HHS Public Access

Author manuscript

Am J Prev Med. Author manuscript; available in PMC 2016 February 01.

Published in final edited form as:

Am J Prev Med. 2015 February ; 48(2): 174–178. doi:10.1016/j.amepre.2014.08.014.

Primary Care Physician Supply, Insurance Type, and Late-Stage Cancer Diagnosis

Jesse J. Plascak, PhD, **James L. Fisher, PhD**, and **Electra D. Paskett, PhD**

Department of Health Services (Plascak), School of Public Health, The University of Washington, Seattle, Washington; James Cancer Hospital and Solove Research Institute (Fisher, Paskett); and the Division of Cancer Control and Prevention (Paskett), Department of Internal Medicine, College of Medicine, The Ohio State University, Columbus, Ohio

Abstract

Background—Understanding the joint effects of insurance type and primary care physician density on stage at diagnosis is essential to elucidating the healthcare access and late-stage cancer relationship.

Purpose—To determine if the relationship between primary care physician density and odds of late-stage cancer is modified by insurance type at diagnosis.

Methods—Case patients were Ohio adults, diagnosed between 1996 and 2008 with cancer of one of the following sites: the female breast, cervix, colon/rectum, lung/bronchus, melanoma of the skin, oral cavity and pharynx, or prostate (N=376,425). County-level physician density was from Ohio Department of Health. Multilevel logistic regression models estimated odds ratios of latestage cancer diagnosis associated with increases in primary care physician density by insurance type. Analyses were conducted in 2014.

Results—Decreases in late-stage diagnosis of cancers of the breast, prostate, melanoma of the skin, oral cavity and pharynx, or lung/bronchus associated with increases in primary care physician density were strongest among those with private insurance, whereas those with Medicare (prostate, oral cavity and pharynx, lung/bronchus), Medicaid (lung/bronchus), uninsured (prostate), and other/unknown (prostate, oral cavity and pharynx, lung/bronchus) did not benefit as greatly or experienced significant increases in late-stage cancer diagnosis (other/unknown [female breast], Medicaid [melanoma of the skin], and uninsured [colon/rectum]).

Conclusions—As primary care physician density increases, those with private insurance consistently benefit the most, in terms of late-stage cancer diagnosis, whereas those with several

Address correspondence to: Jesse J. Plascak, PhD, Department of Health Services, School of Public Health, The University of Washington, Box 359455, Seattle WA 98195-9455. plascak@uw.edu.

No financial disclosures were reported by the authors of this paper.

other insurance types experience flatter decreases or significantly higher odds of late-stage cancer diagnosis.

Introduction

Cancer stage at diagnosis is an important survival indicator.[1] Identifying factors related to late-stage cancer diagnosis is important for reducing mortality. Several biological, demographic, social, and environmental factors are related to cancer stage at diagnosis.[2–6] SES and measures of healthcare access (e.g., insurance coverage, primary care physician [PCP] density—the number of PCPs per residents) are social and environmental factors associated with late-stage cancer diagnosis.[2,4,7–10]

PCP density is inversely associated with late-stage breast cancer,[3,9,11,12] but associations with other cancers are unclear.[13–15] The relationship between PCP use and uptake of cancer screening tests is well-studied; however, less is known about mechanisms governing the relationship between PCP density and late-stage cancer diagnoses.[16–18] It is possible that the association results from increased opportunity for early-stage detection.[3,19]

Insurance type at diagnosis is an important predictor of late-stage cancer diagnosis.[2,6,8,10] Compared to those with private insurance, those lacking any health insurance or with Medicaid have double the odds of late-stage diagnoses of cancers of the breast, colon/rectum, lung/bronchus, urinary bladder, and melanoma of the skin.[8,10] A high proportion of several cancers for which screening is not recommended are diagnosed at early-stage, indicating that these cancers are not found through recommended screening procedures.[1]

It is not reasonable to assume that all health insurance groups experience equal reductions in late-stage cancer diagnosis with increased PCP density. Those who rarely see physicians because of inadequate insurance may not benefit from living in areas with high PCP density. The purpose of this study is to investigate the dependent effects of insurance type and PCP density on odds of late-stage cancer diagnosis across cancer sites. The authors hypothesize that reductions in late-stage cancer diagnosis associated with increases in PCP density are greatest for those with private insurance.

Methods

Data Description

Data were from the Ohio Cancer Incidence Surveillance System (OCISS).[20] Malignancies were coded according to the International Classification of Diseases for Oncology, Third Edition (ICD-O-3), codes C00.0-C80.9.[2122] Invasive cancers with potential to be detected early through screening were included: cervix, colon/rectum, female breast, lung/bronchus, melanoma of the skin, oral cavity and pharynx, and prostate. Case patients (N=456,821) were Ohio adults diagnosed between 1996 and 2008. These non-identifiable data qualified for IRB exemption status.

Stage at diagnosis was dichotomized as late (i.e., regional or distant) or early (i.e., localized) according to Surveillance Epidemiology and End Results summary staging.[22] In situ tumors were excluded.[6,8,12,15] Those with missing/unknown staging information were excluded

(*n*=56,763, 12.3%). Additional individual-level factors included insurance type, age, sex, race, diagnosis year, marital status, and county of residence. Those aged younger than 65 years reporting Medicare were excluded (*n*=13,081, 2.8%). Those with Medicare but eligible for Medicaid were classified as Medicare (*n*=6,582, 1.5%). County-level factors were Rural–Urban Continuum Code (RUCC—based on population size, degree of urbanization, and adjacency to metropolitan area)[23]; year 2007 PCP, total physician, and specialty physician densities (physician count per 100,000 population)[24]; and year 2000 percentage with at least a bachelor's degree (hereafter, "county SES").[25] County physician data were limited to active, non-federal, non-pediatric physicians involved in patient care,[24] and having a practice of family medicine/general practice, general internal medicine, or obstetrics and gynecology; specialty physicians excluded all others.

Statistical Analyses

ORs and 95% CIs comparing late- versus early-stage by the aforementioned factors were calculated. Cancer site-specific, hierarchical logistic regression models were used.[26,27] Interactions were multiplicative. Age, diagnosis year, and county-level factors were modeled as continuous variables. Linearity of the PCP–late-stage cancer relationship was assessed visually using scatter plots. Type-I error was held at 0.05. Analyses were conducted in 2014 using SAS, version 9.2 (SAS Institute Inc., Cary NC).

Results

Of 376,425 (54.5% early-stage, 45.5% late-stage) invasive cancer diagnoses, 44.1% were insured through Medicare, 21.0% with private insurance, 27.5% with unknown (13.9%)/ other (13.6%), 3.9% uninsured, and 3.5% with Medicaid. After adjustment for age, race, sex, year, marital status, county SES, RUCC, and PCP rate (hereafter, "other factors"), insurance type was significantly related to late-stage diagnosis across cancer sites, while the only county-level factor significantly associated with late-stage diagnosis was SES among those with melanoma of the skin (Table 1).

After adjustment for other factors, there was significant effect modification of the PCP density– late-stage cancer relationship in at least one insurance type (compared to private) for each cancer site except that of the cervix (Figure 1A–1F). Decreases in late-stage diagnosis of cancers of the breast, prostate, oral cavity and pharynx, or lung/bronchus associated with increases in PCP density were strongest among those with private insurance, whereas those with Medicare (prostate, oral cavity and pharynx, lung/bronchus), Medicaid (lung/bronchus), uninsured (prostate), and other/unknown (prostate, oral cavity and pharynx, lung/bronchus) did not benefit as greatly or experienced significant increases in late-stage cancer diagnosis (other/unknown [female breast], Medicaid [melanoma of the skin],and uninsured [colon/rectum]).

Discussion

This is the first known study to demonstrate significant effect modification between PCP density and insurance type on odds of late-stage cancer diagnosis. As PCP density increases, those with private insurance consistently benefit the most, in terms of late-stage cancer

diagnosis, whereas those with several other insurance types experience flatter decreases or significantly higher odds of late-stage cancer diagnosis.

Studies of the independent effects of PCP density have consistently demonstrated inverse association with late-stage breast[9,11,12,28] and colorectal cancer diagnoses.[14,29] Though no other study has tested effect modification of the PCP density–late-stage cancer relationship by insurance type, others have found that this relationship does not change when stratifying by fee-for-service insurance plans.[3,19]

Effect modification of the PCP density–late-stage cancer relationship by insurance type may result from differential healthcare access; those with private insurance may capitalize on greater PCP supply and utilize preventive services more frequently than those with other insurance types. This may not occur for cervical cancer because the screening test has high and widespread uptake.[30]

This study is limited by possible uncontrolled confounding by individual-level SES, comorbidities, and additional measures of healthcare accessibility (e.g., insurance acceptability). Insurance type does not capture out-of-pocket costs and duration of coverage. PCP data were available only at the county level,[24] which may be too large an area in which to measure PCP density. Additionally, it was not possible to determine whether those with early-stage cancer diagnosis saw a PCP. Results may be limited by data quality—approximately 12% of case patients were excluded owing to unknown stage and 13.6% had unknown insurance type. Case patients were from Ohio and may not represent other geographic regions, limiting generalizability. Strengths of this study include examination of two measures of healthcare access and consideration of several confounders within hierarchical statistical models.

Future investigations of late-stage cancer diagnoses should examine relationships between multiple measures of healthcare access. Insurance type is associated with late-stage cancer diagnoses across cancer sites. However, effects of PCP density on late-stage cancer diagnosis are more nuanced. The possibility that increases in PCP density may contribute to sharper reductions in late-stage cancer diagnosis among those with private insurance compared to other insurance types necessitates that more detailed attention be given to PCP density and health insurance type. Targeting of healthcare resources in higher–PCP density areas may ensure reductions of late-stage cancer diagnosis equally across all health insurance types.

Acknowledgments

This work was supported by grants from the National Cancer Institute (No. R25CA092408 and CA105632) at the University of Washington and The Ohio State University and cooperative agreement number 5U58DP000795-05 from CDC. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of CDC.

References

1. Siegel R, Naishadham D, Jemal A. Cancer statistics, 2012. CA Cancer J Clin. 2012; 62(1):10–29. [PubMed: 22237781]

2. Bradley CJ, Given CW, Roberts C. Disparities in cancer diagnosis and survival. Cancer. 2001; 91(1):178–188. [PubMed: 11148575]

3. Ferrante JM, Gonzalez EC, Pal N, Roetzheim RG. Effects of physician supply on early detection of breast cancer. J Am Board Fam Pract. 2000; 13(6):408–414. [PubMed: 11117337]

4. Baade PD, Turrell G, Aitken JF. Geographic remoteness, area-level socio-economic disadvantage and advanced breast cancer: a cross-sectional, multilevel study. J Epidemiol Community Health. 2011; 65(11):1037–1043. [PubMed: 21282144]

5. Mandelblatt J, Andrews H, Kao R, Wallace R, Kerner J. The late-stage diagnosis of colorectal cancer: demographic and socioeconomic factors. Am J Public Health. 1996; 86(12):1794–1797. [PubMed: 9003140]

6. Marlow NM, Halpern MT, Pavluck AL, Ward EM, Chen AY. Disparities associated with advanced prostate cancer stage at diagnosis. J. Health Care Poor Underserved. 2010; 21(1):112–131. [PubMed: 20173259]

7. Amey CH, Miller MK, Albrecht SL. The role of race and residence in determining stage at diagnosis of breast cancer. J. Rural Health. 1997; 13(2):99–108. [PubMed: 10169323]

8. Halpern MT, Ward EM, Pavluck AL, Schrag NM, Bian J, Chen AY. Association of insurance status and ethnicity with cancer stage at diagnosis for 12 cancer sites: a retrospective analysis. Lancet Oncol. 2008; 9(3):222–231. [PubMed: 18282806]

9. Gorey KM, Luginaah IN, Holowaty EJ, Fung KY, Hamm C. Associations of physician supplies with breast cancer stage at diagnosis and survival in Ontario, 1988 to 2006. Cancer. 2009; 115(15): 3563–3570. [PubMed: 19484796]

10. Ward EM, Fedewa SA, Cokkinides V, Virgo K. The association of insurance and stage at diagnosis among patients aged 55 to 74 years in the national cancer database. Cancer J. 2010; 16(6):614–621. [PubMed: 21131794]

11. Coughlin SS, Richardson LC, Orelien J, Thompson T, Richards TB, Sabatino SA, et al. Contextual analysis of breast cancer stage at diagnosis among women in the United States, 2004. Open Health Serv Policy J. 2009 Jan 1.2:45–46. [PubMed: 21331349]

12. Davidson PL, Bastani R, Nakazono TT, Carreon DC. Role of community risk factors and resources on breast carcinoma stage at diagnosis. Cancer. 2005; 103(5):922–930. [PubMed: 15651072]

13. Chirumbole M, Gusani N, Howard A, Leonard T, Lewis P, Muscat J. A comparison of stage of presentation for pancreatic and colorectal cancer in Pennsylvania 2000–2005. Anticancer Res. 2009; 29(8):3427–3431. [PubMed: 19661368]

14. Ananthakrishnan AN, Hoffmann RG, Saeian K. Higher physician density is associated with lower incidence of late-stage colorectal cancer. J Gen Intern Med. 2010; 25(11):1164–1171. [PubMed: 20658268]

15. Silverstein MD, Nietert PJ, Ye X, Lackland DT. Access to care and stage at diagnosis for patients with lung cancer and esophageal cancer: analysis of the Savannah River Region Information System cancer registry data. South Med J. 2002; 95(8):900–908. [PubMed: 12190229]

16. Fox SA, Murata PJ, Stein JA. The impact of physician compliance on screening mammography for older women. Arch Intern Med. 1991; 151(1):50–56. [PubMed: 1985609]

17. Lewis SF, Jensen NM. Screening sigmoidoscopy. J Gen Intern Med. 1996; 11(9):542–544. [PubMed: 8905504]

18. Vernon SW. Participation in colorectal cancer screening: a review. J Natl Cancer Inst. 1997; 89(19):1406–1422. [PubMed: 9326910]

19. Roetzheim RG, Pal N, van Durme DJ, et al. Increasing supplies of dermatologists and family physicians are associated with earlier stage of melanoma detection. J Am Acad Dermatol. 2000; 43(2 Pt 1):211–218. [PubMed: 10906640]

20. Ohio Cancer Incidence Surveillance System. Cancer Incidence and Mortality among Ohio Residents, 2003–2007. Columbus, OH: Ohio Department of Health and The Ohio State University; 2011. www.healthy.ohio.gov/~/media/ODH/ASSETS/Files/opi/cancer%20incidence%20surveilla nce%20system%20ociss/cancerincidenceandmortalityamongohioresidents2003-2007.ashx.

21. World Health Organization. International Classification of Diseases for Oncology (ICD-O-3). 3rd ed.. Geneva, (Switzerland): World Health Organization; 2000.

22. National Cancer Institute. Surveillance Epidemiology and End Results. 2010. seer.cancer.gov/about.
23. Ohio Department of Job and Family Services. Ohio Medicaid Income Guidelines. Ohio Department of Medicaid. medicaid.ohio.gov/forohioans/FinancialRequirements.aspx.
24. Bureau of Community Health Services. Primary Care Office, Ohio Department of Health. Ohio Primary Care Workforce Data Compendium. 2010; 59
25. University of Wisconsin Population Health Institute and Robert Wood Johnson Foundation. County Health Rankings and Roadmaps. 2010 County Health Rankings National Data. www.countyhealthrankings.org/rankings/data.
26. Hosmer, DW.; Lemeshow, S. Applied logistic regression. 2nd ed.. New York: Wiley; 2000.
27. Goldstein, H. Multilevel statistical models. 3rd ed.. London: Arnold; 2003.
28. Wang F, McLafferty S, Escamilla V, Luo L. Late-Stage Breast Cancer Diagnosis and Health Care Access in Illinois. Prof.Geogr. 2008; 60(1):54–69. [PubMed: 18458760]
29. Roetzheim RG, Pal N, Gonzalez EC, et al. The effects of physician supply on the early detection of colorectal cancer. J Fam Pract. 1999; 48(11):850–858. [PubMed: 10907621]
30. Smith RA, Cokkinides V, Brooks D, Saslow D, Brawley OW. Cancer screening in the United States, 2010: a review of current American Cancer Society guidelines and issues in cancer screening. CA Cancer J Clin. 2010; 60(2):99–119. [PubMed: 20228384]

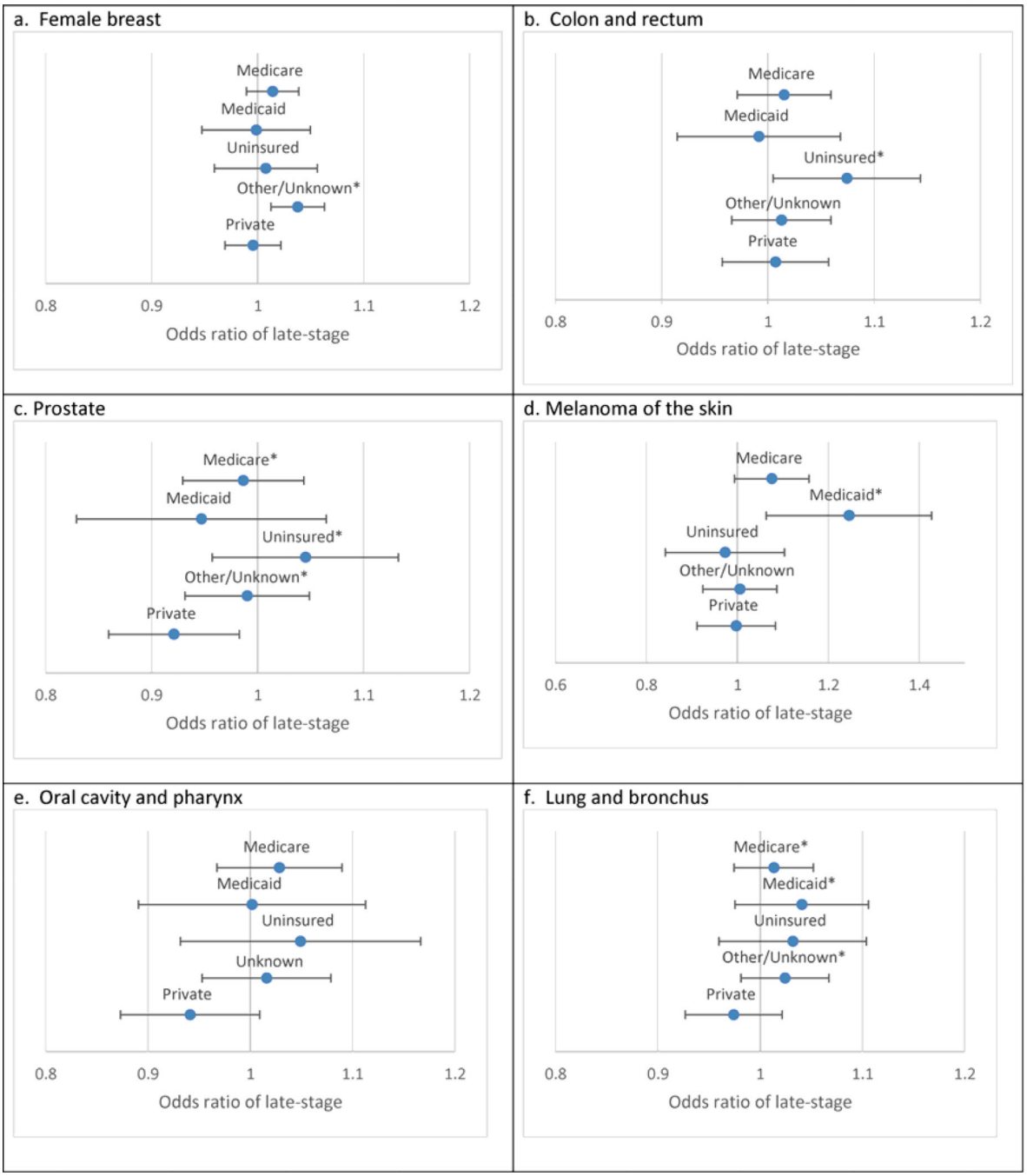

Figure 1.

Insurance type-specific, late-stage cancer diagnosis odds ratios associated with increases in PCP density[a,b]

[a] Odds ratios are for a change in the interquartile range (23.0 per 100,000) of PCP density

[b] Adjusted for age, race, sex, year, marital status, Rural Urban Continuum Code and percent of residents with at least a bachelor's degree

* $P < 0.05$ for test of stratum-specific interaction with private as reference

Table 1

Adjusted, Late-stage odds ratios of individual-level primary payer and county-level factors, by cancer site[a]

	Female Breast	Cervix	Colon and Rectum	Prostate	Melanoma of the Skin	Oral and Pharynx	Lung and Bronchus
	N=96,039	N=5,781	N=70,923	N=83,136	N=16,922	N=12,793	N=90,831
	OR(95% CI)	OR(95% CI)	OR(95% CI)	OR(95% CI)	OR(95% CI)	OR(95% CI)	OR(95% CI)
Individual Level							
Primary Payer[b]							
Private	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Uninsured	1.32(1.23–1.43)	2.15(1.76–2.64)	1.23(1.12–1.35)	1.08(0.96–1.21)	0.99(0.81–1.21)	1.32(1.11–1.59)	1.39(1.26–1.54)
Medicaid	1.49(1.38–1.61)	1.71(1.42–2.06)	1.24(1.12–1.38)	1.29(1.1–1.51)	1.77(1.36–2.31)	1.85(1.56–2.21)	1.20(1.10–1.32)
Medicare(≥65 yrs)	1.00(0.96–1.05)	0.82(0.65–1.03)	1.01(0.96–1.07)	0.78(0.73–0.83)	0.98(0.84–1.14)	0.83(0.73–0.94)	0.97(0.92–1.03)
Unknown	1.00(0.97–1.04)	1.13(0.97–1.31)	0.98(0.93–1.03)	0.94(0.88–1.00)	0.75(0.67–0.85)	0.92(0.83–1.02)	1.04(0.98–1.10)
County Level[c]							
Rural Urban Continuum Code(per 1 level increase of continuum)	1.01(0.99–1.02)	1.01(0.96–1.06)	0.98(0.95–1.00)	1.02(0.99–1.06)	1.00(0.95–1.05)	0.96(0.93–1.00)	0.99(0.97–1.02)
% > Bachelor's Degree(per 8.5% increase)[d]	0.97(0.93–1.00)	1.01(0.91–1.12)	0.96(0.90–1.03)	1.07(0.98–1.16)	**0.89(0.80–1.00)**	0.92(0.85–1.01)	1.00(0.94–1.06)
PCP Rate per 100,000(per 23 per 100,000 increase)[d]	1.02(0.99–1.04)	0.99(0.93–1.04)	1.01(0.97–1.06)	0.98(0.92–1.03)	1.03(0.96–1.10)	1.00(0.95–1.05)	1.01(0.97–1.05)
Total Physician Rate per 100,000(per 90 per 100,000 increase)[d]	1.02(0.99–1.04)	0.98(0.92–1.03)	1.01(0.96–1.07)	1.00(0.93–1.06)	1.00(0.93–1.08)	1.01(0.96–1.07)	0.98(0.92–1.03)
Specialty Physician Rate per 100,000(per 71 per 100,000 increase)[d]	1.02(0.99–1.04)	0.97(0.92–1.03)	1.01(0.96–1.07)	1.01(0.94–1.08)	0.99(0.92–1.07)	1.02(0.96–1.07)	1.02(0.97–1.06)

[a] Primary payer, Rural Urban Continuum Code, percent of residents with at least a bachelor's degree, and PCP rate are adjusted for age, race (White, Black, other, unknown), sex, year, marital status (single, married, separated or divorced, widowed, and unknown) and each other. Total physician and specialty physician rate are not adjusted for one another but are adjusted for primary payer, Rural Urban Continuum Code, percent of residents with at least a bachelor's degree, age, race, sex, year and marital status.

[b] P-value of F-test associated with primary payer is significant ($P < 0.0001$) for each cancer site

[c] Multicollinearity due to high correlations between physician-related variables (Pearson correlations > 0.84) prevented statistical adjustment for each other.

[d] Odds ratios are for a change in the interquartile range of the variable.

Boldface indicates statistical significance ($p < 0.05$).