

## Supplementary Online Content

Sheets NC, Goldin GH, Meyer A-M, et al. Intensity-modulated radiation therapy, proton therapy, or conformal radiation therapy and morbidity and disease control in localized prostate cancer. *JAMA*. 2012;307(15):1611-1620.

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

**eTable 1.** Diagnoses and procedure codes

Type of Outcome	Category		CPT and ICD9 Codes
<b>Cancer Therapy</b>	<b>Radiation</b>	Brachytherapy	77326, 77327, 77328, 77776, 77777, 77778, 77781, 77782, 77783, 77784, 77790, 77799, Q3001, 92.2
		Conformal radiation therapy	77305, 77310, 77315, 77321, 77371, 77372, 77373, 77402, 77403, 77404, 77406, 77407, 77408, 77409, 77411, 77412, 77413, 77414, 77416, 77422, 77423, 92.24, 92.26
		IMRT	77301, 77418, 0073T
		Proton therapy	77380, 77381, 77520, 77522, 77523, 77525
	<b>Androgen Deprivation</b>	Orchiectomy	G9132, 54520, 54522, 54530, 54535, 54690, 62.3, 62.41, 62.42
		Hormone Therapy	54520, 54522, 54530, 54535, 54690, J1050, J1051, J1950, J3315, J9202, J9217, J9218, J9219, J9165, S0175, C9216, C9430, G0356, J0128, S0165, S9560, 62.4, 62.41, 62.42
	<b>Surgery</b>	MIRP	55866
		ORP	55810, 55812, 55815, 55840, 55842, 55845, 60.5
<b>Morbidity</b>	<b>Gastrointestinal</b>	Diagnosis	560.81, 560.89, 560.9, 787.91, 555, 556, 557, 558, 564.5, 569.3, 578.9, 565, 566, 569.2, 569.4, 569.8, 578, 565, 566, 569.2, 569.41, 569.81
		Procedure	45.23, 48.23, 49.21, 48.24, 45.25, 49.23, 46.10, 48.62, 46.14, 46.03, 46.13, 46.11, 96.22, 96.23, 93.95, 48.73, 48.93, 46.1x, 48.31, 48.32, 48.33, 48.33, 48.31, 48.32, 48.93, 58.43, 57.83, 48.73, 49.1, 49.6, 49.7, 48.4 -48.7, 48.9, 49.73, 45300-45345, 45355-45387, 46600-46615, 44140-44160, 44204-44212, 45110-45123, 45905, 45910, 46700, 99183, G0167, 45800, 45805, 45820, 45825, 45562, 45563, 45000, 45005, 45020, 45500, 45800-45805, 45820-45825
	<b>Non-Incontinence Urinary</b>	Diagnosis	595.82, 596.7, 596.0, 598.x, 599.6, 788.2x, 599.82, 596.1, 596.2, 599.1
		Procedure	57.93, 57.85, 57.91, 57.92, 58.0, 58.1, 58.3x, 58.44, 58.46, 58.47, 58.5, 58.6, 58.99, 60.95, 60.2x, 58.93, 59.4, 59.5, 59.6, 59.71, 59.79, 57.83, 57.84, 58.43,

Type of Outcome	Category		CPT and ICD9 Codes
			52275, 52276, 52281, 52510, 53010, 53400, 53405, 53410, 53415, 53420, 53425, 53600, 53601, 53605, 53620, 53621, 52601, 52612, 52614, 52620, 52630, 53850, 53852, 52282, 52283, 53447, 51841, 44660, 44661, 53520
	Urinary Incontinence	Diagnosis	788.3x
		Procedure	59.3, 59.72, 89.21, 89.22, 89.23, 89.24, 89.25, 51715, 53440, 51840, 53442, 53443, 53445, 51736, 51725, 51726, 51772, 51784, 51785, 51792, 51795, 51797, 51798, 51741
	Erectile	Diagnosis	607.84
		Procedure	64.94, 64.95, 64.96, 64.97, 54400, 54401, 54402, 54405, 54406, 54407, 54408, 54409, 54410, 54411, 54415, 54416, 54417, C1007, C1813, C2622, C3500, C8514, C8516, C8534, L7900, 54231, 54235, J0270, J0275, J2440, J2760
	Hip fracture	Diagnosis	733.14, 733.97, 808, 805.6, 805.7, 806.6, 806.7, 820.x

**Abbreviations:** IMRT, intensity-modulated radiation therapy; MIRP, minimally-invasive radical prostatectomy; ORP, open radical prostatectomy.

**eTable 2.** Unadjusted and Propensity-Model Adjusted Outcomes for IMRT vs CRT, Excluding Patients Who Had Any Health Maintenance Organization Enrollment for the Study Duration

Outcome per 100 Person-Years	Unadjusted							Adjusted <sup>a</sup>						
	CRT (n = 5443)			IMRT (n = 6025)			IMRT vs CRT	CRT (n = 5613)			IMRT (n = 5834)			IMRT vs CRT
	Total Events	100 Person-Years	Rate	Total Events	100 Person-Years	Rate	Rate Ratio (95% CI)	Total Events	100 Person-Years	Rate	Total Events	100 Person-Years	Rate	Rate Ratio (95% CI)
Gastrointestinal events														
Procedures (including colonoscopy)	2818	165	17.1	2736	148	18.5	1.08 (1.02-1.14)	2657	152	17.5	2782	157	17.7	1.01 (0.93-1.09)
Diagnoses	2614	179	14.6	2269	162	14.0	0.96 (0.90-1.02)	2528	162	15.6	2396	173	13.9	0.89 (0.82-0.97)
Urinary nonincontinent events														
Procedures	499	249	2.0	407	210	1.9	0.97 (0.85-1.11)	434	221	2.0	454	230	2.0	1.01 (0.85-1.20)
Diagnoses	1785	210	8.5	1625	177	9.2	1.08 (1.01-1.16)	1730	187	9.3	1734	190	9.1	0.98 (0.89-1.09)
Urinary incontinence events														
Procedures	1691	209	8.1	1720	174	9.9	1.23 (1.14-1.32)	1661	186	8.9	1751	188	9.3	1.04 (0.94-1.15)
Diagnoses	868	240	3.6	742	202	3.7	1.02 (0.92-1.12)	828	213	3.9	825	221	3.7	0.96 (0.83-1.10)
Erectile dysfunction events														
Procedures	181	258	0.7	183	215	0.9	1.21 (0.99-1.49)	190	228	0.8	186	237	0.8	0.94 (0.70-1.27)
Diagnoses	1031	226	4.6	1241	186	6.7	1.46 (1.34-1.59)	1074	201	5.4	1239	204	6.1	1.13 (1.01-1.28)
Hip fracture	265	257	1.0	171	215	0.8	0.77 (0.64-0.93)	242	228	1.1	192	237	0.8	0.76 (0.59-0.99)
Additional cancer therapy	810	257	3.2	539	223	2.4	0.77 (0.69-0.86)	761	230	3.3	637	242	2.6	0.80 (0.68-0.93)

Abbreviations: CRT, conformal radiation therapy; IMRT, intensity-modulated radiation therapy.

<sup>a</sup>Rates shown are adjusted for the variables presented in Table 1, using propensity scores implemented by inverse probability of treatment weighting.

**eTable 3.** Outcomes for IMRT vs Proton Therapy With Propensity Score Matching and Instrumental Variable Analyses, Excluding Patients Who Had Any Health Maintenance Organization Enrollment for the Study Duration

Outcome per 100 Person-Years	Propensity Score Matcheda							Instrumental Variable Analysis						
	IMRT (n = 639)			Proton (n = 639)			IMRT vs PT	IMRT (n = 7520)b			Proton (n = 1806)b			IMRT vs PT
	Total Events	100 Person-Years	Rate	Total Events	100 Person-Years	Rate	Rate Ratio (95% CI)	Total Events	100 Person-Years	Rate	Total Events	100 Person-Years	Rate	Rate Ratio (95% CI)
Gastrointestinal events														
Procedures (including colonoscopy)	300	15.4	19.5	329	14.8	22.2	0.88 (0.75-1.03)	2957	159	18.6	850	38.4	22.1	0.59 (0.46-0.77)
Diagnoses	239	16.8	14.2	288	15.3	18.8	0.76 (0.64-0.90)	2508	171.1	14.7	692	41.7	16.6	0.61 (0.46-0.82)
Urinary nonincontinent events														
Proceduresc	34	23.1	1.5	39	23.8	1.6	0.90 (0.57-1.42)	444	216	2.1	109	57.7	1.9	1.57 (0.80-3.07)
Diagnoses	131	20.2	6.5	138	21.0	6.6	0.99 (0.78-1.25)	1789	185	9.7	439	49.9	8.8	1.08 (0.76-1.55)
Urinary incontinence events														
Procedures	135	20.2	6.7	165	20.2	8.1	0.82 (0.65-1.03)	1936	181.2	10.7	489	48.6	10.1	1.04 (0.73-1.47)
Diagnosesc	58	22.6	2.6	79	22.8	3.5	0.74 (0.53-1.04)	795	209.5	3.8	203	55.3	3.7	0.96 (0.58-1.59)
Erectile dysfunction events														
Proceduresc	25	23.6	1.1	34	24.1	1.4	0.75 (0.45-1.26)	194	221.5	0.9	66	58.7	1.1	0.58 (0.24-1.43)
Diagnoses	138	20.3	6.8	156	20.4	7.6	0.89 (0.71-1.12)	1383	194.5	7.1	421	49.4	8.5	0.76 (0.52-1.11)
Hip fractured	17	23.7	0.7	17	24.5	0.7		183	221.5	0.8	41	59.2	0.7	1.36 (0.48-3.89)
Additional cancer therapy	64	24.3	2.6	50	25.4	2.0	1.33 (0.92-1.93)	567	233.4	2.4	123	62.3	2.0	1.56 (0.83-2.95)

Abbreviation: IMRT, intensity-modulated radiation therapy.

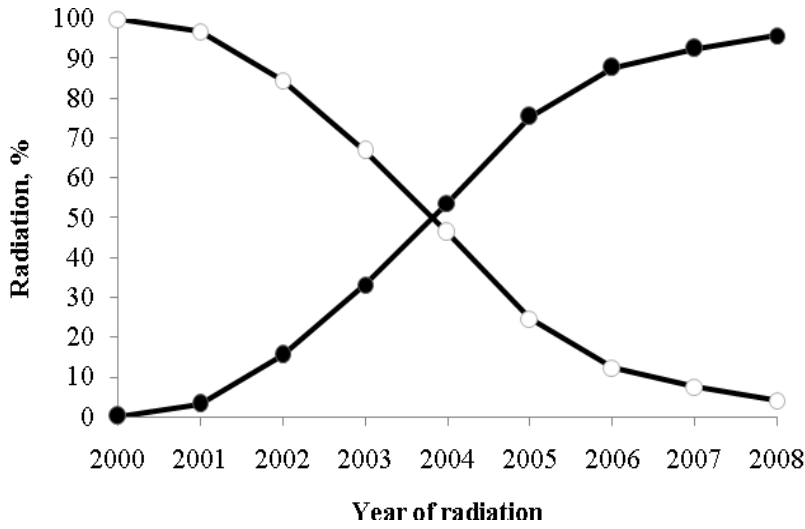
<sup>a</sup>Rates shown are adjusted for the variables presented in Table 3, using propensity scores implemented by matching.

<sup>b</sup>Rates for IMRT and proton were adjusted with a 2-stage least-squares instrumental variable approach in which Radiation Therapy Oncology Group affiliation predicts proton use: this predicted value was subsequently used as exposure in an adjusted outcome model to estimate the effect of IMRT vs proton on the outcome.

<sup>c</sup>Because of zero cell counts, SEER region was not included in propensity score matched models.

<sup>d</sup>Because of the small number of events and zero cell counts in some covariates in the propensity score–matched model, rate ratio could not be calculated.

**eFigure:** Use of IMRT vs. CRT for primary radiation treatment for localized prostate cancer



Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
IMRT	<11	93	448	917	1334	1841	2226	2671	787
CRT	1971	2799	2450	1846	1149	601	312	215	34

**Abbreviations:** IMRT, intensity-modulated radiation therapy; CRT, conformal radiation therapy.

Black circles: IMRT

White circles: CRT