Published in final edited form as:

Gynecol Oncol. 2016 June ; 141(3): 516–523. doi:10.1016/j.ygyno.2016.03.025.

Disparities in the Management and Outcome of Cervical Cancer in the United States According to Health Insurance Status

Thomas Churilla, M.D.¹, Brian Egleston, Ph.D.², Yanqun Dong, M.D., Ph.D.¹, Talha Shaikh, M.D.¹, Colin Murphy, M.D.¹, Gina Mantia-Smaldone, M.D.³, Christina Chu, M.D.³, Stephen Rubin, M.D.³, and Penny Anderson, M.D.¹

¹Department of Radiation Oncology, Fox Chase Cancer Center, Philadelphia, PA 19111

²Department of Biostatistics and Bioinformatics Facility, Fox Chase Cancer Center, Philadelphia, PA 19111

³Department of Surgical Oncology, Fox Chase Cancer Center, Philadelphia, PA 19111

Abstract

Introduction—Our study sought to characterize the presentation, local management and outcomes of invasive cervical cancer with regard to patient insurance status.

Methods—We queried the NCI-SEER database for invasive cervical cancer cases in patients aged 18–64 from 2007–2011. We analyzed clinical and socioeconomic data with regard insurance status (insured, Medicaid, or uninsured). We tested for associations between patient insurance status and treatment with definitive surgery for FIGO IA2-IB1 patients, and treatment with suboptimal radiation therapy (RT) for FIGO IB2-IVA patients (other than combination external beam and brachytherapy). We evaluated overall and cause specific survival according to insurance status.

Results—11,714 cases were analyzed: 60% insured, 31% Medicaid, and 9% uninsured. FIGO III/IV stage at presentation was more frequent with Medicaid (40%) and uninsured (42%) compared to insured patients (28%) ($p < 0.001$). For FIGO IA2-IB1 patients, receipt of definitive surgery was inversely associated with uninsured status ($OR[95\%CI]=0.65[0.47-0.90], p < 0.001$) in univariable analysis; however the relationship lost significance after multivariable adjustment. For FIGO IB2-IVA patients, the use of suboptimal RT was associated with uninsured status ($OR[95\%CI]=1.33[1.07-1.65], p=0.011$) in adjusted analyses. Among all patients, overall mortality was increased with Medicaid ($HR[95\%CI]=1.16[1.05-1.28], p=0.003$) and uninsured status ($HR[95\%CI]=1.17[1.01-1.34], p=0.031$) in multivariable analysis. Cancer specific mortality survival trended towards significance in multivariable analyses for both Medicaid ($HR[95\%CI]=1.11[1.00-1.24]$ and uninsured status ($HR[95\%CI]=1.14[0.98-1.33]$).

Corresponding Author: Thomas M. Churilla, M.D., Resident, Radiation Oncology, Fox Chase Cancer Center, Philadelphia, PA 19111, Phone: 1-215-728-2581, Fax: 1-215-214-1629, ; Email: Thomas.Churilla@fccc.edu

CONFLICT OF INTEREST STATEMENT: The authors declare that there are no conflicts of interest.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Conclusions—Disparities in cervical cancer treatment with regard to insurance status are apparent in a recent cohort of American patients. Later stage at presentation and differences in management partially account for the inferior prognostic outcomes associated with Medicaid and uninsured status.

INTRODUCTION

In 2014, an estimated 12,360 cases of cervical cancer were projected with over 4,000 deaths in the United States.¹ Although screening programs with cervical cytology have led to dramatic decreases in disease incidence and mortality^{2,3}, cervical cancer affects various groups of patients disproportionately. Patient age, race, and socioeconomic status have all been associated with treatment and cancer specific outcome disparities in cervical cancer.^{4–7} Analyses of invasive cervical cancer patients in the National Cancer Database found increased rates of late-stage (stage III/IV) disease among uninsured, Medicaid, and Medicare beneficiaries compared to privately insured patients.^{5,8}

The impact of health insurance coverage on treatment quality and oncologic outcomes⁹ represents a significant national problem as legislative efforts aim to increase access to care.¹⁰ Low rates of physician participation are a major barrier to access to care among Medicaid beneficiaries.¹¹ While public, teaching, and mission-driven hospitals can provide access to specialty care for Medicaid patients, limited access and geographic location can be limiting factors.¹² Herein, the purpose of our study was to examine the relationship between health insurance status and the clinical presentation, local therapy patterns, and outcomes in invasive cervical cancer.

METHODS

Case Selection

We queried patient data from the National Cancer Institute Survival, Epidemiology, and End Results (SEER) database using SEER*Stat Version 8.1.5 (Appendix 1). Registries began reporting insurance status beginning in 2007. We defined cases as women diagnosed between 2007–2011 with invasive cervical cancer per AJCC 6th edition staging¹³, squamous or adenocarcinoma histology. Patients with unknown insurance status (n =469) were excluded. Patients younger than 18 were excluded and patients older than 64 were excluded based on their eligibility for Medicare. Patients diagnosed by death certificate or autopsy only were excluded.

Covariates

Insurance status was defined as non-Medicaid insurance (either insured or insured/no specifics), Medicaid insurance, or uninsured. Patient demographic information included age, race, marital status, urban vs. rural location and income. Marital status defined by SEER included common-law marriage as “married”. Rural/urban location and income information was defined at the county level of residence. Urban was defined as metropolitan or urban regions and rural was defined as rural regions according to SEER definitions. Income was defined according to the percentage of families less than the federal poverty level, and stratified according to the quintiles of the population. Tumor information included histology

(squamous vs. adenocarcinoma), FIGO stage, and grade (well, moderately, poorly differentiated). Definitive oncologic surgery was defined as a modified radical, radical, or extended radical hysterectomy and surgeries were categorized according to SEER Surgery of Primary Site codes (Codes 50–74). We categorized radiation therapy as optimal (external beam radiation therapy and brachytherapy), or sub-optimal (no radiation therapy, external beam radiation therapy alone, brachytherapy alone).

Statistical Analysis

We used IBM SPSS Statistics (Anmonk, NY; IBM corp) Version 22 and STATA (College Station, TX; StataCorp) version 14.1. We defined statistical significance as $\alpha < 0.05$ based on a two-sided significance level. We assessed the distribution of covariates according to insurance status by computing Pearson's χ^2 test. For early stage patients (FIGO IA2-IIA), we tested for associations between insurance status and receipt of definitive surgery. Among patients receiving definitive surgery, we further tested for the receipt of lymphadenectomy (defined as removal of 4 or more lymph nodes) and insurance status. For bulky patients (FIGO stage IB2-IVA), we tested for associations between insurance status and receipt of sub-optimal radiation therapy using logistic regression. For all patients, we assessed overall and cause specific survival according to insurance status by the Kaplan-Meier method and log rank test, and cox regression analysis. We used cox regression instead of competing risk regression analysis due to the low rate of competing mortality among this young cohort (369 of 2,150 deaths). Patients with unknown or non-otherwise specified stage ($n = 335$), or unknown survival time ($n = 2$) were excluded from survival analyses. Covariates were also tested for association with the outcome variables in the same manner for multivariable analyses (logistic regression and cox regression). Year of diagnosis and location of SEER registry were incorporated in multivariable analysis because of reported under-ascertainment of radiation therapy use in the SEER database.^{14,15}

RESULTS

A total of 11,714 patients met inclusion criteria with 59.9% of patients listed as insured, 31.0% Medicaid, and 9.1% uninsured. Medicaid and uninsured status was associated with race, marital status, county level income, and county level education (Table 1). The majority of patients presented with FIGO IA-IB1 disease, whereas 4,591 (39.1%) of patients had bulky, localized disease (FIGO IB2-IVA). Patients with Medicaid or uninsured status were more likely to present with FIGO stage III/IV disease, 40% and 42%, respectively, compared to insured patients (28%), $p < 0.001$. Table 2 lists the surgical procedures and radiation treatment modalities used according to insurance status.

Among 2,879 patients with FIGO stage IA2-IB1 disease, uninsured patients were 35% less likely to receive definitive surgical management in unadjusted analyses. However, after adjustment for clinical and demographic variables, neither Medicaid nor uninsured status remained independently associated with receipt of definitive surgery (Table 3). Among patients receiving definitive surgical management, we observed no relationship between the receipt of lymphadenectomy and Medicaid (OR [95% CI] = 1.159 [0.702–1.914]) or uninsured (OR [95% CI] = 1.17 [0.41–3.31]) status.

Among 4,465 patients with FIGO IB2-IVA disease, uninsured patients were significantly less likely to receive optimal radiation (combination external beam and brachytherapy) in unadjusted analysis. The association between uninsured status and suboptimal radiation therapy retained significance after adjustment for clinical and demographic variables (Table 4). There was no significant association between Medicaid status and receipt of suboptimal radiation therapy in univariable or multivariable analysis.

The crude overall survival of all invasive cervical cancer patients varied by approximately 14% across insurance groups and is outlined in Figure 2a. Survival at the median follow-up of 21 months was 86.6% for insured patients, 75.8% for Medicaid, and 73.0% for Uninsured ($p<0.001$). The crude cause specific survival varied by approximately 12% across insurance groups for this cohort (Figure 2b). Cause specific survival at the median follow-up of 21 months was 88.6% for insured, 79.3% for Medicaid, and 76.6% for uninsured ($p<0.001$). Table 5 displays the unadjusted and adjusted hazard ratios for overall and cause specific survival according to insurance status; inferior overall survival was observed among those with Medicaid and uninsured status, while inferior cause specific survival trended towards significance in both Medicaid and uninsured patients in multivariable analyses.

DISCUSSION

Health insurance coverage remains an important barrier in oncology and has been associated with disparities in cervical cancer care.^{8,16} Although the Affordable Care Act seeks to increase health care coverage, several challenges remain, including high out of pocket cost sharing, limited specialty networks, access to preventative services, and patient outreach and support.¹⁷ Reimbursement rates have further contributed to low specialty physician participation in the national Medicaid program.^{12,18,19}

We observed significant differences in health insurance status with respect to clinical and demographic variables. Patient age, tumor histology, race, marital status, education status, and income all varied according to insurance status ($p<0.001$ for all), as seen in Table 1. Consistent with prior works, we observed that patients with Medicaid or uninsured status more frequently presented with advanced stage cervical cancer (Table 1 and Figure 1).^{5,8} Previous studies have demonstrated decreased cervical cancer screening among those with inadequate health insurance and may explain this association.^{20–24}

Modified radical or radical hysterectomy is a standard of care for early stage cervical cancer in the United States.²⁵ In our series we observed lower rates of definitive surgery among uninsured patients with FIGO IA2 and IB1 disease (37% vs. 44.6% of insured, $p<0.001$). However, after adjustment for radiation therapy use and other clinical and demographic variables, there was no longer a significant association in the receipt of definitive surgery among this cohort (Table 3). The receipt of lymphadenectomy was not associated with insurance status. Our findings suggest that the socioeconomic and demographic variables associated with uninsured status may be important factors in receipt of appropriate surgery. Additional, unmeasured risk factors or comorbidities associated with insurance status likely also contribute to surgical choice.

Among patients with locally advanced cervical cancer, concurrent cisplatin based chemoradiation and brachytherapy represent the standard of care in the United States.²⁵ Disparities in brachytherapy utilization for cervical cancer according to demographic and geographical location have been previously reported in the United States.²⁶ In our study, patients with bulky disease (FIGO stages IB2-IVA) and uninsured status were significantly less likely to receive optimal radiation therapy, defined as combination external beam radiation therapy and brachytherapy. However, we observed no significant association between the receipt of suboptimal radiation therapy and Medicaid status. A single institution study at Johns Hopkins Hospital that found patients with uninsured status were less likely to receive definitive therapy for cervical cancer which is consistent with our results.¹⁶ Another recent analysis of the SEER database found that patients with Medicaid and uninsured status were less likely to receive brachytherapy as a component of definitive or post-operative therapy for breast, prostate, cervical, and endometrial cancer.²⁷

Our data demonstrated significant differences in overall and cause specific survival according to insurance status (Figure 2, Table 5). At a median follow-up of 21 months, overall survival among insured patients (86.6%) was significantly higher than either Medicaid (75.8%) or uninsured (73.0%) patients, $p < 0.001$ overall. At 21 months, cause specific survival was also improved among insured patients (88.6%) relative to either Medicaid (79.3%) or uninsured patients (76.6%), $p < 0.001$ overall. The largest magnitude of difference in overall and cause specific survival according to insurance status existed within the locally advanced cohort, while smaller significant differences were noted among early stage patients, and no significant differences among distant metastatic patients (Figures 2a and 2b). Advanced stage at presentation is likely an important contributing factor in inferior outcomes associated with Medicaid and uninsured patients. Of note, differences in cause specific survival were borderline significant after adjustment for clinical, demographic, and treatment variables suggesting much of the disparity in cancer specific outcome associated with insurance status may exist within these associations, as seen in Table 5. Given the increased all-cause mortality observed in both Medicaid and uninsured patients in multivariable analysis, additional factors may be responsible for alternate causes of mortality in this cohort of cervical cancer patients.

Our study has several important limitations as a national cancer-registry study. Under-ascertainment of radiotherapy in the SEER database has been previously described.^{14,15,29} We have attempted to correct for this limitation by including SEER registry in multivariable analyses, since under-ascertainment varies by registry.¹⁵ Our analysis lacks important information on comorbidities which may be associated with health insurance status, choice of local therapies, and outcomes. Our analysis also lacks information on the setting in which care was delivered (community vs. academic, high vs. low volume centers). Finally, our data lacks systemic therapy, while concurrent cisplatin containing chemotherapy is an important factor in definitive therapy radiation therapy. Strengths of our study include the large sample size, broad representation across the United States, and recent cohort. Further study may be directed to examine the impact of expansions in Medicaid and private health insurance exchanges on access to cervical cancer care afforded by the Patient Protection and Affordable Care Act of 2010.²⁸

CONCLUSION

Our analysis suggests disparities in cervical cancer care according to health insurance status among a nationally representative, recent cohort of women in the United States. Uninsured or Medicaid insured women more frequently presented with advanced stage disease. Optimal radiation treatment with combination external beam radiation therapy and brachytherapy was less frequently utilized among uninsured patients with locally advanced disease. We observed inferior prognostic outcomes among Medicaid and uninsured patients that can partially be explained by the advanced clinical presentation, associated socioeconomic factors, and variation in treatment associated with this cohort.

Acknowledgments

This work was partially supported by the National Institutes of Health, National Cancer Institute, grants P30CA006927.

References

1. Howlader, N.; Noone, AM.; Krapcho, M.; Garshell, J.; Miller, D.; Altekruse, SF.; Kosary, CL.; Yu, M.; Ruhl, J.; Tatalovich, Z.; Mariotto, A.; Lewis, DR.; Chen, HS.; Feuer, EJ.; Cronin, KA., editors. SEER Cancer Statistics Review, 1975–2011. National Cancer Institute; Bethesda, MD: Apr. 2014 http://seer.cancer.gov/csr/1975_2011/, based on November 2013 SEER data submission, posted to the SEER web site
2. Whitlock EP, et al. Liquid-based cytology and human papillomavirus testing to screen for cervical cancer: a systematic review for the U.S. Preventive Services Task Force. *Ann Intern Med.* 2011; 155:687–697. W214–215. [PubMed: 22006930]
3. Peirson L, Fitzpatrick-Lewis D, Ciliska D, Warren R. Screening for cervical cancer: a systematic review and meta-analysis. *Syst Rev.* 2013; 2:35. [PubMed: 23706117]
4. Simard EP, Naishadham D, Saslow D, Jemal A. Age-specific trends in black-white disparities in cervical cancer incidence in the United States: 1975–2009. *Gynecol Oncol.* 2012; 127:611–615. [PubMed: 22922530]
5. Simard EP, Fedewa S, Ma J, Siegel R, Jemal A. Widening socioeconomic disparities in cervical cancer mortality among women in 26 states, 1993–2007. *Cancer.* 2012; 118:5110–5116. [PubMed: 22707306]
6. Sharma C, et al. Patterns of care and treatment outcomes for elderly women with cervical cancer. *Cancer.* 2012; 118:3618–3626. [PubMed: 22038773]
7. Brookfield KF, Cheung MC, Lucci J, Fleming LE, Koniaris LG. Disparities in survival among women with invasive cervical cancer: a problem of access to care. *Cancer.* 2009; 115:166–178. [PubMed: 19097209]
8. Fedewa SA, et al. Association of insurance status and age with cervical cancer stage at diagnosis: National Cancer Database, 2000–2007. *Am J Public Health.* 2012; 102:1782–1790. [PubMed: 22742058]
9. Walker GV, et al. Disparities in stage at diagnosis, treatment, and survival in nonelderly adult patients with cancer according to insurance status. *J Clin Oncol Off J Am Soc Clin Oncol.* 2014; 32:3118–3125.
10. ASPA. [Accessed: 13th October 2014] Key Features of the Affordable Care Act By Year. 2013. Available at: <http://www.hhs.gov/healthcare/facts/timeline/timeline-text.html>
11. Medicaid and CHIP Payment and Access Commission. Examining access to care in Medicaid and CHIP; Report to the Congress on Medicaid and CHIP. Mar. 2011 p. 124-54. <http://www.macpac.gov/reports>
12. Rosenbaum S. Medicaid Payments and Access to Care. *N Engl J Med.* 2014; 371:2345–2347. [PubMed: 25517705]

13. Edge, SB. AJCC Cancer Staging Handbook: From the AJCC Cancer Staging Manual. Springer; 2002.
14. Jaggi R, et al. Underascertainment of radiotherapy receipt in Surveillance, Epidemiology, and End Results registry data. *Cancer*. 2012; 118:333–341. [PubMed: 21717446]
15. Walker GV, et al. Muddy water? Variation in reporting receipt of breast cancer radiation therapy by population-based tumor registries. *Int J Radiat Oncol Biol Phys*. 2013; 86:686–693. [PubMed: 23773392]
16. Levinson KL, Bristow RE, Donohue PK, Kanarek NF, Trimble CL. Impact of payer status on treatment of cervical cancer at a tertiary referral center. *Gynecol Oncol*. 2011; 122:324–327. [PubMed: 21620446]
17. Rosenbaum S. The ACA: Implications for the Accessibility and Quality of Breast and Cervical Cancer Prevention and Treatment Services. *Public Health Rep*. 2012; 127:340–344. [PubMed: 22547867]
18. Felland, LE.; Lechner, A.; Sommers, A. Improving access to specialty care for Medicaid patients: policy issues and options. New York: The Commonwealth Fund; 2013. (http://www.commonwealthfund.org/~media/files/publications/fund-report/2013/jun/1691_felland_improving_access_specialty_care_medicareid_v2.pdf)
19. Berk ML, Schur CL. Access to care: how much difference does Medicaid make? *Health Aff Proj Hope*. 1998; 17:169–180.
20. Breen N, Wagener DK, Brown ML, Davis WW, Ballard-Barbash R. Progress in cancer screening over a decade: results of cancer screening from the 1987, 1992, and 1998 National Health Interview Surveys. *J Natl Cancer Inst*. 2001; 93:1704–1713. [PubMed: 11717331]
21. Swan J, et al. Data and trends in cancer screening in the United States: results from the 2005 National Health Interview Survey. *Cancer*. 2010; 116:4872–4881. [PubMed: 20597133]
22. Hsia J, et al. The importance of health insurance as a determinant of cancer screening: evidence from the Women's Health Initiative. *Prev Med*. 2000; 31:261–270. [PubMed: 10964640]
23. Potosky AL, Breen N, Graubard BI, Parsons PE. The association between health care coverage and the use of cancer screening tests Results from the 1992 National Health Interview Survey. *Med Care*. 1998; 36:257–270. [PubMed: 9520952]
24. Nash D, Chan C, Horowitz D, Vlahov D. Barriers and missed opportunities in breast and cervical cancer screening among women aged 50 and over, New York City, 2002. *J Womens Health*. 2007; 2002–16:46–56.
25. National Comprehensive Cancer Network. [Accessed 1/30/2015] Cervical Cancer (Version 2.2015). http://www.nccn.org/professionals/physician_gls/pdf/cervical.pdf
26. Han K, Milosevic M, Fyles A, Pintilie M, Viswanathan AN. Trends in the utilization of brachytherapy in cervical cancer in the United States. *Int J Radiat Oncol Biol Phys*. 2013; 87:111–119. [PubMed: 23849695]
27. Grant SR, et al. Impact of Insurance Status on Radiation Treatment Modality Selection Among Potential Candidates for Prostate, Breast, or Gynecologic Brachytherapy. *Int J Radiat Oncol Biol Phys*. 2015; 93:968–975. [PubMed: 26452570]
28. [Accessed: 5th November 2015] Public Law 111 – 148 - Patient Protection and Affordable Care Act. Available at: <http://www.gpo.gov/fdsys/pkg/PLAW-111publ148/content-detail.html>
29. Smith GL, Eifel PJ. Trends in the utilization of brachytherapy in cervical cancer in the United States. In regard to Han et al. *Int J Radiat Oncol Biol Phys*. 2014; 88:459–460. [PubMed: 24411614]

Appendix 1. Case selection criteria

12-26-2014 Case
 Filename: Listing.slm
 SEER*Stat
 Version: 8.1.5

28-Dec-

Date: 14

Session Type: Case Listing

SUGGESTED CITATION

Software: Surveillance Research Program, National Cancer Institute SEER*Stat software

(www.seer.cancer.gov/seerstat) version 8.1.5.

Data: Surveillance, Epidemiology, and End Results (SEER) Program

(www.seer.cancer.gov) SEER*Stat

Database: Incidence - SEER 18 Regs

Research Data + Hurricane Katrina Impacted Louisiana Cases, Nov 2013 Sub (1973-2011 varying) -

Linked To County Attributes - Total U.S.,

1969-2012 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, Surveillance Systems Branch, released April 2014

(updated 5/7/2014), based on the November 2013 submission.

DATA

Database: Incidence - SEER 18 Regs Research Data + Hurricane Katrina Impacted Louisiana Cases, Nov 2013

Sub (1973-2011 varying) - Linked To

County Attributes - Total U.S.,

1969-2012 Counties

SELECTION

Select Only: Malignant Behavior, Known Age, Cases in Research Database

Case: {Race, Sex, Year Dx, Registry, County. Year of diagnosis} = '2007', '2008', '2009', '2010', '2011'

AND {Race and Age (case data only). Age recode with single ages and 85+} = '18 years', '19 years', '20 years', '21 years', '22 years', '23 years', '24 years', '25 years', '26 years', '27 years', '28 years', '29 years', '30 years', '31 years', '32 years', '33 years', '34 years', '35 years', '36 years', '37 years', '38 years', '39 years', '40 years', '41 years', '42 years', '43 years', '44 years', '45 years', '46 years', '47 years', '48 years', '49 years', '50 years', '51 years', '52 years', '53 years', '54 years', '55 years', '56 years', '57 years', '58 years', '59 years', '60 years', '61 years', '62 years', '63 years', '64 years'

AND {Site and Morphology.Primary Site - labeled} = 'C53.0-

Endocervix', 'C53.1-Exocervix', 'C53.8-
Overlapping lesion of cervix uteri', 'C53.9-Cervix
uteri'

OUTPUT

Initial query = 13,921 cases

Excluded cases with histologies other than adenocarcinoma or squamous →
12,186 cases

Excluded cases with missing county level socioeconomic data → 12,183 cases

Excluded cases with unknown insurance status → **11,714 cases**

Highlights

- Medicaid and uninsured patients presented with more advanced cervical cancer
- Uninsured women with advanced disease received less optimal radiation therapy
- Inferior cancer specific and overall survival observed among Medicaid and uninsured

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Figure 1.
Distribution of FIGO Stages according to health insurance status among invasive cervical cancer cases from 2007–2011 (n = 11,714)

Figure 2.

Figure 2a. (top row) Overall survival of invasive cervical cancer patients in the United States according to health insurance status, stratified by FIGO stage groups.

Figure 2b. (bottom row) Cause specific survival of invasive cervical cancer patients in the United States according to health insurance status, stratified by FIGO stage groups.

Significance values (p) refer to survival function across insurance statuses compared via log rank test. ($n = 11,377$)

Table 1

Baseline patient and demographic information.

	All patients n=11,714 (100%)	Insured n=7,020 (59.9%)	Medicaid n=3,627 (31.0%)	Uninsured n=1,067 (9.1%)	p
Age (years)					<0.001
18–29	778 (6.6%)	431 (6.1%)	293 (8.1%)	54 (5.1%)	
30–39	2927 (25.0%)	1840 (26.2%)	856 (23.6%)	231 (21.6%)	
40–49	3807 (32.5%)	2298 (32.7%)	1165 (32.1%)	344 (32.2%)	
50–59	3048 (26.0%)	1765 (25.1%)	969 (26.7%)	314 (29.9%)	
60–64	1154 (9.9%)	686 (9.8%)	344 (9.5%)	124 (11.6%)	
Primary Site					<0.001
Cervix uteri	9013 (76.9%)	5044 (71.9%)	3067 (84.6%)	902 (76.9%)	
Endocervix	2227 (19.0%)	1663 (23.7%)	443 (12.2%)	121 (11.3%)	
Ectocervix	251 (2.1%)	169 (2.4%)	64 (1.8%)	18 (1.7%)	
Overlapping lesion	223 (1.9%)	144 (2.1%)	53 (1.5%)	26 (2.4%)	
FIGO Stage					<0.001
I (IA1, IA2, IB1, IB2)	6047 (51.6%)	4147 (59.1%)	1496 (41.2%)	404 (37.9%)	
II (IIA, IIB)	1472 (12.6%)	739 (10.5%)	567 (15.6%)	166 (15.6%)	
III (IIIA, IIIB)	2344 (20.0%)	1218 (17.4%)	864 (23.8%)	262 (24.6%)	
IV (IVA, IVB)	1354 (11.6%)	673 (9.6%)	521 (14.4%)	160 (15.0%)	
Unknown	497 (4.2%)	243 (3.5%)	179 (4.9%)	75 (7.0%)	
Histology					<0.001
Squamous	8672 (74.0%)	4771 (68.0%)	3004 (82.8%)	897 (84.1%)	
Adenocarcinoma	3042 (26.0%)	2249 (32.0%)	623 (17.2%)	170 (15.9%)	
Grade					<0.001
Well differentiated	1301 (11.1%)	960 (13.7%)	257 (7.1%)	84 (7.9%)	
Moderately differentiated	3804 (32.5%)	2264 (32.3%)	1154 (31.8%)	386 (36.2%)	
Poorly differentiated	3211 (27.4%)	1807 (25.7%)	1125 (31.0%)	279 (26.1%)	
Unknown/Anaplastic	3398 (29.0%)	1989 (28.3%)	1091 (30.1%)	318 (29.8%)	
Race					<0.001
White	8932 (76.3%)	5502 (78.4%)	2653 (73.1%)	777 (72.8%)	
Black	1619 (13.8%)	786 (11.2%)	616 (17.0%)	217 (20.3%)	

	All patients n=11,714 (100%)	Insured n=7,020 (59.9%)	Medicaid n=3,627 (31.0%)	Uninsured n=1,067 (9.1%)	p
Other/Unknown	1163 (9.9%)	732 (10.4%)	358 (9.9%)	73 (6.8%)	
Marital Status					<0.001
Married	5333 (45.5%)	3954 (56.3%)	1062 (29.3%)	317 (29.7%)	
Single	5836 (49.8%)	2741 (39.0%)	2396 (66.1%)	699 (65.5%)	
Unknown/Other	545 (4.7%)	325 (4.6%)	169 (4.7%)	51 (4.8%)	
Rural/Urban Location					<0.001
Urban/Metropolitan	11566 (98.7%)	6953 (99.0%)	3561 (98.2%)	1052 (98.6%)	
Rural	132 (1.1%)	65 (0.9%)	52 (1.4%)	15 (1.4%)	
Unknown	16 (0.1%)	2 (<0.1%)	14 (0.4%)	0 (0%)	
Education (% < HS Education)					<0.001
0–20th Percentile	2302 (19.7%)	1627 (23.2%)	467 (12.9%)	208 (19.5%)	
21–40th Percentile	2478 (21.2%)	1630 (23.2%)	614 (16.9%)	234 (21.9%)	
41–60th Percentile	2261 (19.3%)	1382 (19.7%)	726 (20.0%)	153 (14.3%)	
61–80th Percentile	3561 (30.4%)	1840 (26.2%)	1331 (36.7%)	390 (36.6%)	
81–100th Percentile	1112 (9.5%)	541 (7.7%)	489 (13.5%)	82 (7.7%)	
Income (% families below poverty)				<0.001	
0–20th Percentile	2383 (20.3%)	1764 (25.1%)	439 (12.1%)	180 (16.9%)	
21–40th Percentile	2659 (22.7%)	1713 (24.4%)	764 (21.1%)	182 (17.1%)	
41–60th Percentile	1173 (16.7%)	641 (17.7%)	232 (21.7%)	2046 (17.5%)	
61–80th Percentile	2394 (20.4%)	1201 (17.1%)	915 (25.2%)	278 (26.1%)	
81–100th Percentile	2232 (19.1%)	1169 (16.7%)	868 (23.9%)	195 (18.3%)	

Table 2

Surgical and radiation treatment of patients with invasive cervical cancer according to insurance status.

FIGO IA2, IB1 (n=2,879)				
	All patients	Insured	Medicaid	Uninsured
Radiation Therapy				p
EBRT + Brachy	265 (9.2%)	181 (9.0%)	75 (10.7%)	9 (5.6%)
EBRT Alone	351 (12.2%)	221 (11.0%)	101 (14.4%)	29 (17.9%)
Brachy Alone	62 (2.2%)	38 (1.9%)	15 (2.1%)	9 (5.6%)
No RT	2149 (74.6%)	1541 (76.4%)	501 (71.5%)	107 (66.0%)
Unknown/Refused RT	52 (1.8%)	35 (1.7%)	9 (1.3%)	8 (4.9%)
Surgical Management				p
No Surgery	162 (5.6%)	83 (4.1%)	63 (9.0%)	16 (9.9%)
Radical Hysterectomy	695 (24.1%)	511 (25.3%)	155 (22.1%)	29 (17.9%)
Local Destruction	344 (11.9%)	226 (11.2%)	92 (13.1%)	26 (16.0%)
TAH	314 (11.4%)	223 (11.1%)	74 (10.6%)	17 (10.5%)
TAH-BSO	631 (21.9%)	260 (22.8%)	133 (19.0%)	38 (23.5%)
Modified radical, extended hysterectomy	557 (19.3%)	381 (18.9%)	146 (20.8%)	30 (18.5%)
Extended radical hysterectomy	11 (0.4%)	9 (0.4%)	1 (0.1%)	1 (0.6%)
Hysterectomy NOS	161 (5.6%)	121 (6.0%)	36 (5.1%)	4 (2.5%)
Pelvic Exenteration	3 (0.1%)	2 (0.1%)	0 (0%)	1 (0.6%)
Surgery NOS	1 (<0.1%)	0 (0%)	1 (0.1%)	0 (0%)
Surgery unknown	0 (0%)	0 (0%)	0 (0%)	0 (0%)
FIGO IB2, IIA, IIB, IIIA, IIIB, and IVA (n=4,465)				
	All patients	Insured	Medicaid	Uninsured
Radiation Therapy				p
EBRT + Brachy	1955 (42.6%)	1043 (44.1%)	718 (41.9%)	194 (37.7%)
EBRT Alone	1682 (36.6%)	796 (33.7%)	671 (39.2%)	215 (41.7%)
Brachy Alone	381 (8.3%)	203 (8.6%)	135 (7.9%)	43 (8.3%)
No RT	447 (9.7%)	258 (10.9%)	139 (8.1%)	50 (9.7%)
Unknown/Refused RT	126 (2.7%)	63 (2.7%)	50 (2.9%)	13 (2.5%)

FIGO IA2, IBI (n=2,879)					<i>p</i>
	All patients	Insured	Medicaid	Uninsured	
Surgical Management					<0.001
No Surgery	2867 (62.4%)	1292 (54.7%)	1188 (69.4%)	387 (75.1%)	
Radical Hysterectomy	365 (8.0%)	225 (9.5%)	114 (6.7%)	26 (5.0%)	
Local Destruction	376 (8.2%)	220 (9.3%)	121 (7.1%)	35 (6.8%)	
TAH	75 (1.6%)	52 (2.2%)	18 (1.1%)	5 (1.0%)	
TAH-BSO	413 (9.0%)	257 (10.9%)	131 (7.6%)	25 (4.9%)	
Modified radical, extended hysterectomy	301 (6.6%)	198 (8.4%)	79 (4.6%)	24 (4.7%)	
Extended radical hysterectomy	7 (0.2%)	5 (0.2%)	2 (0.1%)	0 (0%)	
Hysterectomy NOS	117 (2.5%)	71 (3.0%)	37 (2.2%)	9 (1.7%)	
Pelvic Exenteration	28 (0.6%)	19 (0.8%)	9 (0.5%)	0 (0%)	
Surgery NOS	37 (0.8%)	20 (0.8%)	14 (0.8%)	3 (0.6%)	
Surgery unknown	5 (0.1%)	4 (0.2%)	0 (0%)	1 (0.2%)	

Logistic regression analysis of association between insurance status and receipt of definitive surgery^a among FIGO IA2 and IB1 invasive cervical cancer patients (n = 2,879).

Table 3

Variable	Unadjusted		Adjusted ^c		p
	OR ^b	[95% CI]	OR	[95% CI]	
Insured	1.00	--	--	1.00	--
Medicaid	0.90	[0.76–1.07]	0.24	[0.87–1.29]	0.549
Uninsured	0.65	[0.47–0.90]	<0.001	0.77 [0.54–1.09]	0.138

^aDefined as modified radical, radical, or extended radical hysterectomy.

^bOdds of receiving definitive surgery versus not receiving definitive surgery.

^cMultivariable adjustment for age, tumor location, stage, histology, grade, RT use, race, education, income, rural/urban location, marital status, SEER registry, and year.

Table 4

Logistic regression analysis of association between insurance status and suboptimal radiation therapy (treatment other than EBRT+brachy) among FIGO IB2-IVA invasive cervical cancer patients (n = 4,465).

Variable	Unadjusted		Adjusted ^b	
	OR ^a	[95% CI]	OR	[95% CI]
Insured	1.00	--	1.00	--
Medicaid	1.09	[0.96–1.24]	1.08	[0.94–1.25]
Uninsured	1.32	[1.08–1.61]	1.33	[1.07–1.65]

^aOdds of receiving suboptimal radiation therapy versus optimal RT (EBRT+brachytherapy)

^bMultivariable adjustment for age, tumor location, stage, histology, grade, race, education, income, rural/urban location, marital status, SEER registry, and year.

Adjusted and unadjusted Cox regression analysis of overall and cause specific survival according to insurance status for patients invasive cervical cancer in the United States (n=11,714).

Table 5

Variable	Overall Survival				Cause Specific Survival			
	Unadjusted HR	[95% CI]	Adjusted ^a HR	[95% CI]	Unadjusted HR	[95% CI]	Adjusted ^a HR	[95% CI]
Insured	1.00	--	1.00	--	1.00	--	1.00	--
Medicaid	1.89	[1.73–2.07]	1.16	[1.05–1.28]	1.91	[1.73–2.11]	1.11	[1.00–1.24]
Uninsured	2.17	[1.90–2.48]	1.17	[1.01–1.34]	2.18	[1.89–2.53]	1.14	[0.98–1.33]

^aMultivariable adjustment for age, tumor location, stage, histology, grade, race, education, income, rural/urban location, marital status, surgery, RT use, SEER registry, and year.