Supplementary Online Content

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

eTable 1. Patient comorbidities included in sensitivity analyses listed by Hierarchical Condition Category (HCC)

Characteristics	Category	N Episodes TM	N Episodes MA	SMD
Overall		22,594	8969	
HCC1	HIV/AIDS	39 (0.17%)	19 (0.21%)	-0.0092
HCC2	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	2191 (9.70%)	858 (9.57%)	0.0044
HCC6	Opportunistic Infections	238 (1.05%)	97 (1.08%)	-0.0027
HCC8	Metastatic Cancer and Acute Leukemia	8885 (39.32%)	3220 (35.90%)	0.0704
HCC9	Lung and Other Severe Cancers	2994 (13.25%)	1149 (12.81%)	0.0130
HCC10	Lymphoma and Other Cancers	1663 (7.36%)	617 (6.88%)	0.0186
HCC11	Colorectal, Bladder, and Other Cancers	1317 (5.83%)	561 (6.25%)	-0.0180
HCC12	Breast, Prostate, and Other Cancers and Tumors	6255 (27.68%)	2567 (28.62%)	-0.0209
HCC21	Protein-Calorie Malnutrition	2922 (12.93%)	1126 (12.55%)	0.0113
HCC22	Morbid Obesity	1015 (4.49%)	366 (4.08%)	0.0201
HCC23	Other Significant Endocrine and Metabolic Disorders	1760 (7.79%)	630 (7.02%)	0.0289
HCC27	End-Stage Liver Disease	185 (0.82%)	61 (0.68%)	0.0158
HCC28	Cirrhosis of Liver	178 (0.79%)	66 (0.74%)	0.0059
HCC29	Chronic Hepatitis	97 (0.43%)	34 (0.38%)	0.0078
HCC33	Intestinal Obstruction/Perforation	810 (3.59%)	319 (3.56%)	0.0015
HCC34	Chronic Pancreatitis	83 (0.37%)	28 (0.31%)	0.0093
HCC35	Inflammatory Bowel Disease	210 (0.93%)	81 (0.90%)	0.0028
HCC39	Bone/Joint/Muscle Infections/Necrosis	250 (1.11%)	74 (0.83%)	0.0279
HCC40	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	1065 (4.71%)	383 (4.27%)	0.0212
HCC46	Severe Hematological Disorders	205 (0.91%)	77 (0.86%)	0.0052
HCC47	Disorders of Immunity	2764 (12.23%)	1056 (11.77%)	0.0141
HCC48	Coagulation Defects and Other Specified Hematological Disorders	2450 (10.84%)	876 (9.77%)	0.0351
HCC51	Dementia With Complications	NA	NA	NA
HCC52	Dementia Without Complication	NA	NA	NA
HCC54	Drug/Alcohol Psychosis	18 (0.08%)	NA	NA
HCC55	Drug/Alcohol Dependence	478 (2.12%)	208 (2.23%)	-0.0140
HCC57	Schizophrenia	62 (0.27%)	21 (0.23%)	0.0079
HCC58	Major Depressive, Bipolar, and Paranoid Disorders	612 (2.71%)	192 (2.14%)	0.0361
HCC70	Quadriplegia	37 (0.16%)	NA	NA
HCC71	Paraplegia	91 (0.40%)	38 (0.42%)	-0.0033
HCC72	Spinal Cord Disorders/Injuries	455 (2.01%)	156 (1.74%)	0.0199
HCC73	Amyotrophic Lateral Sclerosis and Other Motor Neuron Disease	NA	NA	NA
HCC74	Cerebral Palsy	14 (0.06%)	NA	NA

HCC75	Polyneuropathy	602 (2.66%)	187 (2.08%)	0.0371
HCC76	Muscular Dystrophy	NA	NA	NA
HCC77	Multiple Sclerosis	67 (0.30%)	19 (0.21%)	0.0162
HCC78	Parkinson's and Huntington's Diseases	187 (0.83%)	76 (0.85%)	-0.0022
HCC79	Seizure Disorders and Convulsions	958 (4.24%)	332 (3.70%)	0.0272
HCC80	Coma, Brain Compression/Anoxic Damage	1508 (6.67%)	526 (5.86%)	0.0330
HCC82	Respirator Dependence/Tracheostomy Status	196 (0.87%)	87 (0.97%)	-0.0109
HCC83	Respiratory Arrest	14 (0.06%)	NA	NA
HCC84	Cardio-Respiratory Failure and Shock	2834 (12.54%)	1133 (12.63%)	-0.0027
HCC86	Acute Myocardial Infarction	656 (2.90%)	207 (2.31%)	0.0365
HCC87	Unstable Angina and Other Acute Ischemic Heart Disease	368 (1.63%)	136 (1.52%)	0.0090
HCC88	Angina Pectoris	334 (1.48%)	127 (1.42%)	0.0052
HCC99	Cerebral Hemorrhage	389 (1.72%)	146 (1.63%)	0.0073
HCC100	Ischemic or Unspecified Stroke	547 (2.42%)	204 (2.27%)	0.0096
HCC103	Hemiplegia/Hemiparesis	685 (3.03%)	221 (2.46%)	0.0340
HCC104	Monoplegia, Other Paralytic Syndromes	95 (0.42%)	20 (0.22%)	0.0328
HCC106	Atherosclerosis of the Extremities with Ulceration or Gangrene	107 (0.47%)	38 (0.42%)	0.0074
HCC110	Cystic Fibrosis	NA	NA	NA
HCC112	Fibrosis of Lung and Other Chronic Lung Disorders	525 (2.32%)	140 (1.56%)	0.0531
HCC114	Aspiration and Specified Bacterial Pneumonias	826 (3.66%)	337 (3.76%)	-0.0054
HCC115	Pneumococcal Pneumonia, Empyema, Lung Abscess	456 (2.02%)	188 (2.10%)	-0.0055
HCC122	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	19 (0.08%)	NA	NA
HCC124	Exudative Macular Degeneration	40 (0.18%)	NA	NA
HCC134	Dialysis Status	165 (0.73%)	61(0.68%)	0.0059
HCC135	Acute Renal Failure	2834 (12.54%)	1176 (13.11%)	-0.0171
HCC136	Chronic Kidney Disease, Stage 5	33 (0.15%)	14 (0.16%)	-0.0026
HCC137	Chronic Kidney Disease, Severe (Stage 4)	118 (0.52%)	46 (0.51%)	0.0013
HCC138	Chronic Kidney Disease, Moderate (Stage 3)	NA	NA	NA
HCC139	Chronic Kidney Disease, Mild or Unspecified (Stages 1-2 or Unspecified)	NA	NA	NA
HCC140	Unspecified Renal Failure	NA	NA	NA
HCC141	Nephritis	NA	NA	NA
HCC157	Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	43 (0.19%)	20 (0.22%)	-0.0073
HCC158	Pressure Ulcer of Skin with Full Thickness Skin Loss	185 (0.82%)	60 (0.67%)	0.0171

HCC159	Pressure Ulcer of Skin with Partial Thickness Skin Loss	NA	NA	NA
HCC160	Pressure Pre-Ulcer Skin Changes or Unspecified Stage	NA	NA	NA
HCC161	Chronic Ulcer of Skin, Except Pressure	325 (1.44%)	76 (0.85%)	0.0528
HCC162	Severe Skin Burn or Condition	NA	NA	NA
HCC166	Severe Head Injury	NA	NA	NA
HCC167	Major Head Injury	168 (0.74%)	60 (0.67%)	0.0088
HCC169	Vertebral Fractures without Spinal Cord Injury	683 (3.02%)	257 (2.87%)	0.0093
HCC170	Hip Fracture/Dislocation	455 (2.01%)	159 (1.77%)	0.0175
HCC173	Traumatic Amputations and Complications	52 (0.23%)	16 (0.18%)	0.0112
HCC176	Complications of Specified Implanted Device or Graft	805 (3.56%)	305 (3.40%)	0.0088
HCC186	Major Organ Transplant or Replacement Status	123 (0.53%)	46 (0.51%)	0.0043
HCC188	Artificial Openings for Feeding or Elimination	1210 (5.36%)	471 (5.25%)	0.0046
HCC189	Amputation Status, Lower Limb/Amputation Complications	99 (0.44%)	44 (0.49%)	-0.0078

TM: Traditional Medicare, MA: Medicare Advantage, SMD: Standardized Mean Difference, HCC: Hierarchical Condition Category.
Values <12 were unable to reported for privacy reasons and are marked as NA.

eTable 2. *ICD-10* codes used to define each of the 15 cancer types of interest

Cancer Type	ICD-10 Codes
Anal	C21.xx
Bladder	C67.xx
Bone Metastases	C79.5x
Brain Metastases	C79.3x
Breast	C50.xx, D05.xx
Cervical	C53.xx
Central Nervous System	C70.xx, C71.xx, C72.xx
Colorectal	C18.xx, C19.xx, C20.xx
Head & Neck	C00.xx, C01.xx, C02.xx, C03.xx, C04.xx, C05.xx, C06.xx, C07.xx, C08.xx, C09.xx, C10.xx, C11.xx, C12.xx, C13.xx, C14.xx, C30.xx, C31.xx, C32.xx, C76.0x
Lung	C33.xx, C34.xx, C39.xx, C45.xx
Lymphoma	C81.xx, C82.xx, C83.xx, C84.xx, C85.xx, C86.xx, C88.xx, C91.4x
Pancreatic	C25.xx
Prostate	C61.xx
Upper Gastrointestinal	C15.xx, C16.xx, C17.xx
Uterine	C54.xx, C55.xx

ICD: International Classification of Diseases.

eTable 3. Regression results for all Medicare Advantage plans, adjusted for cancer type, age, dual-eligibility status, and patient comorbidities

	MA [95% CI] n=12,509	TM [95% CI] n=22,553	OR/RR [95% CI]	P value
Type of Radiation Treatment Technology (% of Episodes)				
2D/3D Conventional	n=5624 44.88% [44.22%, 45.55%]	n=9578 42.39% [41.89%, 42.88%]	1.19 [1.12, 1.26]	<0.001
Intensity Modulated	n=4720 37.66% [36.98%, 38.33%]	n=8353 36.97% [36.47%, 37.47%]	1.05 [0.99, 1.11]	0.12
Proton	n=69 0.55% [0.35%, 0.74%]	n=371 1.64% [1.50%, 1.78%]	0.33 [0.26, 0.43]	<0.001
Stereotactic	n=1659 13.24% [12.70%, 13.78%]	n=3385 14.98% [14.58%, 15.38%]	0.83 [0.77, 0.89]	<0.001
Brachytherapy	n=437 3.49% [3.19%, 3.78%]	n=868 3.84% [3.62%, 4.06%]	0.88 [0.77, 1.01]	0.067
Radiation Treatment Length (Number of Treatments)				
Overall	21.07 [20.87 ,21.26]	19.50 [19.35 ,19.64]	1.08 [1.06, 1.09]	<0.001
2D/3D Conventional	17.19 [16.98 ,17.41]	16.02 [15.86 ,16.19]	1.07 [1.05, 1.09]	<0.001
Intensity Modulated	32.53 [32.24 ,32.82]	30.67 [30.44 ,30.89]	1.06 [1.05, 1.08]	<0.001
Proton	35.42 [33.25 ,37.60]	31.79 [30.84 ,32.73]	1.11 [1.02, 1.21]	0.012
Stereotactic	4.23 [4.14 ,4.32]	3.93 [3.87 ,3.99]	1.08 [1.04, 1.11]	<0.001
Brachytherapy	7.35 [7.02 ,7.68]	7.11 [6.86 ,7.35]	1.04 [0.98, 1.10]	0.19
Radiation Therapy Spending (Dollars)				
Overall	$8408.44 [$8314.27, $8502.6]	$8395.20 [$8325.14, $8465.25]	1.02 [1.00, 1.03]	0.021
2D/3D Conventional	$4332.86 [$4270.38, $4395.3]	$3966.43 [$3919.18, $4013.69]	1.08 [1.01, 1.11]	<0.001
Intensity Modulated	$13,399.64 [$13,255.88, $13,543.41]	$13,398.30 [$13,288.79, $13,507.81]	1.02 [1.01, 1.04]	0.0041
Proton	$34,709.37 [$32,447.34, $36,971.41]	$31,604.74 [$30,623.23, $32,586.24]	1.10 [0.99, 1.21]	0.075
Stereotactic	$8022.37 [$7876.20, $8168.5]	$7508.55 [$7407.88, $7609.22]	1.07 [1.04, 1.10]	<0.001
Brachytherapy	$3660.11 [$3496.56, $3823.66]	$3152.78 [$3032.85, $3272.72]	1.27 [1.18, 1.37]	<0.001

MA: Medicare Advantage, TM: Traditional Medicare, 2D: two-dimensional, 3D: three-dimensional, OR: Odds Ratio, RR: Rate Ratio, CI: Confidence Interval. Columns MA and TM contain predictive means from alternative linear regression models. Columns OR/RR (95% CI) contains the odds ratio/rate ratio with 95% CI using logistic regression when estimating the proportion of episodes using each treatment technology, a negative binomial model when estimating treatment length, and a log gamma regression model when estimating spending. For this analysis, covariates included insurance type (TM vs MA), cancer type, age, dual-eligibility status, and patient comorbidities. These results were obtained using data from all MA plans.

eTable 4. Regression results adjusted for cancer type, age, dual-eligibility status, patient comorbidities, county, RT center type

	MA No [95% CI] n=8957	TM [95% CI] n=22,553	OR/RR [95% CI]	P value
Type of Radiation Treatment Technology (% of Episodes)				
2D/3D Conventional	n=3998 44.58% [43.80%, 45.36%]	n=9548 42.26% [41.79%, 42.73%]	1.21 [1.12, 1.30]	<0.001
Intensity Modulated	n=3318 36.99% [36.21%, 37.77%]	n=8419 37.26% [36.79%, 37.74%]	0.98 [0.91, 1.06]	0.58
Proton	n=45 0.5% [0.27%, 0.73%]	n=380 1.68% [1.54%, 1.82%]	0.26 [0.19, 0.38]	<0.001
Stereotactic	n=1257 14.01% [13.37%, 14.46%]	n=3369 14.91% [14.52%, 15.30%]	0.88 [0.80, 0.97]	0.013
Brachytherapy	n=339 3.78% [3.51%, 4.05%]	n=838 3.71% [3.54%, 3.87%]	1.04 [0.80, 1.35]	0.77
Radiation Treatment Length (Number of Treatments)				
Overall	21.29 [21.06, 21.51]	19.51 [19.37, 19.65]	1.08 [1.06, 1.10]	<0.001
2D/3D Conventional	17.43 [17.19, 17.67]	15.95 [15.81, 16.10]	1.08 [1.06, 1.10]	<0.001
Intensity Modulated	33.39 [33.06, 33.71]	30.54 [30.35, 30.74]	1.09 [1.07, 1.10]	<0.001
Proton	37.35 [35.24, 39.46]	31.80 [31.15, 32.45]	1.15 [1.07, 1.24]	<0.001
Stereotactic	4.31 [4.22, 4.41]	3.93 [3.88, 3.98]	1.10 [1.05, 1.14]	<0.001
Brachytherapy	7.51 [7.23, 7.80]	7.21 [7.05, 7.36]	1.05 [0.98, 1.13]	0.15
Radiation Therapy Spending (Dollars)				
Overall	$8724.63 [$8615.32, $8833.94]	$8374.51 [8308.15, $8440.88]	1.04 [1.02, 1.06]	<0.001
2D/3D Conventional	$4343.54 [$4275.64, $4411.43]	$3943.86 [$3902.98, $3984.75]	1.08 [1.06, 1.11]	<0.001
Intensity Modulated	$14,309.68 [$14,162.56, $14,456.80]	$13,222.20 [$13,131.81, $13,312.59]	1.09 [1.07, 1.11]	<0.001
Proton	$36,089 .29($34,007.65, $38,170.92]	$31,703.40 [$31,064.29, $32,342.51]	1.11 [1.01, 1.23]	0.037
Stereotactic	$8234.16 [$8071.09, $8397.24]	$7488.45 [$7400.08, $7576.83]	1.09 [1.06, 1.12]	<0.001
Brachytherapy	$3698.87 [$3545.54, $3852.20]	$3231.91 [$3151.08, $3312.74]	1.25 [1.17, 1.34]	<0.001

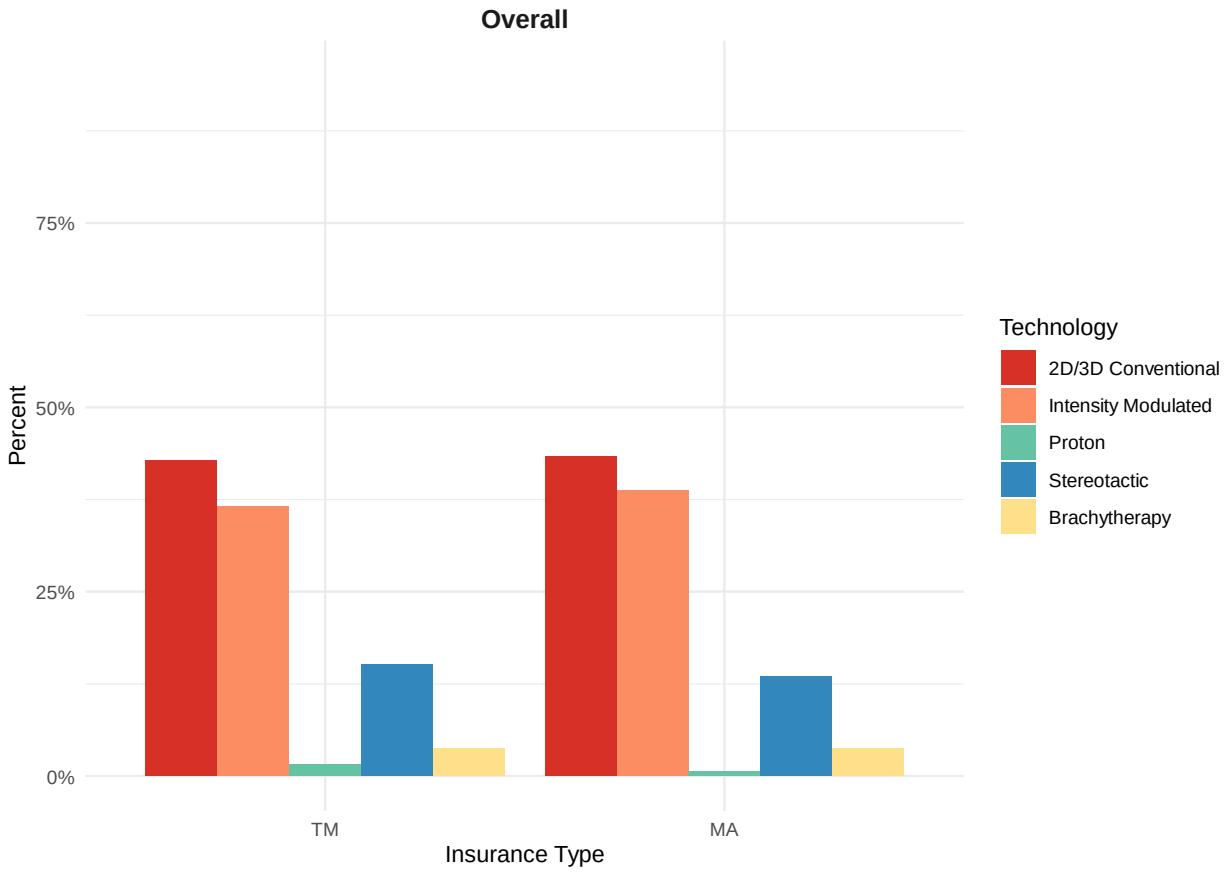
MA: Medicare Advantage, TM: Traditional Medicare, 2D: two-dimensional, 3D: three-dimensional, OR: Odds Ratio, RR: Rate Ratio, CI: Confidence Interval. Columns MA and TM contain predictive means from alternative linear regression models. County was adjusted for using fixed effects. Columns OR/RR (95% CI) contains the odds ratio/rate ratio with 95% CI using logistic regression when estimating the proportion of episodes using each treatment technology, a negative binomial model when estimating treatment length, and a log gamma regression model when estimating spending. For this analysis, covariates included insurance type (TM vs MA), cancer type, age, dual-eligibility status, patient comorbidities, county (fixed effects), and RT center type.

eTable 5. Mean unadjusted number of treatments for all modalities and majority modality only

	MA	TM
	Mean N RT Treatments (Majority Modality Only)	
2D/3D Conventional	17.30	15.90
Intensity Modulated	33.51	29.95
Proton	36.88	31.46
Stereotactic	4.31	3.92
Brachytherapy	7.53	7.16
	Mean N RT Treatments (All Modalities)	
2D/3D Conventional	17.46	15.94
Intensity Modulated	33.98	30.29
Proton	37.18	31.83
Stereotactic	4.31	3.93
Brachytherapy	7.61	7.17

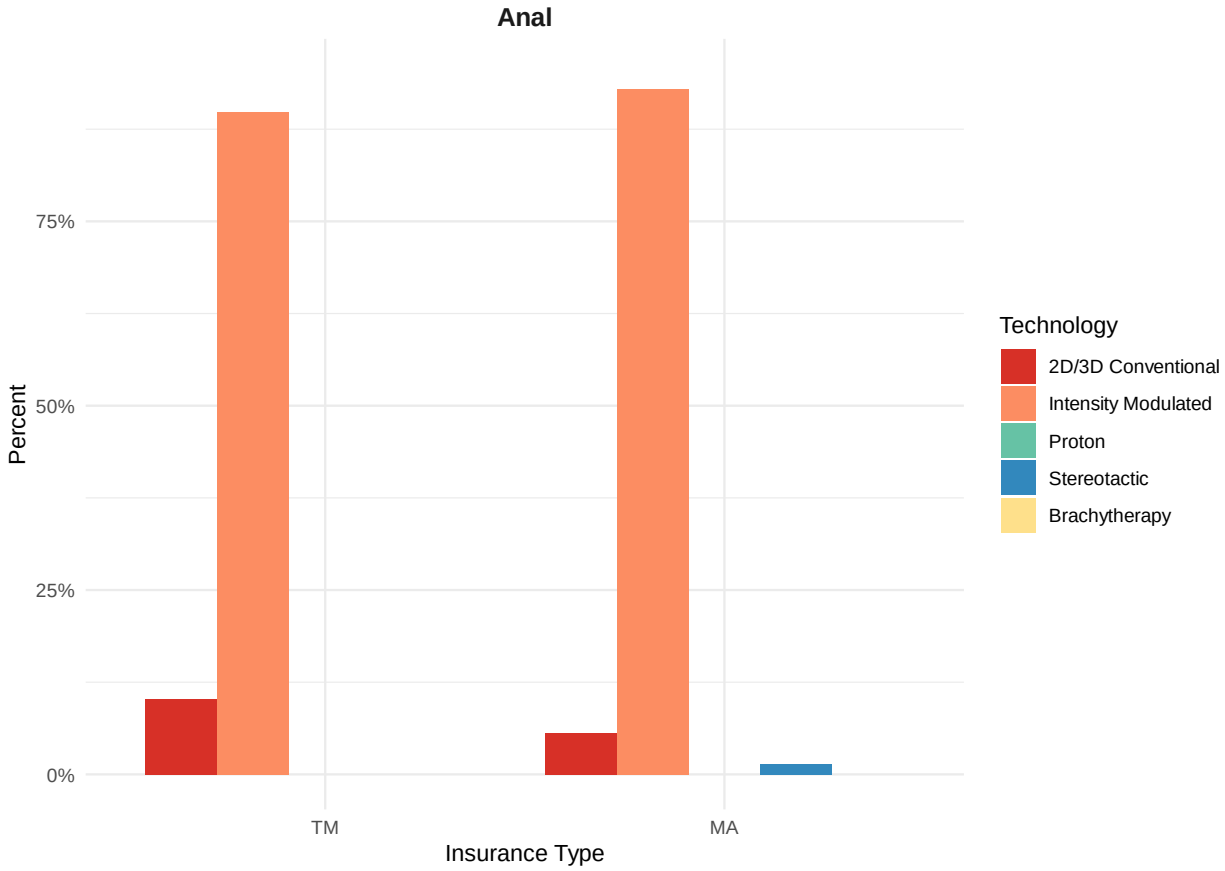
MA: Medicare Advantage, TM: Traditional Medicare, 2D: two-dimensional, 3D: three-dimensional, RT: radiotherapy

eFigure 1. Radiotherapy technology type utilization across 90-day radiation therapy episodes overall, for MA vs TM, 2018



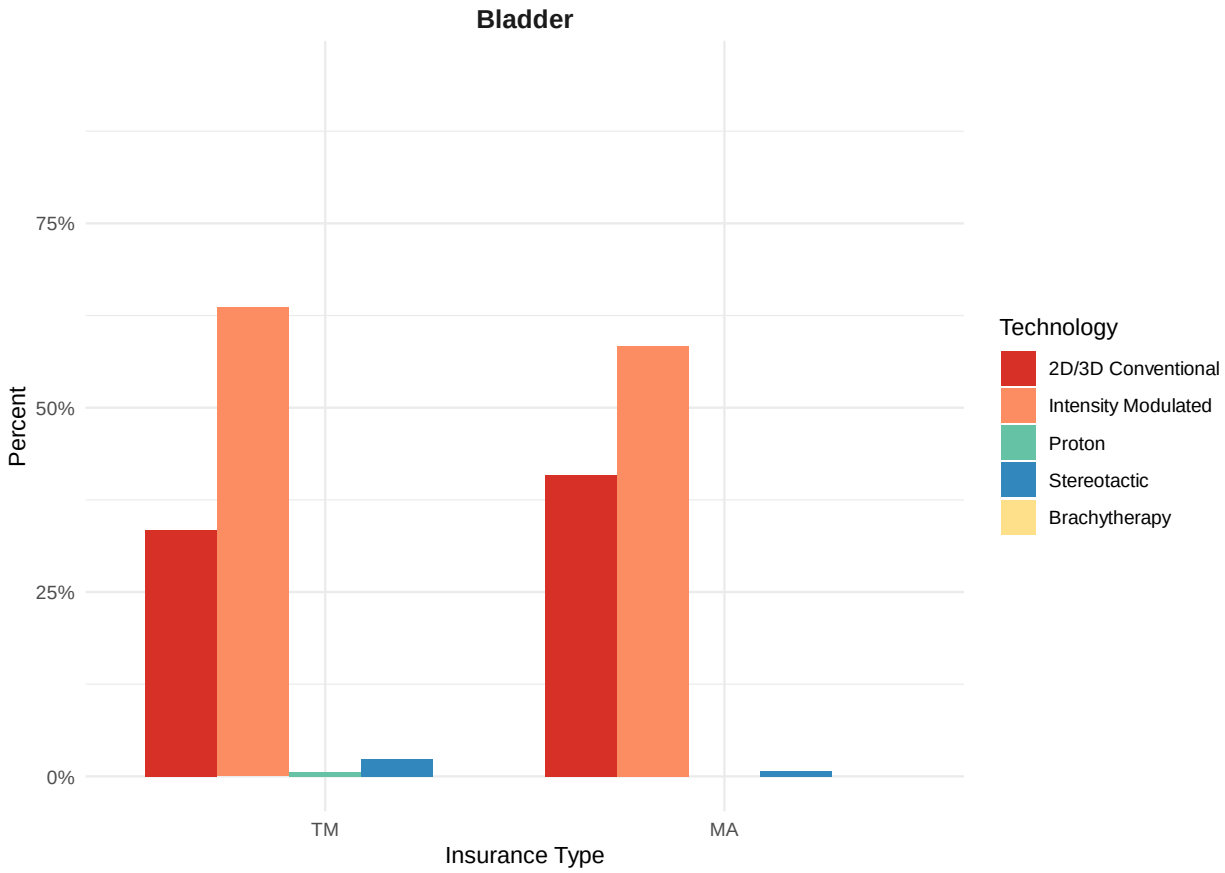
Bar chart showing proportion of episodes utilizing a certain type of radiation treatment technology. 2D, two-dimensional; 3D, three-dimensional; MA, Medicare Advantage; TM, Traditional Medicare.

eFigure 2. Radiotherapy technology type utilization across 90-day radiation therapy episodes for anal cancer, MA vs TM, 2018



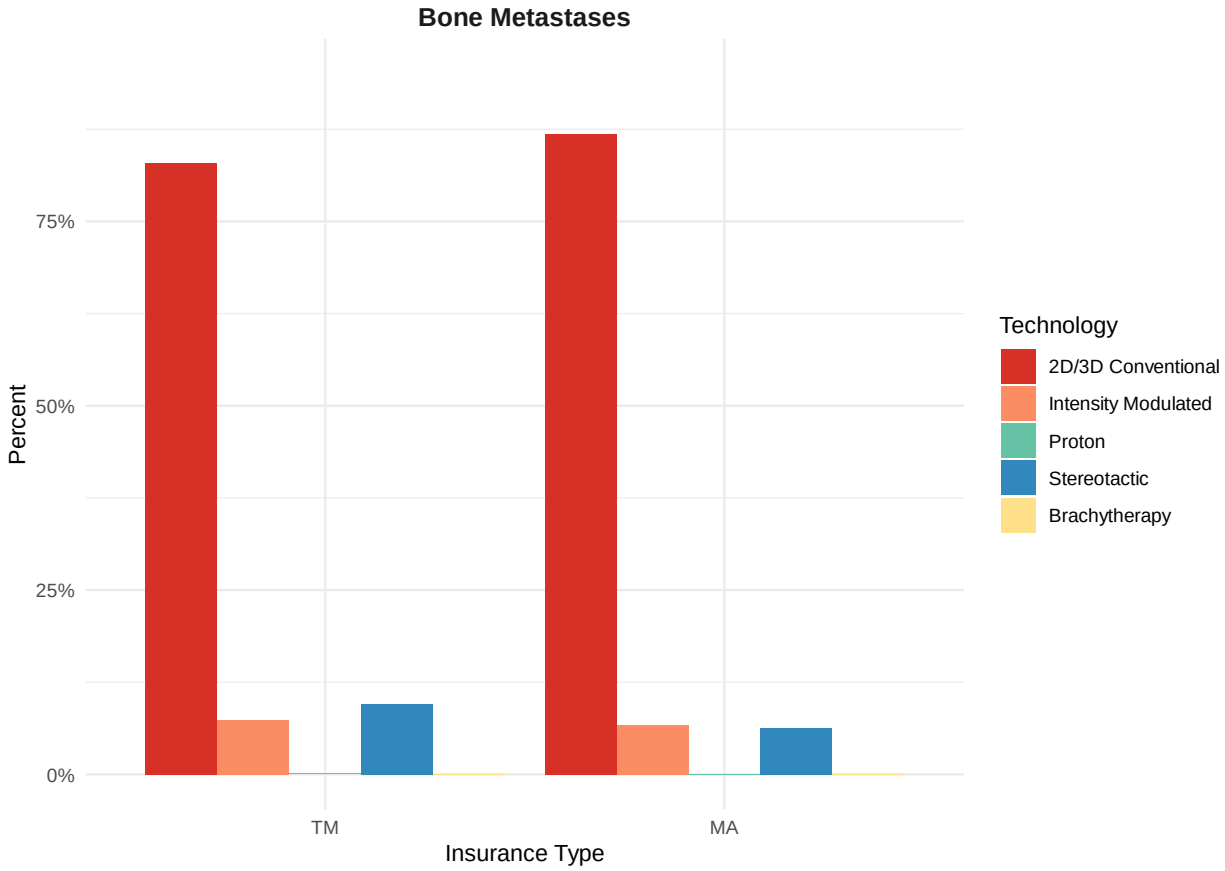
Bar chart showing proportion of episodes utilizing a certain type of radiation treatment technology. 2D, two-dimensional; 3D, three-dimensional; MA, Medicare Advantage; TM, Traditional Medicare.

eFigure 3. Radiotherapy technology type utilization across 90-day radiation therapy episodes for bladder cancer, MA vs TM, 2018



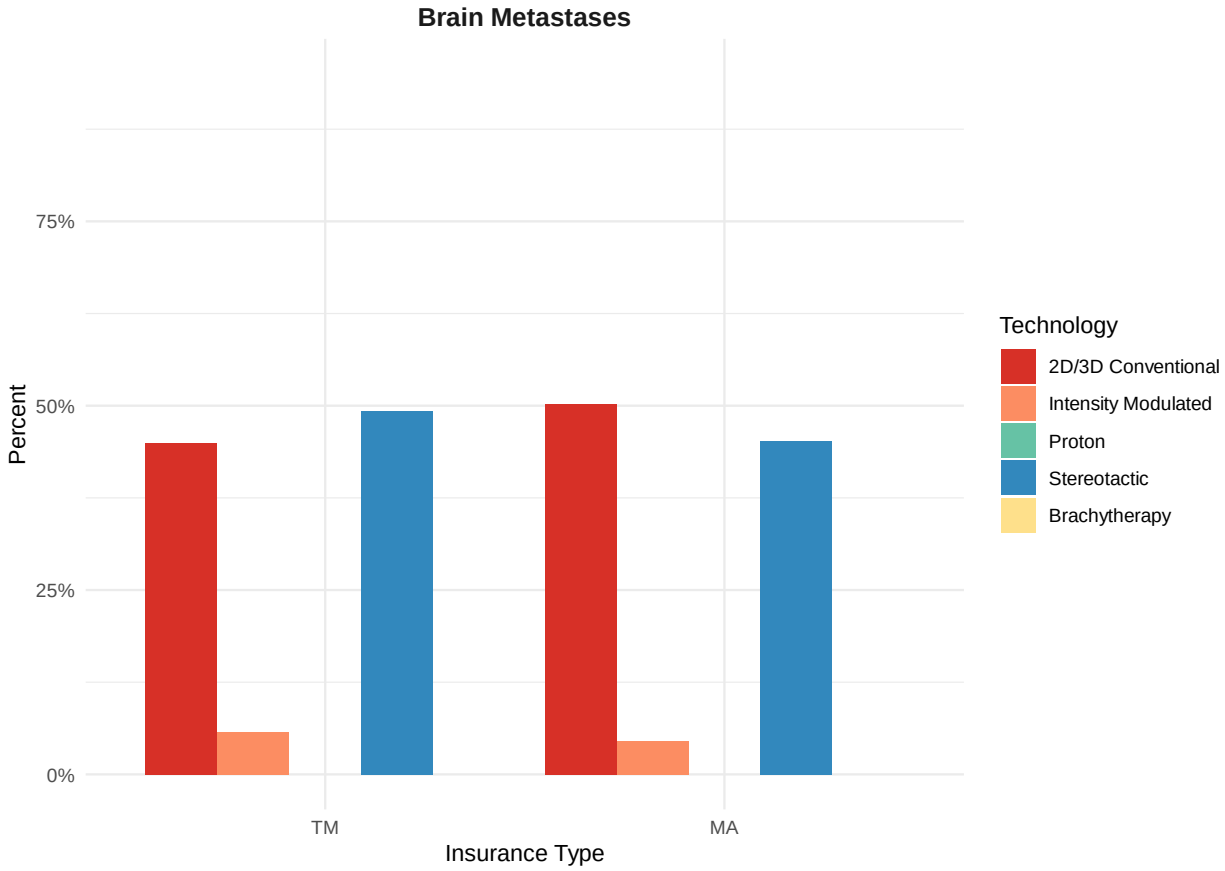
Bar chart showing proportion of episodes utilizing a certain type of radiation treatment technology. 2D, two-dimensional; 3D, three-dimensional; MA, Medicare Advantage; TM, Traditional Medicare.

eFigure 4. Radiotherapy technology type utilization across 90-day radiation therapy episodes for bone metastases, MA vs TM, 2018



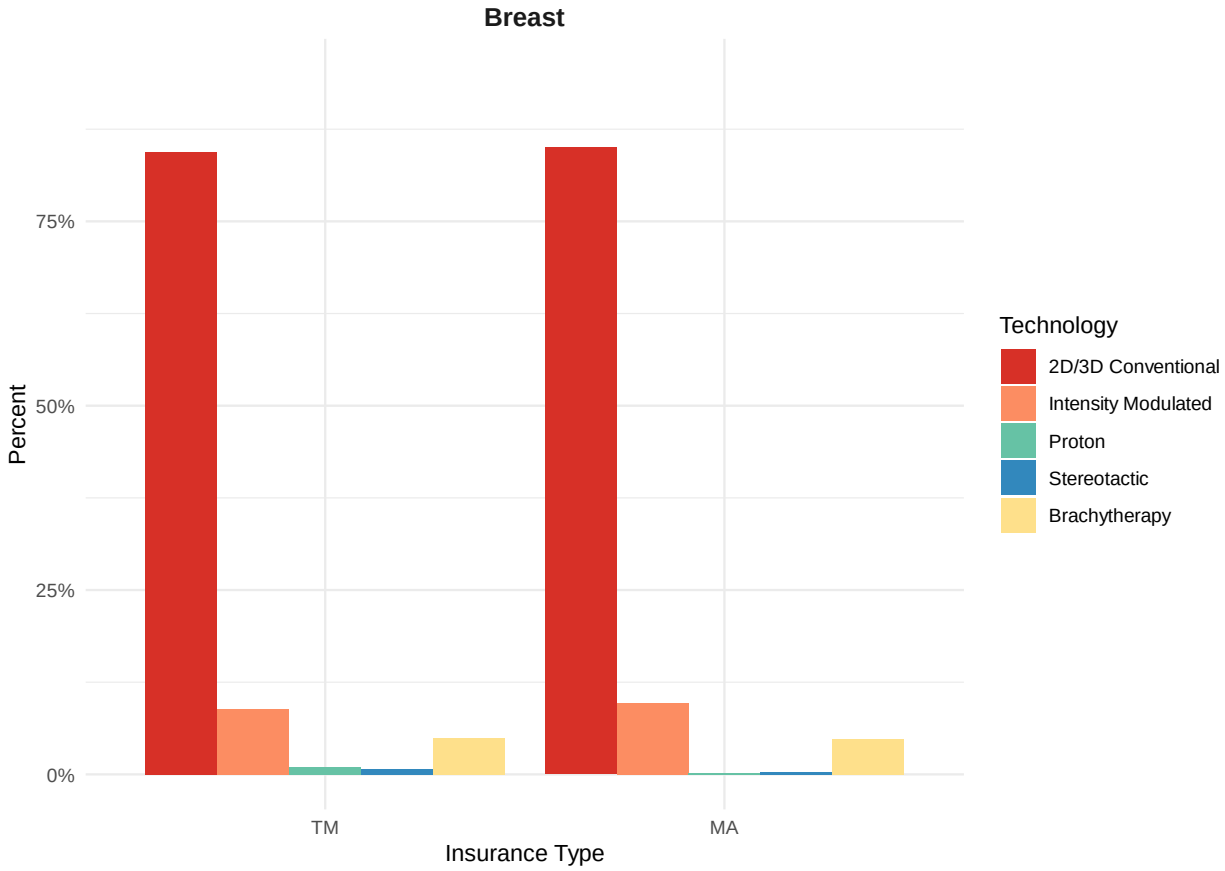
Bar chart showing proportion of episodes utilizing a certain type of radiation treatment technology. 2D, two-dimensional; 3D, three-dimensional; MA, Medicare Advantage; TM, Traditional Medicare.

eFigure 5. Radiotherapy technology type utilization across 90-day radiation therapy episodes for brain metastases, MA vs TM, 2018



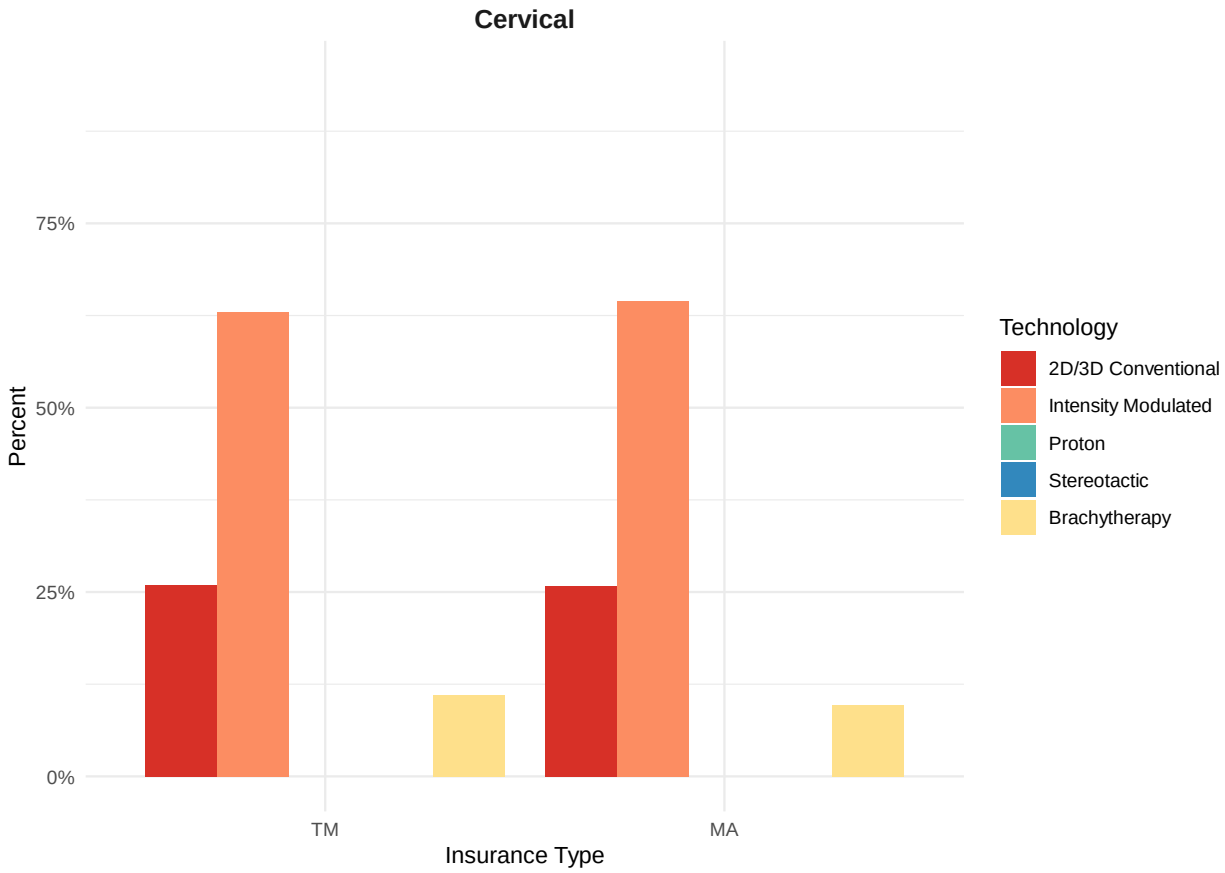
Bar chart showing proportion of episodes utilizing a certain type of radiation treatment technology. 2D, two-dimensional; 3D, three-dimensional; MA, Medicare Advantage; TM, Traditional Medicare.

eFigure 6. Radiotherapy technology type utilization across 90-day radiation therapy episodes for breast cancer, MA vs TM, 2018



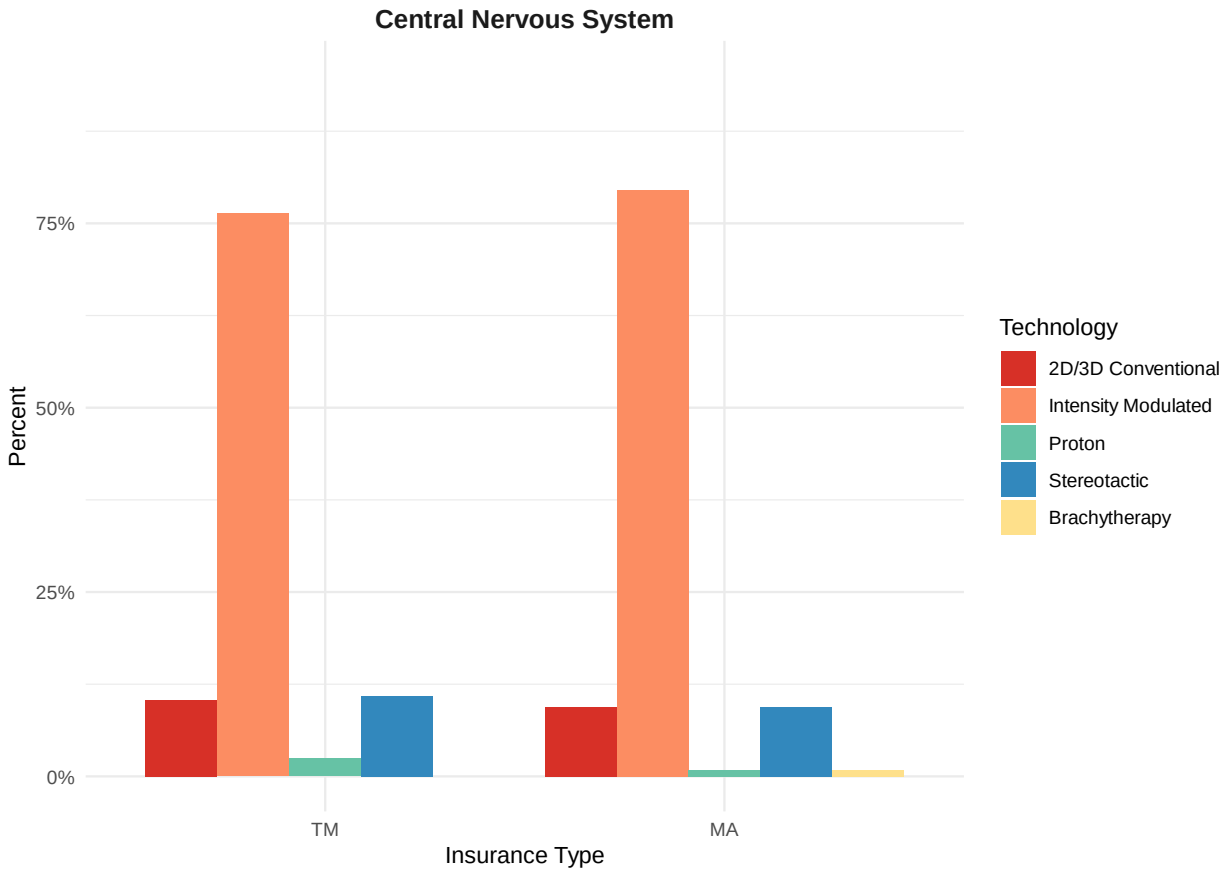
Bar chart showing proportion of episodes utilizing a certain type of radiation treatment technology. 2D, two-dimensional; 3D, three-dimensional; MA, Medicare Advantage; TM, Traditional Medicare.

eFigure 7. Radiotherapy technology type utilization across 90-day radiation therapy episodes for cervical cancer, MA vs TM, 2018



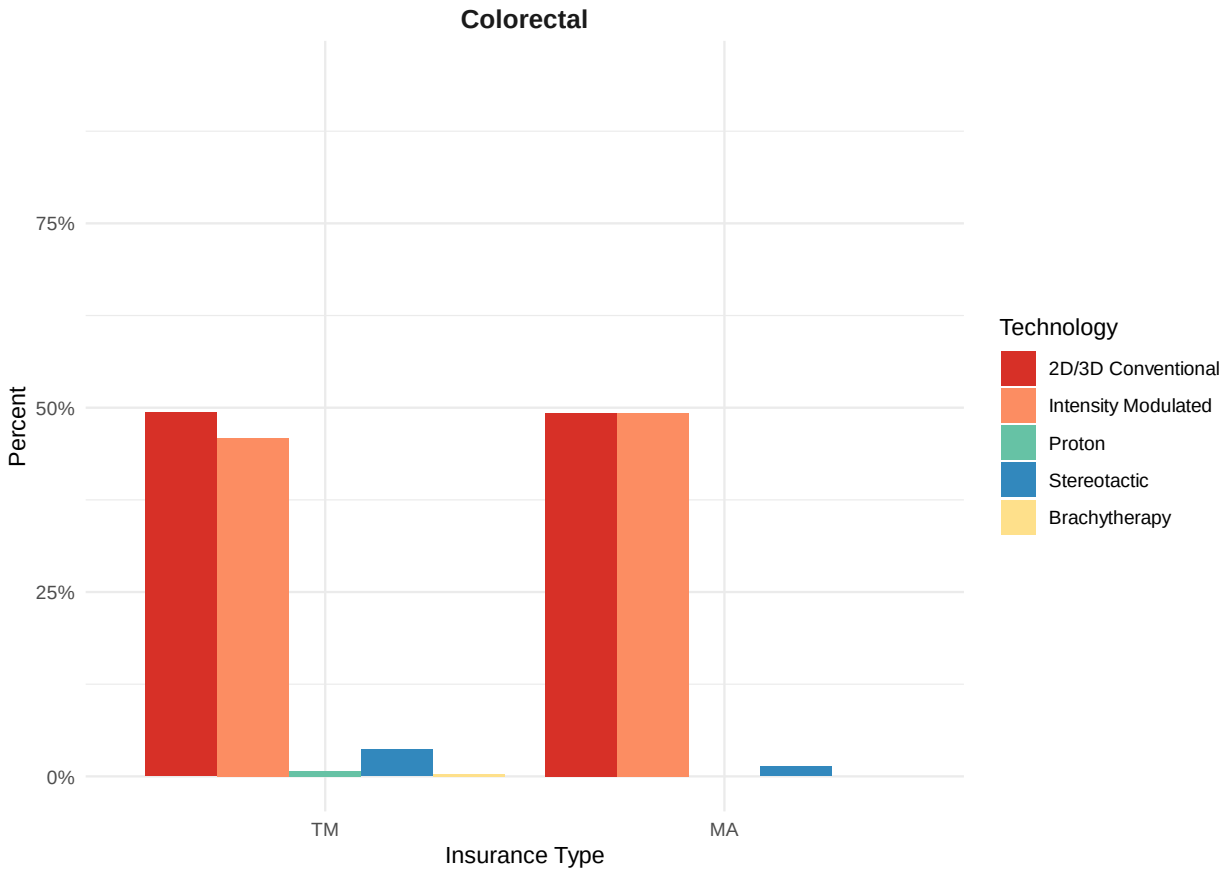
Bar chart showing proportion of episodes utilizing a certain type of radiation treatment technology. 2D, two-dimensional; 3D, three-dimensional; MA, Medicare Advantage; TM, Traditional Medicare.

eFigure 8. Radiotherapy technology type utilization across 90-day radiation therapy episodes for CNS cancer, MA vs TM, 2018



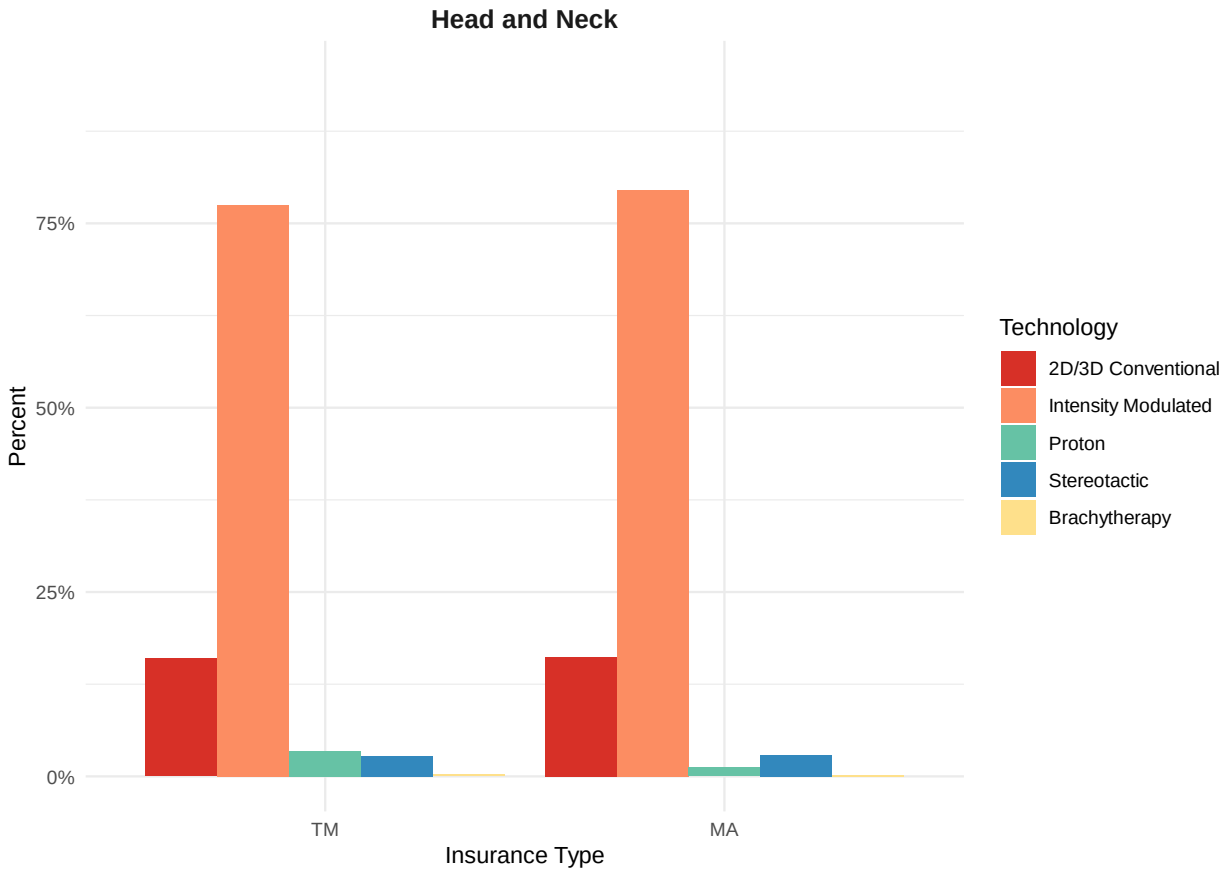
Bar chart showing proportion of episodes utilizing a certain type of radiation treatment technology. 2D, two-dimensional; 3D, three-dimensional; MA, Medicare Advantage; TM, Traditional Medicare; CNS, Central Nervous System.

eFigure 9. Radiotherapy technology type utilization across 90-day radiation therapy episodes for colorectal cancer, MA vs TM, 2018



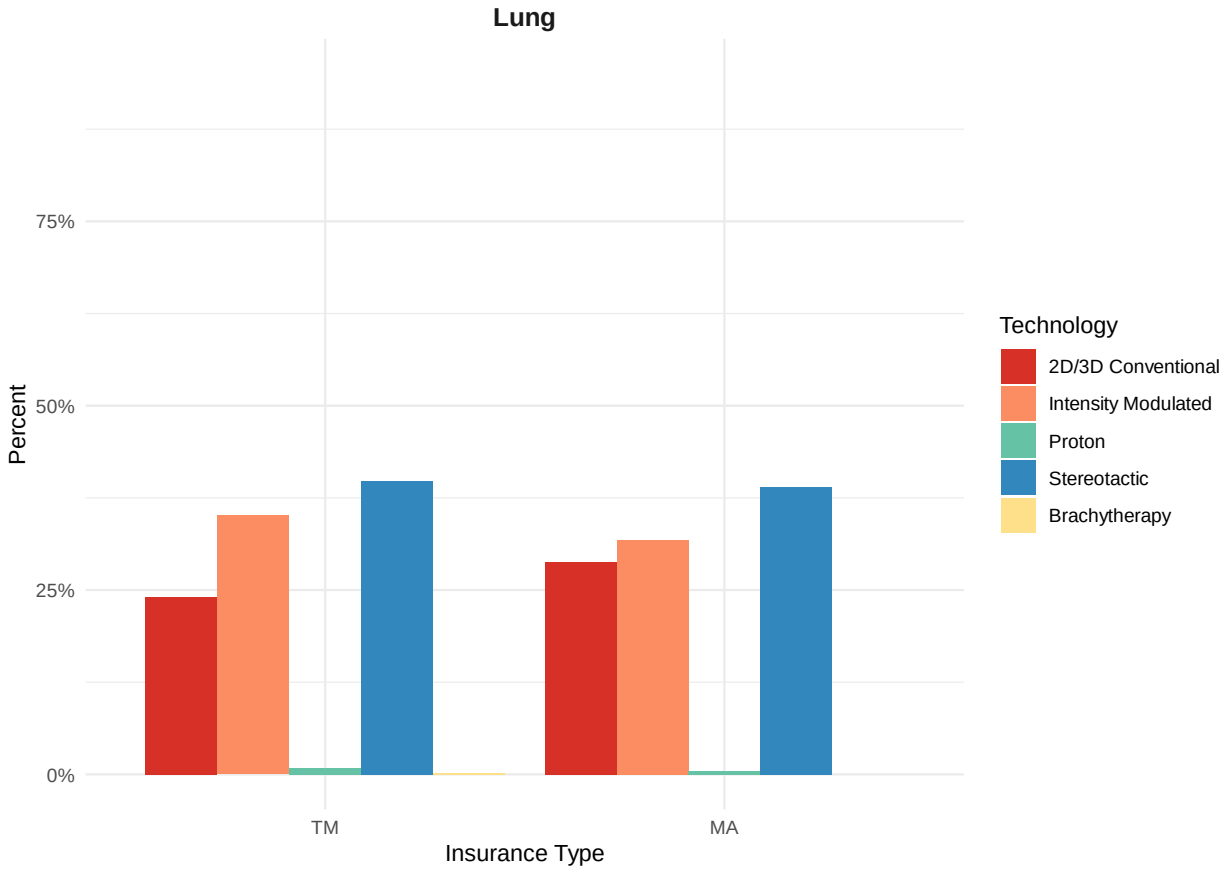
Bar chart showing proportion of episodes utilizing a certain type of radiation treatment technology. 2D, two-dimensional; 3D, three-dimensional; MA, Medicare Advantage; TM, Traditional Medicare.

eFigure 10. Radiotherapy technology type utilization across 90-day radiation therapy episodes for head and neck cancer, MA vs TM, 2018



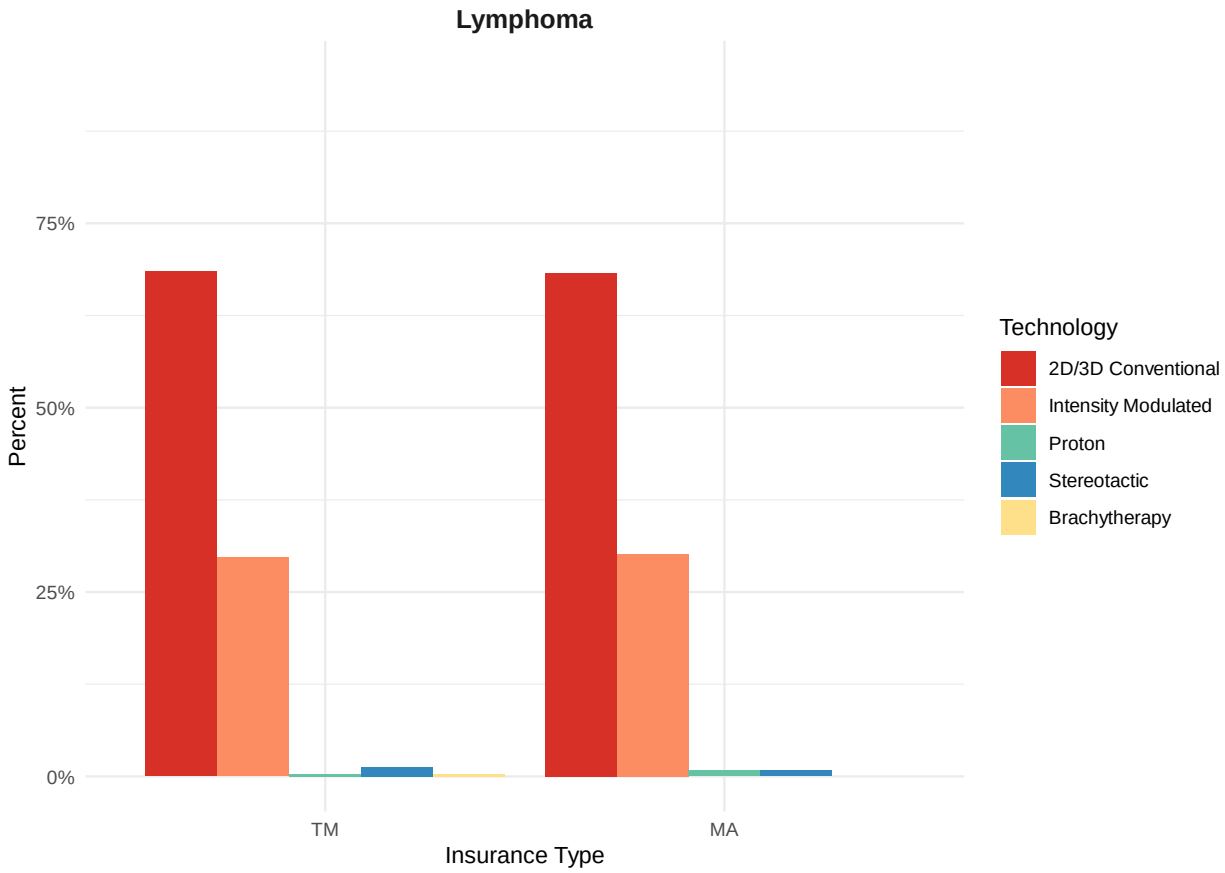
Bar chart showing proportion of episodes utilizing a certain type of radiation treatment technology. 2D, two-dimensional; 3D, three-dimensional; MA, Medicare Advantage; TM, Traditional Medicare; H&N, Head & Neck.

eFigure 11. Radiotherapy technology type utilization across 90-day radiation therapy episodes for lung cancer, MA vs TM, 2018



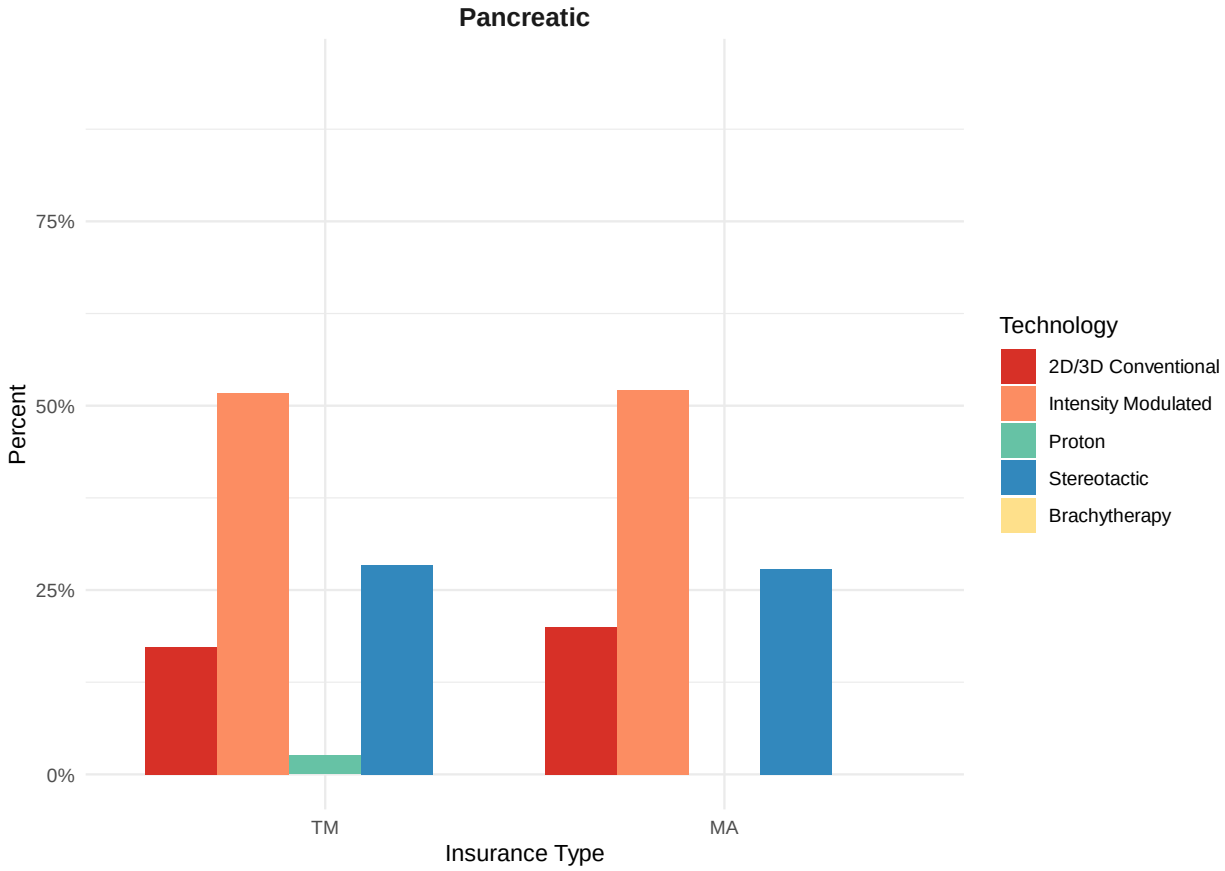
Bar chart showing proportion of episodes utilizing a certain type of radiation treatment technology. 2D, two-dimensional; 3D, three-dimensional; MA, Medicare Advantage; TM, Traditional Medicare.

eFigure 12. Radiotherapy technology type utilization across 90-day radiation therapy episodes for lymphoma, MA vs TM, 2018



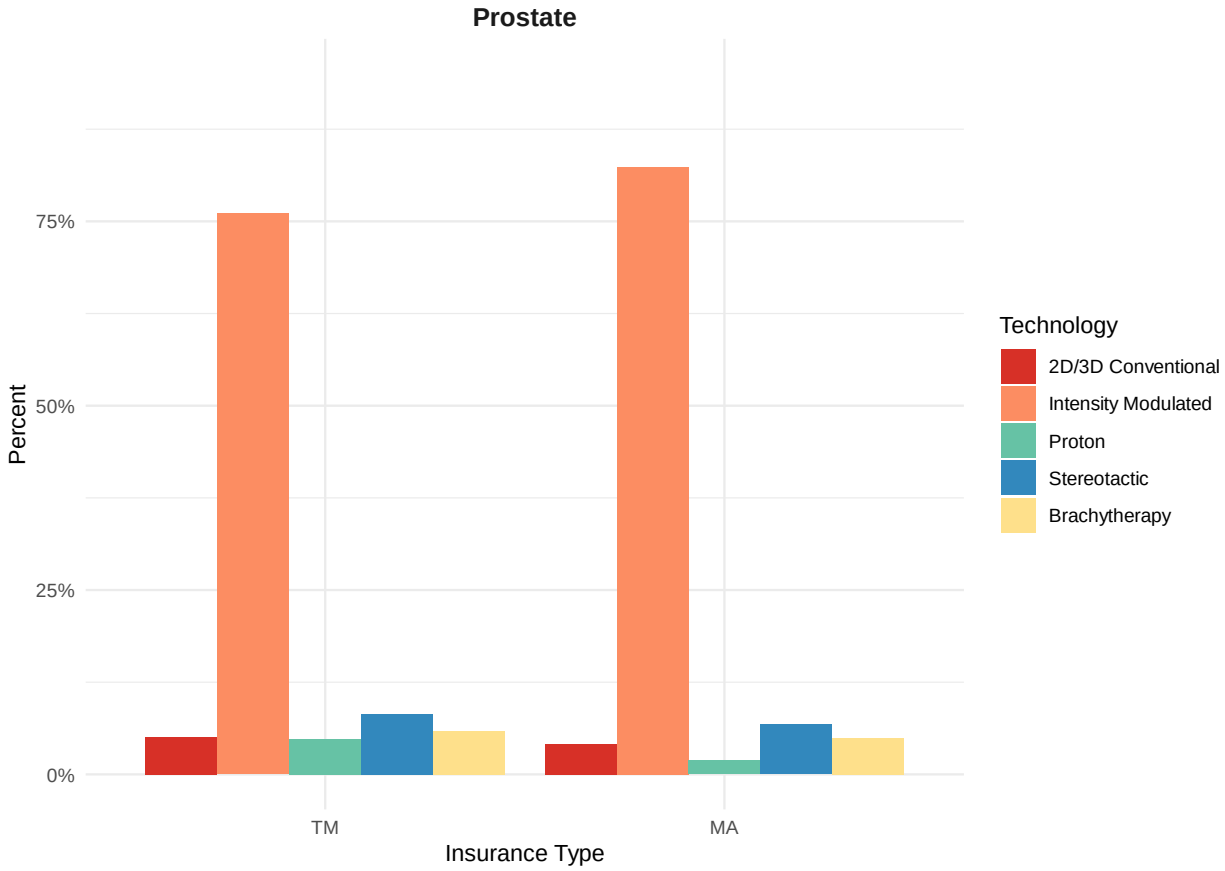
Bar chart showing proportion of episodes utilizing a certain type of radiation treatment technology. 2D, two-dimensional; 3D, three-dimensional; MA, Medicare Advantage; TM, Traditional Medicare.

eFigure 13. Radiotherapy technology type utilization across 90-day radiation therapy episodes for pancreatic cancer, MA vs TM, 2018



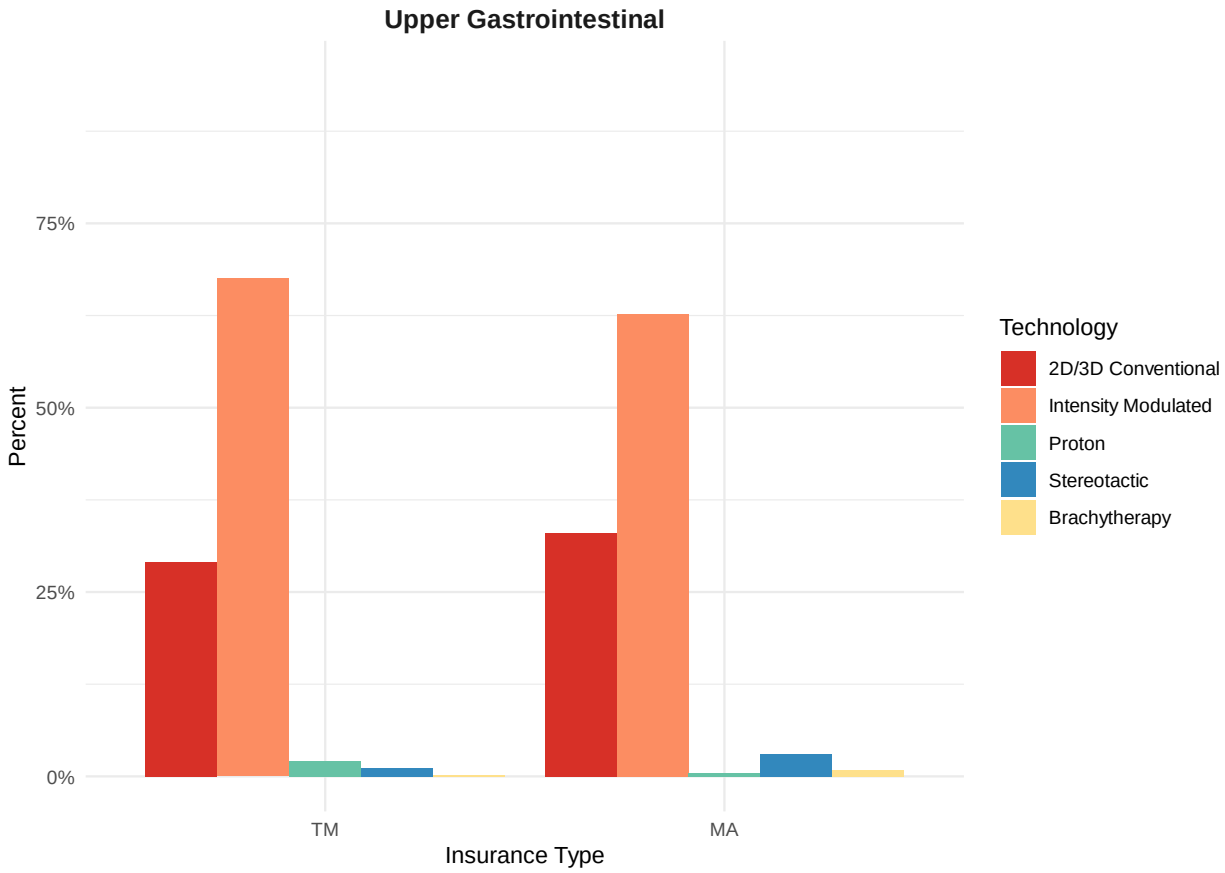
Bar chart showing proportion of episodes utilizing a certain type of radiation treatment technology. 2D, two-dimensional; 3D, three-dimensional; MA, Medicare Advantage; TM, Traditional Medicare.

eFigure 14. Radiotherapy technology type utilization across 90-day radiation therapy episodes for prostate cancer, MA vs TM, 2018



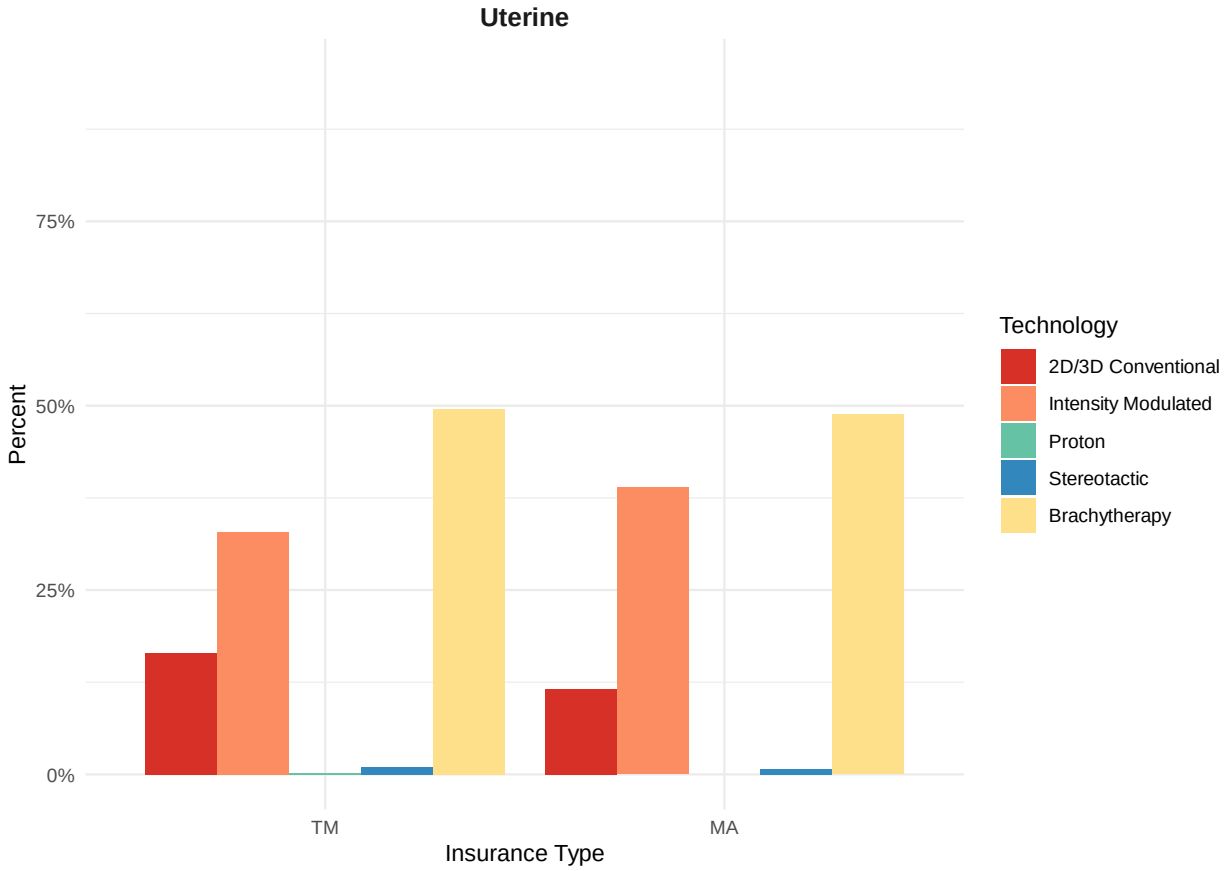
Bar chart showing proportion of episodes utilizing a certain type of radiation treatment technology. 2D, two-dimensional; 3D, three-dimensional; MA, Medicare Advantage; TM, Traditional Medicare.

eFigure 15. Radiotherapy technology type utilization across 90-day radiation therapy episodes for upper gastrointestinal cancer, MA vs TM, 2018



Bar chart showing proportion of episodes utilizing a certain type of radiation treatment technology. 2D, two-dimensional; 3D, three-dimensional; MA, Medicare Advantage; TM, Traditional Medicare.

eFigure 16. Radiotherapy technology type utilization across 90-day radiation therapy episodes for uterine cancer, MA vs TM, 2018



Bar chart showing proportion of episodes utilizing a certain type of radiation treatment technology. 2D, two-dimensional; 3D, three-dimensional; MA, Medicare Advantage; TM, Traditional Medicare.