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Breast Cancer in Men in the US: A population-based study of diagnosis, treatment and survival

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Abstract

Background—Breast cancer in men is rare, so clinical trials are not practical. Recommendations suggest that men diagnosed with breast cancer be treated using guidelines for postmenopausal women, but there are no population-based studies to evaluate patterns of care.

Methods—To examine characteristics, treatment and survival in men newly diagnosed with breast cancer in 2003and 2004, 512 men were identified from the Surveillance, Epidemiology and End-Results program. Data were re-abstracted and therapy verified through the patients' treating physicians.

Results—The majority (79%) of men were diagnosed through discovery of a breast lump or other signs/symptoms. In men with invasive disease 86% were treated with mastectomy, 37% received chemotherapy, and 58% received hormonal therapy. In multivariate analysis, tumor size (p=0.01) and positive nodes (p <0.0001) were positively associated with the use of chemotherapy; age group (p <0.0001) and not currently married (p=0.01) were negatively associated. In men with invasive ER positive/borderline tumors, the use of tamoxifen or aromatase inhibitors was associated with age group (p=0.05). Among men with invasive disease, cancer mortality was associated with tumor size (p<0.0001). Among men with ER positive/borderline disease increased cancer mortality was associated with tumor size (p<0.0001), not currently married (p=0.04) and decreased mortality with tamoxifen (p=0.04).

Conclusions—Tumor characteristics and marital status were the primary predictors of therapy and cancer mortality. Although AIs are not currently recommended they are commonly prescribed. However, they did not result in a decrease in cancer mortality. Research must examine the efficacy of AI's with and without GnRH analogues.

Introduction

Breast cancer in men is rare, accounting for less than 1% of cancer incidence and mortality among men in the US. By contrast, breast malignancy is the most common cancer diagnosis in women, with rates that are more than 100-fold those of men.1 In 2009 an estimated 1,910 men will be diagnosed with breast cancer and 440 will die of this malignancy.2 Giordano reported a 26% increase in the incidence of male breast cancer in the US between 1973 and 1998.3 Anderson found that this increasing trend in male breast cancer was more pronounced for *in situ* and localized disease.4 Although this shift toward an earlier stage

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could not be explained by improved screening practices, there may be a heightened awareness of male breast cancer. Rates of breast cancer among black men are higher than among white and Asian-Pacific Island men in the US, and breast cancer rates among non-Hispanic men are 50% greater than among Hispanic men.5

Randomized controlled clinical trials of breast cancer therapy in men are not practical given the small number of cases diagnosed annually. As a result, therapy provided to men with breast cancer is based primarily on results from clinical trials in women. The prognostic profile (i.e., nuclear grade and hormone receptor expression) of men with breast cancer was reportedly similar to postmenopausal women.6 In a review of publications from 1942 to 2000, Giordano concluded that the distribution of breast cancer immunohistochemical markers in men and women were generally similar, although men were more often hormone receptor positive, suggesting responsiveness to hormone therapy.7 Indeed, the NCI's Physician Desk Query System and the National Comprehensive Cancer Network (NCCN) recommend similar therapy for men and postmenopausal women with breast cancer.8,9 The objective of this population-based study was to describe the demographic and tumor characteristics of men with breast cancer, to compare their treatment with published guidelines for women and to examine survival in men treated for breast cancer.

Methods

The Surveillance Epidemiology and End Results (SEER) Program is a population based registry system covering about 26% of the population and is generally representative of the US population with slightly more foreign-born and urban individuals. 10 SEER routinely collects information on the diagnosis, tumor characteristics, treatment, and maintains vital status follow-up for all persons diagnosed with cancer in defined geographic regions of the US. Data is primarily collected from hospitals, pathology laboratories, surgical centers, and radiation facilities. Because adjuvant therapy is frequently provided in the outpatient setting and is therefore underreported, the NCI annually conducts patterns of care studies (POC) on a sample of persons with selected cancers.

Men who were 20 years of age or older at diagnosis of first primary breast cancer January 1, 2003 through December 31, 2004 were eligible for inclusion in the investigation. Men were ineligible if they were 1) diagnosed with a prior cancer, except non-melanoma skin cancer; 2) diagnosed at autopsy or on death certificate, 3) diagnosed with a synchronous malignancy, or 4) diagnosed with sarcoma or lymphoma of the breast. A total sample of 500 men, randomly selected, was to be included in the study. There were 100 eligible men registered at participating SEER sites in 2003 and 2004 who were not included in this study. Hospital medical records were re-abstracted for demographic and tumor characteristics and each patient's treating physician were asked to verify the treatment administered. The primary physician was asked to provide the names and addresses of other physicians who might have treated the patient. These physicians were contacted and asked to provide treatment information. Centralized training was conducted for the primary abstractor from each participating registry (areas of Atlanta, Detroit, Los Angeles County, Monterey/ San Jose, San Francisco/Oakland, Seattle-Puget Sound, the remainder of the state of California, and the states of Connecticut, Hawaii, Iowa, Kentucky, Louisiana, New Jersey, New Mexico and Utah) to ensure consistency of abstracting and coding. Marital status was taken from the medical record and individuals married or living as married (cohabitating) were classified as married. All individuals with another marital status were included in the "other" category. Re-excision was recorded only if the original surgery was therapeutic, not a diagnostic procedure. All comorbidities recorded at the hospitalization for the most definitive treatment, usually surgery, were abstracted, coded centrally by a single Registered Health Information Technologist and analyzed using the Charlson score.11 AJCC stage 6th edition

was calculated from data recorded by cancer registries including extension of disease, nodal status and metastasis.12 Estrogen receptor status is routinely collected by SEER as positive, negative, borderline or as some form of unknown Borderline and positive ER status were combined. Human epidermal growth factor receptor-2 (HER-2) status was determined using a combination of the fluorescence *in situ* hybridization (FISH) and immunohistochemistry (IHC), with preference given to FISH, when it was available. Values of 2.3 or higher for FISH and values of 3+ for IHC were classified as positive, less than 1.8 for FISH and 1 for IHC were classified as negative and values between those were classified as equivocal. If the actual values were not report, the note of positive, negative or equivocal was recorded.

Bivariate analyses were performed to determine the association between tumor characteristics and clinical, non-clinical, and treatment variables. Sample weights, calculated as the inverse of the sampling proportion for each sampling stratum (defined by race/ethnicity, registry and year of diagnosis), were used to obtain estimates that are representative of all eligible male breast cancer patients in the study areas. We used the statistical software, SUDAAN, for all data analyses. SUDAAN uses the sample weights to adjust the standard errors appropriately. In a logistic regression model we determined predictors of therapy. Among men with invasive breast we used Cox Proportional Hazards Regression models to analyze cancer cause of death. Follow-up for vital status was available through December 31, 2006. All tests were two-sided and statistical tests were determined to be significant if the p-value was ≤0.05.

Results

A total of 512 men with *in situ* or invasive breast cancer were included in the study. Overall, 11% of the men were diagnosed with *in situ* disease; only 7% were diagnosed with stage IV (Table 1).

Men diagnosed with *in situ* breast cancer were younger than men diagnosed with more advanced disease (Table 1). Among men with invasive breast cancer the mean age was 65 years slightly older than men with *in situ* disease, 60 years; while men with an unknown stage were 71 years. About three-quarters of the men had private insurance and 2% had no insurance. However, those covered by Medicaid or with no insurance tended to be diagnosed at later stages.

Initial diagnosis

The majority of men at all stages discovered a lump or displayed other signs or symptoms, such as dimpling or nipple discharge, that led to the diagnosis of breast cancer (Table 2). Men diagnosed with *in situ* breast cancer were significantly ($p<0.01$) more likely than men with invasive disease to seek medical attention because of signs or symptoms; whereas, men with invasive breast cancer were more likely to discover a lump ($p=0.01$).

Tumor Characteristics

Breast tumors among men tended to be small; 7% of men with invasive disease had tumors >5 cm. (Table 2). When only men with known ER status were included, more than 95% of men with stage I-III disease and 88% of men with stage IV disease were ER positive/borderline (data not shown). More than 80% of the men with invasive breast cancer had a HER2 test performed on their tumor. Excluding men with tumors of unknown HER-2 status, the percentage of men with HER-2 positive tumors was 12% for stage I-III, 16% for stage IV, and 19% for unstaged patients (data not shown).

Surgery and Radiation

Surgery and radiation were influenced by stage of disease (Table 3). Men with stages I-III were more likely ($p<0.05$) to receive a mastectomy than men with *in situ* disease. Men with stage IV were less likely than men with stage I-III ($p<0.001$) to receive a mastectomy. Breast conserving surgery (BCS) was more common among men with *in situ* breast cancer compared to invasive disease ($p<0.01$). Twelve percent of men with *in situ* disease had BCS with radiation and 18% had BCS without radiation. Men with stage IV disease more often received BCS than men with stage I-III, although one-third of men with stage IV disease received no cancer directed surgery.

More men with stage I – III disease received nodal sampling than men with *in situ* or stage IV breast cancer. One-third of men with *in situ* cancer had a nodal dissection, and these were evenly split between axillary and sentinel nodes. Nearly 60% of men with *in situ* disease had a re-excision. As stage increased the percentage of men receiving re-excision decreased (test for trend $p<0.001$).

Chemotherapy and Hormonal Therapy

No man with *in situ* disease received chemotherapy; only 10% received hormonal therapy (Table 4). Tamoxifen was given to 76% of men with stage I-III disease who received hormones exclusively; men with stage IV breast cancer received AIs more often (38%) than men with other stages. Overall, among men who were ER positive/borderline 61% received hormones and 3% refused.

Among men who received chemotherapy, patients with I-III most often received anthracycline in combination with taxanes, 67% (Table 4). Patients with stage IV were most often given taxanes alone or with other chemotherapeutics (94%).

Sixty-six percent of men with positive nodes and ER positive/borderline tumors received chemotherapy with or without hormones (data not shown). Men with negative nodes and ER positive/borderline tumors received hormonal therapy with or without chemotherapy, 63%.

Men whose invasive tumors were ER/PR/HER2-negative were more likely to receive surgery alone, although the sample size was small (N=11) (Table 5). Men with ER-positive, HER2-positive tumors were more likely to receive surgery plus chemotherapy. Only 6% of men with HER-2 positive tumors were given trastuzumab (data not shown). Only 2% of men received bisphosphonates.

The association (risk) of chemotherapy among men with invasive cancer and tamoxifen/aromatase inhibitors (AIs) among men with ER-positive/borderline cancer was modeled by selected clinical and non-clinical factors (Table 6). Men with a tumor size of 2-5 cm had a significantly higher risk of chemotherapy than men with smaller tumors, as did men with positive nodes. Men who were ≥70 years and men who were not married received chemotherapy significantly less often than men in the respective reference categories.

The use of tamoxifen and/or AIs among men who had invasive ER-positive/borderline tumors was also examined. Men were significantly more likely to receive hormone therapy if they were age 50-69.

Cancer Mortality

We examined cancer mortality among men with invasive breast cancer (Table 7). Tumor size was positively associated with cancer mortality ($p<0.0001$). Among men with ER positive/borderline, invasive breast cancer, tumor size, marital status, and tamoxifen were associated with mortality. Cancer mortality was associated with tumor size and was higher

in men who were not currently married. Cancer mortality was significantly lower in men who received tamoxifen (HR 0.04, CI 0.1, 0.99) compared with no hormonal therapy; the use of an AI did not decrease mortality (HR 1.2, CI 0.4, 3.8).

Discussion

We examined the patterns of care for male breast cancer patients diagnosed in 2003 and 2004 in a population-based sample of men treated in communities throughout the United States. The majority of men with breast cancer received a mastectomy and nearly 60% received hormonal therapy. In multivariate models, the use of chemotherapy among men with invasive breast cancer was influenced by tumor characteristics, age and marital status. Larger tumors and being currently unmarried was associated with an increased mortality in men with ER positive/borderline invasive tumors. The use of tamoxifen decreased the risk of death from cancer. However, there was no decrease in mortality in men who received AIs.

Yabroff reported that 52% of women diagnosed with invasive breast cancer were diagnosed on mammography.13 Mammography is not a screening tool used for men; self-discovered lumps were a primary form of detection among men with *in situ* and invasive breast cancer. In contrast, women with DCIS are usually screen detected.14 Giordano reported that majority of the men, between 50% and 97%, presented with a breast mass.7

Mastectomy for men with *in situ* and invasive disease was most common. Although men with stage IV were less likely to receive a mastectomy than men with stages I-III, surgery is unlikely to be curative in men with stage IV disease. The NCCN guidelines suggest that men with breast cancer should be treated using the guidelines for post-menopausal women with consideration of patient preference.9 Men have less breast tissue than women and the involved tissue is smaller, therefore surgical margins may also be smaller. Re-excision was performed more frequently in men with *in situ* than in men with invasive disease. It is possible that the surgeons were trying to obtain an adequate margin and because of the small tumor size and lack of definition of the tumor it required re-excision.15

In a British Columbia study of men and women with breast cancer, men receiving mastectomies were more likely to be treated with radiation than were women.16 Men in the current study were also more likely to receive radiation following a mastectomy than were women registered in SEER and diagnosed at the same stage and years, and treated with mastectomy.

Approximately one-third of men with *in situ* carcinoma had nodal surgical procedures. Since nodal dissection is not indicated in DCIS for women, this may represent an overuse with the associated risks of the nodal procedure itself including lymphedema. However, 14 of 17 men who had a nodal surgical procedure had a mastectomy, considered an acceptable option.9

The use of sentinel node biopsy has not been well studied in men with breast cancer. In the current study nearly 36% of men with invasive breast cancer who had a sentinel node biopsy had at least one positive node. While Rushby found in a study of 31 men with breast cancer 61% of the sentinel nodes were positive,17 a study by Boughey reported a rate of 37%.18

Male breast cancer is largely hormone-receptor positive.7,19 Giordano reported that 81% of men had ER positive tumors, similar to this study, (83%).7 Nearly 64% of women with early stage breast cancer have ER-positive tumors, substantially lower than reported for men.20 Giordano also reported that about 37% of men overexpressed HER2, much higher than observed in our data. 7 Men with stage III breast cancer had the highest percentage of HER2-overexpression, but this was less than half that reported by Giordano, although our

data are more recent and included a combination of IHC and FISH tests. This difference in hormone receptor status between men and women in breast cancer phenotype is likely related to meaningful biological variation.

Perou identified 2 subtypes of hormone receptor positive female breast cancer that have very different prognosis.21 An unanswered question is whether male breast cancer has a molecular profile similar to female hormone positive-breast cancer or whether males develop a unique subtype of hormone receptor positive breast cancer. Even if the molecular profile of male breast cancer is identical to that of female breast cancer, the hormonal milieu in men cannot be assumed to be the same as in post-menopausal women. For systemic treatment, tamoxifen is a mainstay of therapy. With the publication of studies that show a small improvement in disease free survival,22،23،24،25 AIs have become recommended adjuvant treatment in post-menopausal women.26 The current study indicates that AIs are also being used in men either as sole initial therapy or after tamoxifen. However, AIs are not the standard of care and the endocrine physiology of men and women differ; this is one instance where treating hormone positive breast cancer in men as one would in women is not scientifically supported. The hormonal effects of AIs in men have not been adequately studied. The NCCN guidelines suggest that treatment of male breast cancer should be similar to that for post-menopausal breast cancer except that the use of AIs “is ineffective without concomitant suppress of testicular steroidogenesis.” 9 A trial of AIs in healthy men demonstrating a marked increase in circulating testosterone with only a 50% decrease in estradiol is consistent with this hypothesis.27 Therefore, the benefits of AIs alone in the treatment of male breast cancer should not be extrapolated from data in females as the efficacy may vary. Some investigators have suggested administering a gonadotropin-releasing hormone concurrently with an AI in men with breast cancer, but this requires further study.28 The decrease in mortality observed with tamoxifen and the lack of a mortality decrease in men treated with an AI supports the use of tamoxifen as the hormonal agent of choice in men with breast cancer. AI should not be used for the treatment of men with breast cancer outside the context of a clinical trial. The use of AIs in men in the present study suggests that additional research into the role and effect of AIs in men with breast cancer is urgently needed.

Almost 10% of men with DCIS received tamoxifen. There are no data to support the use of tamoxifen in men with *in situ* breast cancer. In 2000 72% of women with node negative, ER positive invasive early stage breast cancer received tamoxifen,15 about 10% more than received hormonal therapy in this male breast cancer cohort.

Few men in this study received trastuzumab. However, trastuzumab was only approved by the Federal Drug Administration for use in metastatic disease during the study period. Approval for early stage disease was not granted until November 2006.

The factors associated with chemotherapy use were those associated with prognosis. Men with an increased risk of recurrence were more likely to receive chemotherapy. Approximately 65% of women diagnosed with positive nodes and ER positive early stage breast cancer received chemotherapy 15 compared to 66% of men diagnosed at stages I-III positive nodes and ER positive/borderline tumors.The chemotherapy regimens were similar to those used in women, with anthracycline- and taxane-based regimens preferred. In addition, married men were more likely to receive chemotherapy than men who were single, widowed, divorced or separated. This “marriage” effect has been noted in other studies, but is not well understood.29،30 Perhaps it is due to the increased social support of married individuals.

The study has several limitations. Orchiectomy as a treatment option cannot be ruled out. We do not expect that orchiectomy was a major therapy for male breast cancer in 2003-2004. We did not have physician specialties which might influence therapeutic decision-making. Patient preference for therapy was unknown, although we did know whether specific treatments were refused by the patient. Follow-up time was relatively short, especially for the early stage patients, a maximum of 47 months. This may limit the findings from the mortality data.

Notwithstanding these limitations, this population-based study among men with breast cancer representing communities across the US provides a unique perspective on the treatment of this uncommon malignancy. POC studies are helpful in evaluating dissemination of clinical trials into the community practice, treatment patterns across racial/ethnic and socioeconomic groups and community practice for the treatment of rare tumors, such as male breast cancer, for which there are no evidence based treatment recommendations. Future POC studies should address: 1) AI's with and without GnRH analogues 2) non-anthracycline, 3) molecular profiling tools, 4) hormonal therapy alone, especially lymph node negative breast cancer, 5) biological therapies and 6) the risk of osteoporosis and the use of bisphosphonates.

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Table 1

Demographic and Hospital Characteristics for Men Diagnosed with Breast Cancer, 2003-2004

Total	In-situ Wt % (n) 11% (58)	Stage I-III Wt % (n) 77% (392)	Stage IV Wt % (n) 7% (36)	Unknown stage Wt % (n) 5% (26)
Age at diagnosis				
<50	22(14)	10 (39)	10 (4)	8 (2)
50-59	35 (20)	21 (83)	32 (11)	15 (4)
60-69	18 (11)	28 (107)	30 (11)	26 (7)
70-79	18 (9)	24 (97)	23 (8)	4 (1)
80+	7 (4)	17 (66)	5 (2)	47 (12)
Mean Age at diagnosis	60	66	62	71
Race/Ethnicity				
White	71 (41)	79 (308)	81 (29)	86 (22)
Black	15 (8)	12 (47)	12 (4)	7 (2)
Hispanic	6 (4)	6 (24)	7 (3)	3 (1)
Asian	9 (5)	3 (13)	0	3 (1)
Marital status at diagnosis				
Married/living as	71 (40)	69 (270)	59 (21)	66 (17)
Other	29 (18)	31 (122)	41 (15)	34 (9)
Charlson Comorbidity Score				
0	75 (43)	73 (285)	77 (27)	87 (23)
1	23 (14)	21 (82)	17 (7)	7 (2)
2+	1 (1)	6 (25)	6 (2)	6 (1)
Insurance				
Private	74 (45)	78 (308)	64 (23)	54 (14)
Any Medicaid	6 (3)	7 (29)	16 (6)	10 (3)
Medicare only	15 (8)	11 (42)	11 (4)	21 (5)
No insurance	1 (1)	1 (5)	9 (3)	4 (1)
Unknown	3 (1)	2 (8)	0	11 (3)
Hospital Bed				
<200, OPD	28 (15)	24 (95)	36 (13)	46 (12)
200-299	20 (12)	25 (98)	18 (7)	23 (6)
300-399	24 (14)	17 (67)	18 (6)	11 (3)
400+	29 (17)	32 (130)	27 (10)	20 (5)
Unknown	0	0 (2)	0	0
Residency Training Program				
No/Unknown	42 (25)	55 (216)	50 (18)	48 (13)
Yes	58 (33)	45 (176)	50 (18)	52 (13)
Vital Status				
Alive	97 (56)	86 (337)	35 (13)	79 (21)
Deceased	3 (2)	14 (55)	65 (23)	21 (5)
Median months of survival*	*τ*	*τ*	22.5	*τ*

Total	In-situ Wt % (n) 11% (58)	Stage I-III Wt % (n) 77% (392)	Stage IV Wt % (n) 7% (36)	Unknown stage Wt % (n) 5% (26)
Median number of months of follow-up	36.0	34.0	19.0	34.0

*All causes of death

τMedian has not yet been reached

Table 2

Clinical Characteristics of Men Diagnosed with Breast Cancer, 2003-2004

	In-situ Wt % (n)	Stage I-III Wt % (n)	Stage IV Wt % (n)	Unknown stage Wt % (n)
Initial Diagnosis				
Signs/symptoms	40 (22)	15 (59)	19 (7)	11 (3)
Physician physical exam	7 (4)	9 (43)	11 (4)	4 (1)
Self discovered lump	40 (25)	61 (241)	45 (16)	58 (15)
Mammography	0	0 (1)	0	0
Spouse or partner	0	2 (7)	0	4 (1)
Other specify	2 (1)	2 (8)	13 (5)	0
Unknown	11 (6)	11 (42)	12 (4)	22 (6)
Tumor Size				
<1 cm	33 (18)	11 (42)	2 (1)	0
1-1.9 cm	21 (12)	36 (142)	13 (5)	30 (8)
2-2.9 cm	11 (7)	32 (125)	21 (8)	11 (3)
3-4.9 cm	6 (4)	14 (56)	33 (11)	25 (6)
5+ cm	3 (2)	7 (26)	17 (6)	0
Unknown	26 (15)	0 (1)	14 (5)	33 (9)
Mean size (cm)	1.5	2.2	3.4	2.3
ER Status				
Not done	43 (25)	5 (20)	5 (2)	8 (2)
Positive/Borderline	30 (17)	84 (328)	76 (27)	77 (20)
Negative	2 (1)	3 (11)	11 (4)	0
Unknown/not in chart	25 (15)	9 (33)	8 (3)	15 (4)
Combined FISH/IHC HER-2				
Negative	13 (8)	67 (262)	68 (24)	45 (12)
Positive	1 (1)	10 (37)	13 (3)	17 (4)
Equivocal	0	5 (21)	0	11 (3)
Not done	72 (41)	10 (39)	19 (7)	11 (3)
Unknown	14 (8)	8 (33)	0	19 (5)

Table 3

Surgical Therapy Received by Men Diagnosed with Invasive Breast Cancer, 2003-2004

	In-situ Wt % (n)	Stage I-III Wt % (n)	Stage IV Wt % (n)	Unknown stage Wt% (n)
Type of Surgery				
No surgery	3 (2)	2 (7)	34 (13)	11 (3)
BCS with radiation	12 (7)	3 (12)	11 (3)	8 (2)
BCS no radiation	18 (11)	5 (19)	13 (5)	0
Mastectomy & radiation	1 (1)	25 (97)	16 (6)	19 (5)
Mastectomy no radiation	66 (37)	65 (256)	26 (9)	62 (16)
Surgery, NOS*	0	0 (1)	0	0
Type of Nodal Sampling				
No nodal dissection	67 (41)	8 (31)	58 (22)	36 (9)
Axillary dissection only	14 (8)	51 (199)	40 (13)	37 (10)
Sentinel node only	14 (7)	18 (69)	3 (1)	8 (2)
Sentinel node followed by axillary node dissection	5 (2)	23 (91)	0	8 (2)
Axillary & internal mammary	0	0 (1)	0	0
Unknown/Not stated	0	0 (1)	0	11 (3)
Number Positive Nodes				
None	33 (17)	54 (209)	9 (3)	37 (10)
1-3	0	25 (98)	16 (5)	19 (5)
4-9	0	9 (34)	4 (1)	0
10+	0	5 (19)	8 (3)	0
Positive nodes, number unknown	0	0 (1)	6 (2)	0
No nodes examined	67(41)	8 (31)	58 (22)	44 (11)
Mean number positive	0	1.7	5.7	0.5
Pathological margins				
No segmental resection	52 (30)	52 (202)	49 (18)	59 (15)
Margins free of tumor	35 (20)	39 (153)	26 (9)	30 (8)
Tumor at margins	8 (5)	6 (25)	8 (3)	4 (1)
Margins not stated	2 (1)	1 (4)	0	0
Resection recommended, unk if done	0	0 (1)	0	0
Unknown, not stated	3 (2)	2 (7)	17 (6)	7 (2)
Re-excision				
No	41 (25)	60 (234)	83 (30)	63 (16)
Yes	59 (33)	40 (158)	17 (6)	37 (10)

*Not otherwise specified

Table 4

Distribution of Therapies for Men Diagnosed with Invasive Male Breast Cancer 2003-2004

	In-situ Wt % (n)	Stage I-III Wt % (n)	Stage IV Wt% (n)	Unknown stage Wt% (n)
Therapy				
No adjuvant therapy	90 (52)	30 (120)	23 (8)	53 (14)
Chemotherapy only	0	10 (36)	24 (8)	4 (1)
Chemotherapy + hormone	0	29 (112)	19 (7)	16 (4)
Hormone only	10 (6)	31 (124)	34 (13)	27 (7)
Hormones only				
Tamoxifen	100 (6)	76 (95)	30 (4)	72 (5)
Aromatase Inhibitor	0	15 (19)	38 (5)	28 (2)
Tamoxifen + AI	0	7 (8)	25 (3)	0
Other Hormones	0	2 (2)	7 (1)	0
Chemotherapeutic Agents				
Anthracycline + taxane (+/- other chemo)		46 (67)	12 (2)	20 (1)
Anthracycline + other chemo (not taxane)		34 (51)	0	80 (4)
Taxane + other chemo (not anthracycline)		3 (23)	57 (8)	0
Other chemo (not anthracycline or taxane)		15 (23)	6 (1)	0
Anthracycline only		1 (2)	0	0
Taxane only		1 (1)	25 (4)	0

Table 5

Distribution of Therapy by Hormonal Status for Men Diagnosed with Invasive Breast Cancer, 2003-2004

	ER /PR Negative	ER+/-PR Positive			ER/PR Unknown		
	Her2 Negative n=11 Wt %	Her2 Negative n=265 Wt %	Her2 Positive n=39 Wt %	Her2 Unknown n=71 Wt %	Her2 Negative n=19 Wt %	Her2 Unknown n=40 Wt %	Other combinations n=9 Wt %
Surgery only	54	26	16	33	58	44	31
Surgery plus							
Chemotherapy	37	7	22	11	4	7	10
Tamoxifen	0	24	10	26	13	15	32
AI	0	6	5	2	5	3	15
Chemo + tamoxifen	0	24	28	21	0	13	12
Chemo + AI	9	5	7	1	0	0	0
Chemo + tamoxifen + AI	0	1	2	1	0	3	0
Tamoxifen + AI	0	2	3	1	5	5	0
Other	0	4	7	1	14	3	0
No surgery/chemo/hormone	0	0	0	1	0	7	0

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Table 6

Association of Clinical and Non-Clinical Factors to Chemotherapy in Men with Invasive Breast Cancer and to Tamoxifen or Aromatase Inhibitors in Men with Estrogen Receptor Positive Invasive Tumors

	Invasive tumors Chemotherapy				ER positive/borderline tumors Tamoxifen or Aromatase Inhibitor			
			95% CI				95% CI	
	p-value	OR	LL	UL	p-value	OR	LL	UL
Tumor Size	**<0.01**				0.74			
<2 cm		1.0				1.0		
2-<5cm		2.5	1.5	4.3		0.9	0.6	1.5
5+ cm		1.7	0.6	5.3		1.3	0.4	3.9
Nodal status	**<0.0001**				0.22			
Positive nodes		1.0				1.0		
Negative/other		0.2	0.1	0.3		0.7	0.4	1.2
Estrogen Receptor status	0.06							
Positive/borderline		1.0						
Negative/other		0.5	0.2	1.0				
Charlson Score	0.73				0.65			
Zero		1.0				1.0		
1+		0.9	0.5	1.6		0.9	0.5	1.5
Age	**<0.0001**				**0.05**			
<50		1.0				1.0		
50-59		1.1	0.4	2.8		2.9	1.2	7
60-69		0.8	0.3	1.9		2.3	1.03	5.4
70-79		0.3	0.1	0.8		2.3	0.95	5.5
80+		0.03	0.01	0.1		1.2	0.5	3
Race/ethnicity	0.78				0.23			
Non-Hispanic White		1.0				1.0		
Non-Hispanic Black		0.8	0.4	1.7		0.8	0.4	1.6
Other		0.8	0.4	1.9		1.8	0.8	3.9
Marital Status	**<0.01**				0.79			
Married		1.0				1		
Not married		0.4	0.2	0.8		1.1	0.6	1.8

		Invasive tumors Chemotherapy				ER positive/borderline tumors Tamoxifen or Aromatase Inhibitor		
			95% CI				95% CI	
	p-value	OR	LL	UL	p-value	OR	LL	UL
Insurance	0.07				0.24			
Private		1.0				1.0		
Any Medicaid		1.5	0.6	3.9		0.5	0.2	1.4
Medicare only		2.6	1.2	5.8		1.1	0.5	2.2
No insurance/Unknown		0.6	0.2	2.1		0.4	0.1	1.2
Residency training	0.08				0.07			
No/unknown		1.0				1.0		
Yes		0.6	0.4	1.1		1.6	0.96	2.6
Hospital bed size	0.46				0.3			
<200, OPD		1.0				1.0		
200-299		1.0	0.5	2.0		0.8	0.4	1.6
300-399		0.8	0.4	1.7		0.9	0.4	1.9
400-499		1.6	0.7	3.7		1.9	0.9	4.0
500+		0.8	0.4	1.9		1.3	0.6	2.7

Table 7

Risk of Death from Any Cancer for Men with Invasive Breast Cancer and for Men with Estrogen Receptor Positive Invasive Tumors

	Invasive tumors				ER positive/borderline tumors			
			95% CI				95% CI	
	p-value	HR	LL	UL	p-value	HR	LL	UL
Tumor Size	**<0.0001**				**<0.0001**			
<2 cm		1.0				1.0		
2-5 cm		10.7	2.5	45.7		16.3	2.1	125.5
5+ cm		84.2	17.6	402.4		107.5	12.1	956
Nodal status	0.16				0.19			
Positive		1.0				1.0		
Negative/other		0.6	0.2	1.2		0.5	0.2	1.4
ER status	0.30				--			
Positive/borderline		1.0						
Negative/other		1.6	0.7	3.6				
Age	0.18				0.57			
<50		1.0				1.0		
50-59		2.0	0.5	7.8		1.5	0.3	7.3
60-69		4.4	1.2	15.8		2.4	0.6	9.8
70-79		3.9	0.9	16.7		3.0	0.6	14.7
80+		4.6	0.9	23.2		4.9	0.7	33.3
Race/ethnicity	0.31				0.54			
Non-hispanic White		1.0				1.0		
Non-hispanic Black		0.4	0.1	1.3		0.5	0.1	1.8
Other		0.9	0.3	2.7		1.0	0.3	3.8
Marital Status	0.08				**0.04**			
Married		1.0				1.0		
Not married		1.8	0.9	3.5		2.3	1.03	5.1
Chemotherapy	0.63				0.93			
Yes		1.0				1.0		
No/ unknown		1.2	0.6	2.3		1.0	0.4	2.6
Tamoxifen/ Aromatase inhibitors	--				**0.04**			

	Invasive tumors				ER positive/borderline tumors			
		95% CI				95% CI		
	p-value	HR	LL	UL	p-value	HR	LL	UL
Neither						1.0		
Any tamoxifen						0.4	0.1	0.99
Aromatase inhibitors only						1.2	0.4	3.8