**Online Supplemental Material**

**This online-only document contains the following elements:**

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* eTable 1, Study 1 sample characteristics
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**Additional Data Analytic Technique for Study 1:** Cancer stage and time since treatment were only relevant to cancer survivors. Accordingly, cancer stage and time since treatment were included as covariates by adding the main effects of cancer status and the interactions between cancer status and either variable. The main effects of cancer stage and time since treatment were omitted, because their meaning (i.e., the effect of the covariate for benign controls) would not be interpretable (Kutner, Nachtsheim, Neter, & Li, 2004). The interaction term without the corresponding main effect provided estimates of the effects of these covariates for cancer survivors only (cancer status = 1). This method also changed the interpretation of the main effect of cancer status to be the difference between cancer survivors and benign participants at the referent (zero) levels of stage and time since treatment, i.e., the difference between stage 0 cancer survivors and benign participants immediately after treatment (time since treatment = 0). The interaction terms then capture how this difference changes as the cancer survivor gets further out from treatment (as time since treatment increases) and for higher cancer stages. For example, if we expected the difference between cancer survivors and benign participants to be greatest immediately after cancer treatment, and for the difference to shrink the further out from treatment the participant is, we would expect a large positive main effect of cancer status and a negative effect of the interaction term (reducing the difference as time since treatment increases).

eTable 1.

Study 1 sample characteristics.

|  |  |  |  |
| --- | --- | --- | --- |
| **Characteristic** | **Category** | **Cancer survivors (N = 49)**Number (%)\* | **Benign controls (N = 66)**Number (%)\* |
| **Gender** | Female | 48(98) | 48(73) |
| Male | 1(2) | 18(27) |
| **Race** | White | 42(86) | 56(85) |
| Non-White | 7(14) | 10(15) |
| **Education** | High school or below | 11(22) | 11(17) |
| Some college or college graduate | 21(43) | 29(44) |
| Graduate or professional training | 17(35) | 26(39) |
| **Marital Status** | Single | 5(10) | 10(15) |
| Married/domestic partner | 34(71) | 39(59) |
| Separated/divorced/widowed | 10(19) | 17(26) |
| **Cancer Stage** | 0 | 10(20) | --- |
| I | 20(41) | **---** |
| II | 14(29) | **---** |
| III | 4(8) | **---** |
| IV | 1(2) | **---** |
| **Days since Tx at T1** | N/A – Numbers are Mean (SD) | 278.23(120.65) | --- |
| **Days since Tx at T2** | N/A – Numbers are Mean (SD) | 666.89(117.66) | --- |
| **Age**  | N/A – Numbers are Mean (SD) | 58.06(12.86) | 55.80(9.80) |
| **Body mass index** | N/A – Numbers are Mean (SD) | 29.03(7.75) | 29.14(6.59) |
| **Comorbidities** | N/A – Numbers are Mean (SD) | 0.88(1.60) | 0.55(0.93) |
| **Loneliness** | N/A – Numbers are Mean (SD) | -0.03 (0.75) | 0.07 (0.81) |
| **Exercise (min/wk)** | N/A – Numbers are Mean (SD) | 108.09(155.24) | 101.44(130.50) |
| **Sleep quality** | N/A – Numbers are Mean (SD) | 7.48(3.48) | 7.31(3.74) |

*Note*. Percentages reflect the proportion of participants within their respective group (cancer survivor vs. benign control). Unless otherwise specified, the reported data reflect information obtained at the first post-treatment visit. \*Certain values reflect the mean and standard deviation (rather than the number and percentage) when noted as such in the category column.

eTable 2.

Means and standard deviations of the Study 1 primary variables by cancer status.

|  |  |  |  |
| --- | --- | --- | --- |
| **Characteristic** | **Group Membership** | **T1** | **T2** |
| **Loneliness**  | Cancer survivor | -0.03 (0.75) | -0.06 (0.77) |
| Benign control | 0.07 (0.81) | 0.13 (0.86) |
| **Pain** | Cancer survivor | 72.86 (22.78) | 70.66 (19.81) |
| Benign control | 72.65 (25.09) | 71.70 (23.46) |
| **Depression**  | Cancer survivor | 10.37 (8.69) | 9.57 (9.42) |
| Benign control | 13.80 (10.86) | 11.88 (11.34) |
| **Fatigue (RAND-36)** | Cancer survivor | 54.79 (21.11) | 55.31 (22.07) |
| Benign control | 50.83 (25.73) | 53.64 (26.78) |
| **Fatigue (MFSI-SF)** | Cancer survivor | 8.21 (19.94) | 6.97 (18.59) |
| Benign control | 12.64 (24.54) | 9.73 (23.66) |

Note. *N*=115. Higher numbers reflect more loneliness and depression and more fatigue as measured by the MFSI-SF. Higher numbers also reflect less pain and fatigue as measured by the RAND-36. None of the mean differences between cancer survivors and benign controls are significantly different at either time point. Data from the Medical Outcomes Study using the RAND-36 suggest that average pain levels are around 71 whereas average fatigue levels are around 52 (Hays et al., 1993). No norms exist for the loneliness (NYUL) scale or fatigue as measured by the MFSI-SF. Because we omitted loneliness-related items from the depression measure, no norms exist for the depression scale as well.

eTable 3.

Fully adjusted Study 1 regression analyses: T1 loneliness predicting T1 symptom cluster levels.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Outcome: T1 Symptom Cluster Levels |  |  |
| Predictor | Unstandardized beta coefficient (*b*)\* | Standard Error | t | \*Partial R2 | p |
| T1 Body mass index  | .00 | .01 | 0.31 | .05 | .756 |
| T1 Age  | .00 | .01 | 0.29 | .00 | .770 |
| T1/T2 Gender | -.11 | .15 | -0.72 | .00 | .472 |
| T1 Comorbidities | .09 | .05 | 1.99 | .03 | .049 |
| T1 Marital status | -.10 | .12 | -0.85 | .09 | .396 |
| T1/T2 Cancer status | -.45 | .27 | -1.68 | .00 | .097 |
| T1/T2 Cancer stage(interaction with cancer status) | .03 | .10 | 0.34 | .00 | .734 |
| T1 Days since tx ended(interaction with cancer status) | .00 | .00 | 1.33 | .03 | .186 |
| T1 Exercise | -.00 | .00 | -2.80 | .04 | .006 |
| T1 Sleep quality | .09 | .02 | 5.76 | .22 | .000 |
| T1 Loneliness | .50 | .08 | 6.41 | .16 | .000 |

*Note*. Higher numbers reflect higher symptom cluster levels. These analyses reflect the models reported in the ancillary analyses that include both potential mediators, sleep and exercise. \* Partial R2 refers to the percent of variance in symptom cluster levels explained by each predictor.

eTable 4.

Study 2 sample characteristics.

|  |  |  |  |
| --- | --- | --- | --- |
| **Characteristic** | **Category** | **Caregivers (N=125)**Number (%)\* | **Non-caregivers (N=104)**Number (%)\* |
| **Gender** | Female | 85(68) | 79(76) |
| Male | 40(32) | 25(24) |
| **Race** | White | 114(91) | 83(80) |
| Non-white | 11(9) | 21(20) |
| **Education** | High school or below | 41(33) | 29(28) |
| Some college or college graduate | 66(53) | 54(52) |
| Graduate or professional training | 18(14) | 21(20) |
| **Marital Status** | Single | 0(0) | 0(0) |
| Married/domestic partner | 99(79) | 76(73) |
| Separated/divorced/widowed | 26(21) | 28(27) |
| **Age**  | N/A – Numbers are Mean (SD) | 70.21(10.08) | 69.05(8.89) |
| **Body mass index** | N/A – Numbers are Mean (SD) | 26.15(4.28) | 26.67(5.07) |
| **Comorbidities** | N/A – Numbers are Mean (SD) | 3.29(2.23) | 3.11(2.45) |
| **Loneliness** | N/A – Numbers are Mean (SD) | 0.31(1.20) | -0.33(0.76) |
| **Exercise (hrs/wk)** | N/A – Numbers are Mean (SD) | 2.93(5.23 | 3.20(4.99) |
| **Sleep quality** | N/A – Numbers are Mean (SD) | -1.00(2.69) | -.47(1.40) |

*Note*. Percentages reflect the proportion of participants within their respective group (caregiver vs. non-caregiver control). Unless otherwise specified, the reported data reflect information obtained at the current study’s first visit. \*Certain values reflect the mean and standard deviation (rather than the number and percentage) when noted as such in the category column.

eTable 5.

Means and standard deviations of the Study 2 primary variables by caregiving status.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Characteristic** | **Group Membership** | **T1** | **T2** | **T3** | **T4** |
| **Loneliness**  | Caregiver | 0.31(1.20) | 0.32(1.10) | 0.20(1.10) | 0.27(1.10) |
| Non-caregiver control | -0.33(0.76) | -0.35(0.74) | -0.26(0.81) | -0.32(0.77) |
| **Pain**  | Caregiver | 67.92(25.57) | 73.11(23.20) | 71.32(23.60) | 71.26(23.84) |
| Non-caregiver control | 77.01(20.50) | 78.95(20.89) | 74.38(20.80) | 70.20(26.35) |
| **Depression**  | Caregiver | 5.31(3.94) | 4.64(4.01) | 4.83(3.48) | 5.11(4.01) |
| Non-caregiver control | 3.88(3.17) | 3.27(2.79) | 4.28(3.31) | 4.30(4.04) |
| **Fatigue** | Caregiver | 55.41(20.03) | 56.78(20.07) | 54.39(19.60) | 53.70(21.48) |
| Non-caregiver control | 62.56(16.56) | 62.83(15.87) | 60.44(18.07) | 58.49(24.27) |

Note. *N*=229. Higher numbers reflect more loneliness and depression and less pain and fatigue. Across time, caregivers experienced significantly more loneliness, depression, and fatigue and marginally more pain than non-caregiver controls. Data from the Medical Outcomes Study using the RAND-36 suggest that average pain levels are around 71 whereas average fatigue levels are around 52 (Hays et al., 1993). Depression (BDI–SF) scores from 0 to 4 demonstrate no or minimal depression, 5 to 7 demonstrate mild depression, 8 to 15 demonstrate moderate depression, and scores greater than 15 demonstrate severe depression (Beck & Beck, 1972). No norms exist for the loneliness (NYUL) scale.

eTable 6.

Fully adjusted Study 2 GEE analyses: Loneliness predicting concurrent symptom cluster levels.

|  |  |  |
| --- | --- | --- |
|  | Outcome: Current Year Symptom Cluster Levels |  |
| Predictor | Unstandardized beta coefficient (*b*)\* | Standard Error | χ2 | 95% Wald CI | p |
| Body mass index (current year) | .03 | .01 | 18.94 | .02, .05 | <.001 |
| Age (current year) | .01 | .00 | 10.03 | .01, .02 | .002 |
| Gender  | .12 | .08 | 2.10 | -.04, .28 | .148 |
| Caregiving status (current year) | .04 | .07 | .22 | -.11, .18 | .641 |
| Comorbidities (current year) | .10 | .01 | 48.36 | .07, .13 | <.001 |
| Exercise (current year) | -.01 | .01 | 3.89 | -.02, -.00 | .049 |
| Sleep quality (current year) | -.05 | .02 | 8.98 | -.08, -.02 | .003 |
| Loneliness (current year) | .36 | .04 | 95.28 | .29, .44 | <.001 |

*Note*. *N*=229. Higher numbers reflect higher symptom cluster levels. These analyses reflect the models reported in the ancillary analysis section that includes both potential mediators, sleep and exercise.