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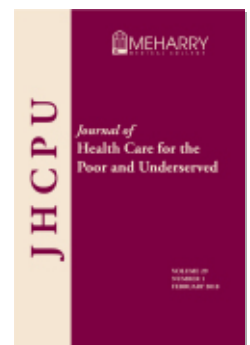
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Journal of Health Care for the Poor and Underserved, Volume 29, Number
1, February 2018, pp. 245-252 (Article)

Published by Johns Hopkins University Press

DOI: <https://doi.org/10.1353/hpu.2018.0017>



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Indian Health Service Care System and Cancer Stage in American Indians and Alaska Natives

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Abstract: Purpose. We aimed to determine whether the association between late-stage cancer and American Indian/Alaska Native (AI/AN) race differed by enrollment in the Indian Health Service Care System (IHSCS). **Methods.** We used Surveillance, Epidemiology, and End Results (SEER) data linked to Medicare files to compare the odds of late-stage breast, colorectal, lung, or prostate cancer between non-Hispanic Whites (NHWs) (n=285,993) and AI/ANs with (n=581) and without (n=543) IHSCS enrollment. **Results.** For AI/ANs without IHSCS enrollment, the odds of late-stage disease were higher in AI/ANs compared with NHWs for breast (OR=3.17, 95%CI: 1.82–5.53) and for prostate (OR=2.59, 95%CI: 1.55–4.32) cancer, but not for colorectal or lung cancers. Among AI/ANs with IHSCS enrollment, there was not a significant association between late-stage disease and AI/AN race for any of the four cancers evaluated. **Conclusion.** Our results suggest that enrollment in the IHSCS reduced the disparity between AI/ANs and NHWs with respect to late-stage cancer diagnoses.

Key words: Cancer stage, American Indian, Alaska Native, SEER-Medicare, Indian Health Service.

The most common cancers in American Indians/Alaska Natives (AI/ANs) are breast, colorectal, lung, and prostate cancers.^{1,2} Overall, AI/ANs have lower cancer

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incidence, but worse five-year survival outcomes, than non-Hispanic Whites (NHWs) for these cancers.¹⁻³ AI/ANs are also more likely to present with late-stage, metastatic cancers, and this is particularly notable for cancers for which screening is available, including breast, colorectal, and prostate cancers.⁴⁻⁶ Thus, differences in stage at diagnosis may be partly driving the disparity in health outcomes for AI/AN compared with NHW cancer patients.

Regular access to primary health care services, including screening in asymptomatic patients and early diagnosis in symptomatic patients, is associated with early stage at diagnosis for cancer patients.^{7,8} However, AI/ANs face several barriers to accessing primary care, including limited insurance coverage, lack of transportation, few nearby health care facilities, high costs of health care services, and mistrust of health care providers.⁹⁻¹¹ The Indian Health Service Care System (IHSCS), including Indian Health Service, Tribal facilities, and urban facilities, provides a potential avenue to reduce barriers to primary care in AI/ANs, because IHSCS clinics offer free primary care services, including cancer screening, to eligible AI/ANs. Additionally, IHSCS clinics tend to be located close to, or within, tribal areas, making them accessible to AI/ANs who may have limited transportation options. However, IHSCS services are restricted to AI/ANs who are members of federally-recognized tribes or who meet other eligibility criteria. Federal recognition status is granted to tribes based on historical treaties, Acts of Congress, United States Court decisions, or by administrative procedures under the Federally Recognized Indian Tribe List Act. Most AI/ANs who are not members of federally-recognized tribes are not eligible for care through the IHSCS.

The objective of this study was to evaluate whether AI/AN race is associated with a higher likelihood of having a late-stage cancer diagnosis and to determine if this association differs between AI/ANs with and without IHSCS enrollment. The IHSCS may help reduce some barriers to primary health care and result in earlier diagnosis of symptomatic AI/ANs and increased cancer screening in asymptomatic AI/ANs. Thus, we hypothesize that AI/AN cancer patients who are eligible for IHSCS services will have a stage distribution that is more similar to NHWs than AI/AN cancer patients without IHSCS care.

Methods

Study population. We conducted a case-case comparison study using Medicare enrollment files and IHSCS enrollment records linked to the Surveillance, Epidemiology, and End Results cancer registry data (SEER-Medicare). We used the SEER-Medicare linked database to identify new cases of breast (women only), colorectal, lung, or prostate cancer who were: 1) diagnosed between 2001 and 2007, 2) residing in a SEER catchment area, 3) enrolled in Medicare parts A and B one year or longer prior to diagnosis, and 4) AI/AN or NHW. SEER race/ethnicity data were abstracted from medical records data which were primarily based on self-reported race/ethnicity. This may result in misclassifying a subset of cancer patients who are truly AI/AN as NHW.¹² To address this, we ascertained AI/AN racial status through both SEER and IHSCS data and used probabilistic linkage data to correct misclassification of AI/AN race.¹³ Those who were enrolled in Medicare due to disability or end-stage renal disease were excluded.

Approval for this study was granted by the institutional review boards of the Fred Hutchinson Cancer Research Center, State of Washington, Oregon Department of Public Health, Oregon Department of Health Services, California Rural Indian Health Board, Northwest Portland Area Indian Health Board, California Committee for the Protection of Human Subjects, and the California Department of Health Care Services.

Statistical analysis. Stage at diagnosis was dichotomized into *early-stage* (SEER local/regional stages) or *late-stage* (SEER distant stage) disease. We used logistic regression models to compare the odds of a late-stage diagnosis between AI/AN and NHW cancer patients. Models included the following adjustment variables: age, sex, diagnosis year, marital status, geographic region, ZIP code-level median income, type of residence according to ZIP code rural-urban commuting area codes, and Klabunde co-morbidity score at diagnosis.¹⁴ We also conducted separate analyses to determine the association between late-stage disease and AI/AN race for those who were, and were not, eligible for IHSCS. Ineligibility for the IHSCS was determined using the SEER-Medicare data that had been linked to IHSCS files.

Results

After excluding patients missing stage at diagnosis (approximately 5% of cancer patients), analyses included 285,993 NHWs and 1,124 AI/ANs diagnosed with breast, colorectal, lung, or prostate cancer during the study period. Compared with NHWs, AI/AN cancer patients tended to be younger, were less likely to be married, and were more likely to live in rural areas and in areas with lower ZIP code-level median incomes (Table 1). In analyses not accounting for IHSCS eligibility, the adjusted odds of presenting with late-stage disease was higher in AI/ANs compared with NHWs diagnosed with breast (OR=2.20, CI: 1.40–3.44) or prostate (OR=2.01, CI: 1.39–2.90) cancer (Table 2). The association between late-stage cancer and AI/AN race was strongest for AI/ANs without IHSCS eligibility for both breast and prostate cancers. AI/AN breast cancer cases who were not eligible for the IHSCS were greater than three times more likely (CI: 1.82–5.53) to be diagnosed with late-stage cancers than NHWs. For prostate cancer, AI/AN patients who were not eligible for the IHSCS were 2.5 times more likely (CI: 1.55–4.32) to be diagnosed with late-stage disease than NHWs, but there was not a significant difference in the distribution of late-stage breast or prostate between NHW and IHSCS eligible AI/AN patients. For colorectal and lung cancers, there was a 17–21% increased odds of late-stage disease in AI/ANs, but this was not statistically significant, and these associations did not change according to IHSCS eligibility status (Table 2).

Conclusions

Our results suggest that older AI/AN cancer patients enrolled in Medicare were more likely than NHW cancer patients to be diagnosed with late-stage cancer, particularly for breast and prostate cancers. These results highlight the reality that barriers to care in AI/ANs extend beyond differences in health insurance coverage.^{9–11} However, our analyses also suggested that enrollment in the IHSCS reduced the disparity in the

Table 1.
CHARACTERISTICS OF NON-HISPANIC WHITE (NHW) AND AMERICAN INDIAN/ALASKA NATIVE (AI/AN) CANCER CASES: SEER-MEDICARE 2001–2007

	NHW N=285,993 N (%)	AI/AN without IHSCS N=543 N (%)	AI/AN with IHSCS N=581 N (%)
Age (years)			
66–69	58,129 (20)	116 (21)	145 (25)
70–74	73,811 (26)	149 (27)	180 (31)
75–79	70,098 (25)	140 (26)	139 (24)
≥80	83,955 (29)	138 (25)	117 (20)
Men	157,023 (55)	292 (54)	341 (59)
Marital status			
Married	157,194 (55)	245 (46)	269 (46)
Not Married	111,918 (39)	257 (47)	265 (46)
Unknown	16,881 (6)	41 (8)	47 (8)
ZIP-code median income (\$/year)			
<35,000	61,537 (22)	174 (32)	321 (55)
35,000–44,999	64,622 (23)	149 (27)	113 (19)
45,000–59,999	76,395 (27)	116 (21)	91 (16)
≥60,000	70,933 (25)	65 (12)	20 (3)
Unknown	12,506 (4)	39 (7)	36 (6)
Region of residence			
Southeast	57,414 (20)	40 (7)	<11 (<2) ^a
Northeast	68,235 (24)	56 (10)	<11 (<2) ^a
Midwest	45,520 (16)	46 (8)	13 (2)
West	114,824 (40)	401 (74)	555 (96)
Type of residence ^b			
Urban	222,759 (78)	396 (73)	301 (52)
Rural	62,965 (22)	147 (27)	280 (48)
Unknown	269 (<1)	0 (0)	0 (0)
Klabunde comorbidity score			
≤0	159,284 (56)	284 (52)	284 (49)
>0 to <1	95,106 (33)	181 (33)	223 (38)
1 to <2	26,536 (9)	60 (11)	62 (11)
≥2	5,067 (2)	18 (3)	12 (2)
Cancer site			
Breast ^c	58,144 (20)	97 (18)	98 (17)
Colorectal	58,963 (21)	99 (18)	133 (23)
Lung	78,602 (28)	195 (36)	150 (26)
Prostate	90,284 (31)	152 (28)	200 (34)
Year of diagnosis			
2001–2002	84,561 (30)	156 (29)	130 (22)
2003–2004	83,305 (29)	163 (30)	179 (31)
2005–2007	118,127 (41)	224 (41)	272 (47)

Notes:

^aTo protect privacy, SEER-Medicare restricts reporting of actual values for cell sizes <11.

^bType of residence based on rural urban commuting area (RUCA) ZIP code at diagnosis.

^cRestricted to cases of female breast cancer.

Table 2.

LOGISTIC REGRESSION ANALYSES OF THE ASSOCIATION BETWEEN AMERICAN INDIAN/ALASKA NATIVE RACE AND LATE-STAGE CANCER AT DIAGNOSIS, BY INDIAN HEALTH SERVICE CARE SYSTEM (IHSCS) ENROLLMENT: SEER MEDICARE 2001–2007

	Early-stage %	%	Late-stage OR ^a	95% CI
Overall (N=287,119)				
NHW	78	22	1.00 (ref)	
AI/AN, overall	71	29	1.38	1.21, 1.57
AI/AN without IHSCS	67	32	1.63	1.36, 1.96
AI/AN with IHSCS	75	25	1.15	0.95, 1.39
Breast ^b (N=58,340)				
NHW	94	6	1.00 (ref)	
AI/AN, overall	89	11	2.20	1.40, 3.44
AI/AN without IHSCS	85	15	3.17	1.82, 5.53
AI/AN with IHSCS	>89 ^c	<11 ^c	1.35	0.62, 2.92
Colorectal (N=59,195)				
NHW	82	18	1.00 (ref)	
AI/AN, overall	79	21	1.17	0.85, 1.61
AI/AN without IHSCS	78	22	1.25	0.77, 2.01
AI/AN with IHSCS	80	20	1.12	0.73, 1.71
Lung (N= 78,948)				
NHW	42	58	1.00 (ref)	
AI/AN, overall	37	63	1.21	0.97, 1.51
AI/AN without IHSCS	38	62	1.11	0.82, 1.49
AI/AN with IHSCS	36	64	1.34	0.95, 1.89
Prostate (N=90,636)				
NHW	95	5	1.00 (ref)	
AI/AN, overall	90	10	2.01	1.39, 2.90
AI/AN without IHSCS	88	12	2.59	1.55, 4.32
AI/AN with IHSCS	91	9	1.61	0.95, 2.71

Notes:

^aAdjusted for age, sex, year of diagnosis, and cancer subtype (for colorectal: colon and rectal, and for lung: adenocarcinoma, large cell carcinoma, non-small cell carcinoma not otherwise specified, and squamous cell carcinoma), marital status, ZIP-code level median income, region of residence, type of residence, and Klabunde co-morbidity score.

^bRestricted to cases of female breast cancer.

^cTo protect privacy, SEER-Medicare restricts reporting of actual values for cell sizes <11.

NHW= non-Hispanic White

AI/AN= American Indian/Alaska Native

proportion of patients with late-stage cancer diagnoses between AI/ANs and NHWs. This may be due, in part, to increased access to primary care and cancer screening services in AI/ANs who are eligible for IHSCS services. Although prior research suggests gaps in preventive care through IHSCS,¹⁵ results from a recent qualitative study of mammography in AI/ANs are consistent with our analyses and support the hypothesis that the IHSCS may help bridge the gap in access to cancer early detection resources for AI/ANs.¹⁶

Our study included robust data from a large population of American cancer patients enrolled in Medicare, but we acknowledge several study limitations, including: 1) limited sample size for AI/AN cancer patients which resulted in reduced power to detect potential modest differences between AI/ANs and NHWs for late-stage disease in lung and colorectal cancers; 2) lack of qualitative data to assess cultural barriers to primary care and cancer screening among AI/ANs in our study population; and 3) likely misclassification of a subset of AI/AN cancer patients as NHW.¹² As noted in the Methods section, we used both SEER and IHSCS data to reduce misclassification of AI/ANs,¹³ but this will not eliminate all misclassification. Because AI/ANs make up a small percent of the U.S. population over the age of 65 years old, the percent of cancer patients that were classified as NHW, but who are actually AI/AN, will be small and will not have a large impact on study results. This type of misclassification may slightly bias our results towards the null, so the overall significant, positive association between AI/AN race and late-stage cancer that we reported is likely conservative. This conservative estimate in our overall analysis does not affect the interpretation of our stratified analyses, which suggest a reduction in the disparity between NHWs and AI/ANs for late-stage cancer diagnosis in breast and prostate cancer patients who are eligible for the IHSCS. Thus, the practical implications of this research point to developing and testing interventions aimed at increasing access to primary care and cancer screening services in AI/ANs. Additionally, future research to address potential cultural and social barriers to cancer screening in AI/ANs is needed to improve the early detection of cancer in this population and improve survival outcomes.

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