Published in final edited form as:

Breast Cancer Res Treat. 2018 April ; 168(2): 501–511. doi:10.1007/s10549-017-4615-8.

Analysis of breast cancer in young women in the Department of Defense (DOD) database

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Abstract

Purpose—Breast tumors from young women under the age of 40 account for approximately 7% of cases and have a poor prognosis independent of established prognostic factors. We evaluated the patient population served by the Military Health System, where a disproportionate number of breast cancer cases in young women are seen and treated in a single universal coverage healthcare system.

Methods—The Military Health System Repository and the DoD Central Registration databases were used to identify female breast cancer patients diagnosed or treated at military treatment facilities from 1998 to 2007.

Results—10,066 women were diagnosed with invasive breast cancer at DoD facilities from 1998 to 2007, of which 11.3% (1139), 23.4% (2355) and 65.2% (6572) were < 40, 40–49 and > 50 years old (yo), respectively, at diagnosis. 53% in the < 40 yo cohort were white, 25% were African American (AA) and 8% were Hispanic, with 14% undisclosed. Breast cancer in women diagnosed < 40 yo was more high grade ($p < 0.0001$), Stage II ($p < 0.0001$) and ER negative ($p < 0.0001$). There was a higher rate of bilateral mastectomies among the women < 40 compared to those 40–49 and > 50 (18.4% vs. 9.1% and 5.0%, respectively). Independent of disease stage, chemotherapy was given more frequently to < 40 yo (90.43%) and 40–49 yo (81.44%) than 50 yo (53.71%). The 10-year overall survival of younger women was similar to the 50 yo cohort. Outcomes in the African American and Hispanic subpopulations were comparable to the overall cohort.

Conflicts of interest

The authors declare they have no competing interests.

Conclusion—Younger women had a similar overall survival rate to older women despite receiving more aggressive treatment.

Keywords

Breast; Cancer; Young; Predictors; Age; African-American; Hispanic

Introduction

Breast cancer is the most prevalent cancer in women in the USA, with 252,710 new diagnoses estimated for 2017 [1]. Women younger than 40 years old (< 40 yo) at diagnosis account for approximately 7% of breast cancer patients in developed countries [2]. Breast tumors in young women have been linked to worse prognosis [3–7]. Other studies have used patient ages ranging from 30 to 50 yo as a cutoff for “young” status with similar findings [8–10]; among the range of cutoff points, the youngest patients tended to have particularly bad outcomes [4, 11–14]. Breast tumors in young women are often hormone-receptor (HR) negative or HER2 positive, with histological grade 3 and nodal involvement at diagnosis [5, 7, 9, 11, 15–18]. In addition, a higher percentage of young breast cancer patients are AA; the AA young patients may have more triple-negative tumors and a worse outcome [12, 19–22]. Multivariate analyses demonstrated young age as an independent predictor of poor outcome [3, 4, 10, 12, 13, 23]. Most published studies are based on a small number of patients and incomplete follow-up. Furthermore, there are potential disparities in treatment and access to care for young women with breast cancer. Young adults may be more likely to have no health insurance and, therefore, diagnosed later and this may contribute to poor outcomes for young patients with cancer [24].

In this study, we report an analysis of young breast cancer patients treated at military treatment facilities between 1998 and 2007. The patient population served by the military treatment facilities DoD is unique in two respects: it has a disproportionate number of young women, and the access of the DoD population to health care is both universal and similar in quality for all participants. In this study, we investigated the clinical features of breast cancer in young women treated in the DoD healthcare system, and tracked characteristics of their treatment and outcomes compared with those of older patients. Our data not only confirm reported trends in tumor characteristics, but demonstrate that aggressively treated young patients fail to obtain better outcomes than their older comparators.

Methods

Patient population

For this study, databases of Military Health System Data Repository (MDR) and Department of Defense Central Registration (DoD CCR) were analyzed. Female subjects diagnosed with invasive breast cancer between January 1, 1998 and December 31, 2007 were included in this study. Subjects with multiple primary tumors, within the breast or other sites, and subjects with unknown age were excluded. Information regarding demographics, tumor characteristics at diagnosis, treatment and follow-up data were collected.

Subjects were divided in three different groups: < 40, 40–49, and ≥ 50 yo, based on their age at diagnosis, for comparisons. Because the patients 40–49 yo formed a heterogeneous group of premenopausal, perimenopause and postmenopausal women, it could influence largely prognostic, treatment and outcomes data. For this reason, we evaluated this group separately, as a transitional group.

Study variables

Demographic and tumor variables were obtained from the DoD CCR and included race/ethnicity, year of diagnosis, tumor stage at diagnosis, tumor grade, estrogen receptor (ER) status, and progesterone receptor (PR) status. Tumor stage was determined per the American Joint Committee on Cancer staging guidelines and categorized as stage I, stage II, stage III, stage IV, and unknown stage. Tumor grade was classified as grade I, grade II, grade III, and unknown grade. ER and PR status were both categorized as positive, or unknown. However, HER2 analysis was not consistently available in this database from 1998 to 2007.

Treatment variables included surgery, chemotherapy, and hormonal therapy. Surgical procedures included breast conserving surgery, unilateral mastectomy, and bilateral mastectomy. Receipt of chemotherapy was derived based on all chemotherapy drugs commonly used for the treatment of breast cancer. Hormonal therapy was defined based on receipt of tamoxifen, anastrozole, letrozole, exemestane, or ovarian ablation.

Breast cancer recurrence status was defined as microscopically confirmed, non-microscopically confirmed, unknown confirmation, or no recurrence. Recurrence status was further grouped into recurrence and no recurrence based on the above groups. Survival time was calculated as the difference between the date of breast cancer diagnosis and the date of death (any cause) for deceased subjects. For subjects that did not die during follow-up, survival time was censored at the date of last contact or the end of the study (December 31, 2007), whichever was more recent. Disease-free survival (DFS) information and cause of death were not available for extraction in the database, therefore, not allowing us to determine disease-specific survival.

Statistical methods

We first compared the distribution of demographic and tumor variables by age category and assessed their significance based on Chi-square tests. The fraction of subjects in each age group that received hormonal therapy, chemotherapy, or surgery were also compared using Chi-square tests. Overall survival of subjects in each age group were compared using Kaplan-Meier plots and Log-Rank test statistics. Univariable and Multivariable Cox proportional hazard models were also used to assess overall survival. Survival analyses were also conducted stratified by stage at diagnosis. All statistical analyses were performed using SAS version 9.3 (SAS Institute Inc, Cary, NC). All tests were two-sided with α set at 0.05.

Results

Demographics

A total of 10,066 women were identified with the diagnosis of breast cancer in the DoD facilities between 1998 and 2007 (Table 1). The age distribution showed that most of the group (65.3%) were ≥ 50 yo, followed by 23.5% with 40–49 yo, and 11.3% < 40 yo. Overall, the cohort was predominantly composed of White females (64%), followed by AA females (14%), and Hispanic females (5.5%). However, the distribution of race or ethnicity in the pre-determined age groups revealed that the proportion of White females increased with age (52.6% of the < 40 yo, 58% of the 40–49 yo, and 68% of the ≥ 50 yo), with statistical significance ($p < 0.0001$). Conversely, AA and Hispanic women were proportionally overrepresented in the younger groups when compared to the older (respectively, 25.2% of < 40 yo, 19.3% of 40–49 yo, and 10.6% of ≥ 50 yo for AA women; and 7.9% of < 40 yo, 6.4% of 40–49 yo, and 4.8% of ≥ 50 yo for Hispanic women) (Table 1).

Baseline tumor characteristics and prognostic factors

In the whole cohort, most women (83.9%) were diagnosed in early stages of disease, Stages I and II (Table 1). However, women < 40 yo were most commonly diagnosed with Stage II disease (45.3%) while women ≥ 50 yo were most commonly diagnosed with Stage I disease (52.4%). Stage III disease at diagnosis was almost double in the < 40 yo group (16.5%) as compared to the ≥ 50 yo group (8.4%), with the 40–49 yo group intermediate. Metastatic disease at diagnosis was seen in 2.5–4.8% of patients, a small percentage through all age groups (Table 1, Fig. 1a).

Tumor grade characteristics also showed differences with patient age at diagnosis (Table 1, Fig. 1b). Overall, 20.4% of tumors were grade I, 35.7% were grade II, and 30.2% were grade III (grade was unknown in 13.5% of patients). High-grade tumors were significantly more frequent in the younger cohort (< 40 yo) compared to the older groups (40–49 and ≥ 50 yo), with 49.5% versus 34.7 and 25.2%, respectively, for Grade III.

Across age groups, most patients presented HR-positive tumors (ER-positive or PR-positive) (Table 1, Fig. 1c). Nevertheless, the < 40 yo group had proportionally less ER-positive tumors (49% versus 61 and 67% in the 40–49 and ≥ 50 yo, respectively). HER2 status was not uniformly obtained during the enrollment period.

Treatment

Surgical treatment was performed in most patients (97.3%). A slight, but statistically significant higher rate of surgeries occurred in younger and midrange patients when compared to ≥ 50 yo group (98.4% and 98.1% vs. 96.8%, ($p < 0.0001$)) (Table 2). The major contributor to this difference lies in those women presenting with Stage IV disease, where rates of surgery were 90.9% in < 40 yo, as compared to 85.0% in the 40–49 yo and 62.1% in the ≥ 50 yo ($p < 0.0001$). In addition, the type of surgery varied by age at diagnosis. Mastectomies (67.15% vs. 55 and 52%) and bilateral mastectomies (7.81% vs. 3.27 and 1.42%) were performed significantly more often in the < 40 yo group when compared to 40–49 yo and ≥ 50 yo groups (Fig. 2).

Women < 40 yo also were more likely to be treated with chemotherapy (Fig. 3). Chemotherapy was given significantly more often to < 40 yo (90.43%), than 40–49 yo (81.44%) or 50 yo (53.71%) (Fig. 3a). Figure 3a graphs chemotherapy treatment by Stage at diagnosis. While the proportion of patients receiving chemotherapy was greater in the < 40 yo group than the 50 yo group at all stages, the greatest difference was observed in Stage 1 patients. These early stage patients were given chemotherapy over twice as often if < 40 yo compared to 50 yo. For stages II-IV, chemotherapy administration was almost universal in younger women (< 40 and 40–49 yo).

For the youngest patients (< 40 yo), chemotherapy was administered comparably to those with HR negative and HR positive disease (Fig. 3b). In this young group, almost double the number of very young patients with HR positive tumors received chemotherapy as compared to the oldest group, suggesting a lack of reliance on hormonal therapy in the younger patients. Roughly, only slightly more than half (~ 56%) of the patients with HR positive disease received hormonal therapy, with same distribution between age groups (Fig. 3b). Interestingly, when we looked at hormonal therapy given independently of HR status, older patients received it more frequently than < 40 yo (44.08% for 50 yo, 40.9% for 40–49 yo vs. 36.35% for < 40 yo, $p < 0.001$). The data indicate a reliance on chemotherapy for breast cancer patients < 40 yo, and to only a slightly lesser extent, those 40–49, even with low stage disease or HR positive disease. We attempted to analyze the drugs given to this population, but were unsuccessful due to multiple factors including the inability of different databases to interact, and use of both generic and trade drug names (data not shown).

Outcomes

Figure 4 plots two key aspects of patient outcomes, recurrence rates and overall patient survival. Despite more aggressive treatment, women < 40 yo developed breast cancer recurrence more frequently than women 50 yo. Of the 10,666 patients, 1161 (11.5%) women had some form of recurrence of the breast cancer during follow-up. In women < 40 yo, 15.1% presented recurrence of disease, while 50 yo had 10.8% of recurrence ($p < 0.001$) (Fig. 4a). Overall survival during the analyzed period was comparable between < 40 and 50 yo, 13.8 and 14.3%, respectively. The 40–49 yo group of women appeared to do better, with a significantly lower mortality of 8.5%, $p < 0.0001$ (Fig. 4b). After adjustment for race, tumor stage and grade, diagnosis year, and cancer treatments, the hazard ratios were 0.74 (95% confidence interval (CI) 0.60–0.91) and 1.36 (95 CI 1.14–1.62) for 40–49 and 50 years or older, respectively, compared to the younger group.

AA and Hispanic subgroups

A strength of this retrospective study is the inclusion of significant numbers of AA and Hispanic women. AA are 14% and Hispanics are 5.5% of all patients analyzed here. Younger patients are more common in the AA and Hispanics subgroups, with 52% patients being < 50 yo (20% are < 40 yo) in the AA, and 43% patients being < 50 yo (16.2% are < 40 yo) in the Hispanics group, while only 30% in the overall cohort are < 50 yo (11.3% are < 40 yo). Figures 5 and 6 detail tumor, treatment and outcome characteristics for these subpopulations.

AA and Hispanic subpopulations presented similar distribution to the overall population in terms of stage, tumor grade, chemotherapy and final surgical treatment (Figs. 5, 6a–f). Proportionally, less AA women had HR positive disease in all age groups when compared to the Hispanics and total cohort (HR positive disease in 45% of < 40 yo, 50% of 40–49 yo, and 59% of ≥ 50 yo in AAs vs. 42% of < 40 yo, 63% of 40–49 yo, and 70% of ≥ 50 yo in Hispanics, and 49% of < 40 yo, 61% of 40–49 yo, and 67% of ≥ 50 yo overall). Both AA and Hispanics had more breast conserving surgery (70%) in younger patients, as opposed to 51% seen in the overall cohort. The incidence of mastectomies (unilateral and bilateral) increased in AA < 40 yo, but not in the Hispanic subpopulation. AA, Hispanics and the overall cohort were concordant in that more chemotherapy was given to the younger patients, independently of stage of disease (Figs. 3a, 5e, 6e, respectively). However, in the Hispanic subpopulation, more patients with HR positive disease received hormone specific therapy (53–66% vs. 47–55% in AA and 55–59% in overall cohort). Outcomes were similar in the two subpopulations, with higher recurrence in younger age, though not statistically significant in the Hispanics, but no difference in overall survival between ages.

Discussion

In this study, we investigated one of the largest cohorts of patients to confirm the impact of young age in diagnosis, treatment and prognosis of breast cancer, despite equal access to healthcare. It is possible that, in the future, young patients will be separated out as a distinct category of breast cancer, possibly subsetted by molecular subtype, due to the prognostic and quality of life issues that they present with. Multiple studies confirm an overall poor prognosis for women diagnosed with breast cancer when young [10, 12, 23]. Postulated underlying contributing factors include biology, racial and ethnic contributions, access to care, treatment, and adherence to treatment, but few have been independently confirmed and multiple factors likely contribute. Once relative contributions to poor outcomes are understood, it is possible that tailored therapeutic strategies can emerge and provide a benefit to this at risk population.

The current study is based on the records of the DoD healthcare system from 1998 to 2007. This cohort is advantageous in terms of its high proportion of young breast cancer patients, high proportion of minority patients, and homogeneous access to and use of the healthcare system. In our study, 11.3% of women were < 40 yo, a higher proportion than the 5–7% described in similar published studies [2, 25]. There are several reasons that could account for this. One is that the patient population served by the military health care system is on average younger than the general population. A second may be the frequent medical evaluation and screening required by the military service.

Overall, our results confirmed the almost universal findings of a worse prognosis for young breast cancer patients, with a higher stage, higher tumor grade, more HR negative tumors [5, 7, 13, 14, 16, 17, 26–28]. In other reports, HER2 status was incorporated with hormone receptor negativity to report higher levels of triple-negative tumors [28]. The luminal B subset has also been identified as being at significantly higher risk in young patients [18,26] but could not be evaluated herein.

Fewer reports detail the surgical and therapeutic interventions administered to young breast cancer patients and their associations with outcomes. In the DoD cohort, patients < 40 yo underwent proportionally more mastectomies (69%), with fewer breast conserving surgeries (31%). The mastectomy rate is higher than that reported for patients < 35 yo from the Netherlands, where 45% had breast conserving therapy and 55% mastectomy [29]. Breast conserving therapy was recently reported to result in low numbers of local relapses in young breast cancer patients [30].

Trends in hormonal therapy and chemotherapy use by patient age were documented. For every stage at diagnosis, use of chemotherapy was highest in the < 40 yo group, lower in the 40–49 yo group and lowest in the ≥ 50 yo group. These trends were most apparent in patients with early breast cancer: 77% of patients with stage I disease received chemotherapy if < 40 yo, compared to 63% of patients 40–49 yo and 32% of patients ≥ 50 yo. These data compare closely to the Prospective study of Outcomes in Sporadic and Hereditary breast cancer (POSH), where data was collected from 2000 to 2008: 73% of patients < 40 yo received adjuvant chemotherapy, predominately anthracycline based [15]. Also, in a Netherlands cohort, collected between 2003 and 2008, 93% of patients < 35 yo had chemotherapy [29]. The data confirm a practice of widespread use of chemotherapy in young breast cancer patients.

We were surprised by the finding that, in all age groups, only 57% of HR positive patients reportedly received hormonal therapy. These data are not dissimilar to trends in other cohorts: in a Swedish cohort, increasing patient age from 20 to 69 correlated with decreased use of neoadjuvant chemotherapy and chemotherapy overall [12]. Endocrine therapy was administered to 40–51% of patients < 50 yo, but 61% of older patients; only 65–69% of HR positive patients < 50 yo received endocrine therapy, compared to 73% of older patients [12]. Tamoxifen became widely used in the 1990s while aromatase-inhibitors became more predominant in the 2000s [31]. However, the adherence and persistence to hormonal treatment has been shown repeatedly to be low in clinical practice, with < 50–70% of HR positive disease patients receiving adjuvant hormonal therapy during the period our patients were evaluated [32]. Even more recent publications continue to show the same pattern of lower adherence to adjuvant hormonal therapy, especially in patients < 40 yo [33]. Current guidelines advocate hormone therapy for all young patients with HR positive tumors [34].

With high levels of mastectomy, and almost universal administration of chemotherapy, it could be hypothesized that the survival of young patients would be significantly improved. We compared the overall survival of the age groups and found that the youngest patients had survival curves overlapping that of the oldest patients. The better survival in the 40–49 yo group in comparison to the younger than 40 yo was an unexpected finding, but this has been previously reported [35]. These survival curves must be weighed against comorbidities of aging and extensive treatment, which need to be documented in future studies. We could not calculate disease-specific survival. Our analysis was limited by the data recorded, which was not created to be an epidemiological database, but rather a clinical and pharmacological registry, with data entered by the health professionals taking care of the patients. Unfortunately, no data on cause of death and disease-specific survival were available for that reason.

AA and Hispanic women represented 33.1% of the young females with breast cancer in this study (compared to 25.7% of women 40–49, and 5.4% of women ≥ 50). A disproportionate representation of AA and Hispanic women in young patients with breast cancer has been described in other studies [22, 28], with an excess of hormone receptor negative tumors and advanced stage [22]. In our study, however, this may also reflect reports of increasing overrepresentation of women of those ethnicities in the US Military Service over the last three decades [36].

Young AA patients are not only overrepresented in young breast cancer, but appear to bear a disproportionate burden of the adverse outcome in the general US population. A large SEER based study showed adjusted hazard ratios for death for women < 40 yo at diagnosis of 0.55 and 0.68 for whites and AA, respectively [19]. AA young patients were distinct from white or “other” categories in stage, grade, estrogen receptor status and nodal involvement. Even when biological subtype of the tumor was held constant, this study confirmed a disadvantage of AA racial status. These data contrast those of the DOD cohort reported herein, where AA outcomes were comparable to the overall cohort suggesting additional factors such as access to care and treatment adherence. Similar conclusions have been independently published [5, 20, 21].

This study has several limitations. Disease-specific survival data may provide a better measure of patient outcome than overall survival. Capture of recurrence might not be complete, and thus we do not exclude the possible effects of the incompleteness on the results. Another limitation is the lack of data regarding HER2, which confers worse prognosis but also selects patients for targeted treatment with improvement in overall survival. HER2 evaluation and targeted treatment of metastatic disease became routine in ~ 2001 and was incorporated in the treatment of early stage disease in ~ 2006. Therefore, the majority of the patients in our database spanning 1998–2007 did not have HER2 evaluation or treatment. Many of the large cohorts of young women published to date report on patients treated prior to 2006, and similarly lack information about HER2 amplification and HER2 targeted treatment [19].

In conclusion, the analysis of this group with good access to healthcare confirmed that younger women had worse clinical features than older women. In addition, younger women still had a similar overall survival rate to older women despite receiving more aggressive treatment and potentially having less comorbidities than the older group. Further data on important prognostic markers such as HER2 and disease-specific mortality will have to be investigated in similar cohorts that include these features to better inform these conclusions.

Acknowledgements

This research was supported by the Intramural Research Program of the National Cancer Institute, Center for Cancer Research and by the Murtha Cancer Center at the Walter Reed National Military Medical Center and Uniformed Services University of the Health Sciences. The authors thank Defense Health Agency, Joint Pathology Center, ICF, and Division of Cancer Epidemiology and Genetics of the National Cancer Institute for their support for the original data linkage. The views expressed in this manuscript are those of the author and do not reflect the official policy of the Department of Army/Navy/Air Force, Department of Defense, or US Government.

Abbreviation

< 40 yo	Less than 40 years old
40–49 yo	40–49 years old
50 yo	50 and above

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Fig. 1. Baseline characteristics of DoD breast cancer patient cohort. Female subjects diagnosed with invasive breast cancer between 1998 and 2007 were stratified based on age at diagnosis, based on records from the Military Health System Data Repository (MDR) and Department of Defense Central Registration (DoD CCR). **a** Disease stage, $p < 0.0001$. **b** Tumor grade, $p < 0.0001$. **c** Hormone receptor status, $p < 0.0001$

Fig. 2.
Surgical interventions. Patients from the cohort described in Fig. 1 underwent surgeries, stratified by type and age at diagnosis. Overall incidence significantly different per age groups, $p < 0.0001$

Fig. 3.

Classes of therapy delivered. Types of hormonal and chemotherapy delivered to the cohort described in Fig. 1 were stratified by age at diagnosis. **a** Use of chemotherapy by patient stage, $p < 0.0001$ **b** use of all systemic therapies, with chemotherapy use stratified by hormone receptor status, and significantly less chemotherapy received by ≥ 50 yo patients, $p < 0.0001$

Fig. 4. Recurrence and survival characteristics. Patients from the cohort described in Fig.1 were followed for the indicated times (median 4.5 years) and outcomes stratified by age at diagnosis. **a** Recurrence, $p = 0.0002$. **b** Overall survival, $p < 0.001$

Fig. 5. African-American subpopulation analysis. **a** Disease stage, $p = 0.046$. **b** Tumor grade, $p < 0.0001$. **c** Hormone receptor status, $p < 0.0001$. **d** Surgical interventions, bilateral mastectomy different between the groups, $p < 0.0001$. **e** Use of chemotherapy by patient stage, $p < 0.0001$ for Stages I and II, and $p = 0.02$ for Stage III. **f** Use of all systemic therapy, $p < 0.0001$ for more chemotherapy in younger age group. **g** Recurrence, $p = 0.002$. **h** Overall survival, $p = 0.25$

Fig. 6. Hispanic subpopulation analysis. **a** Disease stage, $p = 0.18$. **b** Tumor grade, $p < 0.0001$. **c.** Hormone receptor status, $p < 0.0001$. **d** Surgical interventions, mastectomy different between the groups, $p = 0.03$. **e** Use of chemotherapy by patient stage, $p < 0.0001$ for Stages I and $p = 0.0045$ for Stage II. **f** Use of all systemic therapy, $p < 0.0001$ for more chemotherapy in younger age group, except for HR negative where no difference was found. **g** Recurrence, $p = 0.52$. **h** Overall survival, $p = 0.67$

Table 1

Demographics and baseline tumor characteristics

	Age at diagnosis: number (%)				p value
	All	< 40 yo	40–49 yo	50	
Total	10,066 (100%)	1139 (11.3)	2355 (23.5)	6572 (65.3)	
Race/ethnicity					
White	6427 (63.9)	599 (52.6)	1365 (58.0)	4463 (67.9)	< 0.0001
Black	1436 (14.3)	287 (25.2)	455 (19.3)	694 (10.6)	
Other	1025 (10.2)	103 (9.0)	266 (11.3)	656 (10.0)	
Hispanic	556 (5.5)	90 (7.9)	150 (6.4)	316 (4.8)	
Unknown	622 (6.2)	60 (5.2)	119 (5.1)	443 (6.7)	
Stage at diagnosis					
Stage I	4780 (47.5)	352 (31)	980 (41.6)	3448 (52.5)	< 0.0001
Stage II	3662 (36.38)	517 (45.4)	965 (41)	2180 (33.2)	
Stage III	10,256 (10.2)	188 (16.5)	285 (12)	553 (8.4)	
Stage IV	337 (3.3)	55 (4.8)	60 (2.5)	222 (3.4)	
Unknown	261 (2.59)	27 (2.4)	65 (2.7)	169 (2.6)	
Tumor grade					
Grade I	2052 (20.4)	97 (8.5)	420 (17.8)	1535 (23.4)	< 0.0001
Grade II	3590 (35.7)	336 (29.5)	814 (34.5)	2440(37.1)	
Grade III	3041 (30.2)	564 (49.5)	818 (34.7)	1659 (25.2)	
Unknown	1383 (13.5)	142 (12.4)	303 (12.9)	938 (14.3)	
Estrogen receptor					
Positive	6423 (63.8)	542 (49.3)	1437 (61.0)	4424 (67.3)	< 0.0001
Negative	2173 (21.6)	404 (35.5)	595 (25.3)	1174 (17.8)	
Unknown	1470 (14.6)	173 (15.2)	323 (13.7)	974 (14.8)	
Progesterone receptor					
Positive	5648 (56.1)	505 (44.3)	1337 (56.8)	3806 (57.9)	< 0.0001
Negative	2830(28.1)	449 (39.4)	677 (28.8)	1704 (25.9)	
Unknown	1588 (15.8)	185 (16.2)	341 (14.4)	1062 (16.2)	

Table 2

Surgery as a function of patient age and stage at diagnosis

Surgery	Age at diagnosis: number (%)			<i>p</i> -value
	<40	40–49	50	
All stages	1121 (98.4)	2312 (98.1)	6362 (96.8)	< 0.0001
Stage 1	349 (99.1)	967 (98.6)	3404 (98.72)	0.7736
Stage 2	510 (98.6)	957 (99.1)	2151 (98.67)	0.4645
Stage 3	186 (98.9)	280 (98.2)	535 (96.7)	0.1648
Stage 4	50 (90.9)	51 (85.0)	138 (62.1)	< 0.0001