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Treatment and Survival Disparities in the National Cancer Institute's Patterns of Care Study (1987-2017)

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Abstract

The primary objective was to describe cancer treatment and survival disparities in community oncology practice patterns found in the National Cancer Institute's population-based Patterns of Care (POC) Study (1987–2017). Secondly, we compared POC findings to peer-reviewed literature. In POC data, older age was consistently associated with decreased odds of treatment and increased mortality. Interestingly, in contrast to current literature, few POC studies found race/ethnicity significantly predicted disparities. Cancer health disparities are complex; they are multifactorial, differ by cancer site and may wax and wane; supporting the need for deeper understanding and targeted interventions to ensure equitable cancer care and outcomes.

Keywords

Cancer; Health Disparities; Treatment, Survival

Introduction

Disparities in cancer health care delivery often negatively affect patient outcomes. Recognizing and understanding factors that influence disparities in cancer care must precede intervening to eliminate the disparities. Cancer health services research is a primary tool for analyzing the associations between various factors and disparities in cancer health care delivery and outcomes. To guide research agendas, cancer health services investigators may use the “Framework for Advancing Disparities Research within the Health Care System” which divides disparities research into three phases: 1) detecting, 2) understanding, and 3) reducing (1).

The National Cancer Institute's (NCI) Patterns of Care Study (POC) is a population-based study that has described community oncology practice patterns in the United States (US) for

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Declaration of Interest

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thirty years. Focused on detection and understanding, the POC studies have found disparities in the receipt of state-of-the art cancer therapies, diagnostic tests, and biomarkers by patient, hospital and geographic characteristics. Survival differences have also been documented.

Materials and Methods

In this review, we aimed to highlight the disparities detected in cancer treatment and survival over time (1987–2017) in the NCI's POC Study. To this end, within POC publications that described trends in community cancer care, we examined multivariate models adjusted for sociodemographic, clinical, treatment, and hospital characteristics to abstract statistically significant findings. We used the definition of statistical significance as stated for each study; most commonly two-sided p value <0.05. We then compared POC findings to current peer-reviewed literature.

Results

Trends in Treatment Disparities

Disparities in cancer treatment over time in POC studies are shown in Table 1.

Ductal Carcinoma in Situ (DCIS)—Age was a significant predictor of DCIS treatment in POC data (2). In studies of women with DCIS using POC data and Surveillance Epidemiology and End Results (SEER) data from 1973–2000, the oldest women were most likely to undergo breast conserving surgery (2,3). In POC data the oldest women (> 80 years) were also least likely to receive postoperative radiation (2). Similarly, an analysis of the National Cancer Database (NCDB) from 2005–2012 found an association between age and receipt of adjuvant endocrine therapy; favoring younger women (4). Differing from the significant age-DCIS treatment relationship, there was no association between race/ethnicity and DCIS treatment in POC data but race/ethnicity was a predictor of treatment in other data (2–4). Black and Asian women (vs white) had greater likelihood of receiving breast conserving surgery in the SEER study and adjuvant endocrine therapy in the NCDB study (3,4). Furthermore, in contrast to the POC analysis, in the NCDB study, insurance status predicted adjuvant endocrine therapy receipt (2,4).

Invasive Breast (Stages I-IIIa)—POC studies of women with invasive breast cancer found younger women had greater likelihood of receiving therapy than older women (5–6). Similarly, a study of MarketScan health claims found subsequent mastectomy receipt after brachytherapy increased with younger age (7). A study of NCDB data from 2003–2011 found, among women for whom neoadjuvant chemotherapy was strongly recommended, younger women (<60 years vs ≥ 60 years) were more likely to receive the recommended treatment (8). The relationship between race/ethnicity and treatment was mixed. In the NCDB study, African American women were more likely than white women to receive neoadjuvant chemotherapy (8). In contrast, race/ethnicity did not predict treatment receipt in POC studies nor Herceptin use in a study linking cancer registry data from five states to administrative claims for Anthem-insured patients (5,6,9).

Colorectal (Stages II-III)—In POC studies, sociodemographic factors and comorbidity predicted colorectal cancer treatment (10–13). Therapy receipt decreased with increasing age for patients with colorectal cancer in POC (10–12) and SEER data (13) and for patients with locally advanced rectal cancer in NCDB data (15). Non-Hispanic white patients were more likely to receive therapy than non-Hispanic black and Hispanic patients in POC and NCDB data (10,12,13,15). In contrast, the SEER analysis found no racial difference in receipt of standard therapy among elderly African American and Caucasian patients with stages I-III colorectal cancer (14). Results were mixed for the effect of comorbidity on treatment (10,11,15). Interestingly, while one POC study found no significant association between income and guideline therapy receipt for colorectal cancer, the NCDB study found patients with locally advanced rectal cancer living in areas with higher median income were more likely to receive neoadjuvant chemoradiotherapy (11,15).

Ovarian (Stages I-IV)—Likelihood of guideline therapy receipt for ovarian cancer varied by sociodemographic and clinical factors (16). Younger women were more likely to receive guideline therapy in POC data and, in a SEER-Medicare study, to receive either surgery or six cycles of chemotherapy in different models (16,17). In the SEER-Medicare study, older age was associated with receipt of primary chemotherapy versus primary surgery to treat advanced ovarian cancer (17). The association between comorbidity status and ovarian cancer treatment differed by type of treatment. Lower comorbidity was associated with guideline therapy receipt in POC data (16). In the Medicare population, lower comorbidity was associated with receipt of surgical treatment instead of chemotherapy (17). Overall, race/ethnicity was not associated with guideline therapy receipt in POC data (16). But, in SEER-Medicare data black patients were more likely to receive primary chemotherapy and less likely to receive surgery and chemotherapy (17).

Cervical (Stages IA1-IVB and Unstaged)—Age predicted cervical cancer treatment in POC data; the oldest women (> 75 years) had decreased odds of therapy compared to younger women (18). There was no association between age and treatment in an NCDB study of women with cervical cancer (19). In both POC and NCDB data insurance status, favoring the insured, was associated with receiving standard therapy including concurrent chemoradiation (18,19). Race/ethnicity was not a significant factor in cervical cancer treatment in POC data. However, in NCDB data, black patients were less likely than non-Hispanic white patients to receive standard of care therapy (19). Interestingly, in the same data, other race/ethnicity patients were more likely than non-Hispanic white patients to receive standard therapy and a radiotherapy boost (19).

Prostate (Clinically localized)—In POC data, prostate cancer management differed by sociodemographic and clinical factors (20). Younger men were more likely to receive aggressive prostate cancer treatment than older men (20). In an NCDB study (2004–2013) of proton beam therapy use, younger men were more likely to receive proton beam therapy versus any other kind of radiation therapy (21). Prostate cancer treatment also differed by race/ethnicity in POC data and a different NCDB study (2004–2012) analyzing the effects of sociodemographic factors on prostate cancer management; non-Hispanic white men were more likely to be treated aggressively than African American men (20,22). In the same

studies, aggressive therapy was more likely for men with private insurance versus no insurance or government insurance (20,22). Furthermore, men with lower median income were more likely to be treated non-aggressively in POC data and in NCDB data to receive other radiation (versus non-proton beam therapy), radiation therapy (versus radical prostatectomy), and observation (versus definitive treatment) (20–22). For all reviewed studies, men with fewer comorbidities were treated more aggressively (20–22).

Multiple Myeloma—Age and insurance status predicted increasing use of novel agents and hematopoietic stem cell transplantation to treat multiple myeloma in POC data (23). Among non-Hispanic white patients, the oldest patients (> 70 years) had the smallest increase in novel agent receipt and hematopoietic stem cell transplantation (23). Similarly, in a SEER-Medicare study, use of novel agents and autologous stem cell transplantation decreased with increasing age (24). In POC data, among patients who were not non-Hispanic white, increased receipt of novel agents and stem cell transplantation was greatest for private-insured and least for Medicaid-insured patients (23). Similarly, among the Medicare-insured patients, those who were also Medicaid-insured (versus non-Medicaid) were less likely to receive novel agents and stem cell transplantation (24).

Renal Cell (Stages I-IV)—In POC data, treatment receipt varied by sociodemographic factors and comorbidity, for patients with renal cell cancer (25,26). Younger patients (versus older patients) were more likely to receive systemic therapy and undergo less extensive surgery (25,26). In a NCDB study (1998–2010), among patients with metastatic renal cell carcinoma, older patients were more likely than younger patients to receive radiotherapy (27). In POC data and a second NCDB study (2002–2011) of older patients with localized renal cell carcinoma, census level area education predicted treatment (25,28). Patients living in areas with lower educational attainment had decreased likelihood of receiving systemic therapy in POC data and county level education predicted receipt of both non-surgical management and partial nephrectomy in NCDB data (25,28). Uninsured patients were less likely to receive systemic therapy in POC data and radical nephrectomy in a third NCDB study (2004–2013) analyzing trends, determinants and survival (25,29). The same NCDB study (2004–2013) found patients with higher comorbidity score were more likely to receive radical nephrectomy differing from the POC finding of greater odds of less extensive surgery for those with higher comorbidity score (26,29). POC found no significant association between race/ethnicity and systemic therapy receipt (25). However, in NCDB and SEER data black patients (versus white) were more likely to receive radical nephrectomy (29,30) and nonsurgical management (30) and less likely to receive radiotherapy (27). Finally, type of nephrectomy (laparoscopic versus open radical) did not differ by sex in POC data, but a NCDB trend study and a SEER study found females were more likely to undergo radical nephrectomy (29,30).

Non-Small Cell Lung (NSCLC) (Stages I-IV)—Age, marital status, and insurance status predicted NSCLC treatment in POC data (31). Increasing age was associated with decreasing receipt of chemotherapy and surgery (31). Similarly, a Medicare analysis found older age was associated with no local treatment (versus surgery), surgery (versus external beam radiotherapy), intensity modulated radiotherapy (versus surgery), and stereotactic body

radiotherapy (versus surgery) (32). The effect of marital status on treatment in the POC and SEER-Medicare data was mixed (31,32). However, the association between insurance status and treatment was similar in POC data and state cancer registry data (31,33). In POC analysis, odds of surgery receipt were lower for patients with only Medicaid or Medicare insurance and in the state cancer registry analysis, patients without private insurance were less likely to undergo lobectomy (31,33). Race/ethnicity and comorbidity did not significantly influence treatment receipt in POC data (31). In contrast, in SEER-Medicare and state cancer registry data white patients (vs black and other) were more likely to be treated surgically and greater comorbidity was associated with external beam radiotherapy, intensity modulated radiotherapy and no local treatment (32,33).

Trends in Survival Disparities by Cancer Type

Disparities in survival over time in POC studies are shown in Table 2.

Colorectal (Stages II-III)—For patients with colorectal cancer, age alone predicted cancer-specific mortality but, age, marital status and comorbidity predicted all-cause mortality (10,11). Increasing age was associated with increased cancer-specific mortality and all-cause mortality in POC and decreased survival in a study of cancer registry data from patients with stage IV colorectal cancer (10,34). Among patients with a Charlson score of 0 in POC data, decreased all-cause mortality was associated with non-Hispanic white race/ethnicity (10,11). Similarly, among patients with locally advanced rectal cancer in an NCDB study, improved 5-year overall survival was associated with being non-Hispanic white and having low comorbidity (15). Sex was not associated with mortality in POC nor cancer registry data (10,11,34). Finally, income did not predict cancer-specific nor all-cause mortality in POC data, but, in the NCDB study, higher income was associated with better 5-year overall survival for patients with locally advanced rectal cancer (10,11,15).

Cervical Cancer (Stages IA1-IVB and Unstaged)—Demographic factors were associated with all-cause but not cancer-specific mortality for women with cervical cancer in the POC data (18). The risk of all-cause mortality was lower for younger and Hispanic women (18). However, there was no significant difference in all-cause mortality by insurance status or for cancer-specific mortality by age, race/ethnicity and insurance status (18). A comparable study of disparities in cancer mortality, and survival over time found older age, poverty, and lower educational attainment were associated with a higher mortality rate (35). In the same study, black women had higher mortality than white women in all socioeconomic groups (35).

Non-Small Cell Lung (NSCLC) (Stages I-IV)—Sociodemographic factors predicted all-cause mortality for patients with NSCLC (31). Older patients had significantly higher all-cause mortality in both POC data and a study of patients at Moffitt Cancer Center (31,36). Also, in the two studies females had significantly lower all-cause mortality (31,36). In POC and NCDB data, the private-insured patients with NSCLC had better survival (31,37). Interestingly, the association between race/ethnicity and survival was mixed. In POC data, Hispanic ethnicity was associated with decreased all-cause mortality for stage I/II NSCLC but increased all-cause mortality for stage IIIA disease (31). Furthermore, the NCDB study

found better 5-year overall survival for black and Hispanic patients (versus white) but the Moffitt Cancer Center study found black patients had higher mortality than white patients (36,37). Comorbidity was not a significant predictor of all-cause mortality for patients with NSCLC in POC data (31).

Melanoma—Cancer-specific mortality did not vary significantly by age and comorbidity for patients diagnosed with local and regional cutaneous melanoma in POC data (38). Similarly, in a different population-based study of patients with invasive melanoma, sociodemographic characteristics did not affect melanoma-specific survival over a three-year period (39).

Discussion

Advancing Disparities Research

For 30 years, NCI's POC Study has described factors that predict disparities in cancer treatment and survival. POC's contributions to cancer health disparities research have been possible because the study is population-based, has detailed and verified treatment information, allows for long-term follow up, and includes patients of all ages. Furthermore, to obtain more stable estimates, patients in all racial and ethnic groups except non-Hispanic white are oversampled in the POC Study.

In our review of significant findings from multivariate models adjusted for sociodemographic, clinical, treatment, and hospital characteristics in POC trend studies from 1987–2017, we found age was the most common predictor of treatment and survival across cancer sites. Older age was consistently associated with decreased odds of treatment and survival. Interestingly, while disparities studies often focus on the relationship between patient race/ethnicity and cancer care delivery and outcomes, in contrast to current literature, few POC studies found race/ethnicity significantly predicted treatment and survival.

The complexity of cancer health disparities and by extension the difficulty for researchers to fully understand them, is evident in our review of POC and current literature. We found disparities are multifactorial, differ by cancer site, and may wax and wane over time. For example, one POC study found reduction and then reemergence of racial disparity in stage III colon cancer treatment over time (13). Cancer health disparities researchers must move past simply describing disparities to developing a more in-depth understanding of the intricate relationship between factors that are associated with disparate cancer care and outcomes. Greater understanding is the necessary foundation for creating sustainable interventions to eliminate disparities, so that they don't recur. Leading efforts for progress in cancer health disparities work, the NCI supports research that focuses on understanding cancer health disparities and designing interventions to address the disparities.

Some resources that the NCI uses to accomplish its disparities agenda are the SEER Program, the Cancer Moonshot Initiative and the NCI Community Oncology Research Program (NCORP). The SEER program, a set of population-based cancer registries located throughout the United States, collects demographic information, tumor characteristics, initial treatment and vital status for patients diagnosed with cancer in specific geographic regions

(40). SEER contributes to cancer health disparities research by providing data from a diverse patient cohort. SEER data can also be linked to other sources of data that may be used to improve understanding of differences in cancer care delivery and outcomes such as insurance claims (ex. SEER-Medicare) and biomarker testing (ex. Oncotype DX). Given rapid advances in oncology care, there are ongoing efforts at to expand opportunities for cancer researchers including the Cancer Moonshot Initiative.

The goals of the Cancer Moonshot Initiative are to increase cancer research resources and collaboration to ultimately improve cancer prevention, detection and treatment (41). Funding opportunity announcements, reflecting the ten Blue Ribbon Panel recommendations for accelerating cancer research in five years, are now open for applications from investigators. Interestingly, each application must include a health disparities component and a data sharing plan to be considered for funding. These requirements will potentially facilitate progress in the cancer health disparities field through discovery and by providing investigators greater access to richer data resources to study disparities. Success of the Initiative will partially be measured by improvement in cancer care and outcomes for patients treated in private, academic and community oncology practices like those in NCORP.

NCORP is a community network intricately involved in cancer prevention clinical trials and cancer care delivery research (42). The community placement provides research access to individuals who are usually underrepresented in research and many times have high cancer incidence and poor outcomes. Some of the sites are designated minority/underserved community sites because they have at least 30% racial/ethnic minorities or rural residents (42). Importantly, the NCORP infrastructure allows for interventions to be tested in the community setting among those who many times experience differential treatment and outcomes.

NCI's POC study contributing early to the cancer health disparities field by elucidating disparities in cancer care and outcomes in the community. Many of the disparities in treatment and survival that POC studies described during its thirty years of existence provided the background for developing mechanisms to understand disparities. With current NCI resources including the SEER program, the Cancer Moonshot Initiative, and NCORP, the organization is well-positioned to continue its leading role in cancer health disparities research by facilitating movement beyond the first phase of the "Framework for Advancing Disparities Research within the Health Care System" to a greater understanding of the complexity of disparities in order to develop effective interventions to eliminate disparities (1).

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Disparities in Cancer Treatment over Time by Cancer Type and Diagnosis Year, National Cancer Institute Patterns of Care Study, 1987–2017^a

Table 1:

Cancer Type and AJCC Stage at Diagnosis	Diagnosis Years	Treatment Studied	Treatment Disparities
Ductal Carcinoma In Situ	1991, 1995, 2000 and 2005 ²	Breast conserving surgery	Age: ↑ receipt for women 80 years vs <65 years NS: Race/ethnicity, marital status, and insurance
		Radiation therapy after breast conserving surgery	Age: ↓ receipt for women 80 years vs < 50 years NS: Race/ethnicity, marital status, insurance
	1987–1991 and 1995 ⁵	Guideline therapy	Age: Positive lymph nodes ↑ predicted probability of receipt with decreasing age NS: Race/Ethnicity
Breast I-III A	1987–1991, 1995, and 2000 ⁶	Adjuvant Therapy	Age: Tumors 1cm and negative lymph nodes ↓ use for women 70 years vs <50 years
		Anthracycline-based therapy	Age: Positive or negative lymph nodes ↑ use for women < 70 years vs 70 years
	1987–1991 and 1995 ¹⁰	Standard adjuvant therapy	Stage III colon and Stage II/III rectal Age: ↓ use with increasing age Race/Ethnicity: ↑ use for white vs African-American patients Sex: ↑ use for women vs men Marital status: ↑ use for married patients vs patients with other marital status Comorbidity: ↓ use with increasing comorbidity score ^b
Colorectal II-III	1987–1991 1995 and 2000 ¹¹	Guideline therapy	Stage III colon and stage II/III rectal Age: ↑ receipt with decreasing age Race/ethnicity: Overall associated with receipt but differences between groups NS NS: Sex, marital status, income ^c , comorbidity
	1990–1991, 1995, 2000, 2005 and 2010 ¹²	Adjuvant chemotherapy	Stage III colon Age: ↓ use with increasing age Race/ethnicity: ↓ use for non-Hispanic black and Hispanic vs non-Hispanic white patients Comorbidity: ↓ use for patients with comorbidity score 2 vs 0 NS: Insurance
		Chemoradiation	Stage II/III rectal Age: ↓ receipt with increasing age NS: Insurance, comorbidity
	1990–1991, 1995, 2000, 2005 and 2010 ¹³	Adjuvant chemotherapy	Stage III colon Race/ethnicity: ↑ use for non-Hispanic white vs non-Hispanic black patients from 1990–1991 and in 2010 Insurance: Private insurance ↑ use for non-Hispanic white vs non-Hispanic black patients NS: Age, comorbidity

Cancer Type and AJCC Stage at Diagnosis	Diagnosis Years	Treatment Studied	Treatment Disparities
		Optimal chemotherapy	<p>Stage III colon</p> <p>Race/ethnicity: ↑ use for non-Hispanic white vs non-Hispanic black patients⁶ NS: Age, insurance, comorbidity</p>
Ovarian-IV ^e	1991 and 1996 ¹⁶	Guideline therapy	<p>Age: Stage III or IV ↑ receipt for women <65 years vs 65 years Non-Hispanic white ↑ receipt for women <65 years vs 65 years</p> <p>Marital status: Stage III or IV ↑ receipt for married vs unmarried women Non-Hispanic white ↑ receipt for married vs unmarried women</p> <p>Insurance: Stage III or IV ↑ receipt for privately insured vs public, none, or unknown insurance Non-Hispanic black ↑ receipt for women with private vs other insurance status Hispanic ↑ receipt for women with private vs other insurance status</p> <p>Comorbidity: Stage III or IV ↑ receipt among women with Charlson score = 0 vs 1 Non-Hispanic black ↑ receipt for women with Charlson score = 0 vs 1 Non-Hispanic white ↑ receipt for women with Charlson score = 0 vs 1 NS: All stages race/ethnicity Stage I or II age and marital status (Non-Hispanic black, Hispanic, other), insurance (non-Hispanic white), comorbidity (Hispanic, other)</p>
Cervical IA1-IVB and Unstaged ^d	1997, 2000 and 2001 ¹⁸	Concurrent chemoradiation receipt	<p>Age: ↓ receipt for women 75 years vs <45 years Insurance: ↓ receipt for women with unknown insurance status vs no insurance NS: Race/ethnicity</p>
		Combination chemotherapy, intracavitary radiation therapy and external beam radiation receipt	<p>Age: ↓ receipt for women 75 years vs <45 years NS: Race/ethnicity, insurance</p>
		Watchful waiting	<p>Age: ↑ watchful waiting for men 75 years vs <60 years Marital status: ↓ receipt for married vs other marital status men Insurance: Overall associated with receipt but differences between groups NS Comorbidity: ↑ watchful waiting for men with no comorbidities vs 1 NS: Race/ethnicity, income</p>
		Primary androgen deprivation receipt	<p>Age: ↑ receipt for men 65 years vs <60 years NS: Race/ethnicity, marital status, income, insurance, comorbidity</p>
Prostate Clinically localized	1998 and 2002 ²⁰	Radical prostatectomy receipt	<p>Age: ↑ receipt for men <60 years vs >60 years Income: ↑ receipt for men with unknown or \$40,000–75,000 income vs <\$39,000 Insurance: Overall associated with receipt but differences between groups NS NS: Race/ethnicity, marital status, insurance, comorbidity</p>
		External beam radiation therapy use	<p>Age: ↑ receipt for men 65 years vs <60 years Income: ↓ receipt for men with income >\$40,000 vs <\$39,000 NS: Race/ethnicity, marital status, insurance, comorbidity</p>
		Brachytherapy +/-external beam radiation therapy receipt	<p>NS: Age, race/ethnicity, marital status, income, insurance, comorbidity</p>
		Any aggressive initial therapy receipt	<p>Age: ↑ receipt for men <60 years vs 65 years</p>

Cancer Type and AJCC Stage at Diagnosis	Diagnosis Years	Treatment Studied	Treatment Disparities
			Race/ethnicity: ↓ receipt for African American vs non-Hispanic white men Marital status: ↑ receipt for married vs other marital status men Income: Overall associated with receipt but differences between groups <i>NS</i> Insurance: ↑ receipt for men with private vs no/unknown insurance <i>NS</i> ; Comorbidity
Multiple Myeloma	1999, 2003 and 2007 ²³	Novel agent use	Age: Non-Hispanic white ↑ use greatest for those 50–59 years and least for those 70 years Insurance: Other races ↑ use greatest for privately insured patients and least for those with any Medicaid
		Hematopoietic stem cell transplantation use	Age: Non-Hispanic white ↑ use greatest among patients <50 years and least for 70 years Other races ↑ use greatest among patients <50 years and least for those 70 years Insurance: Other races ↑ use greatest for privately insured patients and least for those with any Medicaid
		Any systemic therapy receipt	Stage IV All patients Age: ↓ receipt with increasing age Education: ↓ receipt with decreasing education Insurance: ↓ receipt for unknown vs private insurance <i>NS</i> ; Race/ethnicity, marital status, comorbidity
Renal Cell I-IV	2004–2009 ²⁵	Time to systemic therapy	Stage IV Age: All patients ↓ time with decreasing age Non-surgical patients ↓ time for patients <50 years vs 70 years Education: All patients ↓ time with increasing education Non-surgical patients ↓ time for patients with highest education compared to all other education levels <i>NS</i> ; Race/ethnicity, marital status, comorbidity
		Laparoscopic vs open radical nephrectomy	Stage I-II <i>NS</i> ; Age, sex
		Partial vs. radical nephrectomy	Stage I tumors 7cm Age: ↑ partial nephrectomy for patients <65 years vs 65 years Comorbidity: ↑ partial vs radical for patients with Charlson score 1 vs 0
Non-Small Cell Lung I-IV	1996, 2005 and 2010 ³¹	Chemotherapy	Stage IIIB/IV Age: ↓ use for patients 80 years vs <70 years Marital status: ↑ use for married vs un-married patients <i>NS</i> ; Race/ethnicity, sex, insurance, comorbidity

Cancer Type and AJCC Stage at Diagnosis	Diagnosis Years	Treatment Studied	Treatment Disparities
		Surgery	<div>Stage I/II</div> <div>Age:↓ receipt for patients with increasing with age Insurance:↓ receipt among patients with any Medicaid or Medicare only vs other insurance (Private/Health Maintenance Organization/Veterans Administration) NS: Race/ethnicity, sex, marital status, comorbidity</div>

AJCC, American Joint Cancer Commission, NS, not statistically significant in adjusted multivariable analysis

^aResults of multivariable analyses adjusted for patient, clinical, and healthcare facility characteristics

^bCharlson Co-morbidity Score

^cMedian area income

^dOptimal chemotherapy: patients younger than 75 years who have a comorbidity score of 1

^eInternational federation of gynecology and obstetrics (FIGO) stage

^fArea educational attainment: percent with at least a high school diploma

Table 2:

Disparities in Survival by Cancer Type and Diagnosis Year, National Cancer Institute Patterns of Care Study, 1987–2017^a

Cancer Type and AJCC Stage at Diagnosis	Diagnosis Years	Type of Mortality Measured	Survival Disparities
Colorectal II-III	1987–1991, and 1995 ¹⁰	Cancer Specific	Stage III colon or stage II/III rectal Age: ↑ with increasing age NS: Race/ethnicity, sex, marital status, income ^b , comorbidity ^c
		All-cause	Stage III colon or stage II/III rectal Age: ↑ with increasing age Marital status: ↑ with other marital status Comorbidity: ↑ with Charlson score 2 vs 0 NS: Race/ethnicity, sex, income
	1987–1991, 1995 and 2000 ¹¹	All-cause	Comorbidity: Among patients with Charlson score=0 ↓ for non-Hispanic white vs non-Hispanic black patients NS: Age, sex, marital status, income
Cervical IA1-IVB and Unstaged ^d	1997, 2000 and 2001 ¹⁸	Cancer Specific	NS: Age, race/ethnicity, insurance
		All-cause	Age: ↑ for women >54 years vs <45 years Race/ethnicity: ↓ for Hispanic vs non-Hispanic white women NS: Insurance
Non-Small Cell Lung I-IV	1996, 2005 and 2010 ³¹	All-cause	Age: Stage I/II ↑ for patients 70 years vs <70 years Stage IIIB/IV ↑ for patients 80 years vs <70 years Sex: Stage I/II ↓ for female vs male patients Race/ethnicity: Stages I/II ↓ for Hispanic vs non-Hispanic white patients Stage IIIA ↑ for Hispanic vs non-Hispanic white patients Insurance: Stage I/II ↓ for privately insured vs all others Stage IIIA ↓ for privately insured vs Medicare only NS: Comorbidity
		Cancer Specific	NS: Age, comorbidity

AJCC, American Joint Cancer Commission, NS, not statistically significant in adjusted multivariable analysis

^aResults of multivariable analyses adjusted for patient, clinical, and healthcare facility characteristics

^bMedian area income

^cCharlson Co-morbidity Score

^dInternational federation of gynecology and obstetrics (FIGO) stage