1. Objectives

Primary Objective

The primary objective of the study is to evaluate the disparities in survival for cervical cancer among Hispanic subgroups under guideline-concordant care using the NCDB database.

Secondary Objective

The secondary objectives include but not limited to (1) capture potential confounders (i.e. age, treatments, etc.) that affect survival of cervical cancer for Latino subgroups, (2) compare survival of cervical cancer for Latino subgroups to other groups in U.S., and (3) evaluate effects of guideline-concordant care on cancer survival regarding Latino subgroups.

2. Guideline-concordant care table

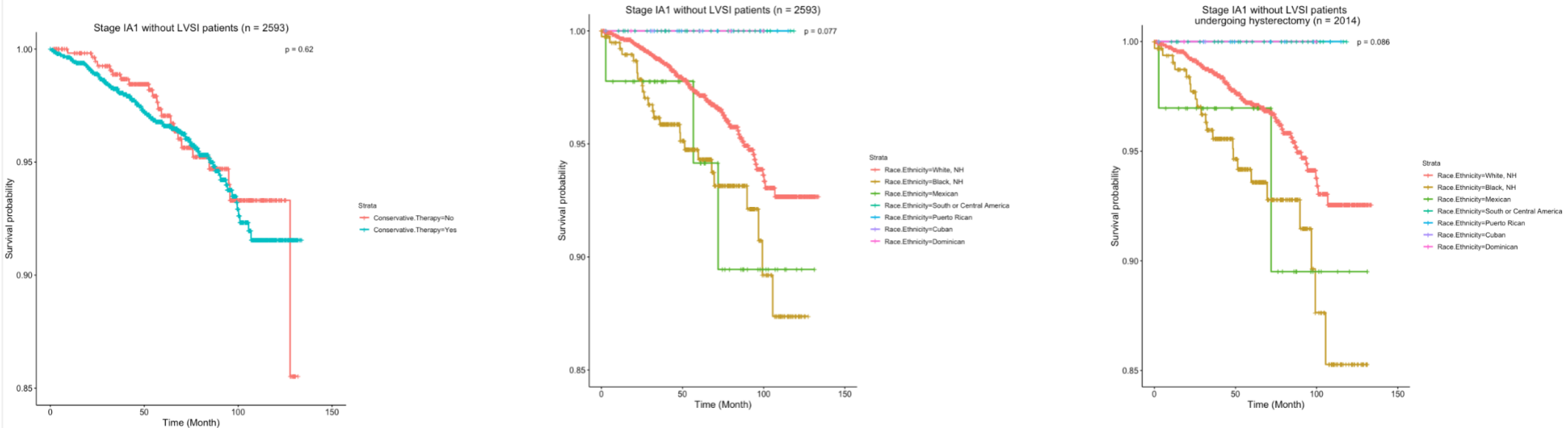| Quality metric	Eligibility	Guideline compliance	Year analyzed	Total analyzed	Adherent %
Non-radical surgery	Stage IA1 without LVSI patients undergoing surgery	Patients undergoing conization, trachelectomy, or simple hysterectomy as primary treatment	2010-2019	2593	77.71%
Radical hysterectomy	Stage IA2 - IIA2 patients undergoing hysterectomy as primary treatment	Patients undergoing modified radical hysterectomy or radical hysterectomy	2004-2019	16174	53.41%
Lymph node assessment	Stage IA2 - IIA2 patients undergoing hysterectomy as primary treatment	Any surgical lymph node assessment	2004-2019	16174	88.58%
Adjuvant chemoradiation	Stage IA2 - IIA2 patients undergoing surgery with positive lymph nodes or positive margins	Patients receiving chemotherapy and radiation within 60 days of surgery	2004-2019	2678	60.34%
Primary chemoradiation	Stage IB2-IVA patients undergoing primary radiation	Receipt of concurrent chemotherapy	2004-2019	31067	81.08%
Chemotherapy	Stage IVB patients without undergoing surgery as primary treatment	Receipt of chemotherapy at any time point	2004-2019	6714	82.93%
Timely initiation of treatment in early-stage disease	Stage IA1–IIA patients	Receipt of primary treatment within 60 calendar days of diagnosis	2004-2019	36592	81.91%
Timely initiation of treatment in locally advanced disease	Stage IIB–IVA patients	Receipt of primary treatment within 60 calendar days of diagnosis	2004-2019	30223	78.03%
Treatment for locally advanced disease	Stage IIB–IIIB patients	Patients receiving primary treatment	2004-2019	27448	92.91%

3. Demographic table

	White, NH (n = 58328;%)	Black, NH (n = 14876;%)	Hispanic (n = 4363;%)	Mexican (n = 2445;%)	Cuban (n = 165;%)	Dominican (n = 160;%)	Puerto Rican (n = 442;%)	South or Central America (n = 1151;%)	P-value (Total)	P-value (Latino)
Age [mean (SD)]	50.97 (14.6)	52.46 (14.99)	50.24 (14.3)	49.4 (13.85)	55.68 (15.41)	56.29 (15.22)	51.01 (14.7)	50.11 (14.44)	< 0.001	0.61
Education										
No HSD >=17.6%	11266 (19.31%)	6412 (43.1%)	2680 (61.43%)	1622 (66.34%)	85 (51.52%)	103 (64.38%)	225 (50.9%)	645 (56.04%)	< 0.001	< 0.001
No HSD 10.9% - 17.5%	15354 (26.32%)	4292 (28.85%)	728 (16.69%)	366 (14.97%)	35 (21.21%)	25 (15.62%)	102 (23.08%)	200 (17.38%)		
No HSD 6.3% - 10.8%	14757 (25.3%)	2045 (13.75%)	439 (10.06%)	211 (8.63%)	25 (15.15%)	18 (11.25%)	53 (11.99%)	132 (11.47%)		
No HSD < 6.3%	10952 (18.78%)	754 (5.07%)	235 (5.39%)	86 (3.52%)	10 (6.06%)	4 (2.5%)	30 (6.79%)	105 (9.12%)		
Neighborhood Income										
< $40,227	10165 (17.43%)	6786 (45.62%)	1292 (29.61%)	750 (30.67%)	47 (28.48%)	57 (35.62%)	172 (38.91%)	266 (23.11%)	< 0.001	< 0.001
$40,227 - $50,353	13341 (22.87%)	2916 (19.6%)	961 (22.03%)	572 (23.39%)	49 (29.7%)	42 (26.25%)	86 (19.46%)	212 (18.42%)		
$50,354 - $63,332	12568 (21.55%)	1947 (13.09%)	1006 (23.06%)	595 (24.34%)	37 (22.42%)	21 (13.12%)	82 (18.55%)	271 (23.54%)		
>= $63,333	16150 (27.69%)	1835 (12.34%)	823 (18.86%)	368 (15.05%)	22 (13.33%)	30 (18.75%)	70 (15.84%)	333 (28.93%)		
Missing	6104 (10.46%)	1392 (9.36%)	281 (6.44%)	160 (6.54%)	10 (6.06%)	10 (6.25%)	32 (7.24%)	69 (5.99%)		
Insurance Status										
No	3827 (6.56%)	1538 (10.34%)	836 (19.16%)	487 (19.92%)	13 (7.88%)	12 (7.5%)	33 (7.47%)	291 (25.28%)	< 0.001	< 0.001
Other Government	692 (1.19%)	139 (0.93%)	34 (0.78%)	20 (0.82%)	2 (1.21%)	1 (0.62%)	4 (0.9%)	7 (0.61%)		
Medicaid	11035 (18.92%)	4538 (30.51%)	1692 (38.78%)	1042 (42.62%)	42 (25.45%)	72 (45%)	160 (36.2%)	376 (32.67%)		
Medicare	11527 (19.76%)	3233 (21.73%)	615 (14.1%)	294 (12.02%)	46 (27.88%)	34 (21.25%)	101 (22.85%)	140 (12.16%)		
Private Insurance	29890 (51.24%)	4956 (33.32%)	1016 (23.29%)	482 (19.71%)	61 (36.97%)	39 (24.38%)	137 (31%)	297 (25.8%)		
Unknown	1357 (2.33%)	472 (3.17%)	170 (3.9%)	120 (4.91%)	1 (0.61%)	2 (1.25%)	7 (1.58%)	40 (3.48%)		
Urban/Rural										
Rural	1167 (2%)	143 (0.96%)	12 (0.28%)	11 (0.45%)	0 (0%)	0 (0%)	0 (0%)	1 (0.09%)	< 0.001	< 0.001
Urban	9965 (17.08%)	1314 (8.83%)	125 (2.87%)	102 (4.17%)	3 (1.82%)	3 (1.88%)	6 (1.36%)	11 (0.96%)		
Metro	44936 (77.04%)	13115 (88.16%)	4170 (95.58%)	2307 (94.36%)	161 (97.58%)	153 (95.62%)	429 (97.06%)	1120 (97.31%)		
Missing	2260	304	56	25	1	4	7	19		

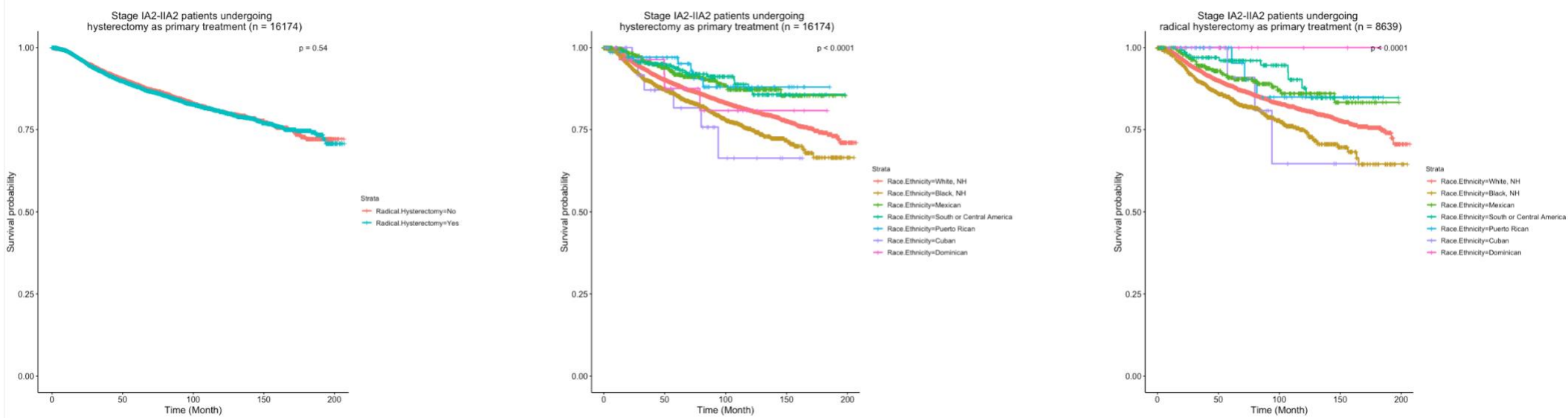|										
	(3.87%)	(2.04%)	(1.28%)	(1.02%)	(0.61%)	(2.5%)	(1.58%)	(1.65%)		
Charlson/Deyo Index										
0	49821 (85.42%)	11964 (80.42%)	3821 (87.58%)	2164 (88.51%)	142 (86.06%)	136 (85%)	347 (78.51%)	1032 (89.66%)	< 0.001	< 0.001
1	6444 (11.05%)	2049 (13.77%)	429 (9.83%)	228 (9.33%)	21 (12.73%)	16 (10%)	68 (15.38%)	96 (8.34%)		
2	1440 (2.47%)	474 (3.19%)	77 (1.76%)	37 (1.51%)	2 (1.21%)	5 (3.12%)	19 (4.3%)	14 (1.22%)		
3	623 (1.07%)	389 (2.61%)	36 (0.83%)	16 (0.65%)	0 (0%)	3 (1.88%)	8 (1.81%)	9 (0.78%)		
Tumor Histology										
Adenocarcinoma	13295 (22.79%)	1748 (11.75%)	860 (19.71%)	487 (19.92%)	31 (18.79%)	29 (18.12%)	68 (15.38%)	245 (21.29%)	< 0.001	0.08
Squamous Cell Carcinoma	39574 (67.85%)	11735 (78.89%)	3094 (70.91%)	1735 (70.96%)	119 (72.12%)	113 (70.62%)	331 (74.89%)	796 (69.16%)		
Unspecified Carcinoma	1554 (2.66%)	467 (3.14%)	102 (2.34%)	46 (1.88%)	5 (3.03%)	5 (3.12%)	14 (3.17%)	32 (2.78%)		
Other	271 (0.46%)	82 (0.55%)	16 (0.37%)	9 (0.37%)	2 (1.21%)	0 (0%)	4 (0.9%)	1 (0.09%)		
Unknown	3634 (6.23%)	844 (5.67%)	291 (6.67%)	168 (6.87%)	8 (4.85%)	13 (8.12%)	25 (5.66%)	77 (6.69%)		
Tumor Grade										
Grade I	5559 (9.53%)	816 (5.49%)	352 (8.07%)	197 (8.06%)	11 (6.67%)	13 (8.12%)	37 (8.37%)	94 (8.17%)	< 0.001	0.97
Grade II	18413 (31.57%)	4639 (31.18%)	1376 (31.54%)	764 (31.25%)	47 (28.48%)	51 (31.87%)	143 (32.35%)	371 (32.23%)		
Grade III	17471 (29.95%)	4902 (32.95%)	1335 (30.6%)	755 (30.88%)	51 (30.91%)	54 (33.75%)	136 (30.77%)	339 (29.45%)		
Grade IV	940 (1.61%)	219 (1.47%)	100 (2.29%)	57 (2.33%)	4 (2.42%)	2 (1.25%)	6 (1.36%)	31 (2.69%)		
Missing	15945 (27.34%)	4300 (28.91%)	1200 (27.5%)	672 (27.48%)	52 (31.52%)	40 (25%)	120 (27.15%)	316 (27.45%)		
Facility Type										
Community Cancer Program	2280 (3.91%)	403 (2.71%)	182 (4.17%)	122 (4.99%)	3 (1.82%)	5 (3.12%)	22 (4.98%)	30 (2.61%)	< 0.001	< 0.001
Comprehensive Community Cancer Program	15990 (27.41%)	3086 (20.74%)	627 (14.37%)	340 (13.91%)	45 (27.27%)	29 (18.12%)	70 (15.84%)	143 (12.42%)		
Academic/Research Program	17398 (29.83%)	6236 (41.92%)	2027 (46.46%)	1138 (46.54%)	51 (30.91%)	91 (56.88%)	195 (44.12%)	552 (47.96%)		
Integrated Network Cancer Program	8366 (14.34%)	2007 (13.49%)	425 (9.74%)	195 (7.98%)	39 (23.64%)	14 (8.75%)	42 (9.5%)	135 (11.73%)		
Missing	14294 (24.51%)	3144 (21.13%)	1102 (25.26%)	650 (26.58%)	27 (16.36%)	21 (13.12%)	113 (25.57%)	291 (25.28%)		
Facility Location										
Northeast	8752 (15%)	2330 (15.66%)	672 (15.4%)	61 (2.49%)	23 (13.94%)	118 (73.75%)	219 (49.55%)	251 (21.81%)	< 0.001	< 0.001
South	17001 (29.15%)	6555 (44.06%)	698 (16%)	306 (12.52%)	108 (65.45%)	18 (11.25%)	79 (17.87%)	187 (16.25%)		
Midwest	11663 (20%)	2255 (15.16%)	216 (4.95%)	158 (6.46%)	3 (1.82%)	3 (1.88%)	24 (5.43%)	28 (2.43%)		
West	6618 (11.35%)	592 (3.98%)	1675 (38.39%)	1270 (51.94%)	4 (2.42%)	0 (0%)	7 (1.58%)	394 (34.23%)		
Missing	14294 (24.51%)	3144 (21.13%)	1102 (25.26%)	650 (26.58%)	27 (16.36%)	21 (13.12%)	113 (25.57%)	291 (25.28%)		
Cancer Stage										
1	3401 (5.83%)	614 (4.13%)	235 (5.39%)	147 (6.01%)	7 (4.24%)	6 (3.75%)	24 (5.43%)	51 (4.43%)	< 0.001	0.003
1A	2425 (4.16%)	495 (3.33%)	192 (4.4%)	116 (4.74%)	7 (4.24%)	5 (3.12%)	14 (3.17%)	50 (4.34%)		
1A1	3410 (5.85%)	648 (4.36%)	158 (3.62%)	80 (3.27%)	5 (3.03%)	6 (3.75%)	15 (3.39%)	52 (4.52%)		
1A2	1046 (1.79%)	178 (1.2%)	62 (1.42%)	33 (1.35%)	2 (1.21%)	5 (3.12%)	7 (1.58%)	15 (1.3%)		
1B	5038 (8.64%)	1054 (7.09%)	492 (11.28%)	292 (11.94%)	8 (4.85%)	12 (7.5%)	29 (6.56%)	151 (13.12%)		
1B1	7808 (13.39%)	1330 (8.94%)	501 (11.48%)	280 (11.45%)	21 (12.73%)	20 (12.5%)	42 (9.5%)	138 (11.99%)		
1B2	3173 (5.44%)	921 (6.19%)	255 (5.84%)	142 (5.81%)	6 (3.64%)	3 (1.88%)	27 (6.11%)	77 (6.69%)		
2	568 (0.97%)	131 (0.88%)	38 (0.87%)	23 (0.94%)	0 (0%)	2 (1.25%)	3 (0.68%)	10 (0.87%)		
2A	1453 (2.49%)	339 (2.28%)	128 (2.93%)	67 (2.74%)	6 (3.64%)	5 (3.12%)	16 (3.62%)	34 (2.95%)		
2A1	353 (0.61%)	66 (0.44%)	20 (0.46%)	11 (0.45%)	0 (0%)	2 (1.25%)	4 (0.9%)	3 (0.26%)		
2A2	614 (1.05%)	146 (0.98%)	37 (0.85%)	18 (0.74%)	1 (0.61%)	1 (0.62%)	7 (1.58%)	10 (0.87%)		
2B	7014 (12.03%)	2096 (14.09%)	616 (14.12%)	353 (14.44%)	19 (11.52%)	21 (13.12%)	60 (13.57%)	163 (14.16%)		
3	452 (0.77%)	131 (0.88%)	36 (0.83%)	18 (0.74%)	4 (2.42%)	0 (0%)	2 (0.45%)	12 (1.04%)		
3A	763 (1.31%)	250 (1.68%)	71 (1.63%)	38 (1.55%)	3 (1.82%)	4 (2.5%)	7 (1.58%)	19 (1.65%)		
3B	11372 (19.5%)	3699 (24.87%)	948 (21.73%)	499 (20.41%)	49 (29.7%)	49 (30.63%)	124 (28.05%)	227 (19.72%)		
4	699 (1.2%)	187 (1.26%)	87 (1.99%)	54 (2.21%)	1 (0.61%)	1 (0.62%)	6 (1.36%)	25 (2.17%)		
4A	2052 (3.52%)	617 (4.15%)	106 (2.43%)	64 (2.62%)	7 (4.24%)	2 (1.25%)	13 (2.94%)	20 (1.74%)		
4B	6687 (11.46%)	1974 (13.27%)	381 (8.73%)	210 (8.59%)	19 (11.52%)	16 (10%)	42 (9.5%)	94 (8.17%)		

4. Frequency table of treatments stratified by quality metric groups

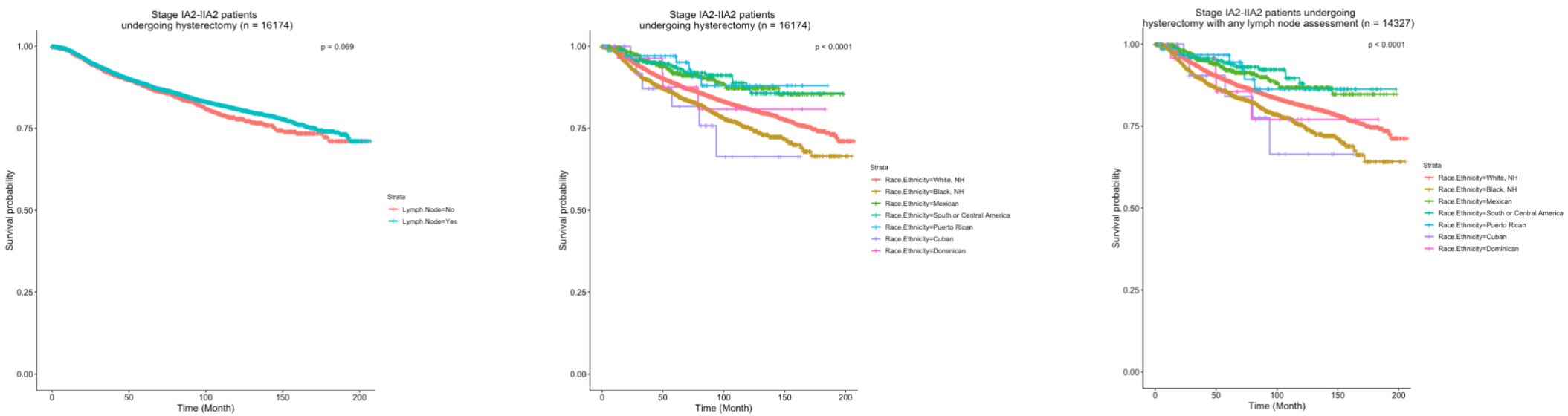| Quality Metric Group	Stage IA1 without LVSl patients undergoing surgery (n = 2593; %)	Stage IA2-IIA2 patients undergoing hysterectomy as primary treatment (n = 16174; %)	Stage IA2-IIA2 patients undergoing surgery with positive lymph nodes or positive margins (n = 2678; %)	Stage IB2-IVA patients undergoing primary radiation (n = 31067; %)	Stage IVB patients without undergoing surgery as primary treatment (n = 6714; %)	Stage IA1-IIA patients (n = 36592; %)	Stage IIB-IIIB patients (n = 27448; %)	Stage IIB-IVA patients (n = 30223; %)
Primary Treatment: the first course of treatment								
Surgery	2593 (100%)	16174 (100%)	2678 (100%)	0 (0%)	0 (0%)	26418 (72.2%)	3148 (11.47%)	3316 (10.97%)
Radiation	0 (0%)	0 (0%)	0 (0%)	26516 (85.35%)	4019 (59.86%)	6911 (18.89%)	18326 (66.77%)	20001 (66.18%)
Chemotherapy	0 (0%)	0 (0%)	0 (0%)	4551 (14.65%)	2695 (40.14%)	1488 (4.07%)	4028 (14.68%)	4537 (15.01%)
Unknown	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1775 (4.85%)	1946 (7.09%)	2369 (7.84%)
Non-radical Surgery: received the treatment at any time point								
No	579 (22.33%)	10607 (65.58%)	1877 (70.09%)	29931 (96.34%)	6620 (98.6%)	22236 (60.77%)	24761 (90.21%)	27419 (90.72%)
Yes	2014 (77.67%)	5567 (34.42%)	801 (29.91%)	1136 (3.66%)	94 (1.4%)	14356 (39.23%)	2687 (9.79%)	2804 (9.28%)
Radical Hysterectomy: received the treatment at any time point								
No	2204 (85%)	7535 (46.59%)	1134 (42.35%)	30526 (98.26%)	6646 (98.99%)	26058 (71.21%)	26599 (96.91%)	29284 (96.89%)
Yes	389 (15%)	8639 (53.41%)	1544 (57.65%)	541 (1.74%)	68 (1.01%)	10534 (28.79%)	849 (3.09%)	939 (3.11%)
Hysterectomy: received the treatment at any time point								
No	657 (25.34%)	0 (0%)	0 (0%)	29261 (94.19%)	6536 (97.35%)	13567 (37.08%)	25178 (91.73%)	27799 (91.98%)
Yes	1936 (74.66%)	16174 (100%)	2678 (100%)	1806 (5.81%)	178 (2.65%)	23025 (62.92%)	2270 (8.27%)	2424 (8.02%)
Lymph node assessment: received the treatment at any time point								
No	1906 (73.51%)	1847 (11.42%)	182 (6.8%)	27972 (90.04%)	6172 (91.93%)	17345 (47.4%)	23531 (85.73%)	26066 (86.25%)
Yes	687 (26.49%)	14327 (88.58%)	2496 (93.2%)	3095 (9.96%)	542 (8.07%)	19247 (52.6%)	3917 (14.27%)	4157 (13.75%)
Adjuvant Chemoradiation								
No	2570 (99.11%)	12992 (80.33%)	1062 (39.66%)	31067 (100%)	6714 (100%)	32012 (87.48%)	25345 (92.34%)	28041 (92.78%)
Yes	23 (0.89%)	3182 (19.67%)	1616 (60.34%)	0 (0%)	0 (0%)	4580 (12.52%)	2103 (7.66%)	2182 (7.22%)
Surgery: received the treatment at any time point								
No	0 (0%)	0 (0%)	0 (0%)	29099 (93.67%)	6505 (96.89%)	9021 (24.65%)	23264 (84.76%)	25781 (85.3%)
Yes	2593 (100%)	16174 (100%)	2678 (100%)	1968 (6.33%)	209 (3.11%)	27571 (75.35%)	4184 (15.24%)	4442 (14.7%)
Radiation: received the treatment at any time point								
No	2521 (97.22%)	10990 (67.95%)	682 (25.47%)	0 (0%)	1625 (24.2%)	21281 (58.16%)	3383 (12.33%)	4069 (13.46%)
Yes	72 (2.78%)	5184 (32.05%)	1996 (74.53%)	31067 (100%)	5089 (75.8%)	15311 (41.84%)	24065 (87.67%)	26154 (86.54%)
Chemotherapy: received the treatment at any time point								
No	2561 (98.77%)	12482 (77.17%)	867 (32.37%)	4662 (15.01%)	1146 (17.07%)	24464 (66.86%)	5610 (20.44%)	6504 (21.52%)
Yes	32 (1.23%)	3692 (22.83%)	1811 (67.63%)	26405 (84.99%)	5568 (82.93%)	12128 (33.14%)	21838 (79.56%)	23719 (78.48%)
Chemoradiation: chemotherapy occurs within 42 days of the start of radiation, vice versa								
No	2570 (99.11%)	12992 (80.33%)	1062 (39.66%)	5879 (18.92%)	3528 (52.55%)	25760 (70.4%)	7514 (27.38%)	8743 (28.93%)
Yes	23 (0.89%)	3182 (19.67%)	1616 (60.34%)	25188 (81.08%)	3186 (47.45%)	10832 (29.6%)	19934 (72.62%)	21480 (71.07%)

5. Survival curves
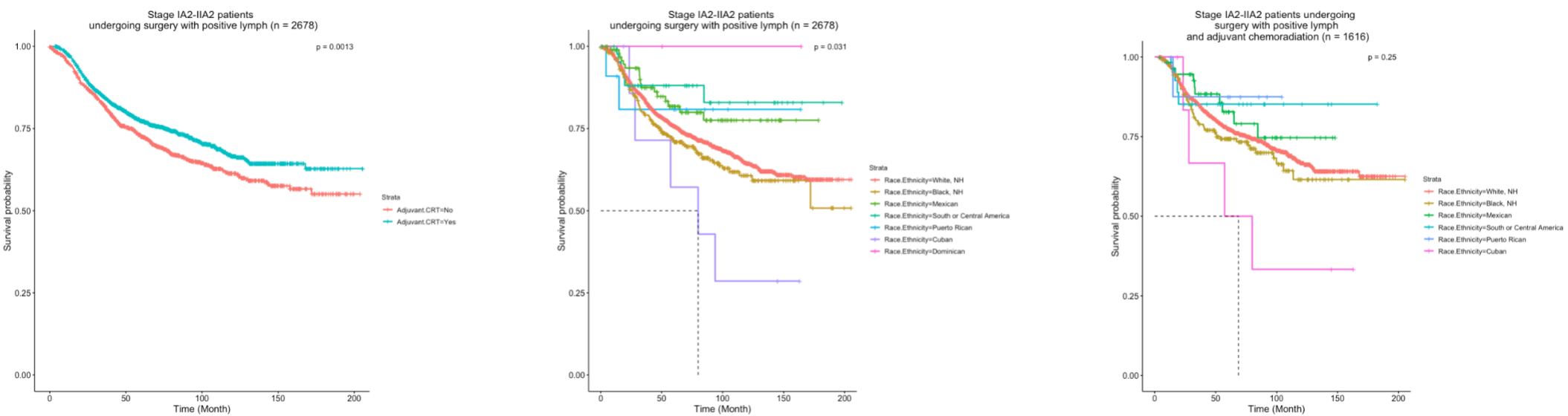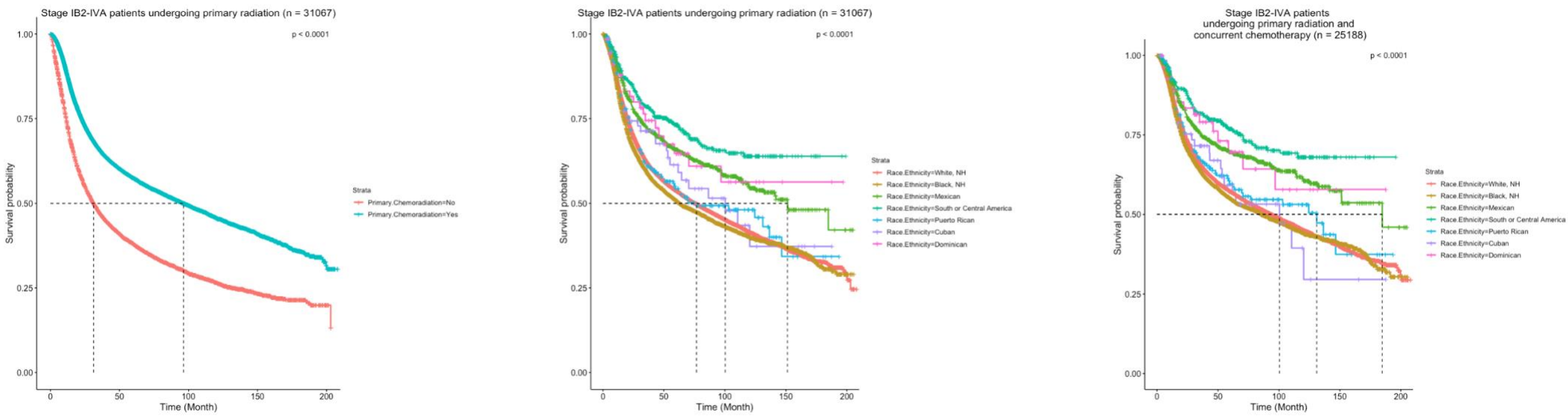### (1). Non-radical surgery

Stage IA1 without LVSI patients (n = 2593) p = 0.62

Stage IA1 without LVSI patients (n = 2593) p = 0.077

Stage IA1 without LVSI patients undergoing hysterectomy (n = 2014) p = 0.086

(2). Radical hysterectomy

Stage IA2-IIA2 patients undergoing
hysterectomy as primary treatment (n = 16174)

Stage IA2-IIA2 patients undergoing
hysterectomy as primary treatment (n = 16174)

Stage IA2-IIA2 patients undergoing
radical hysterectomy as primary treatment (n = 8639)

(3). Lymph node assessment

Stage IA2-IIA2 patients
undergoing hysterectomy (n = 16174)

Stage IA2-IIA2 patients
undergoing hysterectomy (n = 16174)

Stage IA2-IIA2 patients undergoing
hysterectomy with any lymph node assessment (n = 14327)

(4). Adjuvant chemoradiation

Stage IA2-IIA2 patients
undergoing surgery with positive lymph (n = 2678)

Stage IA2-IIA2 patients
undergoing surgery with positive lymph (n = 2678)

Stage IA2-IIA2 patients undergoing
surgery with positive lymph
and adjuvant chemoradiation (n = 1616)

(5). Concurrent chemotherapy

Stage IB2-IVA patients undergoing primary radiation (n = 31067)

Stage IB2-IVA patients undergoing primary radiation (n = 31067)

Stage IB2-IVA patients
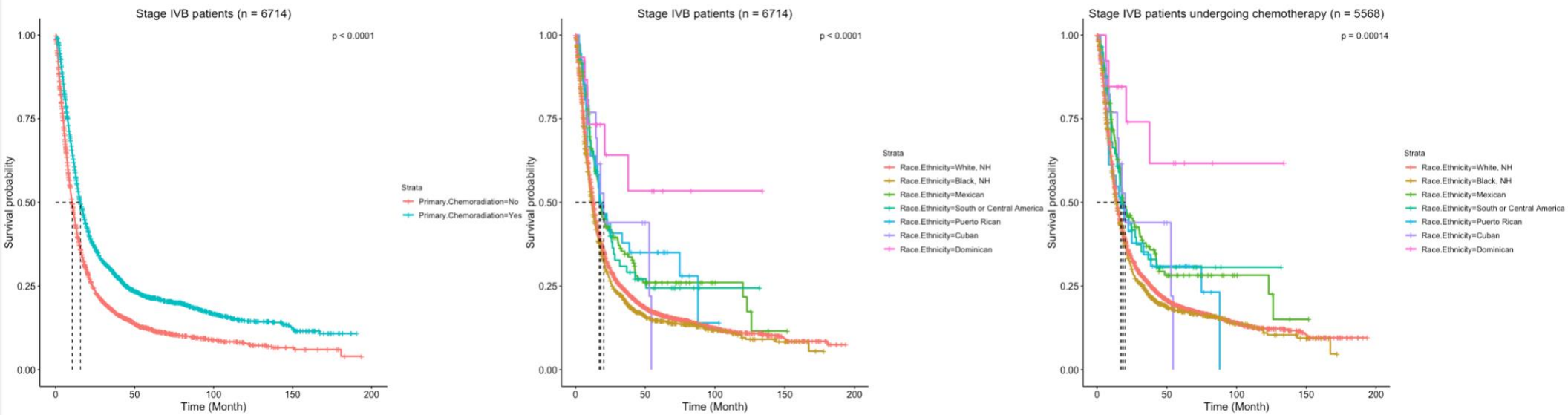undergoing primary radiation and
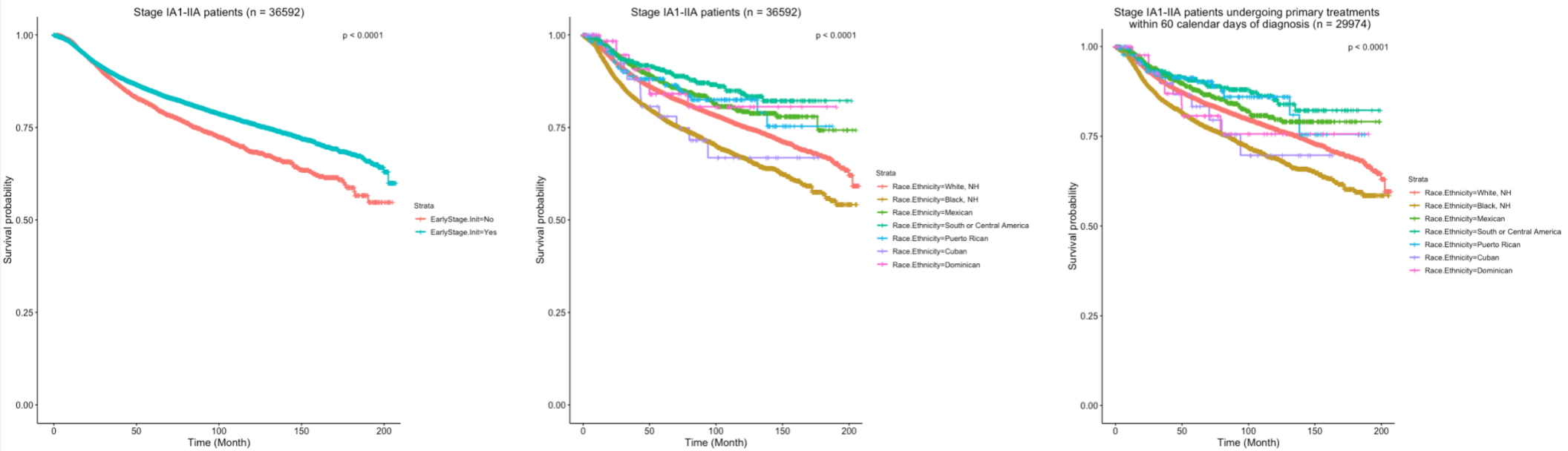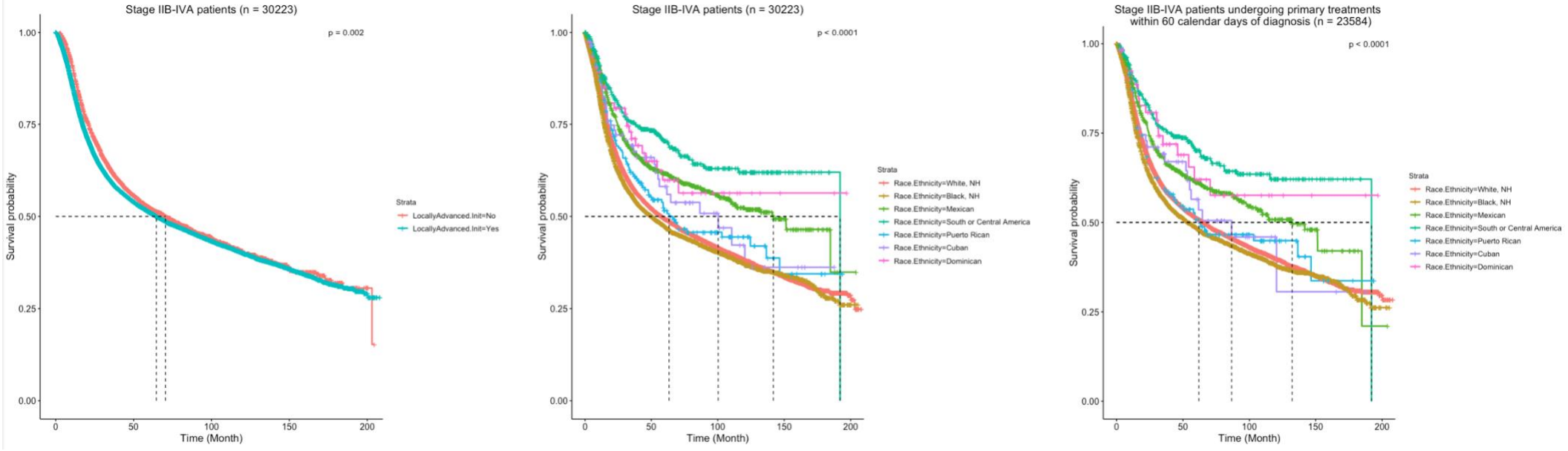concurrent chemotherapy (n = 25188)

(6). Chemotherapy

(7). Timely initiation of treatment in early-stage disease

(8). Timely initiation of treatment in locally advanced disease

(9). Treatment for locally advanced disease