**SUPPORTING INFORMATION**

**Supporting Table 1. Study Participant Characteristics (n=1,968 participants with invasive breast cancer)**

|  |  |  |
| --- | --- | --- |
| 　 | **no.** | **(%)** |
| **Study**  |  |  |
| Sister Study | 1,015 | (52) |
| Two Sister Study | 953 | (48) |
| **Age at diagnosis (years)** |  |  |
| Mean (SD), range | 52.7 (10.5), 28–80 |
| <45 | 448 | (23) |
| 45-54 | 805 | (41) |
| 55-64 | 367 | (19) |
| ≥65 | 348 | (18) |
| **Time since diagnosis at survey (years)** |  |  |
| Mean (SD), range | 5.0 (1.9), 1–8.6 |
| 1-5 years | 862 | (44) |
| ≥5 years | 1,106 | (56) |
| **Race/Ethnicity** |  |  |
| Non-Hispanic White | 1,768 | (90) |
| Non-Hispanic Black | 84 | (4) |
| Hispanic | 64 | (3) |
| Other\* | 51 | (3) |
| Missing | 1 |  |
| **Education** |  |  |
| High school/GED and lower | 268 | (14) |
| Associate's degree/some college | 568 | (29) |
| Bachelor’s degree | 600 | (31) |
| Graduate or professional degree | 531 | (27) |
| Missing | 1 |  |
| **Annual household income per person** |  |  |
| <$25,000 | 462 | (24) |
| $25,000-$37,499 | 340 | (18) |
| $37,500-$74,999 | 706 | (37) |
| ≥$75,000 | 393 | (21) |
| Missing | 67 |  |
| **Married, living with someone as married or in significant relationship at diagnosis** |  |  |
| No | 331 | (17) |
| Yes | 1,634 | (83) |
| Missing | 3 |  |
| **Menopausal status at diagnosis** |  |  |
| Premenopausal | 1,042 | (53) |
| Postmenopausal | 926 | (47) |
| **Employment status at diagnosis** |  |  |
| Employed for wages | 1,318 | (67) |
| Out of work/unable to work | 257 | (13) |
| Retiree | 354 | (18) |
| Other | 31 | (2) |
| Missing | 8 |  |
| **Health insurance coverage during breast cancer treatment** |  |  |
| Fully covered | 1,891 | (97) |
| Partially covered | 37 | (2) |
| Not covered | 21 | (1) |
| Missing | 19 |  |
| **Any history of other cancer excluding NMSC** |  |  |
| No | 1,704 | (87) |
| Yes | 264 | (13) |

Abbreviations: NMSC, nonmelanoma skin cancer; SD, standard deviation; GED, generalized education development

\*Other includes those who identified as Asian/Pacific Islander, American Indian Alaskan Native, or multi-racial.

**Supporting Table 2. Unadjusted means (95% CIs) and difference between adjusted means (95% CIs) for physical and mental HRQOL PROMIS T-scores associated with clinical characteristics, treatment history, comorbidities present at survey, and breast cancer-related survivorship experience (n=1,968 participants with invasive breast cancer).**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 　 | **no.** | **(%)** | **PROMIS Physical HRQOL** **T-score** | **PROMIS Mental HRQOL** **T-score** |
| **Unadjusted Mean****(95% CI)** | **Difference** **Between** **Adjusted Means****(95% CI)** | **Unadjusted Mean****(95% CI)** | **Difference** **Between** **Adjusted Means****(95% CI)** |
| **Breast cancer characteristics** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **AJCC Stage at diagnosis a** | 　 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| I | 1,131 | (58) | 51.97 | (51.49, 52.44) | Ref. |  | 52.08 | (51.55, 52.61) | Ref. |  |
| II | 610 | (31) | 50.48 | (49.83, 51.13) | -1.56 | (-2.38, -0.73) | 50.88 | (50.15, 51.60) | -0.73 | (-1.67, 0.20) |
| III | 206 | (11) | 49.70 | (48.59, 50.81) | -2.27 | (-3.50, -1.05) | 49.04 | (47.79, 50.29) | -2.21 | (-3.60, -0.82) |
| IV | 21 | (1) | 45.21 | (41.72, 48.70) | -6.32 | (-9.78, -2.87) | 50.92 | (47.01, 54.83) | -0.11 | (-4.02, 3.81) |
| **Hormone receptor status \*** b |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Any ER (+) or PR (+) | 1,645 | (84) | 51.24 | (50.84, 51.64) | Ref. |  |  | 51.61 | (51.17, 52.05) | Ref. |  |  |
| ER (-) and PR (-) | 318 | (16) | 50.87 |  (49.97, 51.78) | -0.30 | (-1.30, 0.69) | 50.16 | (49.15, 51.17) | -1.19 | (-2.31, -0.08) |
| Missing | 5 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Breast cancer treatment history** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Initial treatment** c | 　 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| No treatment | 2 | (0.1) | 42.55 | (31.18, 53.92) | -3.91 | (-16.10, 8.27) | 39.95 | (27.25, 52.65) | -4.35 | (-18.19, 9.49) |
| Lumpectomy or Breast-conserving surgery alone | 14 | (1) | 53.64 | (49.34, 57.93) | Ref. |  |  | 50.74 | (45.94, 55.54) | Ref. |  |  |
| Mastectomy with no adjuvant therapy | 237 | (12) | 52.34 | (51.29, 53.38) | -2.73 | (-7.05, 1.59) | 52.70 | (51.53, 53.87) | 2.17 | (-2.74, 7.08) |
| Radiation therapy with or without breast surgery | 486 | (25) | 51.65 | (50.92, 52.38) | -3.49 | (-7.74, 0.77) | 52.00 | (51.19, 52.82) | 1.23 | (-3.61, 6.06) |
| Any chemotherapy  | 1,229 | (62) | 50.78 | (50.32, 51.24) | -4.20 | (-8.48, 0.07) | 50.90 | (50.39, 51.41) | 1.37 | (-3.48, 6.23) |
| **Breast reconstruction surgery †** c |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Yes  | 651 | (68) | 51.95 | (51.32, 52.57) | Ref. |  |  | 51.39 | (50.67, 52.11) | Ref. |  |  |
| No  | 311 | (32) | 49.62 | (48.71, 50.52) | -1.37 | (-2.56, -0.17) | 50.74 | (49.69, 51.79) | -0.63 | (-2.04, 0.78) |
| Missing | 7 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Endocrine therapy for initial treatment ‡** c |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Endocrine therapy | 1,546 | (94) | 51.19 | (50.78, 51.59) | Ref. |  |  | 51.62 | (51.16, 52.08) | Ref. |  |  |
| No endocrine therapy | 98 | (6) | 52.20 | (50.59, 53.82) | 1.09 | (-0.61, 2.80) | 51.46 | (49.63, 53.28) | -0.38 | (-2.32, 1.57) |
| Missing | 6 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Comorbidities present at survey** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Comorbidity score** d |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 | 749 | (38) | 52.66 | (52.23, 53.09) | Ref. |  |  | 52.17 | (51.68, 52.67) | Ref. |  |  |
| 1 | 511 | (26) | 49.64 | (48.94, 50.34) | -4.03 | (-4.95, -3.10) | 50.48 | (49.47, 51.29) | -2.64 | (-3.73, -1.55) |
| ≥2 | 336 | (17) | 44.55 | (43.39, 45.71) | -9.16 | (-10.57, -7.75) | 47.89 | (46.54, 49.24) | -5.41 | (-7.07, -3.75) |
| **Breast cancer-related survivorship experience** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Any recent recurrence, metastasis or secondary malignancy (past 12 months)** e |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| No | 1,845 | (95) | 51.56 | (51.19, 51.92) | Ref. |  |  | 51.60 | (51.18, 52.01) | Ref. |  |  |
| Yes | 107 | (6) | 45.45 | (43.93, 46.98) | -5.06 | (-6.70, -3.42) | 47.79 | (46.07, 49.52) | -3.76 | (-5.63, -1.88) |
| Missing | 16 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Any complications during or after a breast surgery** §f |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Did not experience surgical complications | 1,650 | (85) | 51.64 | (51.24, 52.03) | Ref. |  |  | 51.80 | (51.36, 52.24) | Ref. |  |  |
| Experienced surgical complications | 300 | (15) | 48.88 | (47.95, 49.81) | -2.66 | (-3.66, -1.66) | 49.08 | (48.04, 50.11) | -2.42 | (-3.55, -1.29) |
| Missing | 1 |  |  |  |  |  |  |  |  |  |
| **Satisfaction with mastectomy** ¶g |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Satisfied | 872 | (92) | 51.46 | (50.92, 52.00) | Ref. |  |  | 51.69 | (51.08, 52.30) | Ref. |  |  |
| Neither satisfied nor dissatisfied | 51 | (5) | 49.16 | (46.93, 51.39) | -2.47 | (-4.75, -0.18) | 46.48 | (43.96, 49.00) | -5.16 | (-7.76, -2.56) |
| Dissatisfied | 24 | (3) | 43.14 | (39.89, 46.39) | -7.88 | (-11.16, -4.59) | 40.67 | (36.99 44.35) | -10.93 | (-14.67, -7.20) |
| Missing | 22 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Satisfaction with reconstruction surgery** #g |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Satisfied | 486 | (77) | 52.90 | (52.21, 53.59) | Ref. |  |  | 52.47 | (51.66, 53.28) | Ref. |  |  |
| Neither satisfied nor dissatisfied | 32 | (5) | 50.08 | (47.39, 52.78) | -2.76 | (-5.53, 0.02) | 49.96 | (46.80, 53.11) | -2.32 | (-5.59, 0.95) |
| Dissatisfied | 115 | (18) | 48.39 | (46.96, 49.81) | -4.52 | (-6.10, -2.94) | 46.73 | (45.07, 48.40) | -5.82 | (-7.68, -3.96) |
| Missing | 25 |  |  |  |  |  |  |  |  |  | 　 |  |  |  |

Note: Higher PROMIS T scores represent better HRQOL. Higher comorbidity scores represent a greater number of conditions. The comorbidity score was defined as the sum of the number of chronic conditions reported in the survivorship survey.

Abbreviations: PROMIS, Patient Reported Outcome Measurement Information System; CI, confidence intervals; ER, estrogen receptor; PR, progesterone receptor

\* Borderline results for both ER and PR were combined with any ER (+) or PR (+) category

† Analysis was limited to women who underwent mastectomy (n=968)

‡ Analysis was limited to women with ER (+) or PR (+) breast cancer (n=1,645)

§ Analysis was limited to women who underwent any breast surgery (n=1,950)

¶ Analysis was limited to women who underwent mastectomy (n=X968)

# Analysis was limited to women who underwent breast reconstruction surgery (n=651)

a Adjusted for age at diagnosis, race/ethnicity, socioeconomic status (education, income, employment status, and insurance coverage), and any history of other cancer excluding NMSC

b Adjusted for age at diagnosis, race/ethnicity, and menopausal status

c Adjusted for age at diagnosis, race/ethnicity, socioeconomic status (education, income, employment status, and insurance coverage), any history of other cancer excluding NMSC, and cancer stage

d Adjusted for age at diagnosis, race/ethnicity, socioeconomic status (education, income, employment status, and insurance coverage), any history of other cancer excluding NMSC, cancer stage, and cancer treatment

e Adjusted for age at diagnosis, race/ethnicity, any history of other cancer excluding NMSC, cancer stage, hormone receptor status, and cancer treatment

f Adjusted for age at diagnosis, cancer stage, and race/ethnicity

g Adjusted for age at diagnosis, race/ethnicity, and time from diagnosis to survey

**Supporting Table 3. Multivariable analyses of associations between PROMIS T-scores and all-cause mortality (n=1,968 participants with invasive breast cancer)**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Alive****(n=1,884)** | **All-cause death (n=79 events)** | **Adjusted HR**‡ **(95% CI)** |
| **Physical HRQOL scores** \* |  |  |  |  |  |  |  |
| Decrease in PROMIS T score (continuously), mean (SD) | 51.6 (8.0) | 42.4 (7.8) | 1.09 | (1.06, 1.12) |
| Good (T score ≥1 SD below the U.S. population mean), no. participants | 1,681 | 46 | Ref. |  |  |
| Poor (T score <1 SD below the U.S. population mean), no. participants | 203 | 33 | 2.96 | (1.77, 4.94) |
| **Mental HRQOL scores** † |  |  |  |  |  |  |  |
| Decrease in PROMIS T score (continuously), mean (SD) | 51.6 (9.1) | 46.1 (9.8) | 1.04 | (1.01, 1.06) |
| Good (T score ≥1 SD below the U.S. population mean), no. participants | 1,680 | 55 | Ref. |  |  |
| Poor (T score <1 SD below the U.S. population mean), no. participants | 207 | 24 | 2.25 | (1.29, 3.95) |

Note: Higher PROMIS T scores represent better HRQOL.

Abbreviations: PROMIS, Patient Reported Outcome Measurement Information System; SD, standard deviation; HRQOL, health-related quality of life; HR, hazard ratios; CI, confidence intervals

\*Five women with missing physical HRQOL scores were excluded.

† Two women with missing mental HRQOL scores were excluded

‡ Hazard ratios were adjusted for age at diagnosis, time from diagnosis to survey, menopausal status at diagnosis, cancer stage, hormone receptor status, cancer treatment, comorbidity score, and any experience of recent recurrence, metastasis or secondary malignancy.

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**Supporting Figure 1. Difference between adjusted mean PROMIS T-scores (95% CIs) for physical and mental HRQOL associated with comorbidities present at the Survivorship Survey (n=1,968 participants with invasive breast cancer).**

Marginal means and 95% confidence intervals (CI) for physical and mental HRQOL T-scores associated with presence of each comorbidity were estimated first, then differences between the means of groups within a category and corresponding 95% CIs were calculated (e.g., difference between adjusted mean T-scores = adjusted mean T-score (yes comorbidity) – adjusted mean T-score (no comorbidity)). Ordinary least-squares regression models that were used to estimate marginal means were adjusted for age at diagnosis, race/ethnicity, socioeconomic status (education, income, employment status, and insurance coverage), any history of other cancer excluding NMSC, cancer stage, and cancer treatment. Analyses for lymphedema and neuropathy were limited to those who underwent any breast surgery (n=1,950) and those who underwent any chemotherapy (n=1,229), respectively. Prevalence counts and proportions for each condition are: lymphedema after completing surgery (348/1,936 [18%]), neuropathy after completing chemotherapy (355/1,207 [29%]), heart disease following breast cancer (80/1,943 [4%]), osteoporosis following breast cancer (225/1,939 [12%]), and currently receiving treatment or taking medications for depression (432/1,959 [22%]) and anxiety or nervousness (325/1,964 [17%]).