Motivation and mortality in older women with early stage breast cancer: A longitudinal study with ten years of follow-up

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Abstract

Objectives: The Getting Out of Bed Scale (GOB) was validated as a health-related quality of life (HRQoL) variable in older women with early stage breast cancer, suggesting its potential as a concise yet powerful measure of motivation. The aim of our project was to assess the association between GOB and mortality over 10 years of follow-up.

Materials and Methods: We studied 660 women ≥ 65-years old diagnosed with stage I-IIIA primary breast cancer. Data were collected over 10 years of follow-up from interviews, medical records, and death indexes.

Results: Compared to women with lower GOB scores, women with higher GOB had an unadjusted hazard ratio (HR) of all-cause mortality of 0.78 at 5 years, 95% confidence interval (CI) (0.52, 1.19) and 0.77 at 10 years, 95%CI (0.59, 1.00). These associations diminished after adjusting for age and stage of breast cancer, and further after adjusting for other HRQoL variables including physical function, mental health, emotional health, psychosocial function, and social support. Unadjusted HRs of breast cancer-specific mortality were 0.92, 95%CI (0.49, 1.74), at 5 years, and 0.82, 95%CI (0.52, 1.32), at 10 years. These associations also decreased in adjusted models.

Conclusion: Women with higher GOB scores had a lower hazard of all-cause mortality in unadjusted analysis. This effect diminished after adjusting for confounding clinical and HRQoL variables. GOB is a measure of motivation that may not be independently associated with cancer mortality, but reflects other HRQoL variables making it a potential outcome to monitor in older cancer patients.

Introduction

The number of cancer survivors is expected to grow to 19 million by January 2024, contributed by advances in detection and treatment as well as an aging population (1). About 40% of new breast cancer diagnoses occur in those ≥65 years old, and these patients comprise the majority of breast cancer deaths and current breast cancer survivors (2). Among the challenges of caring for older patients with cancer is appropriately balancing treatment outcomes, such as survival, with health-related quality of life (HRQoL) (3). There is growing evidence that HRQoL in cancer patients of all ages is not only an important outcome in itself but also a predictor of mortality (4-7).

Motivation plays an important role in an older patient's ability to overcome illness and stay engaged with healthy behaviors. Clough-Gorr et al. developed and validated a measure of motivation called the "Getting-Out-of-Bed (GOB) Scale" in a large cohort of older patients with early stage breast cancer (8). GOB was shown to correlate with several other HRQoL measures such as mental health and physical functioning, however GOB predicted certain outcomes and behaviors, such as participating in regular exercise, that were not predicted by HRQoL. Their results suggested that GOB reflects aspects of motivation potentially relevant to health behaviors and outcomes that overlap conceptually with, but are not entirely captured by, HRQoL. Measures similar to motivation, such as optimism and hope, have been linked to both disease-specific and all-cause mortality (9-11). However, GOB's ability to predict mortality, either independently or in association with HRQoL, has yet to be studied.

In this secondary analysis of the same cohort of older women with early stage breast cancer studied by Clough-Gorr et al., we assessed the association between GOB and 5- and 10-year mortality, both all-cause and breast cancer-specific (BC-specific). We hypothesized that higher GOB scores would be associated with lower all-cause and BC-specific mortality. Moreover, we hypothesized that GOB would independently predict mortality, and included potential confounding clinical and HRQoL variables in our analysis to test this hypothesis. **Figure 1** summarizes these hypothesized relationships: HRQoL measures have a direct effect on mortality and are associated with GOB. Knowledge of HRQoL will therefore allow an investigation into whether GOB has an independent effect on mortality (12).

Materials and Methods

Study Population

The longitudinal study design and subject recruitment procedures have been reported previously (13). In brief, 660 women ≥65-years old with stage I tumor diameter ≥1cm or stage II-IIIA disease and permission from attending physicians to be contacted in four geographic regions (Los Angeles, California; Minnesota; North Carolina; Rhode Island) were identified through regular pathology report review at hospitals or collaborating tumor registries. Women could not have a prior primary breast cancer or simultaneously diagnosed or treated second primary tumor. Data were collected by medical record review (definitive surgery date, surgery type, tumor characteristics) and telephone interviews (socio-demographic, HRQoL variables, breast cancer therapy) beginning at least three-months after surgery and continuing annually for 10 years. Causes of death – characterized as breast cancer-specific, all-cause, all-cancer-related – were collected through 10 years of follow-up.

Mortality, all-cause and breast cancer-specific

Decedents were identified by first and last name, middle initial, Social Security number, date of birth

(DOB), sex, race, marital status, and state of residence matched against National Death Index (NDI) and Social Security Death Index (SSDI) records (14). Survival status at the end of 2007 was complete for all women.

Socio-demographic characteristics
We classified patient age as 65–69, 70–79, ≥80-years; race as white, other; education as <12-years, 12-years, >12-years; and marital status as married (yes/no).

Breast cancer characteristics

We categorized stage as I-III using the TNM classification (15). Definitive primary therapy was mastectomy plus axillary lymph node dissection (ALND) or breast-conserving surgery (BCS) plus ALND.

Getting out of Bed

GOB (**Table** 1) consists of four items scored on an ordinal scale of 1 to 5. The language used in these items was intended to be straightforward using concepts and terms universally understood at a layperson's level of understanding. GOB total score is calculated as an equally weighted sum of items (1=poor, 2=fair, 3=good, 4=very good, 5=excellent) giving a total score range from 4 to 20. The final score is transformed to 0-100, with a higher score indicating greater motivation (8).

Health-related quality of life characteristics

To further evaluate an independent association between GOB and mortality, we studied other HRQoL measures as potentially confounding variables in adjusted analyses, including physical function, general mental health, emotional health, psychosocial function, and social support. Physical function has been linked to mortality in older patients with cancer (7, 16). Moreover, physical function has been shown to be associated with other measures similar to motivation (8, 17-19). We calculated physical function using the 10-item Physical Function Index (PFI-10) from the Medical Outcomes Study Short Form-36 (MOS SF-36) (20). PFI-10 specifically has previously been linked to mortality in men and women (21, 22). Mental health has also been linked to survival in both older and younger cancer patients (23, 24). Furthermore, mental health has been shown to be associated with GOB and other measures similar to motivation (8, 25-27). General mental health was assessed by the Mental Health Index (MHI-5), a five-item measure of mental health from the MOS-SF-36 (20). MHI-5 specifically has been linked to mortality in cancer patients and in other populations (14, 28, 29).

Emotional health, psychosocial function, and social support have all been associated with measures similar to motivation (8, 30, 31). Breast cancer-specific emotional health (BCSEH) was assessed using a four-item measure reflecting how well the respondent was dealing with breast cancer-specific worries (32). We used the Psychosocial Summary Scale of the 17-item Cancer Rehabilitation Evaluation System-Short Form (CARES-SF) to capture cancer-specific psychosocial function (33). The CARES-SF item scores range from 1 to 4 (a higher score indicating more problems). Social support is related to survival in patients with breast and other cancers (34, 35). Social support was measured using a reduced set of eight items derived from the 19-item MOS Social Support Scale (mMOS-SS) (36).

All of the above HRQoL measures were transformed to a 0-100 score, with higher scores indicating better physical function, mental health, emotional health, social support, and psychosocial function, respectively.

Statistical methods

The study population was described by counts, percentage (%), mean, standard deviation (SD), median, and interquartile range (IQR). We used Spearman's rank correlation coefficient as an estimate of correlation. Mortality rates were calculated by the number of events divided by the total person-years under observation. We used Multiple Imputation (MI) to address missing baseline data, using a fully conditional specification approach (37). We assumed missing data to be missing at random (MAR) (38). In addition to variables used in the main analysis model, including GOB, age, stage of breast cancer, PFI-10, MHI-5, BCSEH, CARES-SF, and mMOS-SS, we used enrollment site, education, number of comorbidities, body mass index, type of therapy, tamoxifen prescribed, recurrence of breast cancer, and received chemotherapy in the imputation model to make the MAR assumption more plausible (39). Further, we included survival status and the Nelson-Aalen estimator in the imputation model to account for survival (38). We imputed continuous variables by predictive mean matching and categorical variables by polytomous logistic regression. We generated 25 multiple imputed datasets. All reported results are based on MI. As a sensitivity analysis we report complete case results. The associations between GOB and survival time were evaluated by modeling the hazard of dying using Cox regression models from all-cause mortality and BC-specific mortality. We did the same to assess the association between GOB and all-cancer mortality. We report hazard ratios (HR) as effect measures. Observation time began at the date of definitive surgery and ended on the date of death, 31 December 2002 (5-year survival) or 31 December 2007 (10-year survival), whichever came first. The proportional hazard assumption was tested by Schoenfeld's test (40). We present unadjusted models (i.e., Model 1: only GOB as predictor), and models adjusted for 1) age, stage of breast cancer (Model 2), and then additionally for 2) PFI-10, MHI-5, BCSEH, CARES-SF and mMOS-SS (Model 3). GOB and HRQoL measures were *a priori* dichotomized at a cutoff point of ≥ 80 versus < 80 (14, 41). A cutoff of 80 was chosen since it was similar to the other cutoffs used and nearly equally divided the population in half. To account for the possibility that GOB might be associated with mortality but with a different cutoff, we performed a sensitivity analysis using GOB and the HRQoL measures as continuous linear predictors, i.e. on their original 0-100 scale, in modeling.

Approval of the study was obtained from each institutional review board associated with the four geographic regions from which the study participants were identified and consented.

Results

Study population

Socio-demographic, breast cancer, and HRQoL characteristics of the baseline study population are shown in **Table 2**. The majority of women were ≥ 70 years (74.0%), white (93.9%), and had at least 12 years of education (82.4%). Approximately half had stage I disease and the majority (82%) received either a mastectomy, or BCS followed by radiation. Nearly half (47.7%) of the population had GOB ≥ 80, 64.8% had PFI-10 ≥ 80, and 68.9% had MHI-5 ≥ 80. 61.1% had BCSEH ≥ 80, 57.7% had CARES-SF ≥ 80, and 50.5% had mMOS-SS ≥ 80. The percentage of missing values of baseline characteristics ranged from 0.1% (missing BC stage) to 6.8% (missing BCSEH) with 3.6% of GOB baseline values missing.

GOB and mortality

Through 31 December 2002 (five years of follow-up), 99 (15.0%) women died, and of these, 39 (39.4%) were due to breast cancer, with 2712 persons-years of observation. The 5-year all-cause mortality rate was 3.6%, 95%CI (3.0% - 4.4%), and the 5-year BC-specific mortality rate was 1.4%,

154 95%CI (1.1% - 2.0%). Through 31 December 2007 (10 years of follow-up), 230 (34.8%) women died,
155 and of these, 72 (31.3%) were due to breast cancer, with 5179 persons-years of observation. The 10-
156 year all-cause mortality rate was 4.4%, 95%CI (3.9% - 5.1%), and the 10-year BC-specific mortality
157 rate was 1.4% 95%CI (1.1% - 1.8%).

159 **Table 3** displays the results of unadjusted (Model 1) and adjusted regression models (Model 2:
160 adjusted for age and stage of BC, and Model 3: adjusted for age, stage of BC, and HRQoL
161 measures) at both at 5- and 10-year time points. At 5 years, women with GOB $\geq$ 80 had an
162 unadjusted HR of all-cause mortality of 0.78, 95%CI (0.52, 1.19), compared to women with GOB <
163 80. In adjusted models this hazard ratio increased to 0.87, 95%CI (0.57, 1.32), in Model 2, and to
164 1.04, 95%CI (0.65, 1.66), in Model 3. At 10 years, women with GOB $\geq$ 80 had an unadjusted HR of
165 all-cause mortality of 0.77, 95%CI (0.59, 1.00), compared to women with GOB < 80. This HR
166 increased from Model 2 [HR 0.84, 95%CI (0.64, 1.10)] to Model 3 [HR 1.08, 95%CI (0.80, 1.46)].
167 Unadjusted HRs of BC-specific mortality were 0.92, 95%CI (0.49, 1.74), at 5 years, and 0.82, 95%CI
168 (0.52, 1.32), at 10 years. These HRs also increased in adjusted models. There was no evidence of
169 violation of the proportional hazard assumption across all covariates. Kaplan-Meier survival curves
170 from complete case results are shown in **Figure 2**, showing trends toward improved all-cause and
171 breast cancer-specific survival in patients with GOB $\geq$ 80. **Table 4** shows the Spearman rank
172 correlations among baseline HRQoL measures. Weak to moderate positive correlations were found
173 between GOB and PFI-10, MHI-5, BCSEH, mMOS-SS, and CARES-SF.

175 **Supplemental Table 1** summarizes sensitivity results from a complete case analysis. Estimates are
176 comparable to estimates from **Table 3**. **Supplemental Table 2** reports MI Cox regression estimates
177 using GOB and HRQoL measures as linear variables per one-unit standard deviation increase. The
178 results are similar to results using dichotomized variables. **Supplemental Table 3** shows results from
179 adjusted and unadjusted regression models testing the association between GOB and all-cancer
180 mortality. At 5 years, women with GOB $\geq$ 80 had an unadjusted HR of all-cancer mortality of 0.86,
181 95%CI (0.50, 1.48) that increased towards 1 after adjusted analyses. Results were similar at 10
182 years.

184 **Discussion**

186 In a cohort of older women with early stage breast cancer we determined whether a measure of
187 motivation, the 4-item GOB scale, was associated with mortality over 10 years of follow-up. We found
188 that women with better motivation had a lower hazard of all-cause mortality in unadjusted analysis.
189 This effect diminished after adjusting for confounding variables age, stage of breast cancer, and other
190 HRQoL measures. We found no association between motivation and BC-specific mortality at 5 years
191 and 10 years. The similar hazard ratios found by our sensitivity analysis using GOB as a continuous
192 variable suggest that selecting a different cutoff other than 80 would not have changed the results.
193 Our findings extend the goals of the original GOB validation study, which highlighted the need to
194 further test GOB's predictive ability over longer periods of time (8). Our results partially support our
195 hypothesis in that GOB would be related to mortality, however they do not support our hypothesis that
196 this relationship is independent of the other clinical and HRQoL variables included as confounders in
197 adjusted analyses (as depicted in **Figure 1**).

199 Previous studies have measured concepts similar to motivation such as hope and optimism and
200 found them to be related to health outcomes in a variety of patient populations. However the evidence
201 is equivocal that these concepts are independently associated with mortality in cancer patients (42-
202 45). In support of an independent association, "dispositional optimism" was found to predict one-year
203 survival in patients with head and neck cancer (46), "pessimism" was linked to lower survival in lung

cancer patients (47), and a hope for the curability of cancer correlated with higher survival in nonmetastatic colon cancer patients (48). Other studies do not support an independent association between measures similar to motivation and mortality: in over 90,000 women from the Women's Health Initiative who were at baseline free of cardiovascular disease and cancer, optimism measured using the Life Orientation Test-Revised was found to be independently associated with a lower hazard of coronary heart disease and coronary heart disease-related mortality in all patients, but was found only in black patients to be independently associated with cancer-related mortality (49). Our analysis of all-cancer mortality found a weak association with high GOB in unadjusted analyses that diminished after adjustment for age, stage, and other HRQoL variables, akin to the results of the analysis conducted on our main outcomes of breast cancer-specific and all-cause mortality (**Supplementary Table 3)**. In patients with advanced colon cancer, Schofield et al. measured hopefulness and optimism using the State Hope Scale (50) and Life Orientation Test (51), respectively (24). The authors found that baseline hopefulness was associated with overall survival in unadjusted analysis, whereas optimism was not. Similar to our study, the association between hopefulness and survival weakened after adjusting for known prognostic variables. Our results suggest that much of the decrease in mortality in women with baseline GOB $\geq$ 80 vs. women with GOB < 80 was because women with GOB$\geq$ 80 were younger and/or had less advanced disease, not because they had higher levels of motivation per se. Moreover, younger patients are more likely to have fewer comorbidities and receive guideline-recommended therapy – two factors not included in our analysis that might also contribute to lower mortality (52-57).

Our study shows that the relation between GOB and mortality is confounded not only by age and cancer stage, but also by the HRQoL variables included in our study **(Table 3)**. We found weak to moderate correlations among GOB, MHI-5, PFI-10, BCSEH, CARES-SF, and mMOS-SS **(Table 4)**, complementing the original GOB study that found associations between GOB and MHI-5 as well as GOB and PFI-10 both at baseline and at 6 months (8). Other studies have found relations between measures similar to motivation (GOB) and each of the other HRQoL variables studied (8, 17-19, 25-27, 30, 31). Physical function and mental health were not only related to GOB (**Table 4**) but were also independently associated with mortality (**Table 3**, PFI-10 with all-cause mortality and MHI-5 with both all-cause and BC-specific mortality). This finding reinforces prior research (16, 23, 52, 58). Schofield et al. noted that after adjusting for factors such as depression – a variable similar to general mental health that they found to be negatively correlated with hope – the unadjusted association between hope and mortality weakened (24). Likewise, our results suggest that even after adjusting for age and stage, much of the remaining decrease in mortality in women with baseline GOB $\geq$ 80 was because these women had higher scores of mental health and physical functioning, not a higher score of motivation.

Strengths of our study include the long follow-up period, tracking mortality in participants for 10 years. Further, survival status was complete through 10 years, thus avoiding selection bias due to lost to follow-up. Limitations include a population that was largely white, well-educated, and from four specific regions in the US, limiting the generalizability of our findings. Whereas we found that GOB was not independently associated with breast cancer-specific or all-cause mortality, we did not test whether it was associated with other important outcomes such as disability-free life expectancy or hospitalization. If an independent association between motivation and mortality does exist, a larger sample size may have been necessary to detect it. Moreover, GOB was validated in only one study, and GOB's four questions and the manner in which they are worded might not adequately stratify patients into high and low risk in terms of mortality; measures of motivation with more items and different content might be more discriminatory. Lastly, the low number of deaths within 5 years and breast cancer-related deaths within 10 years coupled with the observed moderate correlations between investigated HRQoL measures increase imprecision in model estimates, given by the bias-

variance trade-off. Thus, point estimates from adjusted models in our data might vary across different models due to wide confidence intervals rather than reflecting the true population values.

In conclusion, our results suggest that a previously validated measure of motivation, GOB, is associated with other important HRQoL variables. However, independent of these variables and age and stage of cancer, GOB is weakly associated with mortality. There is a great need for efficient strategies to risk stratify older adults with cancer, as they are different from younger patients with respect to life expectancy, physiologic reserve, and life values (59). Our study suggests that GOB does not contribute to the goal of aiding providers and researchers with a stand-alone tool that can predict mortality in older cancer patients; other strategies, namely Comprehensive Geriatric Assessment, have shown more promise to that end (52, 60-67). However, GOB is a measure of motivation that reflects other HRQoL variables and like these other HRQoL variables might be an important outcome to monitor in older cancer patients, either by itself or as part of longer instruments. Its brevity paired with its proven internal reliability and stability over time support this purpose (8). It has not only been shown to correlate with other HRQoL variables, as in the current study, but has also been shown to be predictive of HRQoL variables such as mental, emotional, and self-perceived health. More promising are our findings that build on the growing evidence linking mental and physical function to mortality, both of which are domains of the Comprehensive Geriatric Assessment. Further research using these HRQoL variables by themselves or in combination with other known predictive factors such as age and stage could lead to brief yet powerful prognostic tools to help guide treatment of older cancer patients.

References
1.   DeSantis CE, Lin CC, Mariotto AB, Siegel RL, Stein KD, Kramer JL, et al. Cancer treatment and survivorship statistics, 2014. CA: a cancer journal for clinicians. 2014 Jul-Aug;64(4):252-71. PubMed PMID: 24890451.

2.   Yancik R. Population aging and cancer: a cross-national concern. Cancer journal. 2005 Nov-Dec;11(6):437-41. PubMed PMID: 16393477.

3.   Lichtman SM, Hurria A, Jacobsen PB. Geriatric oncology: an overview. Journal of clinical oncology : official journal of the American Society of Clinical Oncology. 2014 Aug 20;32(24):2521-2. PubMed PMID: 25513235.

4.   Verdonck-de Leeuw IM, van Nieuwenhuizen A, Leemans CR. The value of quality-of-life questionnaires in head and neck cancer. Current opinion in otolaryngology & head and neck surgery. 2012 Apr;20(2):142-7. PubMed PMID: 22249168.

5.   Montazeri A. Quality of life data as prognostic indicators of survival in cancer patients: an overview of the literature from 1982 to 2008. Health and quality of life outcomes. 2009;7:102. PubMed PMID: 20030832. Pubmed Central PMCID: 2805623.

6.   Epplein M, Zheng Y, Zheng W, Chen Z, Gu K, Penson D, et al. Quality of life after breast cancer diagnosis and survival. Journal of clinical oncology : official journal of the American Society of Clinical Oncology. 2011 Feb 1;29(4):406-12. PubMed PMID: 21172892. Pubmed Central PMCID: 3058286.

7.   Saquib N, Pierce JP, Saquib J, Flatt SW, Natarajan L, Bardwell WA, et al. Poor physical health predicts time to additional breast cancer events and mortality in breast cancer survivors. Psycho-oncology. 2011 Mar;20(3):252-9. PubMed PMID: 20878837. Pubmed Central PMCID: 3297415.

8.   Clough-Gorr KM, Rakowski W, Clark M, Silliman RA. The Getting-Out-of-Bed (GoB) scale: a measure of motivation and life outlook in older adults with cancer. Journal of psychosocial oncology. 2009;27(4):454-68. PubMed PMID: 19813135. Pubmed Central PMCID: 2760030.

9.   Giltay EJ, Geleijnse JM, Zitman FG, Hoekstra T, Schouten EG. Dispositional optimism and all-cause and cardiovascular mortality in a prospective cohort of elderly dutch men and women. Archives of general psychiatry. 2004 Nov;61(11):1126-35. PubMed PMID: 15520360.

305   10.   Nemeroff CB, Goldschmidt-Clermont PJ. Heartache and heartbreak--the link between depression and
306   cardiovascular disease. Nature reviews Cardiology. 2012 Sep;9(9):526-39. PubMed PMID: 22733213.
307   11.   Schulz R, Bookwala J, Knapp JE, Scheier M, Williamson GM. Pessimism, age, and cancer mortality. Psychology
308   and aging. 1996 Jun;11(2):304-9. PubMed PMID: 8795058.
309   12.   Hernan MA, Hernandez-Diaz S, Werler MM, Mitchell AA. Causal knowledge as a prerequisite for confounding
310   evaluation: an application to birth defects epidemiology. American journal of epidemiology. 2002 Jan 15;155(2):176-84.
311   PubMed PMID: 11790682.
312   13.   Silliman RA, Guadagnoli E, Rakowski W, Landrum MB, Lash TL, Wolf R, et al. Adjuvant tamoxifen prescription in
313   women 65 years and older with primary breast cancer. Journal of clinical oncology : official journal of the American
314   Society of Clinical Oncology. 2002 Jun 1;20(11):2680-8. PubMed PMID: 12039930.
315   14.   Clough-Gorr KM, Thwin SS, Stuck AE, Silliman RA. Examining five- and ten-year survival in older women with
316   breast cancer using cancer-specific geriatric assessment. European journal of cancer. 2012 Apr;48(6):805-12. PubMed
317   PMID: 21741826. Pubmed Central PMCID: 3196774.
318   15.   American Joint Committee on Cancer., American Cancer Society., American College of Surgeons. AJCC cancer
319   staging manual. 5th ed. Philadelphia: Lippincott-Raven; 1997. xv, 294 p. p.
320   16.   Eng JA, Clough-Gorr K, Cabral HJ, Silliman RA. Predicting 5- and 10-year survival in older women with early-stage
321   breast cancer: self-rated health and walking ability. Journal of the American Geriatrics Society. 2015 Apr;63(4):757-62.
322   PubMed PMID: 25900489. Pubmed Central PMCID: 4407370.
323   17.   Reuben DB, Siu AL. An objective measure of physical function of elderly outpatients. The Physical Performance
324   Test. Journal of the American Geriatrics Society. 1990 Oct;38(10):1105-12. PubMed PMID: 2229864.
325   18.   Garber CE, Greaney ML, Riebe D, Nigg CR, Burbank PA, Clark PG. Physical and mental health-related correlates of
326   physical function in community dwelling older adults: a cross sectional study. BMC geriatrics. 2010;10:6. PubMed PMID:
327   20128902. Pubmed Central PMCID: 2835714.
328   19.   Verhaak PF, Dekker JH, de Waal MW, van Marwijk HW, Comijs HC. Depression, disability and somatic diseases
329   among elderly. Journal of affective disorders. 2014;167:187-91. PubMed PMID: 24992026.
330   20.   Ware JE, Jr., Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and
331   item selection. Medical care. 1992 Jun;30(6):473-83. PubMed PMID: 1593914.
332   21.   Tice JA, Kanaya A, Hue T, Rubin S, Buist DS, Lacroix A, et al. Risk factors for mortality in middle-aged women.
333   Archives of internal medicine. 2006 Dec 11-25;166(22):2469-77. PubMed PMID: 17159012.
334   22.   De Buyser SL, Petrovic M, Taes YE, Toye KR, Kaufman JM, Goemaere S. Physical function measurements predict
335   mortality in ambulatory older men. European journal of clinical investigation. 2013 Apr;43(4):379-86. PubMed PMID:
336   23398295.
337   23.   Clough-Gorr KM, Stuck AE, Thwin SS, Silliman RA. Older breast cancer survivors: geriatric assessment domains
338   are associated with poor tolerance of treatment adverse effects and predict mortality over 7 years of follow-up. Journal
339   of clinical oncology : official journal of the American Society of Clinical Oncology. 2010 Jan 20;28(3):380-6. PubMed
340   PMID: 20008637. Pubmed Central PMCID: 2815700.
341   24.   Schofield PE, Stockler MR, Zannino D, Tebbutt NC, Price TJ, Simes RJ, et al. Hope, optimism and survival in a
342   randomised trial of chemotherapy for metastatic colorectal cancer. Supportive care in cancer : official journal of the
343   Multinational Association of Supportive Care in Cancer. 2015 Jun 21. PubMed PMID: 26093975.
344   25.   Lam WW, Soong I, Yau TK, Wong KY, Tsang J, Yeo W, et al. The evolution of psychological distress trajectories in
345   women diagnosed with advanced breast cancer: a longitudinal study. Psycho-oncology. 2013 Dec;22(12):2831-9.
346   PubMed PMID: 24038545.
347   26.   Groarke A, Curtis R, Kerin M. Global stress predicts both positive and negative emotional adjustment at diagnosis
348   and post-surgery in women with breast cancer. Psycho-oncology. 2013 Jan;22(1):177-85. PubMed PMID: 22006585.
349   27.   Colby DA, Shifren K. Optimism, mental health, and quality of life: a study among breast cancer patients.
350   Psychology, health & medicine. 2013;18(1):10-20. PubMed PMID: 22690751.
351   28.   Ho PM, Masoudi FA, Spertus JA, Peterson PN, Shroyer AL, McCarthy M, Jr., et al. Depression predicts mortality
352   following cardiac valve surgery. The Annals of thoracic surgery. 2005 Apr;79(4):1255-9. PubMed PMID: 15797059.
353   29.   Boulware LE, Liu Y, Fink NE, Coresh J, Ford DE, Klag MJ, et al. Temporal relation among depression symptoms,
354   cardiovascular disease events, and mortality in end-stage renal disease: contribution of reverse causality. Clinical journal
355   of the American Society of Nephrology : CJASN. 2006 May;1(3):496-504. PubMed PMID: 17699251.

356 30.   Smith SK, Herndon JE, Lyerly HK, Coan A, Wheeler JL, Staley T, et al. Correlates of quality of life-related outcomes
357 in breast cancer patients participating in the Pathfinders pilot study. Psycho-oncology. 2011 May;20(5):559-64. PubMed
358 PMID: 20878862. Pubmed Central PMCID: 3013242.
359 31.   Matthews EE, Cook PF. Relationships among optimism, well-being, self-transcendence, coping, and social
360 support in women during treatment for breast cancer. Psycho-oncology. 2009 Jul;18(7):716-26. PubMed PMID:
361 19034884. Pubmed Central PMCID: 3152259.
362 32.   Silliman RA, Dukes KA, Sullivan LM, Kaplan SH. Breast cancer care in older women: sources of information, social
363 support, and emotional health outcomes. Cancer. 1998 Aug 15;83(4):706-11. PubMed PMID: 9708934.
364 33.   Schag CA, Ganz PA, Heinrich RL. CAncer Rehabilitation Evaluation System--short form (CARES-SF). A cancer
365 specific rehabilitation and quality of life instrument. Cancer. 1991 Sep 15;68(6):1406-13. PubMed PMID: 1873793.
366 34.   Kroenke CH, Kwan ML, Neugut AI, Ergas IJ, Wright JD, Caan BJ, et al. Social networks, social support mechanisms,
367 and quality of life after breast cancer diagnosis. Breast cancer research and treatment. 2013 Jun;139(2):515-27. PubMed
368 PMID: 23657404. Pubmed Central PMCID: 3906043.
369 35.   Pinquart M, Duberstein PR. Associations of social networks with cancer mortality: a meta-analysis. Critical
370 reviews in oncology/hematology. 2010 Aug;75(2):122-37. PubMed PMID: 19604706. Pubmed Central PMCID: 2910231.
371 36.   Sherbourne CD, Stewart AL. The MOS social support survey. Social science & medicine. 1991;32(6):705-14.
372 PubMed PMID: 2035047.
373 37.   Kenward MG, Carpenter J. Multiple imputation: current perspectives. Statistical methods in medical research.
374 2007 Jun;16(3):199-218. PubMed PMID: 17621468.
375 38.   White IR, Royston P. Imputing missing covariate values for the Cox model. Statistics in medicine. 2009 Jul
376 10;28(15):1982-98. PubMed PMID: 19452569. Pubmed Central PMCID: 2998703.
377 39.   Sterne JA, White IR, Carlin JB, Spratt M, Royston P, Kenward MG, et al. Multiple imputation for missing data in
378 epidemiological and clinical research: potential and pitfalls. Bmj. 2009;338:b2393. PubMed PMID: 19564179. Pubmed
379 Central PMCID: 2714692.
380 40.   Schoenfield D. Chi-squared goodness-of-fit tests for the proportional hazards regression model. Biometrika.
381 1979 April 1, 1979;67(1):145-53.
382 41.   Clough-Gorr KM, Ganz PA, Silliman RA. Older breast cancer survivors: factors associated with change in
383 emotional well-being. Journal of clinical oncology : official journal of the American Society of Clinical Oncology. 2007 Apr
384 10;25(11):1334-40. PubMed PMID: 17312327.
385 42.   Garner MJ, McGregor BA, Murphy KM, Koenig AL, Dolan ED, Albano D. Optimism and depression: a new look at
386 social support as a mediator among women at risk for breast cancer. Psycho-oncology. 2015 Dec;24(12):1708-13.
387 PubMed PMID: 25782608.
388 43.   Goodin BR, Bulls HW. Optimism and the experience of pain: benefits of seeing the glass as half full. Current pain
389 and headache reports. 2013 May;17(5):329. PubMed PMID: 23519832. Pubmed Central PMCID: 3935764.
390 44.   Thornton LM, Cheavens JS, Heitzmann CA, Dorfman CS, Wu SM, Andersen BL. Test of mindfulness and hope
391 components in a psychological intervention for women with cancer recurrence. Journal of consulting and clinical
392 psychology. 2014 Dec;82(6):1087-100. PubMed PMID: 24884347. Pubmed Central PMCID: 4244261.
393 45.   Anthony EG, Kritz-Silverstein D, Barrett-Connor E. Optimism and Mortality in Older Men and Women: The
394 Rancho Bernardo Study. Journal of aging research. 2016;2016:5185104. PubMed PMID: 27042351. Pubmed Central
395 PMCID: 4794576.
396 46.   Allison PJ, Guichard C, Fung K, Gilain L. Dispositional optimism predicts survival status 1 year after diagnosis in
397 head and neck cancer patients. Journal of clinical oncology : official journal of the American Society of Clinical Oncology.
398 2003 Feb 1;21(3):543-8. PubMed PMID: 12560447.
399 47.   Novotny P, Colligan RC, Szydlo DW, Clark MM, Rausch S, Wampfler J, et al. A pessimistic explanatory style is
400 prognostic for poor lung cancer survival. Journal of thoracic oncology : official publication of the International
401 Association for the Study of Lung Cancer. 2010 Mar;5(3):326-32. PubMed PMID: 20139778. Pubmed Central PMCID:
402 2854019.
403 48.   Soler-Vila H, Dubrow R, Franco VI, Saathoff AK, Kasl SV, Jones BA. Cancer-specific beliefs and survival in
404 nonmetastatic colorectal cancer patients. Cancer. 2009 Sep 15;115(18 Suppl):4270-82. PubMed PMID: 19731356.
405 Pubmed Central PMCID: 2779703.

406   49.   Tindle HA, Chang YF, Kuller LH, Manson JE, Robinson JG, Rosal MC, et al. Optimism, cynical hostility, and incident
407   coronary heart disease and mortality in the Women's Health Initiative. Circulation. 2009 Aug 25;120(8):656-62. PubMed
408   PMID: 19667234. Pubmed Central PMCID: 2901870.
409   50.   Snyder CR, Sympson SC, Ybasco FC, Borders TF, Babyak MA, Higgins RL. Development and validation of the State
410   Hope Scale. Journal of personality and social psychology. 1996 Feb;70(2):321-35. PubMed PMID: 8636885.
411   51.   Scheier MF, Carver CS, Bridges MW. Distinguishing optimism from neuroticism (and trait anxiety, self-mastery,
412   and self-esteem): a reevaluation of the Life Orientation Test. Journal of personality and social psychology. 1994
413   Dec;67(6):1063-78. PubMed PMID: 7815302.
414   52.   Klepin H, Mohile S, Hurria A. Geriatric assessment in older patients with breast cancer. Journal of the National
415   Comprehensive Cancer Network : JNCCN. 2009 Feb;7(2):226-36. PubMed PMID: 19200420. Pubmed Central PMCID:
416   4397965.
417   53.   Schonberg MA, Marcantonio ER, Li D, Silliman RA, Ngo L, McCarthy EP. Breast cancer among the oldest old:
418   tumor characteristics, treatment choices, and survival. Journal of clinical oncology : official journal of the American
419   Society of Clinical Oncology. 2010 Apr 20;28(12):2038-45. PubMed PMID: 20308658. Pubmed Central PMCID: 2860406.
420   54.   Wallwiener CW, Hartkopf AD, Grabe E, Wallwiener M, Taran FA, Fehm T, et al. Adjuvant chemotherapy in elderly
421   patients with primary breast cancer: are women >/=65 undertreated? Journal of cancer research and clinical oncology.
422   2016 Aug;142(8):1847-53. PubMed PMID: 27350260.
423   55.   Yardley DA. Taxanes in the elderly patient with metastatic breast cancer. Breast cancer. 2015;7:293-301.
424   PubMed PMID: 26379446. Pubmed Central PMCID: 4567240.
425   56.   Owusu C, Lash TL, Silliman RA. Effect of undertreatment on the disparity in age-related breast cancer-specific
426   survival among older women. Breast cancer research and treatment. 2007 Apr;102(2):227-36. PubMed PMID: 17004115.
427   57.   Extermann M, Overcash J, Lyman GH, Parr J, Balducci L. Comorbidity and functional status are independent in
428   older cancer patients. Journal of clinical oncology : official journal of the American Society of Clinical Oncology. 1998
429   Apr;16(4):1582-7. PubMed PMID: 9552069.
430   58.   Satin JR, Linden W, Phillips MJ. Depression as a predictor of disease progression and mortality in cancer patients:
431   a meta-analysis. Cancer. 2009 Nov 15;115(22):5349-61. PubMed PMID: 19753617.
432   59.   Korc-Grodzicki B, Holmes HM, Shahrokni A. Geriatric assessment for oncologists. Cancer biology & medicine.
433   2015 Dec;12(4):261-74. PubMed PMID: 26779363. Pubmed Central PMCID: 4706523.
434   60.   Hurria A, Togawa K, Mohile SG, Owusu C, Klepin HD, Gross CP, et al. Predicting chemotherapy toxicity in older
435   adults with cancer: a prospective multicenter study. Journal of clinical oncology : official journal of the American Society
436   of Clinical Oncology. 2011 Sep 1;29(25):3457-65. PubMed PMID: 21810685. Pubmed Central PMCID: 3624700.
437   61.   Spina M, Balzarotti M, Uziel L, Ferreri AJ, Fratino L, Magagnoli M, et al. Modulated chemotherapy according to
438   modified comprehensive geriatric assessment in 100 consecutive elderly patients with diffuse large B-cell lymphoma.
439   The oncologist. 2012;17(6):838-46. PubMed PMID: 22610154. Pubmed Central PMCID: 3380883.
440   62.   Caillet P, Canoui-Poitrine F, Vouriot J, Berle M, Reinald N, Krypciak S, et al. Comprehensive geriatric assessment
441   in the decision-making process in elderly patients with cancer: ELCAPA study. Journal of clinical oncology : official journal
442   of the American Society of Clinical Oncology. 2011 Sep 20;29(27):3636-42. PubMed PMID: 21709194.
443   63.   Kanesvaran R, Li H, Koo KN, Poon D. Analysis of prognostic factors of comprehensive geriatric assessment and
444   development of a clinical scoring system in elderly Asian patients with cancer. Journal of clinical oncology : official
445   journal of the American Society of Clinical Oncology. 2011 Sep 20;29(27):3620-7. PubMed PMID: 21859998.
446   64.   Hamaker ME, Vos AG, Smorenburg CH, de Rooij SE, van Munster BC. The value of geriatric assessments in
447   predicting treatment tolerance and all-cause mortality in older patients with cancer. The oncologist. 2012;17(11):1439-
448   49. PubMed PMID: 22941970. Pubmed Central PMCID: 3500366.
449   65.   Klepin HD, Geiger AM, Tooze JA, Kritchevsky SB, Williamson JD, Pardee TS, et al. Geriatric assessment predicts
450   survival for older adults receiving induction chemotherapy for acute myelogenous leukemia. Blood. 2013 May
451   23;121(21):4287-94. PubMed PMID: 23550038. Pubmed Central PMCID: 3663423.
452   66.   Muffly LS, Kocherginsky M, Stock W, Chu Q, Bishop MR, Godley LA, et al. Geriatric assessment to predict survival
453   in older allogeneic hematopoietic cell transplantation recipients. Haematologica. 2014 Aug;99(8):1373-9. PubMed PMID:
454   24816237. Pubmed Central PMCID: 4116837.
455   67.   Wildes TM, Ruwe AP, Fournier C, Gao F, Carson KR, Piccirillo JF, et al. Geriatric assessment is associated with
456   completion of chemotherapy, toxicity, and survival in older adults with cancer. Journal of geriatric oncology. 2013
457   Jul;4(3):227-34. PubMed PMID: 23795224. Pubmed Central PMCID: 3686522.

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Figure 1: Hypothesized relationships among Getting Out of Bed (GOB), health-related quality of life (HRQoL) variables, and mortality*.
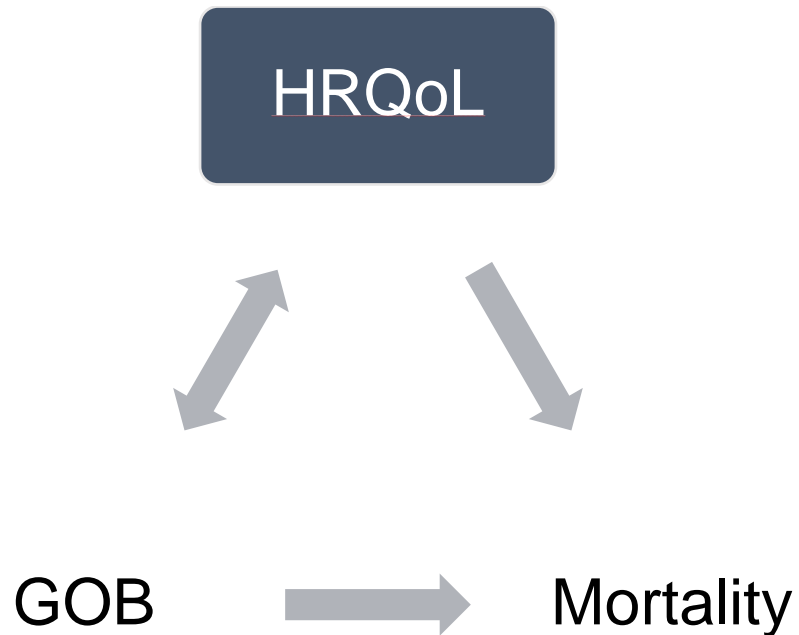
* GOB affects mortality and is associated with HRQoL, which also affects mortality. Therefore, any observed effect GOB may have on mortality might in fact be due to its association with HRQoL (12). This confounding situation can be solved by adjusting for HRQoL, such that GOB is an independent predictor for mortality.

Table 1: Getting out of bed questionnaire.

"This set of questions asks about things that encourage you to get up each morning and begin your day. Please indicate whether it is an Excellent description of you, a Very Good description of you, a Good description of you, a Fair description of you, or a Poor description of you.

GOB Item	Excellent	Very Good	Good	Fair	Poor
1. I am the type of person who almost always has a reason to get out of bed in the morning.	5	4	3	2	1
2. It is important for me to get out of bed each day and to do what I have to do.	5	4	3	2	1
3. I have reasons in my life to get up and to get going every day.	5	4	3	2	1
4. In the future, I am sure there will be things in my life to keep me getting up each day.	5	4	3	2	1

Table 2: Baseline socio-demographic and health-related characteristics in a population of older women with breast cancer (N=660).

Characteristic	n (%) / Median (IQR)
Enrollment site	
Los Angeles	150 (22.7)
Rhode Island	163 (24.7)
Minnesota	188 (28.5)
North Carolina	159 (24.1)
Age	
65–69 years	172 (26.1)
70–79 years	372 (56.4)
80+ years	116 (17.6)
Ethnicity	
White	620 (93.9)
Other	40 (6.1)
Education	
Less than 12 years	115 (17.4)
12 years	228 (34.5)
More than 12 years	316 (47.9)
Missing	1 (0.1)
Marital status	
Married	304 (46.1)
Not married	356 (53.9)
Breast Cancer Stage	
I	336 (50.9)
II	298 (45.1)
III	25 (3.8)
Missing	1 (0.1)
Type of therapy	
BCS	317 (48.0)
Mastectomy	316 (47.9)
Other	17 (2.6)
Missing	10 (1.5)
GOB	75.0 (31.2)
GOB ≥ 80	315 (47.7)
GOB < 80	321 (48.6)
Missing	24 (3.6)
PFI-10	90.0 (33.3)
PFI-10 ≥ 80	428 (64.8)
PFI-10 < 80	229 (34.7)
Missing	3 (0.5)
MHI-5	84.0 (20.0)
MHI-5 ≥ 80	455 (68.9)
MHI-5 < 80	204 (30.9)
Missing	1 (0.5)
BCSEH	75.0 (31.2)
BCSEH ≥ 80	403 (61.1)
BCSEH < 80	212 (32.1)
Missing	45 (6.8)
CARES-SF	82.1 (19.6)
CARES-SF ≥ 80	381 (57.7)
CARES-SF < 80	279 (42.3)
mMOS-SS	81.2 (31.2)
mMOS-SS ≥ 80	333 (50.5)
mMOS-SS < 80	327 (49.5)

IQR: Interquartile range; GOB: Getting-Out-of-Bed Scale; PFI-10: Physical Function Index; MHI-5: General mental health; BCSEH: Breast cancer-specific emotional health; CARES-SF: Cancer-specific psychosocial function; mMOS-SS: Modified Social Support Scale.

Table 3: Five- and ten-year survival analysis for all-cause and breast-cancer-specific mortality*.

		All-cause mortality		Breast-cancer-specific mortality	
		5-years HR (95%CI)	10-years HR (95%CI)	5-years HR (95%CI)	10-years HR (95%CI)
Model 1†:					
GOB ≥ 80 at baseline		0.78 (0.52, 1.19)	0.77 (0.59, 1.00)	0.92 (0.49, 1.74)	0.82 (0.52, 1.32)
Model 2†:					
GOB ≥ 80 at baseline		0.87 (0.57, 1.32)	0.84 (0.64, 1.10)	1.05 (0.55, 1.99)	0.89 (0.56, 1.43)
Age	65-69 years	Reference	Reference	Reference	Reference
	70-79 years	1.05 (0.61, 1.83)	1.43 (1.00, 2.05)	1.11 (0.46, 2.70)	1.17 (0.65, 2.1)
	80+ years	2.92 (1.65, 5.15)	3.18 (2.14, 4.71)	3.04 (1.23, 7.51)	2.00 (1.02, 3.95)
Stage	I	Reference	Reference	Reference	Reference
	II	1.51 (1.0, 2.30)	1.42 (1.09, 1.86)	6.84 (2.65, 17.7)	5.27 (2.81, 9.86)
	III	3.05 (1.43, 6.54)	3.20 (1.91, 5.37)	12.2 (3.28, 45.6)	10.2 (4.01, 26.0)
Model 3†:					
GOB ≥ 80 at baseline		1.04 (0.65, 1.66)	1.08 (0.80, 1.46)	1.10 (0.53, 2.27)	1.02 (0.59, 1.74)
Age	65-69 years	Reference	Reference	Reference	Reference
	70-79 years	1.02 (0.58, 1.77)	1.37 (0.96, 1.97)	1.10 (0.45, 2.67)	1.18 (0.65, 2.12)
	80+ years	3.25 (1.79, 5.89)	3.11 (2.07, 4.66)	3.62 (1.4, 9.40)	2.27 (1.12, 4.61)
Stage	I	Reference	Reference	Reference	Reference
	II	1.42 (0.93, 2.15)	1.40 (1.06, 1.83)	6.44 (2.49, 16.7)	5.12 (2.73, 9.61)
	III	2.58 (1.19, 5.62)	3.05 (1.80, 5.14)	10.2 (2.66, 38.8)	8.93 (3.45, 23.1)
PFI-10 ≥ 80 at baseline		0.64 (0.43, 0.97)	0.63 (0.48, 0.82)	0.83 (0.43, 1.61)	0.85 (0.52, 1.39)
MHI-5 ≥ 80 at baseline		0.43 (0.28, 0.68)	0.60 (0.45, 0.80)	0.46 (0.22, 0.97)	0.54 (0.32, 0.93)
BCSEH ≥ 80 at baseline		1.21 (0.72, 2.04)	0.93 (0.66, 1.31)	1.46 (0.65, 3.26)	1.14 (0.63, 2.08)
CARES-SF ≥ 80 at baseline		0.73 (0.47, 1.12)	0.96 (0.72, 1.26)	0.75 (0.38, 1.50)	0.88 (0.53, 1.46)
mMOS-SS ≥ 80 at baseline		1.26 (0.81, 1.98)	0.84 (0.62, 1.12)	1.41 (0.68, 2.91)	1.06 (0.63, 1.78)

HR: Hazard ratio; CI: Confidence interval; GOB: Getting-Out-of-Bed Scale; PFI-10: Physical Function Index; MHI-5: General mental health; BCSEH: Breast cancer-specific emotional health; CARES-SF: Cancer-specific psychosocial function; mMOS-SS: Modified Social Support Scale.

* All estimates from multiple imputed baseline variables using Cox regression.

† Model 1: Unadjusted; Model 2/3: Adjusted for all listed variables.

Table 4: Spearman rank correlations between baseline HRQoL measures.

	GOB	PFI-10	MHI-5	BCSEH	CARES-SF	mMOS-SS
GOB	1.00					
PFI-10	0.17	1.00				
MHI-5	0.33	0.26	1.00			
BCSEH	0.49	0.11	0.44	1.00		
CARES-SF	0.26	0.16	0.43	0.52	1.00	
mMOS-SS	0.36	0.14	0.31	0.45	0.39	1.00

GOB: Getting-Out-of-Bed Scale; PFI-10: Physical Function Index; MHI-5: General mental health; BCSEH: Breast cancer-specific emotional health; CARES-SF: Cancer-specific psychosocial function; mMOS-SS: Modified Social Support Scale.

Figure 2: Kaplan-Meier survival curves comparing A) survival from all-cause mortality and B) survival from breast-cancer-specific mortality between subjects with GOB ≥ 80 and those with GOB < 80*.
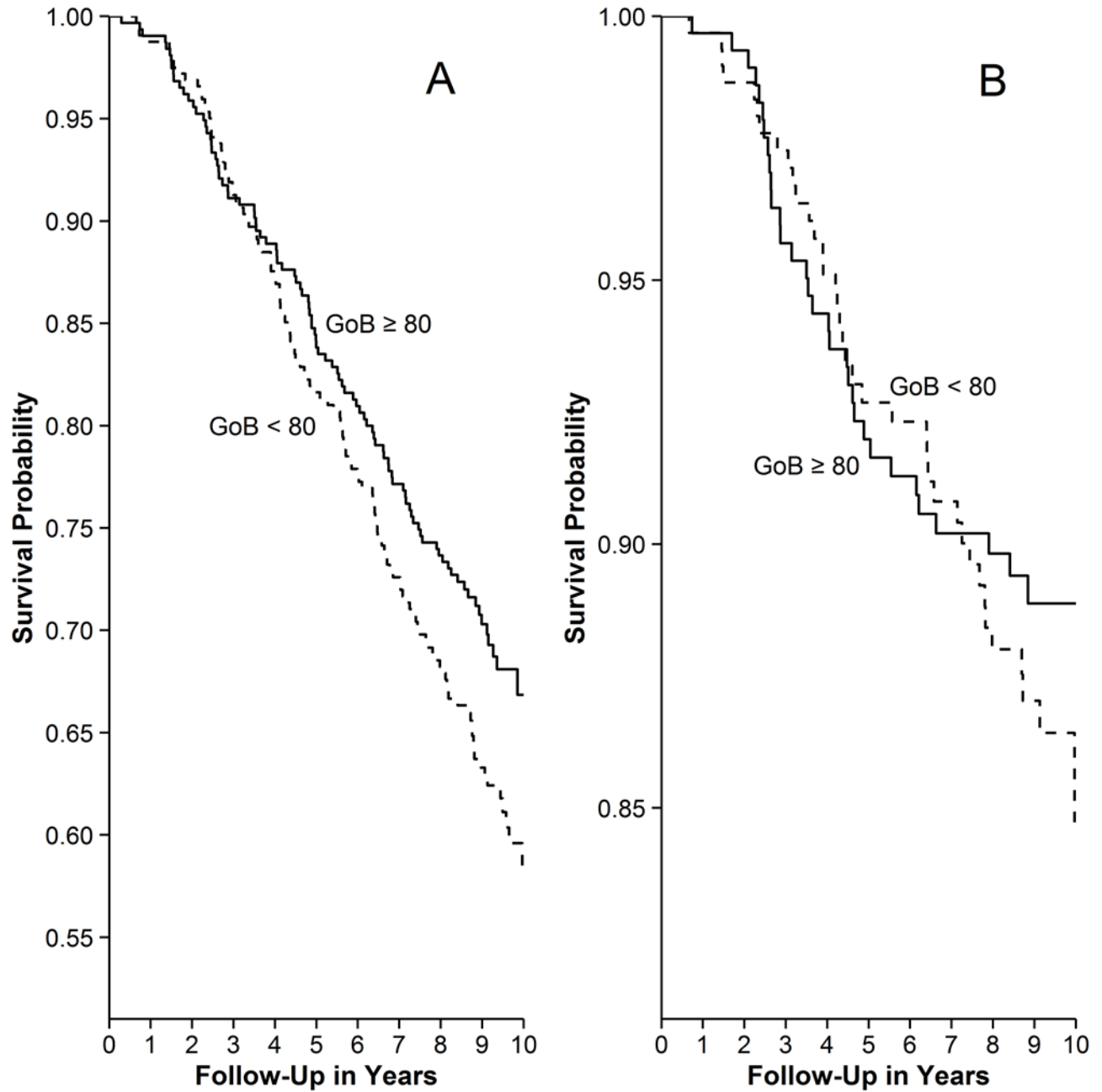
* Graphs based on complete case results.

Supplemental Table 1: Five- and ten-year survival analysis for all-cause and breast-cancer-specific mortality from complete case analysis using Cox regression models.

		All-cause mortality		Breast-cancer-specific mortality	
		5-years HR (95%CI)	10-years HR (95%CI)	5-years HR (95%CI)	10-years HR (95%CI)
Model 1*:					
GOB ≥ 80 at baseline		0.80 (0.53, 1.21)	0.78 (0.60, 1.02)	0.94 (0.50, 1.77)	0.84 (0.52, 1.34)
Model 2*:					
GOB ≥ 80 at baseline		0.86 (0.56, 1.3)	0.84 (0.64, 1.10)	0.99 (0.52, 1.91)	0.87 (0.54, 1.41)
Age	65-69 years	Reference	Reference	Reference	Reference
	70-79 years	0.98 (0.56, 1.72)	1.40 (0.98, 2.01)	1.15 (0.47, 2.78)	1.18 (0.65, 2.13)
	80+ years	2.68 (1.50, 4.78)	3.05 (2.05, 4.54)	2.73 (1.08, 6.89)	1.88 (0.94, 3.78)
Stage of breast cancer	I	Reference	Reference	Reference	Reference
	II	1.54 (1.00, 2.37)	1.47 (1.12, 1.94)	6.54 (2.52, 17.0)	5.61 (2.92, 10.8)
	III	3.00 (1.33, 6.74)	3.12 (1.80, 5.39)	12.4 (3.33, 46.4)	11.4 (4.40, 29.4)
Model 3*:					
GOB ≥ 80 at baseline		0.95 (0.59, 1.55)	1.05 (0.77, 1.42)	0.94 (0.44, 2.02)	0.93 (0.53, 1.63)
Age	65-69 years	Reference	Reference	Reference	Reference
	70-79 years	1.03 (0.58, 1.82)	1.37 (0.95, 1.97)	1.32 (0.51, 3.36)	1.26 (0.69, 2.32)
	80+ years	2.73 (1.44, 5.17)	2.84 (1.86, 4.34)	3.28 (1.15, 9.40)	2.14 (1.00, 4.58)
Stage of breast cancer	I	Reference	Reference	Reference	Reference
	II	1.38 (0.88, 2.17)	1.37 (1.03, 1.83)	5.52 (2.11, 14.5)	4.97 (2.57, 9.60)
	III	2.36 (1.01, 5.49)	2.90 (1.65, 5.09)	9.23 (2.38, 35.8)	8.93 (3.37, 23.7)
PFI-10 ≥ 80 at baseline		0.60 (0.39, 0.94)	0.63 (0.47, 0.84)	0.85 (0.42, 1.72)	0.95 (0.57, 1.60)
MHI-5 ≥ 80 at baseline		0.45 (0.27, 0.74)	0.58 (0.43, 0.79)	0.51 (0.23, 1.13)	0.53 (0.30, 0.92)
BCSEH ≥ 80 at baseline		1.43 (0.84, 2.43)	1.00 (0.70, 1.41)	1.65 (0.72, 3.78)	1.23 (0.67, 2.28)
CARES-SF ≥ 80 at baseline		0.74 (0.46, 1.17)	1.01 (0.75, 1.36)	0.78 (0.37, 1.63)	0.97 (0.56, 1.66)
mMOS-SS ≥ 80 at baseline		1.27 (0.78, 2.07)	0.83 (0.61, 1.14)	1.49 (0.69, 3.23)	1.12 (0.65, 1.94)

HR: Hazard ratio; CI: Confidence interval; GOB: Getting-Out-of-Bed Scale; PFI-10: Physical Function Index; MHI-5: General mental health; BCSEH: Breast cancer-specific emotional health; CARES-SF: Cancer-specific psychosocial function; mMOS-SS: Modified Social Support Scale.

* Model 1: Unadjusted; Model 2/3: Adjusted for all listed variables.

Supplemental Table 2: Five- and ten-year survival analysis for all-cause and breast-cancer-specific mortality using non-dichotomized standardized health measures from Cox regression models.

		All-cause mortality		Breast-cancer-specific mortality	
		5-years	10-years	5-years	10-years
		HR (95%CI)	HR (95%CI)	HR (95%CI)	HR (95%CI)
Model 1*:					
GOB linear†		0.90 (0.74, 1.09)	0.85 (0.75, 0.96)	1.00 (0.73, 1.36)	0.95 (0.75, 1.19)
Model 2*:					
GOB linear†		0.96 (0.79, 1.17)	0.89 (0.79, 1.01)	1.09 (0.79, 1.50)	1.01 (0.80, 1.27)
Age	65-69 years	Reference	Reference	Reference	Reference
	70-79 years	1.06 (0.61, 1.84)	1.43 (1.00, 2.04)	1.13 (0.47, 2.73)	1.18 (0.66, 2.13)
	80+ years	2.94 (1.66, 5.20)	3.13 (2.11, 4.64)	3.11 (1.26, 7.70)	2.04 (1.03, 4.02)
Stage of breast cancer	I	Reference	Reference	Reference	Reference
	II	1.51 (1.00, 2.29)	1.41 (1.08, 1.85)	6.89 (2.67, 17.8)	5.28 (2.82, 9.88)
	III	3.07 (1.43, 6.56)	3.20 (1.91, 5.36)	12.6 (3.28, 45.7)	10.3 (4.06, 26.3)
Model 3*:					
GOB linear†		1.08 (0.86, 1.36)	1.06 (0.91, 1.23)	1.11 (0.77, 1.62)	1.12 (0.84, 1.48)
Age	65-69 years	Reference	Reference	Reference	Reference
	70-79 years	1.07 (0.61, 1.88)	1.40 (0.98, 2.01)	1.23 (0.50, 3.02)	1.27 (0.70, 2.30)
	80+ years	3.06 (1.67, 5.61)	3.11 (2.06, 4.70)	3.68 (1.38, 9.84)	2.42 (1.17, 5.01)
Stage of breast cancer	I	Reference	Reference	Reference	Reference
	II	1.44 (0.94, 2.19)	1.41 (1.07, 1.86)	6.34 (2.44, 16.5)	5.10 (2.71, 9.59)
	III	2.82 (1.29, 6.16)	3.07 (1.81, 5.20)	11.2 (2.90, 43.1)	9.10 (3.49, 23.7)
PFI-10 at baseline, linear†		0.80 (0.66, 0.97)	0.76 (0.67, 0.87)	1.03 (0.73, 1.45)	0.98 (0.76, 1.26)
MHI-5 at baseline, linear†		0.79 (0.63, 0.99)	0.84 (0.72, 0.97)	0.79 (0.55, 1.12)	0.77 (0.60, 0.99)
BCSEH at baseline, linear†		1.08 (0.82, 1.42)	0.96 (0.80, 1.14)	1.31 (0.85, 2.01)	1.03 (0.76, 1.41)
CARES-SF at baseline, linear†		0.95 (0.74, 1.22)	1.04 (0.88, 1.22)	0.79 (0.54, 1.15)	0.98 (0.74, 1.31)
mMOS-SS at baseline, linear†		1.04 (0.81, 1.33)	0.94 (0.80, 1.10)	1.09 (0.73, 1.63)	1.01 (0.75, 1.35)

HR: Hazard ratio; CI: Confidence interval; GOB: Getting-Out-of-Bed Scale; PFI-10: Physical Function Index; MHI-5: General mental health; BCSEH: Breast cancer-specific emotional health; CARES-SF: Cancer-specific psychosocial function; mMOS-SS: Modified Social Support Scale.

* Model 1: Unadjusted; Model 2/3: Adjusted for all listed variables.

† Per 1-unit SD increase.

Supplemental Table 3: Five- and ten-year survival analysis for all-cancer mortality*.

		All-cancer mortality	
		5-years HR (95%CI)	10-years HR (95%CI)
Model 1†:			
GOB ≥ 80 at baseline		0.86 (0.50, 1.48)	0.78 (0.53, 1.14)
Model 2†:			
GOB ≥ 80 at baseline		0.93 (0.53, 1.61)	0.83 (0.56, 1.22)
Age	65-69 years	Reference	Reference
	70-79 years	0.77 (0.39, 1.53)	1.14 (0.71, 1.82)
	80+ years	2.18 (1.08, 4.42)	1.87 (1.08, 3.25)
Stage	I	Reference	Reference
	II	2.35 (1.31, 4.21)	2.60 (1.71, 3.96)
	III	3.59 (1.21, 10.7)	5.64 (2.77, 11.5)
Model 3†:			
GOB ≥ 80 at baseline		0.96 (0.51, 1.80)	0.92 (0.59, 1.42)
Age	65-69 years	Reference	Reference
	70-79 years	0.76 (0.38, 1.52)	1.13 (0.70, 1.81)
	80+ years	2.59 (1.23, 5.44)	1.91 (1.08, 3.39)
Stage	I	Reference	Reference
	II	2.23 (1.25, 4.00)	2.56 (1.68, 3.90)
	III	2.91 (0.96, 8.88)	5.18 (2.51, 10.7)
PFI-10 ≥ 80 at baseline		0.89 (0.51, 1.55)	0.76 (0.51, 1.12)
MHI-5 ≥ 80 at baseline		0.45 (0.24, 0.83)	0.72 (0.47, 1.11)
BCSEH ≥ 80 at baseline		1.34 (0.68, 2.66)	1.05 (0.65, 1.70)
CARES-SF ≥ 80 at baseline		0.85 (0.48, 1.52)	0.91 (0.60, 1.37)
mMOS-SS ≥ 80 at baseline		1.44 (0.79, 2.63)	1.02 (0.68, 1.55)

HR: Hazard ratio; CI: Confidence interval; GOB: Getting-Out-of-Bed Scale; PFI-10: Physical Function Index; MHI-5: General mental health; BCSEH: Breast cancer-specific emotional health; CARES-SF: Cancer-specific psychosocial function; mMOS-SS: Modified Social Support Scale.

* All estimates from multiple imputed baseline variables using Cox regression.

† Model 1: Unadjusted; Model 2/3: Adjusted for all listed variables.