DR. CHRISTINE M VEENSTRA (Orcid ID : 0000-0001-9947-7156)

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Partnered Status & Receipt of Guideline-Concordant Adjuvant Chemotherapy Among Patients with Colon Cancer

Running Title: Partnered Status & Adjuvant Chemotherapy

Christine M. Veenstra, MD, MSHP[1,2]; Sarah T. Hawley, PhD, MPH[1,2,3]; M. Chandler McLeod, PhD[4]; Mousumi Banerjee, PhD[4]; Jennifer J. Griggs, MD, MPH[1,2]

[1]Department of Internal Medicine, University of Michigan, Ann Arbor, MI

[2]Institute for Healthcare Policy and Innovation, University of Michigan, Ann Arbor, MI

[3]Ann Arbor VA Healthcare System, Ann Arbor, MI

[4]Department of Biostatistics, University of Michigan, Ann Arbor, MI

Corresponding Author:

Christine M. Veenstra, MD, MSHP

300 North Ingalls, NIB

Ann Arbor, MI 48109

(734) 615-4762 — phone

(734) 936-4940 — fax

cveenstr@med.umich.edu

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Author Contributions:

Christine Veenstra: conceptualization, methodology, investigation, writing original draft, writing review and editing, visualization

Chandler McLeod: methodology, software, formal analysis, writing review and editing, visualization

Mousumi Banerjee: methodology, formal analysis, writing review and editing

Sarah Hawley: conceptualization, methodology, writing review and editing

Jennifer Griggs: conceptualization, methodology, investigation, writing original draft, writing review and editing, visualization

Precis: In this innovative investigation of associations between partnered status and specific attributes of curative-intent chemotherapy, having a partner increased the odds of completing the full course of chemotherapy. To improve cancer-related outcomes, future

interventions should incorporate supports to help unpartnered patients complete the recommended course of chemotherapy.

ABSTRACT

Background: Partnered status is an independent predictor of clinical outcomes, including overall survival, among patients with cancer. However, the mechanisms by which partnered status impacts survival are not fully understood and associations between partnered status and specific attributes of chemotherapy have not been studied.

Methods: This was an observational study of patients with resected Stage III colon cancer diagnosed 2008-2015, recruited from an academic cancer center and two large community oncology practices. Outcome measures were specific attributes of adjuvant chemotherapy. Partnered status (partnered vs. unpartnered) was the primary independent variable. Bivariate comparisons between independent variables and the primary outcomes were performed. Associations between partnered status and the outcomes were also analyzed by multivariable generalized estimating equations (GEEs) using a logit link.

Results: Data were collected from 436 patients; 65% from community oncology practices. 62% were partnered (married or living with a partner). 86% received adjuvant chemotherapy. Among those, 87% received multi-agent chemotherapy, and 65% completed 6 months of therapy. Partnered patients had a higher odds of completing chemotherapy (odds ratio, OR 1.98, 95% confidence interval, CI, 1.04-3.77).

Conclusion: In this innovative investigation of associations between partnered status and specific attributes of curative-intent chemotherapy, 35% of patients terminated

chemotherapy early. Having a partner increased the odds of completing therapy, which may be one mechanism through which having a partner improves disease-specific outcomes in colon cancer. Identifying those aspects of partner support that can be reproduced with community or clinical personnel may help unpartnered patients complete the recommended course of curative-intent chemotherapy.

Key words: Chemotherapy, adjuvant; colonic neoplasms; marriage

INTRODUCTION

Patients who have a partner, whether married or not, have been shown to have better cancer-specific outcomes than unpartnered patients.[1,2] Improved cancer-specific survival has been demonstrated for married patients with the ten most common cancers.[3] The mechanisms by which marital status impacts survival are not fully understood,[4,5] although the protective effect of being partnered on cancer-specific survival is greater than the published survival benefit of chemotherapy for multiple cancers, including colorectal cancer.[3]

A study of adherence to specific treatment guidelines in a single, prevalent cancer such as colon cancer is one method for investigating this issue and identifying aspects of care to target for intervention and improvement. The National Comprehensive Cancer Network (NCCN) guidelines for Stage III colon cancer recommend a defined course of multi-agent, adjuvant chemotherapy following resection, based on a survival advantage to this approach.[6] The purpose of this study is to investigate the possibility that specific attributes of adjuvant chemotherapy in patients with Stage III colon cancer, including

receipt of chemotherapy, receipt of multi-agent vs. single-agent therapy, and completion of the guideline-recommended course of chemotherapy, differ by partnered status.

PATIENTS AND METHODS

This was an observational study of patients age 21-80 diagnosed 2008-2015 with resected Stage III colon cancer. Exclusion criteria included rectal primary, non-adenocarcinoma histology, and second active malignancy. Patient data were abstracted from an academic cancer center and two community oncology practices within the Michigan Community Research Consortium. Eligible patients were identified via tumor registries at each site. Diagnosis and stage were verified by review of pathology and radiology records. The primary outcomes and independent variables were obtained by exhaustive review of inpatient and outpatient digital and paper medical records, including records from medical oncology, surgery, primary care, laboratory, and radiology. Medical record review was conducted by 4-5 trained abstractors at each site, using a standardized codebook with frequent checks for accuracy. Data were de-identified and entered into an electronic database by a research assistant; data analysis and interpretation were performed in a blinded fashion. All study protocols were approved by the institutional review boards of the University of Michigan and St. Joseph Mercy Hospital.

Primary Outcome Variables.

There were 3 primary outcome variables: 1) Receipt of adjuvant chemotherapy, 2) Receipt of multi-agent chemotherapy, 3) Completion of a 6-month course of chemotherapy. Receipt of adjuvant chemotherapy was ascertained from medical records and coded as a binary (yes/no) variable. To assess multi- versus single-agent chemotherapy, we considered only the first dose of chemotherapy to measure therapeutic intent. Receipt of single- or multi-agent chemotherapy was recorded as a binary (single-/multi-agent) variable. When the patients in this study were diagnosed and treated, the recommended duration of adjuvant chemotherapy for all patients with Stage III colon

cancer was 6 months. To determine whether a patient completed a 6-month course, the the number of days between the first and last administered doses was calculated, a method used in previous studies.[7] An interval of 154 days was used as the cutoff because a complete and timely course of FOLFOX consists of 12 doses administered every 14 days, spanning 154 days between the first and twelfth dose.

Independent Variables.

We considered both clinical and non-clinical independent variables. The main independent variable of interest, partnered status, was categorized as a binary variable with a partner defined as a spouse or significant other living in the same household as the patient. Information regarding partnered status was found in clinicians' notes, the demographics section of the medical record, and patient intake forms. Clinical variables included number of comorbid conditions at diagnosis (0-1, 2 or more), surgical complications (yes/no), and American Joint Committee on Cancer T and N stage. Surgical complications were assessed by review of outpatient notes and inpatient hospital records. Both major complications that required readmission and/or another surgery or procedure, and minor complications that did not require readmission, were considered in the definition of a surgical complication. Non-clinical variables included age at diagnosis (<60, 60-70, >70), gender (male/female), and self-identified race (white/black/other). Area-level socioeconomic status (SES) was determined using the patient's ZIP code and a validated 6-measure composite score.[8] Insurance at diagnosis was recorded as private, Medicare, Medicaid/state-provided or none. To account for provider- and practice-level variation, we collected de-identified provider and practice information for each patient.

Statistical Analyses.

Bivariate comparisons between independent variables were performed using chi square tests for the primary outcomes. The outcomes were also analyzed by multivariable generalized estimating equations (GEEs) using a logit link. The GEEs employed compound symmetry correlation structure with clustering by provider and robust standard

errors to explore partnered status marginal effects while adjusting for patient-level covariates. Potential interactions between gender and partnered status were assessed for all outcomes and showed no significant associations.

To address missing data for some abstracted variables we conducted multiple imputations under the assumption that data were missing at random. In a secondary analysis we computed average adjusted probabilities (predictive margins) of completion of each of the outcomes at selected levels of age, gender, and partnered status for our study sample. All independent variables other than age, gender, and partnered status were left as originally recorded. Finally, as a sensitivity analysis to reduce bias due to any covariate imbalance, we employed propensity score methods to address potential confounding. Propensity scores were estimated using a multivariable logistic regression model of patients' partnered status, given the observed covariates age, gender, race, and area-level SES. Once estimated, the propensity scores were grouped into quintiles. The quintiles were then added as an additional factor to our GEE logistic regression to model completion of chemotherapy as a function of partnered status. Stata 14.2 was used to calculate the average adjusted probabilities via the margins command. SAS software, version 9.4, was used for all other analyses. All statistical tests were two sided with confidence at the 95% level.

RESULTS

Study Population and Data Completeness.

The study flow diagram is shown in Figure 1. In total, 436 patients diagnosed with Stage III colon cancer between 2008-2015 met inclusion criteria. Nearly two-thirds of patients (62%) were partnered. Fifty patients (11%) were widowed and were categorized with other unpartnered patients for these analyses. The majority (65%) were treated in community oncology practices (Table 1). Data were missing due to lack of information in patient medical records with the percentage of missing values ranging from 0.5% for gender to 10% for receipt (or non-receipt) of adjuvant chemotherapy. Overall, 80% of cases were available for complete case multivariable regression of

receipt of chemotherapy. Of those who received chemotherapy, 299 (86%) and 287 (82%) were available for complete case analysis of receipt of multi- vs. single-agent chemotherapy and chemotherapy completion, respectively. Results based on multiple imputation were similar to complete case analysis. Consequently, we show GEE results using complete case data and note where significance differs. Multiple imputation results are included in the Supplemental Table.

Receipt of adjuvant chemotherapy.

Of 392 patients with chemotherapy information available in the medical record, 337 (86%) received adjuvant chemotherapy. There was a non-significant trend towards earlier initiation of adjuvant chemotherapy in partnered patients compared to unpartnered patients (77.8 vs. 86.3 days, p=0.11). In unadjusted analyses patients who were partnered, younger, white, with 0-1 comorbid conditions, with higher area-level SES, with private insurance, without surgical complications, and from study sites 1 and 2 were significantly more likely to receive adjuvant chemotherapy (all $p<0.05$; Table 1). After adjustment, older patients (age 60-70: OR 0.12, 95% CI=0.03-0.52; age >70: OR 0.05, 95% CI=0.01-0.21), those with surgical complications (OR 0.27, 95% CI=0.16-0.48) and those with lower area-level SES (low SES: OR 0.92, 95% CI=0.45-1.91; high SES: OR 3.56, 95% CI=1.54–8.35) had lower odds of receipt of adjuvant chemotherapy (Table 2). While marginally significant in complete case analysis (p=0.08), women had higher odds of receipt of adjuvant chemotherapy (OR 2.06, 95% CI=1.04-4.09) when using multiply imputed data (Supplemental Table).

Receipt of multi-agent chemotherapy.

Of 331 patients with information regarding the specific chemotherapy regimen given, 287 (87%) received multi-agent chemotherapy with their first dose. In unadjusted analyses patients who were younger, had private insurance, had 0-1 comorbid conditions, and from study site 3 were more likely to receive multi-agent chemotherapy (all $p<0.01$ except study site, p=0.03; Table 1). After adjustment, female patients had higher odds of

receipt of multi-agent chemotherapy (OR 2.32, 95% CI=1.16-4.62) (Table 2). Results did not differ substantially between complete case and multiple imputation analyses.

Completion of chemotherapy.

Of 314 patients with information on chemotherapy start and end dates, 204 (65%) completed the course. The median chemotherapy duration was 156 days. In unadjusted analyses patients who were partnered, younger, and had private insurance were more likely to complete chemotherapy (all $p<0.05$). After adjustment, partnered patients had increased odds of completion (OR=1.98, 95% CI 1.04-3.77) (Table 2). To ensure that results were not biased by the 154-day indicator of completion, intervals of 146-151 days were also evaluated with no relevant changes in outcomes. Because there are fewer days (147) in a complete course of capecitabine plus oxaliplatin (CAPOX) than in a course of FOLFOX, we performed a sensitivity analysis excluding the 7 patients who received CAPOX, without significant change in results. Results did not vary meaningfully between complete case and multiple imputation analyses.

Population averaged estimates and propensity score analysis.

The average predicted probabilities for receipt of each of the components of chemotherapy for select age and gender profiles are shown in Table 3. Across all ages and genders, partnered patients had a 13-16% higher probability of completing 6 months of chemotherapy than unpartnered patients. In the propensity score analysis, the association of partnered status and completion of chemotherapy remained significant ($p=0.05$) and unchanged (OR=2.0, 95% CI 1.0-3.9 vs. OR=2.0, 95% CI 1.0-3.8) after multivariable adjustment for all covariates as well as propensity quintile.

DISCUSSION

In this observational study of 436 patients diagnosed with Stage III colon cancer, 65% recruited from community oncology practices, we found that most patients received adjuvant, multi-agent chemotherapy in concordance with guidelines. Early cessation of

chemotherapy, however, was common—35% of patients did not complete the guideline-recommended course of curative-intent adjuvant chemotherapy. Notably, non-clinical factors that have been shown to be associated with differential receipt of cancer care, including age, race, and socioeconomic status, were not associated with early cessation of chemotherapy in our innovative study that also adjusted for partnered status to investigate specific attributes of curative-intent chemotherapy. Being partnered was protective against early cessation of adjuvant chemotherapy, even after adjusting for other important clinical and sociodemographic variables.

There are 2 main theories for the protective effect of being partnered on survival: via economic/financial support, and via social/emotional support.[5] At least 2 studies of marital status and clinical outcomes among patients with cancer have failed to find an association between marital status, SES, and disease-specific outcomes.[9,10] While those in our study in the highest tertile of area-level SES were more likely to receive adjuvant chemotherapy, we did not find significant associations between area-level SES and receipt of multi-agent therapy or completion of therapy.

It therefore seems likely that partnered status is associated with completion of chemotherapy via social and emotional support mechanisms. Though we were unable to identify these attributes in our study, we hypothesize that partners provided the emotional and social support necessary for patients to cope with the physical side effects of chemotherapy. Partners might have provided tangible support such as transportation to and from appointments or help with household responsibilities.[11] In a prior study of caregivers of patients with colorectal and lung cancers, caregivers reported that they watched for side effects of treatment and helped decide when to call a doctor.[12] It is therefore plausible that the partners of patients in our study may have helped patients identify and address with clinicians symptoms such as oxaliplatin-related neuropathy, reducing the possibility that patients stopped chemotherapy early due to untreated side effects. A prior study of patients with prostate cancer found that spouses often valued treatment more than patients themselves did, and were more willing to accept adverse side effects of treatment as a tradeoff for more years of life for the patient.[13] Having a partner may have encouraged the patients in our study to continue and complete curative-intent chemotherapy, even if the patient would have preferred to stop treatment early.

The higher odds of receiving multi-agent chemotherapy in women in our study is intriguing and was unexpected. In patients with advanced cancer, women have demonstrated more accurate understanding of their prognosis and treatment intent compared to men.[14] It is possible that the women in our study had a better understanding of the curative intent of adjuvant chemotherapy and the survival benefit associated with multi-agent chemotherapy compared to single-agent chemotherapy.

Older studies showed a clear detriment to cancer-specific and overall survival when a 6-month course of adjuvant, single-agent fluoropyrimidine was not completed.[7,15] Our study, performed in the modern era of combination therapy with oxaliplatin, should be viewed in parallel with recent analyses from the International Duration Evaluation of Adjuvant therapy (IDEA) collaboration. This study was designed to assess non-inferiority of 3 months of combination chemotherapy compared with 6 months. Non-inferiority was not achieved, although subgroup analyses suggested that 3 months of oral CAPOX was non-inferior for patients with low-risk Stage III disease.[16] Thus, the 2018 NCCN guidelines include options for 3-6 months of adjuvant chemotherapy for low-risk disease.[6] All patients in our study were diagnosed and treated before these recent changes; 6 months of chemotherapy would have been the guideline-recommended course. Furthermore, we found a difference in completion of guideline-concordant care based upon partnered status, an important non-clinical factor that may persist even with shorter durations of therapy. Our findings, therefore, are relevant to clinicians and patients today.

Multiple clinical implications can be drawn from our findings. Future efforts should focus on interventions and support for patients at risk for early cessation of curative-intent chemotherapy. Clinicians could use anticipatory strategies, such as psychosocial needs assessment and distress screening,[17] and include questions about partnered status and availability of support from a partner.[18] Once identified, unpartnered patients could receive encouragement to help complete chemotherapy from clinic- or community-based lay navigators.[19,20] Programs that provide patients with individualized support from trained oncology nurses, such as the private insurer-based Cancer Support Program,[21] are another resource clinicians can leverage to help unpartnered patients complete chemotherapy. Additionally, electronic symptom-monitoring systems that

ascertain chemotherapy-related symptoms and report them to the clinical care team[22] can potentially be used to reduce the possibility that unpartnered patients stop chemotherapy early due to unaddressed side effects. Finally, our findings underscore the important role that partners play in patients' care. Prior work suggests that partners themselves may require more recognition and support from the clinical care team. Clinicians should recognize the patient-partner dyad as the unit of care, provide partners with the information and education needed to understand the care plan, briefly assess partners' needs, and suggest appropriate resources for support.[23]

There are several limitations to our study that warrant mentioning. Though the geographic generalizability of our results may be limited as we studied patients treated in one state, the majority of patients in our study were recruited from community oncology practices, reflecting the fact that the majority of oncology care in the US is delivered in community settings. While our study did include a representative sample of black patients, there were a limited number of other racial and ethnic minority patients and we are unable to draw conclusions based on ethnicity. Because some patients completed chemotherapy outside of the practice where they initiated treatment, we could not reliably ascertain the number of doses received or dose delays that may have occurred. However, our method of ascertaining completion of chemotherapy using the first and last date of administration is one that has been used in previously published studies.[7] To address chemotherapy data missing due to some patients receiving chemotherapy at a different institution than the institution where their surgery was performed or being lost to follow up after surgery, we conducted multiple imputations under the assumption that data were missing at random. Finally, our study was not designed to assess survival outcomes but instead investigated specific details of curative-intent chemotherapy by partnered status, to identify areas of care that may potentially impact patient outcomes and can be targeted for intervention in future studies.

There are potential confounding factors we were unable to identify in our study that warrant further investigation. These include distance to the treatment center and whether or not a patient has children. In addition, future studies should incorporate qualitative data from patients and their partners to identify specific attributes of the patient-partner relationship, such as length and quality of the relationship and the role that

partners play in patient-provider encounters, that may be associated with chemotherapy completion. Additionally, information about other family members or friends who provide instrumental or other support to patients during treatment could be collected.

Despite these limitations, our findings suggest that partnered status plays an independent role in attributes of adjuvant chemotherapy, specifically completion of the guideline-recommended course. Recognition by clinicians and practices that unpartnered patients are at risk for premature chemotherapy cessation may provide opportunities for early intervention with practice-based and lay resources to increase the likelihood that all patients benefit from high-quality, guideline-concordant cancer care.

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Figure 1. Flow of patients into the study and availability of complete case data.

*A patient could have missing data for more than one covariate

Table 1. Patient demographics (N=436) and bivariate analyses of the three primary outcomes						
			Among those who received adjuvant chemotherapy			
	Receipt of adjuvant chemotherapy (N=392 patients with evaluable data)		Receipt of single- vs. multi-agent chemotherapy (N=331 patients with evaluable data)		Completion of 6 months chemotherapy (N=314 patients with evaluable data)	
Patient Characteristic (N, %)	Received adjuvant chemotherapy, N (% received)	P value	Received multi-agent chemotherapy, N (% received)	P value	Completed 6 months of chemotherapy, N (% completed)	P value
Overall (436, 100)	337 (86)		287 (87)		204 (65)	
Partnered Status		0.02		0.20		0.03
Unpartnered (157, 36)	108 (81)		88 (83)		54 (56)	
Married/Partnered (269, 62)	223 (89)		193 (88)		147 (69)	
Missing (10, 2)						
Age		<0.01		<0.01		0.03
<60 (173, 40)	153 (96)		138 (93)		103 (73)	
60-70 (122, 28)	90 (85)		81 (91)		53 (62)	
>70 (141, 32)	94 (74)		68 (73)		48 (56)	
Gender		0.30		0.13		0.76
Male (227, 52)	170 (84)		140 (84)		103 (64)	
Female (207, 47)	166 (88)		146 (90)		101 (66)	
Missing (2, 0.5)						
Race		0.04		0.58		0.65
White (340, 78)	271 (88)		231 (87)		164 64)	

Black (76, 17)	51 (77)		45 (90)		31 (67)	
Other (13, 3)	10 (77)		7 (78)		7 (78)	
Missing (7, 2)						
Area-level SES, by tertile		<0.01		0.15		0.13
Low (151, 35)	102 (80)		87 (88)		58 (63)	
Medium (128, 29)	101 (86)		90 (91)		69 (73)	
High (138, 32)	125 (94)		102 (82)		72 (61)	
Missing (19, 4)						
Health Insurance		<0.01		<0.01		0.03
Private (182, 42)	155 (94)		142 (93)		104 (71)	
Medicare (200, 46)	145 (81)		112 (79)		75 (56)	
Medicaid/State-provided (34, 8)	21 (72)		18 (90)		14 (70)	
None (15, 3)	12 (92)		11 (92)		8 (80)	
Missing (5, 1)						
Comorbid conditions (number)		<0.01		<0.01		0.81
0-1 (197, 45)	169 (94)		152 (92)		103 (66)	
2 or more (239, 55)	168 (79)		135 (82)		101 (64)	
Surgical Complications		<0.01		0.54		0.62
No (308, 71)	261 (91)		224 (87)		161 (66)	
Yes (98, 22)	64 (72)		52 (84)		38 (62)	
Missing (30, 7)						
T Stage		0.70		0.54		0.27
T1-T2 (67, 15)	51 (90)		43 (83)		36 (75)	
T3 (265, 61)	207 (86)		175 (87)		122 (64)	

T4 (100, 23)	76 (85)		68 (89)		45 (62)	
Missing (4, 1)						
N Stage		0.50		0.91		0.73
N1 (285, 65)	220 (85)		186 (87)		135 (66)	
N2 (146, 34)	115 (88)		100 (87)		69 (64)	
Missing (4, 1)						
Study site		0.02		0.03		0.39
Academic (151, 35)	123 (86)		102 (85)		79 (68)	
Community (189, 43)	160 (90)		133 (84)		93 (61)	
Community (96, 22)	54 (76)		52 (98)		32 (70)	

Table 2. Analyses of the three primary outcomes using multivariable generalized estimating equations with logit link, complete case data

		Among those who received adjuvant chemotherapy	
	Receipt of adjuvant chemotherapy	Receipt of single- vs. multi-agent	Completion of 6 months chemotherapy

	(N=348)		chemotherapy (N=299)		(N=287)	
Patient Characteristic	Received adjuvant chemotherapy, OR (95% CI)	P value	Received multi-agent chemotherapy, OR (95% CI)	P value	Completed 6 months of chemotherapy, OR (95% CI)	P value
Partnered Status		0.46		0.18		0.04
Unpartnered	ref		ref		ref	
Married/Partnered	1.29 (0.65-2.58)		1.82 (0.76-4.38)		1.98 (1.04-3.77)	
Age		<0.001		0.06		0.29
<60	ref		ref		ref	
60-70	0.12 (0.03-0.52)		1.12 (0.42-2.97)		0.70 (0.40-1.22)	
>70	0.05 (0.01-0.21)		0.30 (0.10-0.91)		0.57 (0.28-1.15)	
Gender		0.08		0.02		0.37
Male	ref		ref		ref	
Female	2.14 (0.91-5.03)		2.32 (1.16-4.62)		1.28 (0.75-2.18)	
Race		0.18		0.45		0.60
White	ref		ref		ref	
Black	0.49 (0.20-1.17)		0.66 (0.21-2.06)		1.21 (0.58-2.54)	
Other	0.40 (0.12-1.36)		0.39 (0.09-1.75)		2.38 (0.36-15.51)	
Area-level SES, by tertile		<0.01		0.17		0.17
Medium	ref		ref		ref	
High	3.56 (1.54-8.35)		0.50 (0.22-1.14)		0.52 (0.25-1.07)	
Low	0.92 (0.45-1.91)		0.71 (0.20-2.51)		0.65 (0.31-1.37)	
Health Insurance		0.16		0.15		0.30
Private	ref		ref		ref	

Medicare	0.83 (0.35-1.96)		0.41 (0.18-0.92)		0.72 (0.38-1.34)	
Medicaid/State-provided	0.36 (0.14-0.92)		0.60 (0.12-2.85)		1.53 (0.43-5.52)	
None	0.37 (0.04-3.89)		1.17 (0.14-9.57)		2.17 (0.42-11.20)	
Comorbid conditions (number)		0.15		0.22		0.65
0-1	ref		ref		ref	
2 or more	0.35 (0.08-1.45		0.66 (0.33-1.29)		1.20 (0.55-2.61)	
Surgical Complications		<0.001		0.40		0.34
No	ref		ref		ref	
Yes	0.27 (0.16-0.48)		0.67 (0.27-1.70)		0.78 (0.46-1.30)	
T Stage		0.92		0.14		0.12
T1-T2	ref		ref		ref	
T3	0.80 (0.28-2.29)		0.97 (0.41-2.26)		0.48 (0.22-1.03)	
T4	0.81 (0.15-4.35)		2.31 (0.58-9.23)		0.48 (0.22-1.02)	
N Stage		0.66		0.70		0.96
N1	ref		ref		ref	
N2	0.89 (0.51-1.53)		0.88 (0.47-1.65)		1.01 (0.58-1.77)	

Table 3. Differential benefit of being partnered for each attribute of guideline-concordant adjuvant chemotherapy									
	Receipt of adjuvant chemotherapy			Receipt of multi-agent chemotherapy			Completion of 6 months of chemotherapy		
Patient Profile	% unpartnered	% partnered	Differential	% unpartnered	% partnered	Differential	% unpartnered	% partnered	Differential

	achieving outcome	achieving outcome	benefit of being partnered, % (95% CI)	achieving outcome	achieving outcome	benefit of being partnered, % (95% CI)	achieving outcome	achieving outcome	benefit of being partnered, % (95% CI)
Woman <60 years of age	98.4 (96.3, 1.00)	98.7 (96.8, 1.00)	0.4 (-0.5, 0.1)	91.5 (83.4, 99.6)	95.1 (89.2, 1.00)	3.6 (-1.9, 9.0)	58.1 (42.5, 73.7)	71.7 (59.2, 84.2)	13.3 (0.2, 26.3)
Man <60 years of age	96.7 (93.0, 1.00)	97.4 (94.0, 1.00)	0.7 (-1.1, 2.5)	83.0 (72.5, 93.4)	89.6 (82.1, 97.0)	6.6 (-3.5, 16.6)	49.7 (32.4, 67.0)	64.3 (52.9, 75.6)	14.4 (-0.3, 29.1)
Woman age 60-70	90.0 (81.1, 98.8)	91.8 (83.3, 1.00)	1.8 (-3.0, 6.7)	92.3 (84.0, 1.00)	95.6 (90.9, 1.00)	3.2 (-2.7, 9.2)	47.8 (33.1, 62.5)	62.5 (49.1, 75.9)	15.0 (0.1, 28.7)
Man age 60-70	82.6 (73.3, 91.8)	85.4 (77.0, 93.8)	2.8 (-4.9, 10.6)	84.4 (70.5, 98.3)	90.5 (84.0, 97.0)	6.1 (-5.0, 17.2)	39.5 (24.8, 54.1)	54.3 (44.4, 64.1)	15.8 (0.9, 30.6)
Woman >70 years of age	80.9 (70.8, 91.1)	83.9 (74.3, 93.6)	3.0 (-5.2, 11.2)	77.5 (65.6, 89.4)	85.8 (74.6, 97.0)	8.3 (-3.4, 19.9)	33.4 (19.6, 47.2)	47.8 (33.5, 62.1)	15.7 (1.4, 29.9)
Man >70 years of age	69.9 (54.7, 85.0)	73.9 (62.1, 85.7)	4.1 (-7.2, 15.3)	61.7 (42.2, 81.1)	73.5 (57.2, 89.7)	11.8 (-0.06, 29.2)	26.3 (13.1, 39.4)	39.4 (28.5, 50.3)	16.2 (1.2, 31.1)

Data derived from primary analyses based on multivariable logistic regression modeling. Average adjusted probabilities were calculated using pre-selected values of age, gender, and partnered status as shown in the Table. Race, area-level SES, health insurance, comorbid conditions, surgical complications, and T and N stage were included in the model as covariates using their original values.

Figure 1. Flow of patients into the study and availability of complete case data.