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Examining urban and rural differences in how distance to care influences the initiation and completion of treatment among insured cervical cancer patients

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Abstract

Background: While rural cancer patients encounter substantial barriers to care, they more often report receiving timely care than urban patients. We examined whether geographic distance, a contributor to urban-rural health disparities, differentially influences treatment initiation and completion among insured urban and rural cervical cancer patients.

Methods: We identified women diagnosed with cervical cancer from 2004-2013 from a statewide cancer registry linked to multi-payer, insurance claims. Primary outcomes were initiation of guideline-concordant care within 6 weeks of diagnosis and, among stage IB2-IVA cancer patients, completion of concurrent chemoradiotherapy (CCRT) in 56 days. We estimated risk ratios using modified Poisson regressions, stratified by urban/rural status, to examine the association between distance and treatment timing (initiation or completion).

Results: Among 999 stage IA-IVA patients, 48% initiated guideline-concordant care within 6 weeks of diagnosis, and 37% of 492 stage IB2-IVA cancer patients completed CCRT in 56 days. In urban areas, stage IA-IVA patients who lived ≥15 miles from the nearest treatment facility were less likely to initiate timely treatment compared to those <5 miles (RR:0.72, 95% CI:0.54-0.95). Among IB2-IVA stage cancer patients, rural women residing ≥15 miles from the nearest radiation facility were more likely to complete CCRT in 56 days (RR:2.49, 95% CI:1.12-5.51).

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Conclusions: Geographic distance differentially influences the initiation and completion of treatment among urban and rural cervical cancer patients.

Impact: Distance was an access barrier for insured cervical cancer patients in urban areas whereas rural patients may require more intensive outreach, support, and resources, even among those living closer to treatment.

Keywords

urban/rural; distance to care; disparities; cervical cancer care quality; health services research

Introduction

Women with cervical cancer experience substantial treatment disparities. Even among privately insured patients, only 44% of women diagnosed with advanced cervical cancer receive guideline-concordant care.[1] In comparison, 65% and 80% of breast cancer and prostate cancer patients, respectively, receive guideline-concordant care.[2–3] Underserved populations such as minority, low socioeconomic status (SES), and rural residents comprise a significant proportion of cervical cancer patients in the US.[4–6] These patients are particularly susceptible to access barriers to care; they often do not have a usual source of medical care, travel long distances to receive care, have low health literacy, and experience financial strain.[7] The persistent burden of cervical cancer among these vulnerable populations[5,8-9] makes it essential to target resources that decrease access barriers to care.

Distance to care, often used as a proxy for geographic access, is one specific measure of access.[10] However, recent evidence suggests the relationship between distance to care and urban/rural status in predicting cancer care receipt is complex. A recent study among breast cancer patients observed a paradoxical relationship between distance to care and urban/rural status: in rural areas, women living farther from radiation facilities were *more likely* to receive guideline-concordant radiotherapy; however, in urban areas, women living farther from care were *less likely* to receive guideline-concordant radiotherapy than those who lived closer to treatment.[11] While recent evidence suggests that rural cancer patients are more likely to report receiving timely care than urban patients,[12] it is unclear exactly how distance and urban/rural residence interact to predict receipt of timely cancer care, and to our knowledge, no studies have explored this relationship in cervical cancer.

The National Comprehensive Cancer Network (NCCN) and the Institute of Medicine cite timely treatment as a critical dimension of quality cancer care. Among cervical cancer patients, the timely completion of concurrent chemoradiotherapy (CCRT) has been prioritized by the American Brachytherapy Society, Radiation Therapy Oncology Group, and Gynecologic Oncology Group.[13–15] As a predominately medically underserved population, both rural and urban cervical cancer patients may be at greater risk of experiencing treatment delays. Access to timely cancer treatment, however, may be exacerbated by geographic barriers. This study examines the differential effects of distance on the timing of cervical cancer treatment among women residing in urban and rural settings.

Methods

Data & Study Population

We employed data from the Cancer Information and Population Health Resource (CIPHR), which links the North Carolina Central Cancer Registry (NCCCR) to claims data from Medicare, Medicaid, and private insurance files. This population-based dataset included patient demographics, tumor information, utilization of health care services, physician identifiers and geocoded patient and physician locations, making it well-suited for evaluating distance to care. Additionally, we linked county-specific contextual data (e.g., sociodemographic and health care workforce information) from the Area Health Resource File (AHRF). This study was approved by the University of North Carolina Institutional Review Board.

The cohort included insured women diagnosed with cervical cancer between January 1, 2004 and June 30, 2013 (Figure 1). We identified women aged 18 or older with cervical cancer who had no additional primary cancer diagnosis within 1 year of the index diagnosis (N=4013). We excluded patients who were diagnosed at death (N=51), died of any cause in the same month as being diagnosed (N=25), had a non-epithelial cervical cancer histology (N=44), or were missing stage of cancer at diagnosis or were stage IVB or stage 0 carcinoma in situ (N=373). We excluded stage IVB patients because treatment focuses on a palliative rather than curative strategy, and we excluded stage 0 patients since diagnosis and treatment are often determined simultaneously. Finally, patients had to be continuously enrolled in private, Medicare, or Medicaid insurance 3 months before diagnosis through 6 months after diagnosis to fully capture treatment detail around the time of diagnosis. We considered requiring patients to be continuously enrolled for at least 12 months post-diagnosis. However, because over 99% initiated treatment within 6 months of diagnosis, we used 6 months to define continuous enrollment. Our final cohort included 999 stage IA-IVA cervical cancer patients and 492 stage IB2-IVA cancer patients.

Dependent Variables

Initiation of treatment: We measured the number of days between diagnosis and initiation of guideline-concordant treatment. Using the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) codes, we defined guideline-concordant treatment using stage-specific NCCN guidelines:

- Stage IA1: Days to conization, loop electrosurgical excision procedure (LEEP), radical hysterectomy, simple hysterectomy, or trachelectomy.
- Stage IA2: Days to radical hysterectomy, simple hysterectomy, or trachelectomy.
- Stage IB: Days to radical hysterectomy or external beam radiation therapy (EBRT).
- Stage IIA-IVA: Days to initiating concurrent chemotherapy and EBRT.

We created a binary variable to indicate if guideline-concordant treatment had been initiated within 6 weeks of diagnosis. The decision to use 6 weeks was based on expert opinion as well as previous gynecological cancer studies suggesting this to be an appropriate interval between diagnosis and treatment.[16]

Completion of guideline-concordant CCRT: We determined completion of CCRT indicated by ICD-9-CM codes. For patients with stage IB2-IVA cervical cancer, we measured the number of days between the first and last day of CCRT. Patients with stage IIA-IVB cancer were only considered as having completed treatment if they had also finished brachytherapy in accordance with NCCN guidelines (Figure 2). We then created a binary outcome reflecting whether CCRT had been completed in 56 days since prolonged CCRT treatment has been shown to harm survival.[13]

Independent Variables

The key independent variable was distance to *nearest* treatment facility providing cervical surgery, chemotherapy, or radiotherapy. Using the straight-line method,[11] we measured the distance between the geographic centroid of patients' residential zip code at diagnosis and the treatment centers' physical address. Patient addresses were geocoded by the NCCCR using North American Association of Central Cancer Registries guidelines.[17] To determine treatment facilities' locations, we used insurance claims to identify all surgical, medical, and gynecological oncologists who provided either cervical surgery or chemotherapy to cervical cancer patients in the CIPHR database. Similarly, we identified all radiation oncologists who provided radiotherapy. For analyses where the outcome was initiation of treatment, distance to nearest treatment center was based on patient's stage of cancer:

- <u>Stage IA</u>: Nearest facility providing primary operative management.
- <u>Stage IB1</u>: Nearest facility providing either radiotherapy or radical hysterectomy.
- <u>Stage IB2-IVA</u>: Nearest facility providing radiotherapy or chemotherapy. Since both treatments are required, we then used the further of the two distances.

For analyses where the outcome was completion of CCRT, we employed distance to nearest radiation treatment facility. In all analyses, distance measures were categorized as: <5 miles, 5-<15 miles, and ≥15 miles.[18]

We also examined patient- and tumor-level characteristics shown to influence timeliness of treatment including: year of diagnosis, American Joint Commission on Cancer stage (stage I; stage II; stage III; stage IV), age at diagnosis (<60 years; 60–70 years; >70 years), race (non-white; white), insurance status at diagnosis (Medicaid only; Medicare only; any private; dual--Medicare and Medicaid), and residence status (urban; rural). We defined race as a binary variable since over 90% of non-white patients in the study population were black (N=285). Specifically, the non-white category included black, Hispanic, Asian, Native American, and other race patients. We defined residence status using the rural-urban continuum codes (RUCC) and delineated urban/rural status based on the United States Department of Agriculture's (USDA) classification scheme. We used RUCC because it takes both population levels and proximity to an urban area into consideration when determining urban/rural status. We measured comorbid conditions during the study period (3 months prior to diagnosis to 6 months after diagnosis) using a modified Charlson Comorbidity

Index. Lastly, we included county-level sociodemographic characteristics previously shown to influence receipt of guideline-concordant care, such as number of generalist physicians, percent unemployed, and median household income.[1,11]

Statistical Methods

We used χ^2 tests and t-tests to evaluate whether differences in patient, tumor, and county-level characteristics were associated with women of all stages initiating guideline-concordant treatment within 6 weeks of diagnosis; for women with stage IB2-IVA cervical cancer, we also examined factors associated with completing CCRT in 56 days. In multivariable analyses, we used modified Poisson regression to estimate risk ratios (RRs) and 95% confidence intervals (CI). We employed this approach since our outcomes occurred in more than 10% of our study populations; using logistic regression to estimate odds ratios would have upwardly biased our results. Models included full and urban/rural stratified samples. Only patients with stage IB2-IVA cervical cancer were included in model where the outcome was completion of CCRT in 56 days. In a sensitivity analysis, we also examined initiation of guideline-concordant treatment within 8 weeks since some gynecological cancer studies have suggested this as a target interval between diagnosis and treatment.[19] All analyses were conducted using SAS version 9.4 software (SAS Institute, Inc., Cary, NC).

Results

Among 999 women with stage IA-IVA disease at diagnosis, 48% initiated stage-specific guideline-concordant treatment regimens within 6 weeks of diagnosis. These patients were more likely to be younger than 60 years, enrolled in private insurance, have zero comorbidities, and diagnosed at a later cancer stage (Table 1). No significant differences in initiating guideline-concordant care within 6 weeks were found by race, urban/rural residence, tumor-, or county-level characteristics. Among stage IB2-IVA cancer patients, 37% completed guideline-recommended CCRT in 56 days. These patients were more likely to be younger, on Medicaid only or private insurance, and resided in counties with lower median household incomes (Table S1). No differences were found between those who did and did not complete CCRT in 56 days by race, comorbidity, urban/rural residence, or tumor characteristics.

In multivariable analyses among stage IA-IVA cervical cancer patients, living ≥15 miles from the nearest treatment center was associated with a lower likelihood of initiating guideline-concordant care within 6 weeks of diagnosis (RR:0.78, 95% CI:0.64–0.95; Table 2). In analyses stratified by rural/urban residence, urban patients living ≥15 miles from nearest treatment facility had a lower likelihood of initiating treatment within 6 weeks of diagnosis compared to those living <5 miles from the nearest facility (RR:0.72, 95% CI: 0.54–0.95). In contrast, among rural residents, distance from the nearest treatment center was not associated with initiation of treatment within 6 weeks.

Across the full and urban/rural stratified samples, being older than 70 years was associated with a lower likelihood of initiating timely guideline-concordant treatment compared to patients younger than 60 years (Full sample RR:0.64, 95% CI:0.48–0.85; Rural RR: 0.64, 95% CI:0.40–1.00; Urban RR:0.58, 95% CI:0.40–0.85). Urban residents with private insurance were more likely to initiate care within 6 weeks compared to urban residents enrolled only in Medicare (RR:1.66, 95% CI:1.21–2.28). Rural patients diagnosed with stage II cervical cancer were more likely to receive care within 6 weeks compared to rural patients with stage I cervical cancer (RR:1.75, 95% CI:1.32–2.33). Results were similar when the outcome indicated receipt of care within 8 weeks of diagnosis (Table S2).

Among women with stage IB2-IVA cervical cancer, living 5-<15 miles from the nearest radiotherapy facility was significantly associated with completing CCRT in 56 days compared to patients residing <5 miles from the closest radiotherapy facility (RR:1.42, 95% CI:1.02–1.98; Table 3). These findings became more pronounced among rural residents; specifically, compared to rural patients living within 5 miles of a radiotherapy facility, those living 5-<15 miles (RR:2.43, 95% CI:1.10–5.35) or ≥15 miles (RR:2.49, 95% CI:1.12–5.51) were more likely to complete CCRT. In contrast, among urban residents, distance to radiotherapy facility did not influence timely completion of CCRT; however, urban residents >70 years old were less likely to complete CCRT in 56 days (RR:0.55, 95% CI:0.34–0.90) compared to those <60 years old. Among rural residents, those between 60–70 years old (RR:0.54, 95% CI:0.34–0.84) and >70 years old (RR:0.32, 95% CI:0.18–0.54) had a lower likelihood of completing CCRT in 56 days.

Discussion

Distance to care is one measure of an individual's access to guideline-concordant cancer treatment. We examined the influence of distance on the timely initiation and completion of treatment in women with cervical cancer. Less than half of this population-based cohort of cervical cancer patients received timely guideline-concordant care, indicating significant quality concerns. The influence of distance on timely treatment varied between urban and rural residents. Interestingly, in urban areas, living further away from care was associated with being less likely to initiate timely guideline concordant treatment. Women with stage IB2-IVA cervical cancer living in rural areas residing farther from care were *more* likely to complete CCRT in a timely manner. However, distance was not associated with timely completion of CCRT among these patients in urban areas.

Geographic access is only one of myriad factors that influence access to cancer care.[20–21] Our findings suggest that factors other than distance may present greater access barriers to care for rural women. We find that rural, elderly patients were less likely to receive timely care, a population that is already at risk of receiving guideline-discordant care and generally benefits less from advances in cancer treatment.[22–23] We speculate this may be due to the additional burden of traveling out of town to access specialty care and the high cost of health care services.[24] Interventions such as telemedicine may be able to address these barriers. A recent study among complex cancer cases showed that telecommunication visits with a surgical oncologist reduced patient travel by 80% and decreased travel-related costs on average by $525 per patient.[25] Vulnerable cancer populations such as the elderly may require more intensive outreach, support, and resources to help ensure timely treatment, even among those living closer to treatment. Further evidence is needed to determine precisely what factors contribute to disparities in care for this population to ensure interventions are meaningful and effective.[26]

Interestingly, among urban and rural women with stage IB2-IVA cervical cancer, distance did not appear to be a barrier to timely completion of CCRT. We suspect this is occurring for two reasons. First, rural patients may be more accustomed to traveling further distances[27] and are also more likely to rely on private transportation to access health care services.[28] Subsequently, rural patients in the most remote (i.e., farthest distances from care) areas are potentially the most willing to drive further to receive cancer treatments since they already do so to access other goods and services. Second, rural patients who live far from treatment centers and urban patients who lack access to private transportation or face daily, heavy driving congestion may utilize temporary housing in close proximity to their radiation treatment center. For example, health-related organizations such as the American Cancer Society will provide cancer patients with discounted or free extended-stay housing through programs such as the Hope Lodge. However, these patients may still face significant barriers to treatment. Living in temporary accommodations while undergoing treatment or having to travel long distances to receive treatment may lead to additional financial stress for cancer patients.[29] This financial toxicity from cancer-related costs negatively affects both survival and quality of life.[30–31] Future research should identify and examine the added financial concerns encountered by these patients, and whether these challenges influence patients' health outcomes.

This study has several limitations. First, our ability to detect relationships between certain factors and outcomes was limited by our relatively small sample size. For example, while we did not find evidence of white versus non-white disparities, we had too few individuals within specific minority groups to allow for a more detailed examination of racial/ethnic disparities; this should be explored in future research with greater representation of these patients. Second, we used the straight-line method instead of road distance or travel time to measure distance. Nonetheless, this method has been shown to be an acceptable proxy for evaluating distance.[32] Third, both analytic cohorts only include insured patients. Thus, we cannot generalize to the uninsured cancer population who often encounter the greatest challenges overcoming access barriers to care. Finally, our findings may not be generalizable outside North Carolina.

Cervical cancer patients persistently suffer from delayed initiation and completion of guideline-concordant care, potentially due to these patients often being of low socioeconomic status and minority backgrounds. Consequently, this cancer population would greatly benefit from targeted access to care interventions. This study is novel in that it examines how distance and urban/rural location influences both the initiation and completion of treatment in a population based-sample of cervical cancer patients and highlights sometimes paradoxical relationships between geographic access and timeliness of cancer treatment in rural versus urban populations. This is a critical step for developing effective interventions since, as our findings illustrate, urban and rural cancer patients face different barriers to initiating and completing treatment. Our findings imply that interventions that reduce travel such as telemedicine should be targeted at older patients, particularly those in rural areas, while interventions that make transportation more accessible and reliable may be most effective among urban residents. However, pinpointing the diverse and particular barriers encountered during treatment will most likely require the use of qualitative research methods, potentially in the form of interviews or focus groups, among rural and urban cancer patients.[33–34] Recognizing the importance of urban/rural differences in the context of significant variation in treatment timing may help policymakers, clinicians, and other stakeholders to better identify and treat women at risk for suboptimal care and reduce observed outcome disparities.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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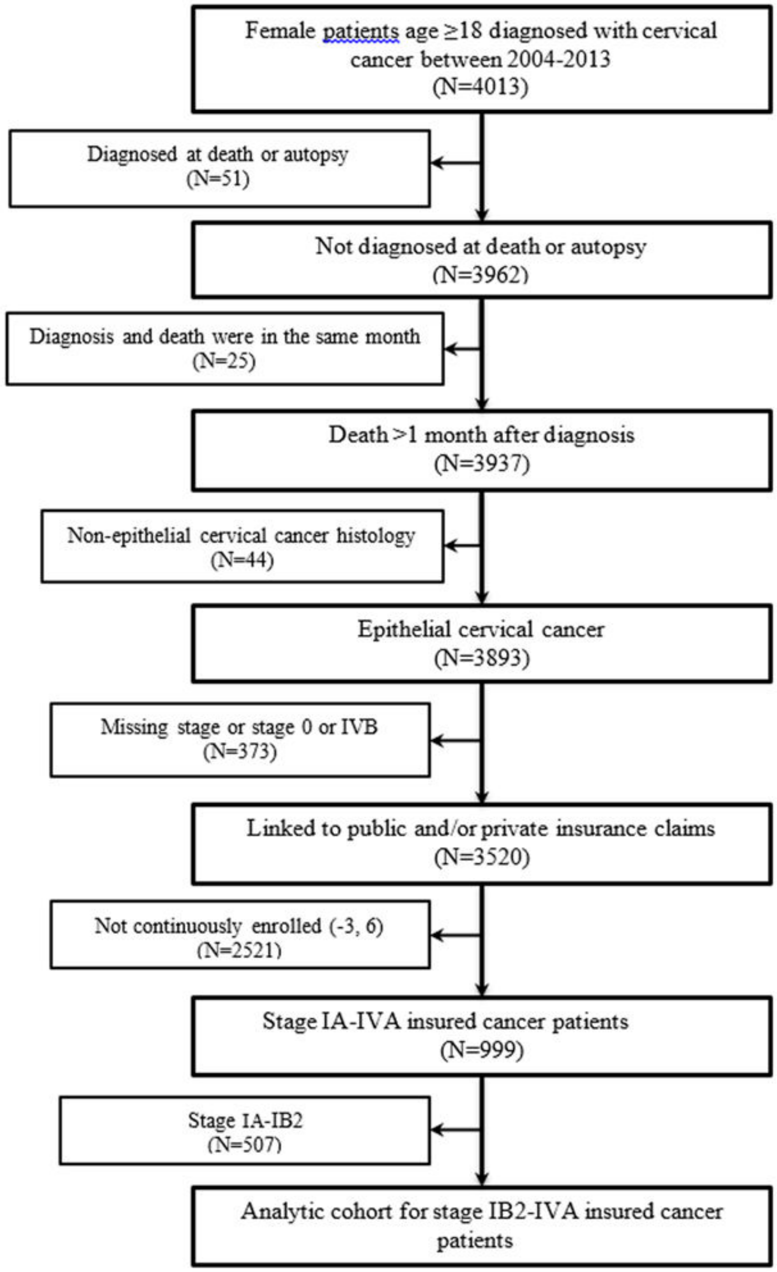

Figure 1. Analytic Cohorts.

Figure 1 describes the analytic cohorts using the Consolidated Standard of Reporting Trials (CONSORT) diagram.

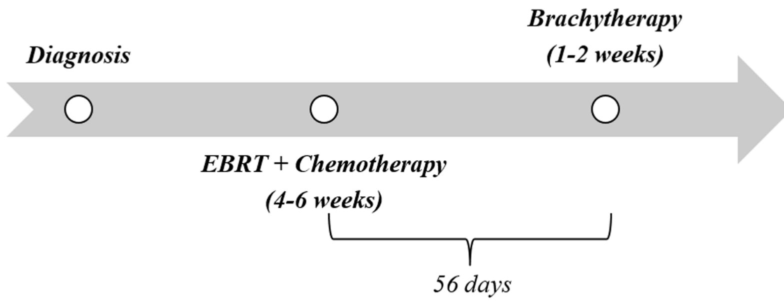

Figure 2. Timeline of guideline-concordant care.

Figure 2 describes guideline-concordant care for stage IIA-IVA cervical cancer patients.

Table 1.

Characteristics of insured women with cervical cancer

	Full sample (N=999)	GC care ≤ 6 weeks from diagnosis (N=478)	No GC care ≤ 6 weeks from diagnosis (N=521)	*P*
	N(%) or mean(SD)	N(%) or mean(SD)	N(%) or mean(SD)	
Patient characteristics				
Age at diagnosis				
<60	475 (47.55)	269 (56.28)	206 (39.54)	<0.0001
60-70	240 (24.02)	113 (23.64)	127 (24.38)	
>70	284 (28.43)	96 (20.08)	188 (36.08)	
Race				
White	683 (68.37)	334 (69.87)	349 (66.99)	0.33
Non-white	316 (31.63)	144 (30.13)	172 (33.01)	
Insurance				
Medicare Only	374 (37.44)	153 (32.01)	221 (42.42)	<0.0001
Medicaid Only	128 (12.81)	68 (14.23)	60 (11.52)	
Any Private	298 (29.83)	184 (38.49)	114 (21.88)	
Medicare and Medicaid	199 (19.92)	73 (15.27)	126 (24.18)	
Comorbidity index				
0	661 (66.17)	331 (69.25)	330 (63.34)	0.01
1	198 (19.82)	90 (18.83)	108 (20.73)	
2+	140 (14.01)	57 (11.92)	83 (15.93)	
Residence location				
Urban	633 (63.36)	309 (64.64)	324 (62.19)	0.43
Rural	366 (36.64)	169 (35.36)	197 (37.81)	
Tumor characteristics				
AJCC stage at diagnosis				
I	572 (57.26)	244 (51.05)	328 (62.96)	0.01
II	176 (17.62)	97 (20.29)	79 (15.16)	
III	227 (22.72)	127 (26.57)	100 (19.19)	
IV	24 (2.40)	* *	14 (2.69)	
Histology				
Squamous	688 (68.87)	331 (69.25)	357 (68.52)	0.24
Adenocarcinoma	212 (21.22)	107 (22.38)	105 (20.15)	
Unknown	99 (9.91)	40 (8.37)	59 (11.32)	
Tumor Grade				
Well differentiated	123 (12.31)	56 (11.72)	67 (12.86)	0.39
Moderately differentiated	289 (28.93)	144 (30.13)	145 (27.83)	
Poorly differentiated	319 (31.93)	160 (33.47)	159 (30.52)	
Unknown/anaplastic	268 (26.83)	118 (24.69)	150 (28.79)	

	Full sample (N=999)	GC care ≤ 6 weeks from diagnosis (N=478)	No GC care ≤ 6 weeks from diagnosis (N=521)	***P***
	N(%) or mean(SD)	N(%) or mean(SD)	N(%) or mean(SD)	
County characteristics				
Median household income	$40487 (7434)	$40994 (7775)	$40120 (7162)	0.07
Mean % unemployed	5 (1.27)	5 (1.24)	6 (1.30)	0.16
Mean number of generalists	8 (9.11)	7 (8.68)	8 (9.50)	0.31

Note. GC, guideline-concordant; AJCC, American Joint Committee on Cancer.

* indicates cell values less than 11 and is suppressed to protect patients' confidentiality.

Table 2.

Risk ratios from multivariate models for receiving treatment within 6 weeks of diagnosis among insured cervical cancer patients and stratified by urban/rural status

	Full sample			Rural			Urban		
	RR	**(95% CI)**	***P***	**RR**	**(95% CI)**	***P***	**RR**	**(95% CI)**	***P***
Age at diagnosis									
<60	1.00	ref.		1.00	ref.		1.00	ref.	
60-70	0.88	(0.70-1.09)	0.24	0.98	(0.68-1.41)	0.91	0.83	(0.63-1.10)	0.19
>70	0.64	(0.48-0.85)	<.001	0.64	(0.40-1.00)	0.05	0.58	(0.40-0.85)	<.001
Race									
White	1.00	ref.		1.00	ref.		1.00	ref.	
Non-white	0.96	(0.81-1.13)	0.60	0.95	(0.71-1.25)	0.70	0.99	(0.80-1.21)	0.90
Insurance at diagnosis									
Medicare only	1.00	ref.		1.00	ref.		1.00	ref.	
Medicaid only	1.12	(0.83-1.50)	0.46	1.09	(0.67-1.78)	0.74	1.19	(0.82-1.72)	0.35
Any private	1.47	(1.14-1.89)	<.001	1.33	(0.88-2.01)	0.17	1.66	(1.21-2.28)	<.001
Medicare and Medicaid	0.93	(0.72-1.21)	0.59	1.02	(0.69-1.50)	0.92	0.83	(0.58-1.18)	0.30
Comorbidity index									
0	1.00	ref.		1.00	ref.		1.00	ref.	
1	1.22	(1.01-1.49)	0.04	1.13	(0.83-1.53)	0.43	1.23	(0.96-1.57)	0.10
2+	1.06	(0.80-1.39)	0.69	0.79	(0.51-1.23)	0.30	1.15	(0.82-1.62)	0.42
Residence location									
Urban	1.00	ref.		--			--		
Rural	1.06	(0.89-1.27)	0.52	--			--		
Distance to care									
<5 miles	1.00	ref.		1.00	ref.		1.00	ref.	
5-<15 miles	1.01	(0.86-1.19)	0.90	1.10	(0.77-1.59)	0.60	0.93	(0.77-1.13)	0.46
≥15 miles	0.78	(0.64-0.95)	0.01	0.73	(0.51-1.04)	0.08	0.72	(0.54-0.95)	0.02

Note. Models also included diagnosis year, stage of diagnosis, and county-level characteristics (median household income, % unemployed, number of generalists)

Table 3.

Risk ratios from multivariate models for completing CCRT within 56 days among stage IB2-IVA insured cervical cancer patients and stratified by urban/rural status

	Full sample			Rural			Urban		
	RR	**(95% CI)**	***P***	**RR**	**(95% CI)**	***P***	**RR**	**(95% CI)**	***P***
Age at diagnosis									
<60	1.00	ref.	.	1.00	ref.	.	1.00	ref.	
60-70	0.61	(0.43 - 0.85)	0.00	0.54	(0.34 - 0.84)	0.01	0.65	(0.41 - 1.03)	0.07
>70	0.44	(0.30 - 0.63)	0.00	0.32	(0.18 - 0.54)	0.00	0.55	(0.34 - 0.90)	0.02
Race									
White	1.00	ref.		1.00	ref.		1.00	ref.	
Non-white	1.09	(0.85 - 1.39)	0.50	0.95	(0.63 - 1.46)	0.83	1.27	(0.92 - 1.77)	0.15
Insurance at diagnosis									
Medicare only	1.00	ref.		1.00	ref.		1.00	ref.	
Medicaid only	0.86	(0.58 - 1.28)	0.45	0.61	(0.33 - 1.14)	0.12	1.13	(0.66 - 1.93)	0.65
Any private	0.82	(0.57 - 1.19)	0.30	0.69	(0.44 - 1.09)	0.11	1.00	(0.59 - 1.69)	0.99
Medicare and Medicaid	0.87	(0.62 - 1.22)	0.41	0.90	(0.55 - 1.48)	0.68	0.83	(0.52 - 1.32)	0.43
Comorbidity index									
0	1.00	ref.		1.00	ref.		1.00	ref.	
1	1.10	(0.83 - 1.47)	0.50	0.78	(0.44 - 1.39)	0.40	1.41	(0.99 - 2.00)	0.06
2+	0.88	(0.61 - 1.27)	0.50	0.67	(0.36 - 1.23)	0.19	1.22	(0.75 - 1.97)	0.43
Residence location									
Urban	1.00	ref.		--			--		
Rural	1.10	(0.82 - 1.46)	0.52	--			--		
Distance to care									
<5 miles	1.00	ref.		1.00	ref.		1.00	ref.	.
5-<15 miles	1.42	(1.02 - 1.98)	0.04	2.43	(1.10 - 5.35)	0.03	1.17	(0.80 - 1.69)	0.42
≥15 miles	1.35	(0.94 - 1.93)	0.10	2.49	(1.12 - 5.51)	0.02	0.99	(0.63 - 1.57)	0.97

Note. Models also included diagnosis year, stage of diagnosis, and county-level characteristics (median household income, % unemployed, number of generalists