

Supplementary Appendix

This appendix has been provided by the authors to give readers additional information about their work.

Supplement to: Tej A. Patel, Jonathan Heintz, Jinbo Chen, et al. Spending Analysis of Machine Learning–Based Communication Nudges in Oncology. *NEJM AI*. DOI: [10.1056/Aloa2300228](https://doi.org/10.1056/Aloa2300228).

SUPPLEMENT

Supple. Table 1: Variables included in machine learning algorithm

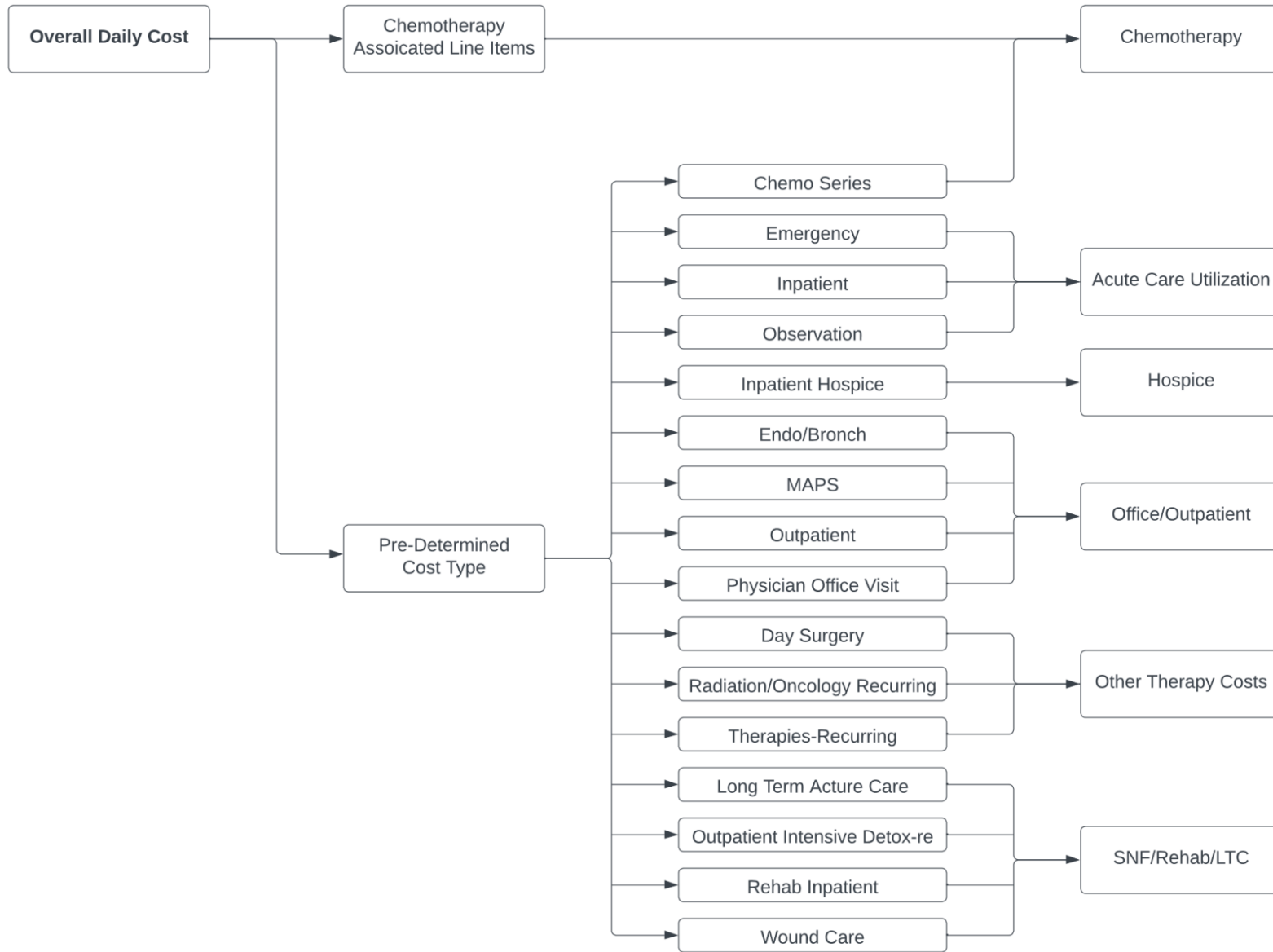
Laboratories	Units	Features included
Age	Years	
Gender	Male/Female	
Elixhauser comorbidities	Count	Count of number times comorbidity was ever coded (“total”) Count of number of times comorbidity was coded in the past 180 days (“recent”)
Metastatic cancer		
Diabetes, uncomplicated		
Alcohol abuse		
Rheumatoid arthritis/collagen vascular diseases		
Weight loss		
Iron deficiency anemia		
Lymphoma		
Cardiac arrhythmias		
Pulmonary circulation disorder		
Liver disease		
Obesity		
Chronic pulmonary disease		
Hypertension, uncomplicated		
Fluid and electrolyte disorders		
Renal failure		
Other neurological disorders		
Pulmonary valvular disorder		
Peptic ulcer disease excluding bleeding		
Hypothyroidism		
Valvular disease		
Congestive heart failure		
Depression		
Paralysis		
Drug abuse		
Diabetes, complicated		
Coagulopathy		
Blood loss anemia		
Solid tumor without metastasis		
AIDS/HIV		
Hypertension, complicated		
Psychoses		
EKG Values		Count
T Axis	degrees	First value checked

R Axis	degrees	Last value checked Maximum value Minimum value Proportion of Values ordered as STAT
P Axis	degrees	
Q-T Interval	ms	
QRS Duration	ms	
P-R Interval	ms	
QTC Calculation(Bazett)	ms	
Atrial Rate	BPM	
Ventricular Rate	BPM	
Laboratories		Count First value checked Last value checked Maximum value Minimum value Proportion of values ordered as STAT
% Basophils Manual	%	
% Eosinophils Manual	%	
Reticulocyte count	%	
% Band Neutrophils	%	
% Lymphocytes Manual	%	
% Eosinophils	%	
% Basophils	%	
% Lymphocyte Variants	%	
% Segmented Neutrophils Manual	%	
% Monocytes	%	
% Lymphocytes	%	
% Myelocytes	%	
% Monocytes Manual	%	
Alkaline Phosphatase	IU/L	
WBC Corrected	THO/uL	
Abs Retic	THO/uL	
# Eosinophils Manual	THO/uL	
# Segmented Neutrophils Manual	THO/uL	
# Basophils Manual	THO/uL	
# Monocytes Manual	THO/uL	
# Atypical Lymphocytes	THO/uL	
# Lymphocytes Manual	THO/uL	
AST	U/L	
Lactate dehydrogenase	U/L	
ALT	U/L	
UA pH	[pH]	
# Band Neutrophils	cells/uL	
MCV	fL	
RDW	fL	
Gamma-Globulin Fraction	g/dL	

MCHC	g/dL
Beta-Globulin Fraction	g/dL
Albumin Fraction	g/dL
Alpha2-Globulin Fraction	g/dL
Alpha1-Globulin Fraction	g/dL
% Nucleated Red Blood Cells	k/cumm
% Neutrophils	k/uL
eGFR, AA	mL/min/1.73m2
eGFR, Non-AA	mL/min/1.73m2
Magnesium	mg/dL
Immunoglobulin G	mg/dL
Immunoglobulin M	mg/dL
Fibrinogen	mg/dL
BUN	mg/dL
Urea Nitrogen	mg/dL
POC Glucose (Fingerstick)	mg/dL
Glucose	mg/dL
Calcium	mg/dL
Bilirubin, Indirect	mg/dL
Uric acid	mg/dL
Bilirubin, Direct	mg/dL
Phosphate	mg/dL
Creatinine	mg/dL
Hemoglobin	mg/dL
Triglycerides	mm/l
Total Cholesterol	mm/l
pCO2 Art	mmHg
Carbon Dioxide	mmol/L
Anion Gap	mmol/L
Lactic acid	mmol/L
Chloride	mmol/L
Sodium	mmol/L
Potassium	mmol/L
Carcinoembryonic antigen	ng/mL
Ferritin	ng/mL
MCH	pg
INR	ratio
PTT	second(s)
PT	seconds

TSH	u[IU]/mL	
Tacrolimus level	ug/L	
# Basophils	x10E3/uL	
# Neutrophils	x10E3/uL	
# Monocytes	x10E3/uL	
# Eosinophils	x10E3/uL	
White blood cells	x10E3/uL	
Platelets	x10E3/uL	
# Lymphocytes	x10E3/uL	
Red blood cells	x10E6/uL	
Albumin	g/dL	
Bilirubin, Total	mg/dL	
Immunoglobulins A	mg/dL	
Protein, Total	g/dL	

Suppl. Figure 1: Flowchart depicting the different categorizations of spending used in the study



Suppl. Table 2: Unadjusted mean total and daily spending, stratified by sectors. Mean daily spending was calculated for 6 months, 3 months, and 1 month before death.

	Cost type	Cohort	Time before death								
			6 months			3 months			1 month		
			N	Median	Mean	N	Median	Mean	N	Median	Mean
Overall	Total Spending	All	1187	\$51,100.40	\$71,521.87	1187	\$22,768.41	\$40,133.72	1187	\$654.18	\$14,021.77
		Treatment	957	\$47,559.84	\$68,977.18	957	\$21,040.98	\$39,401.71	957	\$547.39	\$13,588.01
		Control	230	\$63,179.42	\$82,109.99	230	\$25,936.82	\$43,179.52	230	\$2,156.57	\$15,826.56
	Daily Spending	All	1187	\$280.00	\$391.90	1187	\$249.52	\$439.82	1187	\$21.52	\$461.24
		Treatment	957	\$260.60	\$377.96	957	\$230.59	\$431.80	957	\$18.01	\$446.97
		Control	230	\$346.19	\$449.92	230	\$284.24	\$473.20	230	\$70.94	\$520.61
Daily spending by sectors	Acute Care Utilization	All	1187	\$60.84	\$201.49	1187	\$0.00	\$270.92	1187	\$0.00	\$353.18
		Treatment	957	\$55.22	\$201.75	957	\$0.00	\$272.30	957	\$0.00	\$346.62
		Control	230	\$81.58	\$200.42	230	\$69.70	\$265.19	230	\$0.00	\$380.48
	Systemic Therapy	All	1187	\$60.85	\$122.92	1187	\$27.63	\$107.42	1187	\$0.00	\$72.83
		Treatment	957	\$48.27	\$112.97	957	\$17.72	\$99.71	957	\$0.00	\$64.92
		Control	230	\$114.87	\$164.32	230	\$71.16	\$139.53	230	\$0.00	\$105.72
	Hospice	All	1187	\$0.00	\$0.82	1187	\$0.00	\$1.64	1187	\$0.00	\$4.72
		Treatment	957	\$0.00	\$0.89	957	\$0.00	\$1.78	957	\$0.00	\$5.34
		Control	230	\$0.00	\$0.52	230	\$0.00	\$1.04	230	\$0.00	\$2.14
	Office/ Outpatient	All	1187	\$19.15	\$26.84	1187	\$14.89	\$23.51	1187	\$0.00	\$15.84
		Treatment	957	\$17.74	\$24.01	957	\$13.96	\$22.15	957	\$0.00	\$14.72
		Control	230	\$23.17	\$38.61	230	\$17.61	\$29.13	230	\$0.00	\$20.50
	Other Therapy	All	1187	\$0.00	\$31.43	1187	\$0.00	\$25.55	1187	\$0.00	\$10.30
		Treatment	957	\$0.00	\$29.42	957	\$0.00	\$22.99	957	\$0.00	\$9.95
		Control	230	\$1.45	\$39.77	230	\$0.00	\$36.19	230	\$0.00	\$11.77
	SNF/ Rehab/ LTC	All	1187	\$0.00	\$8.39	1187	\$0.00	\$10.78	1187	\$0.00	\$4.34
		Treatment	957	\$0.00	\$8.90	957	\$0.00	\$12.86	957	\$0.00	\$5.38
		Control	230	\$0.00	\$6.28	230	\$0.00	\$2.11	230	\$0.00	\$0.00

Suppl. Table 3a: Daily spending for patients who received at least one serious illness conversation (SIC) before and after the first SIC in the last 6 months of life

Daily Spending Before and After 1st SIC in Last 6 Months of Life									
Treatment Group	Time Period	N	Mean	Std Dev	Min	Q1	Median	Q3	Max
All patients	Before 1st SIC	448	\$329.87	\$513.57	\$0.00	\$0.00	\$148.82	\$484.80	\$6,398.25
	After 1st SIC	448	\$291.95	\$591.47	\$0.00	\$0.00	\$16.74	\$350.81	\$5,340.23
Control	Before 1st SIC	75	\$390.75	\$393.18	\$0.00	\$19.97	\$347.57	\$590.62	\$1,417.64
	After 1st SIC	75	\$258.12	\$418.15	\$0.00	\$0.00	\$13.92	\$339.32	\$2,007.98
Treatment	Before 1st SIC	373	\$317.63	\$534.12	\$0.00	\$0.00	\$122.19	\$441.69	\$6,398.25
	After 1st SIC	373	\$298.75	\$620.74	\$0.00	\$0.00	\$17.20	\$352.00	\$5,340.23

Suppl. Table 3b: Daily spending for patients in the cohort who received exactly one SIC before and after their first SIC in the last 6 months of life

Daily Spending Before and After 1st SIC in Last 6 Months of Life (Only Patients with 1 SIC)									
Treatment Group	Time Period	N	Mean	Std Dev	Min	Q1	Median	Q3	Max
All patients	Before 1st SIC	293	\$348.91	\$569.50	\$0.00	\$0.00	\$151.15	\$503.11	\$6,398.25
	After 1st SIC	293	\$295.19	\$667.36	\$0.00	\$0.00	\$0.00	\$311.57	\$5,340.23
Control	Before 1st SIC	54	\$424.25	\$409.03	\$0.00	\$41.99	\$371.14	\$602.24	\$1,417.64
	After 1st SIC	54	\$220.22	\$409.98	\$0.00	\$0.00	\$0.00	\$254.31	\$2,007.98
Treatment	Before 1st SIC	239	\$331.88	\$599.23	\$0.00	\$0.00	\$119.56	\$454.83	\$6,398.25
	After 1st SIC	239	\$312.13	\$712.34	\$0.00	\$0.00	\$0.00	\$332.66	\$5,340.23

Suppl. Table 4: Proportion of patients that received the intervention, stratified by wedge period

		wedge(wedge)						
		0	1	2	3	4	5	Total
Intervention	No	17	26	22	15	18	132	230
		7.39	11.3	9.57	6.52	7.83	57.39	
		23.29	32.1	22	18.75	21.95	17.12	
	Yes	56	55	78	65	64	639	957
		5.85	5.75	8.15	6.79	6.69	66.77	
		76.71	67.9	78	81.25	78.05	82.88	
	Total	73	81	100	80	82	771	1187

Key
Frequency
Row Percent
Column Percent