Table S1 Testing for collinearity: tolerance, variance inflation factor (VIF), and diagnostics

A. Stage I

Characteristic	Squared partial correlation	Tolerance	VIF
Age	0.02619	0.9603	1.04135
Sex	0.0005163	0.87045	1.14883
Race	0.00202	0.9883	1.01184
Marital status	0.00697	0.85894	1.16422
Insurance	0.09884	0.99724	1.00277
T stage	0.0009521	0.97813	1.02236
N stage	0	0	0
Treatment	0.0305	0.97393	1.02677

The table above does not show evidence of collinearity. For all variables, tolerance is above 0.1 and VIF is below 10.

A. Collinearity diagnostics (intercept adjusted)

Number	Eigenvalue	Condition index	Proportion of Variation							
			Age	Sex	Race	Marital Status	Insurance	T Stage	N Stage	Treatment
1	1.38247	1	0.05151	0.2377	0.00439	0.27649	0.00000563	0.05475	0	0.01394
2	1.134	1.10413	0.20902	0.10193	0.00625	0.0176	0.01806	0.11174	0	0.37779
3	1.09572	1.12325	0.16696	0.02004	0.40248	0.04077	0.11953	0.11532	0	0.02268
4	0.98603	1.18408	0.02466	0.01299	0.13859	0.00001194	0.82779	0.0000095	0	0.00313
5	0.92362	1.22343	0.00069491	0.03231	0.18098	0.03467	0.01583	0.6729	0	0.11447
6	0.87681	1.25567	0.41796	0.01389	0.25259	0.00337	0.01318	0.00224	0	0.4035
7	0.60133	1.51625	0.1292	0.58113	0.01472	0.6271	0.0056	0.04304	0	0.06449
8	1.00E-12	1175785	0	0	0	0	0	0	1	0

The table above does not show evidence of collinearity. The condition index stays below 30. Due to the condition index, tolerance, and VIF values no further inspection is required.

B. Stage II

Characteristic	Squared partial correlation	Tolerance	VIF
Age	0.00167	0.897	1.11482
Sex	0.00434	0.93785	1.06627
Race	0.03117	0.93541	1.06905
Marital status	0.02384	0.83182	1.20218
Insurance	0.09495	0.96275	1.03869
T stage	0.02131	0.28646	3.49089
N stage	0.00374	0.28948	3.45446
Treatment	0.04946	0.85101	1.17508

The table above does not show evidence of collinearity. For all variables, tolerance is above 0.1 and VIF is below 10. T stage and N stage have tolerance values close to 0.1 and higher VIF values than the other covariates, but these do not reach the normal cutoff values.

B. Collinearity diagnostics (intercept adjusted)

Number	Eigenvalue	Condition index	Proportion of Variation							
			Age	Sex	Race	Marital Status	Insurance	T Stage	N Stage	Treatment
1	1.94469	1	0.00047926	0.00013	0.02455	0.00085586	0.01412	0.06318	0.0662	0.01903
2	1.44391	1.16053	0.07699	0.06521	0.00492	0.22879	3.6605E-10	0.00701	0.00166	0.19291
3	1.22309	1.26095	0.31538	0.1412	0.15341	0.03759	0.05727	0.00322	0.0002958	0.02938
4	0.99828	1.39572	0.00089207	0.08385	0.09856	0.00825	0.74882	0.00127	0.00159	0.00706
5	0.92638	1.44887	7.4222E-07	0.49323	0.45757	0.00554	0.0011	0.00336	0.00695	0.01776
6	0.65808	1.71904	0.60416	0.08826	0.19935	0.01996	0.13576	0.00211	6.444E-05	0.31166
7	0.6505	1.72903	0.00070434	0.10527	0.06035	0.64373	0.04179	0.0023	0.01363	0.41473
8	1.55E-01	3.54138	0.00138	0.02285	0.00129	0.05528	0.00115	0.91756	0.90961	0.00749

The table above does not show evidence of collinearity. The condition index stays below 30. Due to the condition index, tolerance, and VIF values no further inspection is required.

C. Stage III

Characteristic	Squared partial correlation	Tolerance	VIF
Age	0.02343	0.92281	1.08365
Sex	0.00588	0.90968	1.09928
Race	0.00153	0.9564	1.04558
Marital status	0.00322	0.87278	1.14577
Insurance	0.02486	0.98673	1.01345
T stage	0.02335	0.82751	1.20844
N stage	0.00874	0.84118	1.1888
Treatment	0.044	0.78442	1.27484

The table above does not show evidence of collinearity. For all variables, tolerance is above 0.1 and VIF is below 10.

C. Collinearity diagnostics (intercept adjusted)

Number	Eigenvalue	Condition index	Proportion of variation							
			Age	Sex	Race	Marital Status	Insurance	T Stage	N Stage	Treatment
1	1.43569	1	0.11228	0.02396	0.0115	0.16814	0.00821	0.02207	0.04943	0.19617
2	1.33674	1.03635	0.00005759	0.1613	0.09701	0.03625	0.00010671	0.2634	0.02338	0.06397
3	1.17832	1.10382	0.01179	0.09928	0.00389	0.11158	0.00185	0.06054	0.38244	0.05111
4	1.14735	1.11862	0.21907	0.06992	0.24796	0.01995	0.2335	0.0001317	0.02995	0.00218
5	0.95122	1.22854	0.12779	0.1285	0.02558	0.00153	0.66774	0.01562	0.00622	0.03142
6	0.83134	1.31414	0.20699	0.05939	0.54531	0.06589	0.07173	0.13509	0.00263	0.02241
7	0.63576	1.50274	0.30841	0.45697	0.06717	0.55055	0.01161	0.01161	0.00778	0.000223
8	4.84E-01	1.72302	0.01362	0.00067	0.00158	0.0461	0.00525	0.49154	0.49817	0.63252

The table above does not show evidence of collinearity. The condition index stays below 30. Due to the condition index, tolerance, and VIF values no further inspection is required.

Table S2 Demographical factors associated with treatment in stage I disease

Factors	Classification	No surgery or RT		RT alone		Surgery alone		Surgery + RT		P
		Count	%	Count	%	Count	%	Count	%	
Age	0–67	11	32.4%	16	33.3%	305	48.6%	17	43.6%	0.06
	68 and over	23	67.6%	32	66.7%	322	51.4%	22	56.4%	
Sex	Female	15	44.1%	23	47.9%	309	49.3%	25	64.1%	0.29
	Male	19	55.9%	25	52.1%	318	50.7%	14	35.9%	
Race	American Indian/Alaska Native	0	0.0%	0	0.0%	3	0.5%	0	0.0%	0.61
	Asian or Pacific Islander	1	2.9%	0	0.0%	22	3.5%	3	7.7%	
	Black	8	23.5%	8	16.7%	73	11.6%	3	7.7%	
	White	25	73.5%	40	83.3%	528	84.2%	33	84.6%	
	Unknown	0	0.0%	0	0.0%	1	0.2%	0	0.0%	
Marital Status	Married/Partner	9	26.5%	25	52.1%	348	55.5%	18	46.2%	0.005
	Divorced/Separated	5	14.7%	4	8.3%	99	15.8%	8	20.5%	
	Single (never married)	5	14.7%	7	14.6%	57	9.1%	3	7.7%	
	Widowed	14	41.2%	9	18.8%	92	14.7%	10	25.6%	
	Unknown	1	2.9%	3	6.3%	31	4.9%	0	0.0%	
Insurance Status	Uninsured	1	2.9%	1	2.1%	11	1.8%	0	0.0%	0.85
	Insured	21	61.8%	35	72.9%	400	63.8%	27	69.2%	
	Medicaid	1	2.9%	3	6.3%	50	8.0%	2	5.1%	
	Unknown	11	32.4%	9	18.8%	166	26.5%	10	25.6%	
T Stage	T1	16	47.1%	21	43.8%	349	55.7%	18	46.2%	0.23
	T2	18	52.9%	27	56.3%	278	44.3%	21	53.8%	

RT, radiotherapy.

Table S3 Demographical factors associated with treatment in stage II disease

Factors	Classification	No surgery or RT		RT alone		Surgery alone		Surgery + RT		P
		Count	%	Count	%	Count	%	Count	%	
Age	0–67	6	33.3%	4	44.4%	72	63.7%	28	75.7%	0.01
	68 and over	12	66.7%	5	55.6%	41	36.3%	9	24.3%	
Sex	Female	9	50.0%	6	66.7%	48	42.5%	16	43.2%	0.53
	Male	9	50.0%	3	33.3%	65	57.5%	21	56.8%	
Race	American Indian/Alaska Native	0	0.0%	0	0.0%	1	0.9%	0	0.0%	0.12
	Asian or Pacific Islander	0	0.0%	0	0.0%	5	4.4%	2	5.4%	
	Black	4	22.2%	0	0.0%	10	8.8%	1	2.7%	
	White	13	72.2%	9	100.0%	97	85.8%	34	91.9%	
	Unknown	1	5.6%	0	0.0%	0	0.0%	0	0.0%	
Marital status	Married/Partner	5	27.8%	4	44.4%	63	55.8%	28	75.7%	0.07
	Divorced/Separated	3	16.7%	0	0.0%	17	15.0%	3	8.1%	
	Single (never married)	2	11.1%	2	22.2%	15	13.3%	2	5.4%	
	Widowed	6	33.3%	2	22.2%	11	9.7%	3	8.1%	
	Unknown	2	11.1%	1	11.1%	7	6.2%	1	2.7%	
Insurance status	Uninsured	0	0.0%	0	0.0%	2	1.8%	1	2.7%	0.99
	Insured	10	55.6%	6	66.7%	71	62.8%	23	62.2%	
	Medicaid	3	16.7%	1	11.1%	9	8.0%	4	10.8%	
	Unknown	5	27.8%	2	22.2%	31	27.4%	9	24.3%	
T stage	T1	3	16.7%	2	22.2%	38	33.6%	10	27.0%	0.03
	T2	6	33.3%	2	22.2%	54	47.8%	14	37.8%	
	T3	9	50.0%	5	55.6%	21	18.6%	13	35.1%	
N stage	N0	9	50.0%	5	55.6%	21	18.6%	13	35.1%	0.003
	N1	9	50.0%	4	44.4%	92	81.4%	24	64.9%	

RT, radiotherapy.

Table S4 Demographical factors associated with treatment in stage III disease

Factors	Classification	No surgery or RT		RT alone		Surgery alone		Surgery + RT		P
		Count	%	Count	%	Count	%	Count	%	
Age	0–67	11	32.4%	16	33.3%	305	48.6%	17	43.6%	<0.001
	68 and over	23	67.6%	32	66.7%	322	51.4%	22	56.4%	
Sex	Female	15	44.1%	23	47.9%	309	49.3%	25	64.1%	<0.001
	Male	19	55.9%	25	52.1%	318	50.7%	14	35.9%	
Race	American Indian/Alaska Native	0	0.0%	0	0.0%	3	0.5%	0	0.0%	<0.001
	Asian or Pacific Islander	1	2.9%	0	0.0%	22	3.5%	3	7.7%	
	Black	8	23.5%	8	16.7%	73	11.6%	3	7.7%	
	White	25	73.5%	40	83.3%	528	84.2%	33	84.6%	
	Unknown	0	0.0%	0	0.0%	1	0.2%	0	0.0%	
Marital status	Married/partner	9	26.5%	25	52.1%	348	55.5%	18	46.2%	<0.001
	Divorced/separated	5	14.7%	4	8.3%	99	15.8%	8	20.5%	
	Single (never married)	5	14.7%	7	14.6%	57	9.1%	3	7.7%	
	Widowed	14	41.2%	9	18.8%	92	14.7%	10	25.6%	
	Unknown	1	2.9%	3	6.3%	31	4.9%	0	0.0%	
Insurance status	Uninsured	1	2.9%	1	2.1%	11	1.8%	0	0.0%	<0.001
	Insured	21	61.8%	35	72.9%	400	63.8%	27	69.2%	
	Medicaid	1	2.9%	3	6.3%	50	8.0%	2	5.1%	
	Unknown	11	32.4%	9	18.8%	166	26.5%	10	25.6%	
T stage	T1	16	47.1%	21	43.8%	349	55.7%	18	46.2%	<0.001
	T2	18	52.9%	27	56.3%	278	44.3%	21	53.8%	
	T3	0	0.0%	0	0.0%	0	0.0%	0	0.0%	
	T4	0	0.0%	0	0.0%	0	0.0%	0	0.0%	
	TX	0	0.0%	0	0.0%	0	0.0%	0	0.0%	
N stage	N0	34	100.0%	48	100.0%	627	100.0%	39	100.0%	<0.001
	N1	0	0.0%	0	0.0%	0	0.0%	0	0.0%	
	N2	0	0.0%	0	0.0%	0	0.0%	0	0.0%	
	N3	0	0.0%	0	0.0%	0	0.0%	0	0.0%	
	NX	0	0.0%	0	0.0%	0	0.0%	0	0.0%	

RT, radiotherapy.

Table S5 Univariable and multivariable analysis of overall survival in stage I disease

Variable	Reference	Univariable				Multivariable			
		P	HR	95% CI		P	HR	95% CI	
				Lower	Upper			Lower	Upper
Age		<0.001	1.05	1.04	1.06	<0.001	1.04	1.03	1.05
Sex (female)	Male	0.98	1.00	0.81	1.23	–	–	–	–
Race	White	0.12				0.027			
American Indian/Alaska Native		0.007	4.84	1.55	15.14	0.001	7.14	2.21	23.06
Asian or Pacific Islander		0.98	1.01	0.58	1.76	0.90	1.04	0.59	1.82
Black		0.96	1.01	0.72	1.41	0.47	1.14	0.80	1.62
Unknown		0.93	0.00	0.00	3.62E+81	0.94	0.00	0.00	6.57E+87
Marital status	Married/partner	0.07				0.87			
Divorced/separated		0.18	0.79	0.57	1.11	0.38	0.86	0.61	1.21
Single (never married)		0.45	1.16	0.79	1.68	0.81	1.05	0.70	1.57
Unknown		0.72	0.90	0.50	1.61	0.70	0.89	0.50	1.60
Widowed		0.03	1.36	1.03	1.80	0.58	0.92	0.68	1.24
Insurance status	Uninsured	0.40				–			
Insured		0.19	2.56	0.64	10.33	–	–	–	–
Medicaid		0.21	2.54	0.60	10.84	–	–	–	–
Unknown		0.14	2.89	0.71	11.72	–	–	–	–
T Stage (T2)	T1	0.09	1.21	0.98	1.49	0.06	1.23	0.99	1.53
Surgery Status	No surgery	<0.001				<0.001			
RT alone		<0.001	0.37	0.22	0.62	<0.001	0.39	0.23	0.66
Surgery alone		<0.001	0.15	0.10	0.23	<0.001	0.21	0.13	0.32
Surgery + RT		<0.001	0.18	0.10	0.34	<0.001	0.22	0.12	0.41

RT, radiotherapy.

Table S6 Univariable and multivariable analysis of overall survival in stage II disease

Variable	Reference	Univariable				Multivariable			
				95% CI				95% CI	
		P	HR	Lower	Upper	P	HR	Lower	Upper
Age		0.07	1.02	1.00	1.03	0.17	1.01	0.99	1.03
Sex (female)	Male	0.30	0.82	0.56	1.20	–	–	–	–
Race	White	0.241				–			
American Indian/Alaska Native		0.981	0.00	0.00		–	–	–	–
Asian or Pacific Islander		0.662	1.25	0.46	3.42	–	–	–	–
Black		0.02	2.06	1.12	3.78	–	–	–	–
Unknown		0.974	0.00	0.00	5.66 E+228	–	–	–	–
Marital status	Married/partner	0.03				0.21			
Divorced/separated		0.12	1.58	0.89	2.79	0.12	1.62	0.89	2.96
Single (never married)		0.007	2.25	1.25	4.05	0.04	1.92	1.03	3.57
Unknown		0.29	1.49	0.71	3.13	0.46	1.33	0.63	2.84
Widowed		0.03	1.86	1.05	3.29	0.26	1.42	0.77	2.62
Insurance status	Uninsured	0.98				–			
Insured		0.80	0.84	0.20	3.44	–	–	–	–
Medicaid		0.82	0.84	0.18	3.79	–	–	–	–
Unknown		0.74	0.79	0.19	3.31	–	–	–	–
T Stage	T1	0.98				–			
T2		<0.001	5.52	4.09	7.45	–	–	–	–
T3		0.74	0.79	0.19	3.31	–	–	–	–
N stage (N1)	N0	0.10	0.70	0.47	1.07	0.43	0.84	0.54	1.30
Surgery status	No surgery	0.001				0.03			
RT alone		0.14	0.51	0.21	1.24	0.15	0.51	0.20	1.27
Surgery alone		<0.001	0.32	0.17	0.58	0.004	0.39	0.20	0.74
Surgery + RT		<0.001	0.27	0.13	0.54	0.01	0.38	0.18	0.79

RT, radiotherapy.

Table S7 Univariable and multivariable analysis of overall survival in stage III disease

Variable	Reference	Univariable				Multivariable			
		P	HR	95% CI		P	HR	95% CI	
				Lower	Upper			Lower	Upper
Age		<0.001	1.02	1.02	1.03	<0.001	1.02	1.01	1.03
Sex (female)	Male	0.008	0.78	0.64	0.94	0.03	0.81	0.67	0.98
Race	White	0.59				–			
American Indian/Alaska Native		0.83	1.23	0.17	8.79	–	–	–	–
Asian or Pacific Islander		0.12	0.65	0.38	1.11	–	–	–	–
Black		0.53	0.91	0.68	1.22	–	–	–	–
Unknown		0.93	0.00	0.00	3.46E+69	–	–	–	–
Marital status	Married/partner	0.41				–			
Divorced/separated		0.74	0.95	0.72	1.26	–	–	–	–
Single (never married)		0.98	1.00	0.74	1.34	–	–	–	–
Unknown		0.51	1.22	0.68	2.18	–	–	–	–
Widowed		0.08	1.25	0.97	1.61	–	–	–	–
Insurance status	Uninsured	0.69				–			
Insured		0.27	0.67	0.33	1.36	–	–	–	–
Medicaid		0.39	0.72	0.34	1.52	–	–	–	–
Unknown		0.35	0.71	0.35	1.45	–	–	–	–
T stage	T1	0.007				0.003			
T2		0.84	1.05	0.67	1.64	0.13	0.76	0.54	1.08
T3		0.11	1.53	0.91	2.59	0.92	1.02	0.66	1.58
T4		0.01	1.66	1.12	2.48	0.13	1.28	0.93	1.76
T0		0.27	0.45	0.11	1.87	0.06	0.44	0.18	1.05
TX		0.05	1.70	1.00	2.89	0.54	0.87	0.56	1.36
N stage	N0	<0.001				0.12			
N1		0.82	1.05	0.67	1.65	0.38	1.23	0.77	1.97
N2		0.64	0.94	0.71	1.23	0.35	1.16	0.85	1.59
N3		0.04	1.41	1.01	1.96	0.05	1.47	0.99	2.16
NX		<0.001	3.16	1.74	5.75	0.03	1.95	1.05	3.62
Surgery status	No surgery	<0.001				<0.001			
RT alone		<0.001	0.42	0.34	0.52	<0.001	0.49	0.39	0.61
Surgery alone		<0.001	0.38	0.29	0.50	<0.001	0.43	0.31	0.58
Surgery + RT		<0.001	0.27	0.19	0.38	<0.001	0.36	0.25	0.53

RT, radiotherapy.

Table S8 Multivariable Analysis of Cause-Specific Survival Based on Stage and Treatment

Variable	Reference	Stage I				Stage II				Stage III			
		P Value	HR	95% CI		P Value	HR	95% CI		P Value	HR	95% CI	
				Lower	Upper			Lower	Upper			Lower	Upper
Surgery status	No surgery	<0.001				0.05				<0.001			
RT alone		0.006	0.39	0.20	0.76	0.07	0.32	0.09	1.10	<0.001	0.46	0.35	0.61
Surgery alone		<0.001	0.17	0.10	0.29	0.008	0.35	0.16	0.76	<0.001	0.35	0.23	0.52
Surgery + RT		<0.001	0.19	0.08	0.43	0.02	0.35	0.15	0.83	<0.001	0.30	0.19	0.49

RT, radiotherapy.