centers	PA	184	3949	0.97
37	Edwards Comprehensive Cancer Center	WV	172	389	0.98
38	Mary Bird Perkins Cancer Center	LA	171	1454	1.04
39	John Theurer Cancer Center	NJ	165	1870	0.93
40	Kettering Cancer Care	OH	164	709	0.96
41	Intermountain Cancer Center	UT	156	679	1.03
42	St Peters Hospital Cancer Care Center	NY	150	957	0.97
43	Stephenson Cancer Center OU Medical	OK	146	900	0.99
44	USC Norris Comprehensive Cancer Center	CA	135	263	1.00
45	Upstate Cancer Center	NY	133	767	1.04
46	Integris Cancer Institute of OK	OK	132	1210	1.01

47	Providence Cancer Center	AK, OR, WA	127	5486	0.98
48	Reid Cancer Center	IN	124	531	1.07
49	Montefiore Einstein Center for Cancer Care	NY	120	951	1.00
50	Inova Comprehensive Cancer & Research Institute	VA	106	2580	1.01

[1]Advertisers include hospitals or set of hospitals involved under one advertising campaign.
[2]These are the states for the hospitals that were used to calculate the five-year risk-adjusted mortality ratio for that advertiser.
[3]Advertising spend for 2014.
[4]Volume is summed over the set of hospitals involved under one advertising campaign.
[5]Hospital risk-adjusted mortality ratio for patients with FFS Medicare coverage beginning treatment in 2011-2012.