Published in final edited form as:

Psychooncology. 2018 October ; 27(10): 2389–2397. doi:10.1002/pon.4836.

Dyadic stress of breast cancer survivors and their caregivers: Are there differences by sexual orientation?

Ulrike Boehmer¹, Jeffrey E. Stokes², Angela R. Bazzi¹, Michael Winter³, and Melissa A. Clark⁴

¹Department of Community Health Sciences, Boston University School of Public Health, Boston, MA, USA

²Department of Sociology and Anthropology, Illinois State University, Normal, IL, USA

³Biostatistics and Epidemiology Data Analytics Center, Boston University School of Public Health, Boston, MA, USA

⁴Department of Quantitative Health Sciences, University of Massachusetts Medical School, Worcester, MA, USA

Abstract

Objective: The objective of the study is to assess dyadic stress among sexual minority cancer survivor and caregivers compared to heterosexual cancer survivors and their caregivers.

Methods: We recruited 167 survivors of nonmetastatic breast cancer of different sexual orientations and their caregivers, who were interviewed via telephone after obtaining consent. We used inverse propensity score weighting to account for differences by sexual orientation in age and length of the survivor-caregiver relationship and simultaneous equation models consistent with the needs for analyzing dyadic data.

Results: Survivors and caregivers reported stress levels consistent with population norms, irrespective of survivors' sexual orientation. Accounting for covariates, survivors' and caregivers' stress did not mutually influence one another overall. However, differences by sexual orientation were noted such that caregivers' stress was influential for sexual minority survivors' stress, but not for heterosexual survivors' stress.

Conclusions: Careful consideration should be given to caregivers of sexual minority survivors, an underserved group for whom currently no interventions exist.

Correspondence: Ulrike Boehmer, Department of Community Health Sciences, Boston University School of Public Health, Boston, MA, USA. boehmer@bu.edu.

CONFLICT OF INTEREST

None of the authors declared a conflict of interest.

ETHICAL APPROVAL

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

INFORMED CONSENT

Informed consent was obtained from all individual participants included in the study.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Keywords

breast cancer; caregiving; dyads; psychological needs; stress

1 | BACKGROUND

Breast cancer is the most common cancer diagnosis in US women.¹ Because effective treatments have increased survival, research has expanded from the immediate diagnosis and treatment phase to cancer survivorship.¹ Social support provided by informal caregivers (ie, partners, spouses, family members, or friends) affects the survivorship experience from diagnosis and treatment through remission.² Overwhelming evidence shows that caregivers to cancer patients are psychologically affected and report high distress levels.² Two meta-analyses of cancer patient-partner dyads indicated that dyad members' distress levels are moderately related ($r = 0.29\text{--}0.35$)^{3,4} and similar in that highly distressed patients have highly distressed caregivers.^{3,4} Additional studies suggest interdependence in dyad members' outcomes, with 1 member's stress impacting the outcomes of the other member.^{5,6}

Most research has focused on heterosexual women (HSW) with breast cancer and their husbands, neglecting breast cancer survivors who are supported by nonspousal caregivers and sexual minority women (SMW), defined as lesbian, bisexual women, and women with a woman partner.⁷ Only limited information is available on SMW caregivers, who are often female and the partners of survivors.^{8,9} More research is needed to understand outcomes in these understudied breast cancer survivor and caregiver populations.

Different theoretical frameworks can help to understand the well-being of breast cancer survivor-caregiver dyads.¹⁰ Lazarus and Folkman's stress-coping framework¹¹ stipulates that, when confronted with a stressor such as cancer, individuals evaluate their available social and cultural resources and then use coping strategies to mediate the stressor and restore balance. The stress-coping framework acknowledges that coping responses differ based on demographic characteristics. This implies that stress appraisal may vary because of survivors' sexual orientation. According to Meyer's minority stress model, SMW's disadvantaged status in society subjects them to discrimination and social prejudice that creates stress above and beyond general life stress and may explain SMW's worse mental health outcomes compared to heterosexuals.¹² When applied to breast cancer survivorship, it has been hypothesized that SMW minority stress compounds the stress of a cancer diagnosis.⁷ While generalized stress may be more prevalent among SMW than HSW with breast cancer,¹³ to our knowledge, this has never been assessed among dyads of SMW and their caregivers.

Given the limited information on stress among SMW and their caregivers, we examined generalized stress among survivor-caregiver dyads of sexual minority and heterosexual survivors using a dyadic modeling approach.¹⁴ We focused on the interdependence of stress between survivors and caregivers, while controlling for correlates of stress. First, in light of the minority stress framework and past research identifying differences in stress by sexual orientation, we determined whether survivors' and caregivers' levels of stress differed by

sexual orientation. We hypothesized that SMW survivors and their caregivers would report more stress than HSW survivors and their caregivers. Second, we hypothesized that caregivers' and survivors' stress would be interrelated, meaning they either mutually influence each other's stress, or only 1 individual influences the other. Finally, we examined whether differences by sexual orientation exist in the hypothesized interdependence of survivors' and caregivers' stress.

2 | METHODS

All aspects of this study were approved by the Institutional Review Board of Boston University (H-31625).

2.1 | Recruitment

Recruitment focused on survivors first, and we subsequently recruited their caregivers. We initially recontacted participants from an earlier study that included SMW and HSW survivors with a diagnosis of non-recurrent and nonmetastatic breast cancer¹⁵ who had agreed to be contacted for future studies. Additionally, we invited SMW and HSW who were ineligible for a study of advanced breast cancer for which we recruited concurrently. Eligibility criteria for breast cancer survivors were a diagnosis of nonmetastatic (stage in situ to III) and nonrecurrent breast cancer after age 21. After obtaining verbal consent, eligible SMW and HSW survivors were invited to participate in a 45-minute telephone interview. Following the interview, each participant was given the opportunity to invite her partner, if partnered, or her primary support person if unpartnered, to participate in a similarly structured phone interview. Any individual who was identified as the partner or the primary support person for a survivor was invited to participate in a telephone interview of approximately the same length and asked the same or similar questions asked of survivors.

From May to July 2012, we recruited 297 breast cancer survivors of whom 203 (68.4%) provided contact information for their partner or primary support person (eg, caregiver); 167 (82.3%) participated in the survey,⁸ resulting in data on 167 dyads. Of these, 124 were SMW dyads (74.3%).

2.2 | Measures

The outcome, perceived stress, was assessed using a 10-item self-report scale that included items such as, "How often have you found that you could not cope with all the things that you had to do?"¹⁶ With higher scores indicating greater stress, this scale measures the degree to which a person perceives her life to be unpredictable, uncontrollable, or overloading during the last month. The scale developer reported a national probability sample of adults' perceived stress scores as $M = 13.02$, $SD = 6.35$.¹⁶

The main independent measure, sexual orientation, distinguished heterosexuals from sexual minorities, defined as self-reported lesbian, gay, or bisexual individuals, as well as individuals reporting a preference for same-sex partners.

We also collected information on potential confounders. Other demographic data included age, race, education, employment, and income for all participants. In addition, for survivors,

we assessed having a partner, living alone, and health insurance. From survivors' addresses and Census 2000 data, we derived 2 measures of neighborhood socioeconomic status¹: poverty level, the percentage of the population in a census block living below the Federal poverty level, and² median household income within census blocks. We also assessed lifetime discrimination experiences, measured as whether the participant ever felt discriminated against because of their age, race/ethnicity, gender, sexual orientation, appearance, income level, or having had cancer.¹⁷

Medical information included survivors' cancer-related experiences including time since diagnosis (from diagnosis to interview date), stage, and cancer treatments, from which we derived measures of surgery, radiation, chemotherapy, and receipt of antiestrogen (tamoxifen or aromatase inhibitor) therapy. For both survivor and caregiver participants, we determined comorbidities using a measure developed by Ganz¹⁸ that captures 14 conditions including heart disease, allergies, and asthma.

Consistent with prior studies, we considered psychosocial factors that may be related to perceived stress. We used a scale of fear of recurrence developed by Northouse,¹⁹ which includes negatively and positively worded items to determine the amount of worry and concern survivors and their caregivers have about the cancer recurring (eg, "I seldom think about my health"). As a measure of social support, we used a 6-item short form of the Interpersonal Support Evaluation List (ISEL).^{20,21} This scale measures belonging, tangible support, and appraisal using items such as, "When I feel lonely, there are several people I can talk to." We also used a 12-item instrument (Multidimensional Scale of Perceived Social Support) assessing social support from 3 sources: family, friends, and significant others (eg, "My family tries to help me").²² We assessed use of cancer-related support groups and whether the participant had sought mental health counseling to deal with breast cancer, or had used mental health counseling prior to breast cancer.

As dyadic characteristics, we assessed survivor and caregiver's coresidence, the type of survivor-caregiver relationship, and the duration of the relationship, from which we determined the proportion of life they were in this relationship. We also assessed dyadic cohesion, which includes items such as, "How often do you and your partner calmly discuss something?" Dyadic cohesion is a subscale of the Dyadic Assessment Scale.²³ Finally, we determined breast cancer's effect on closeness of the relationship by adapting a single item from a study on couples.²⁴ We assessed each scale's internal consistency in this sample (see online Table).

2.3 | Statistical analysis

We used simultaneous equation modeling (SIM) with 3-stage least squares (3SLS) estimation to account for the nonindependence of observations from survivors and their caregivers.^{14,25} This approach allowed for analysis of both "actor" and "partner" effects, where "actor effects" refer to associations between a survivor's or caregiver's reports and their own level of perceived stress, and "partner effects" refer to associations between a survivor's or caregiver's reports and the other person's level of perceived stress. Moreover, SIM with 3SLS estimation allows for endogenous explanatory variables in the simultaneous

equations; that is, the outcome for 1 equation can be used as a predictor in the other equation.

We used propensity scores to create weights to account for potential selection biases. Propensity scores were generated using a multivariate logistic regression model predicting survivor sexual orientation. Age and proportion of life in a relationship were selected as focal predictors for generating weights, as these are unmodifiable factors and were highly unbalanced in this sample.²⁶

Because of the relatively small sample size, we examined potential confounders empirically to have parsimonious final analyses. We used stepwise regression models to estimate each outcome separately, using measures reported in Table 1 as potential covariates with an inclusion criteria of $P < .10$. However, age and relationship time of dyads were excluded because these variables were used for the propensity weights, while caregiver sexual orientation and gender were excluded because of their almost complete overlap with survivor sexual orientation. Categorical variables with group sizes less than $n = 10$ were recoded to prevent zero-cell problems. Following these initial stepwise regressions, we retained significant covariates when analyzing survivors' and caregivers' perceived stress in tandem by SIM. Covariates that were not significant at $P < .10$ in the SIM model were removed. Because the same covariates did not all serve as significant predictors of both survivors' and caregivers' perceived stress, there were sufficient degrees of freedom remaining to test endogenous effects, or "mutual influence."¹⁴ Mutual influence modeling is a dyadic approach that can incorporate both actor and partner effects, but which also models actor and partner outcomes as causally related to one another and not merely as covarying.

We first estimated a SIM model that included all significant covariates along with survivor sexual orientation in the equations for both survivors' and caregivers' perceived stress (model 1). Next, we added dyadic partner's perceived stress to both simultaneous equations (model 2). We then added interaction terms between survivor sexual orientation and dyadic partner's perceived stress to both equations (model 3).

Missing data were not problematic in this sample. A total of 143(85.6%) of 167 dyads had complete data on all measures included in the final SIM model. The item with the greatest amount of missing data was caregiver discrimination, for which 20 (12.0%) of 167 dyads were missing valid data. There were no clear patterns of missingness detected; therefore, missing data were addressed using multiple imputation by chained equations, with a total of 10 imputed data sets produced.²⁷ Listwise analyses produced similar results to those presented, with no change in the significant findings of interest. However, imputed models were preferred to retain the full analytic sample and to protect against potential bias from listwise deletion. Statistical analyses were performed using Stata Version 15.

3 | RESULTS

Sexual minority women and HSW survivors were similar on most demographic characteristics, in that most survivors were white, highly educated, and had relatively high income (eg, more than 40% had an income \$70 000 and resided in low poverty-level

neighborhoods and only 25% lived in neighborhoods with median household income \$43,846). The majority of survivors reported in situ or stage I breast cancer; most were treated with breast conserving surgery, radiation, and antiestrogen therapy, and both groups of survivors shared similar levels of other comorbidities. However, the average years since diagnosis was 7 for SMW compared to 6 for HSW ($P < .05$). Sexual minority women survivors were more likely to report having used counseling prior to the cancer diagnosis ($P < .01$) and afterwards made greater use of cancer support groups ($P < .05$) compared to HSW survivors. Relative to caregivers to SMW, more caregivers to HSW were male ($P < .01$) and not employed ($P < .01$) and all self-reported as heterosexual, while most caregivers to SMW were female and self-reported as sexual minority. Relationship type ($P < .05$) differed by sexual orientation. While most caregivers were the survivor's spouse or partner, HSW survivors more likely had family members as caregivers, while SMW more likely had friends as caregivers. Caregivers to SMW reported greater use of counseling prior to breast cancer compared to caregivers to HSW ($P < .01$). Sexual minority and heterosexual dyads were similar in cohesion and closeness. Further, survivors reported similar levels of fear of recurrence as their respective caregivers. However, we also identified some differences by sexual orientation in caregiver and survivor characteristics. Compared to HSW survivors and their caregivers, SMW survivors and their caregivers were significantly younger ($P < .01$), had a shorter relationship duration ($P < .01$), and reported more experiences of discrimination ($P < .01$).

Overall, survivors and caregivers reported moderate levels of stress, averaging 13.0 and 11.8 on the 40-point scale. Survivors reported slightly higher levels of perceived stress than their caregivers ($P = .07$). Neither survivor nor caregiver stress differed between heterosexual and sexual minority dyads. Overall, survivors' and caregivers' reports of stress were moderately and significantly correlated ($P < .01$). Notably, this correlation was stronger among sexual minority dyads ($r = .32$, $P < .001$) than among heterosexual dyads ($r = -.05$, $P > .10$). Thus, our multivariate analyses examined interactions between survivor sexual orientation and the "interdependence" of perceived stress within dyads.

Table 2 displays the results of our analytic SIM models. Model 1 included significant covariates identified via stepwise regression, along with survivor sexual orientation. For survivors' stress, significant associations were found with survivors' own fear of recurrence ($B = 0.21$, $P < .001$) and with their own employment ($B = -1.89$, $P < .10$). Further, caregivers' fear of recurrence ($B = -0.08$, $P < .01$), caregivers having sought counseling to deal with the survivor's breast cancer ($B = 4.46$, $P < .01$), and caregivers' employment ($B = 2.84$, $P < .01$) were also significantly associated with survivors' stress. Sexual orientation was not significantly associated with survivors' stress ($B = 1.01$, $P > .10$). Among caregivers, their own employment ($B = 2.28$, $P < .01$), social support (ISEL) ($B = -0.85$, $P < .001$), having 2 ($B = 3.57$, $P < .01$) or more ($B = 5.46$, $P < .001$) comorbidities, and perceived discrimination ($B = 0.70$, $P < .05$) were significantly associated with caregivers' stress. Further, survivors' having a college degree ($B = -2.67$, $P < .05$) was significantly associated with caregivers' stress. Survivor sexual orientation was not associated with caregivers' stress.

Model 2 added dyadic partner's stress as predictors to the equations from model 1. For survivors' stress, all significant covariates from model 1 remained unchanged. Further, caregivers' stress was not significantly associated with survivors' stress. For caregivers' stress, all significant covariates remained unchanged from model 1. Likewise, survivors' stress was not a significant predictor of caregivers' stress.

Model 3 shows the results after we added interaction terms between survivor sexual orientation and dyadic partner's perceived stress to both equations from model 2. The interaction between survivor sexual orientation and caregivers' stress ($B = 0.56, P < .01$) was positive and significant. This indicates that only among SMW dyads, caregivers' stress was a significant predictor of survivors' stress. Of the covariates, survivor employment was no longer significant. For caregivers' stress, the interaction between survivor sexual orientation and survivors' stress was not significant, indicating no difference in effects between heterosexual and sexual minority dyads. Among covariates, caregiver employment and caregiver discrimination were no longer significant, while the effect of survivors' having a college degree ($B = -2.15, P < .10$) was reduced to trend-level significance. No other covariates' effects were significantly altered. As a robustness check, we also performed SIM analyses for SMW and HSW dyads separately. The results of interest were consistent with those presented: Caregivers' stress significantly predicted survivors' stress among SMW dyads, but not among HSW dyads; survivors' stress did not significantly predict caregivers' stress among SMW or HSW dyads.

4 | DISCUSSION

Stress is an important risk factor for negative outcomes, including poor quality of life, poor health behaviors, and mortality.^{28,29} We examined this potential explanatory mechanism of poor outcomes, hypothesizing that SMW survivors and their respective caregivers will report greater stress than HSW survivors and their caregivers. We found no support for this hypothesis, which is inconsistent with the literature on sexual minorities' experiences of minority stress.¹² In contrast to our study, in a study of recently diagnosed breast cancer survivors, lesbians reported greater stress than HSW,¹³ while we found SMW survivors' and their caregivers' stress was similar to HSW survivors' and caregivers' stress.

At first, we also found no support for an interrelationship of survivor and caregiver stress overall. While stress was slightly higher among survivors than caregivers, each dyad member's stress matched with population norms.¹⁶ We propose that lack of support for both hypotheses may be because of the time point at which we measured survivor and caregiver stress. Sexual minority women and their care-givers may experience more stress around the time of diagnosis, when current experiences within heterosexist medical settings result in minority stress. Our sample included individuals who had survived 5 or more years after a breast cancer diagnosis, and SMW and their caregivers may have developed strategies to respond to discrimination in these settings, consistent with models of chronic lifetime-related minority stress rooted in social disadvantage because of sexual minority identity.¹² These findings mirror an earlier finding of perceived stress in gay and lesbian couples that also concluded that discrimination and minority stress were constants rather than additive factors in sexual minorities' lives.³⁰ Our findings of similar stress levels of SMW survivors

and their caregivers compared to HSW dyads may indicate that cancer represents one additional stressor above and beyond the chronic minority stress with which sexual minorities have learned to cope.^{7,21}

Consistent with Lazarus and Folkman's stress-coping framework,¹¹ a central question of this study was whether dyad member's interdependence of stress differed by sexual orientation, in that stress appraisal and coping responses may vary because of survivors' sexual orientation. We confirmed that dyad members' interdependence of stress differed by survivors' sexual orientation. Specifically, we found support for interdependence among sexual minority dyads, whereas mutual influence was absent among heterosexual survivors and care-givers. These findings mirror earlier findings of fear of recurrence, which showed mutual influence among SMW dyads' fear of recurrence and an absence of mutual influence among HSW dyads.²⁶ However, we recognize that studies of other outcomes (eg, mental health, quality of life, anxiety, depression) found evidence of "mutual influence" among heterosexual dyads.^{5,6} It is thus possible that the sexual orientation difference found in this study is specific to the experience of stress or the sample of participants included in this study.

While it is beyond the scope of the cross-sectional data available to us to make causal inferences that caregivers' stress increases survivors' stress, our finding that associations between caregivers' and survivors' stress vary according to sexual orientation is noteworthy and contributes enhanced information for the development of suitable interventions for the underserved population of sexual minority survivors and their caregivers.

Consistent with earlier findings,³¹ each dyad member's stress regardless of sexual orientation was explained by both actor and partner effects. Among survivors, fear of recurrence, which has previously been targeted by interventions to improve survivors' psychological well-being,³² was associated with increased stress. Caregivers' social support, a widely recognized buffer of stress, reduced their level of stress.¹¹ Caregivers who were sicker themselves reported more stress, likely speaking to the difficulty of caregiving in addition to one's own health concerns. Employed caregivers reported more stress than those who were not employed, which may reflect challenges to the caregiving role above and beyond employment.³³ Caregivers' employment also was positively associated with survivors' stress, possibly because of survivors' perception that caregivers struggled to balance work and caregiving. The association between caregivers' use of counseling to deal with breast cancer and survivors' stress likely reveals a noteworthy dynamic within survivor-caregiver dyads with multiple possible interpretations. One possible interpretation is that, because stress is known to decrease over time,²⁹ survivors who show stress years later likely had strong negative psychological reactions at diagnosis, prompting their caregivers to seek out counseling to cope with this situation. Another equally likely interpretation is that survivors' stress in this survivorship phase stems from concerns about overburdening caregivers who already had sought counseling in response to their diagnosis.

4.1 | Limitations

Our study has several limitations worth noting. First, our assessment of perceived stress was based on individuals' one-time self-reports at an average of 5 years post diagnosis. Second,

there is limited general-izability of the findings for caregivers who are nonpartners, same-sex partner caregivers, and racial and ethnic minorities because we lacked sufficient numbers to further examine differences in these subgroups of survivor-caregiver dyads. Furthermore, because our sample was comprised of breast cancer survivors who were without recurrence or worsening cancer, our findings only apply to survivors in full remission and their caregivers. Finally, perceived stress is a global measure, which has been previously identified as an important mediator of quality of life of breast cancer survivors,²⁸ but which is not an indication of clinical psychological morbidity.

4.2 | Clinical implications

Despite these limitations, this is, to our knowledge, the first study to test a dyadic model of stress in cancer survivors of different sexual orientations who are supported by partner and nonpartner caregivers. While a general recommendation for the integration of cancer caregivers into the health care setting exists,³⁴ our findings expand on this by highlighting the particular importance of considering SMW's caregivers. We showed that sexual minority survivors experienced greater stress when their caregivers experienced stress. To date, neither interventions tailored to sexual minority survivors nor their caregivers exist, exposing an inequity in sexual minorities' survivorship resources. Our study findings document the need for developing interventions tailored to caregivers of SMW to improve sexual minority survivorship. In the short term, our study provides a call to action for cancer care teams and other health care providers to integrate SMW's caregivers into the care process to mitigate survivors' stress.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

ACKNOWLEDGEMENTS

Support for this research was provided by the American Cancer Society, Grant No. RSGT-06-135-01-CPPB PI: U. Boehmer. Additional supplemental funding was made available by a Boston University School of Public Health pilot grant. The authors are grateful to the participants who took the time to respond to our questions and complete the survey. The authors would like to thank Bruce Barton, PhD for his statistical consultation.

Funding information

Boston University School of Public Health; American Cancer Society, Grant/Award Number: RSGT-06-135-01-CPPB PI

REFERENCES

1. American Cancer Society. Cancer treatment & survivorship facts & figures 2016–2017. Atlanta: American Cancer Society; 2016.
2. Pitceathly C, Maguire P. The psychological impact of cancer on patients' partners and other key relatives: A review. *Eur J Cancer*. 2003;39(11):1517–1524. [PubMed: 12855257]
3. Hagedoorn M, Sanderman R, Bolks H, Tuinstra J, Coyne JC. Distress in couples coping with cancer: A meta-analysis and critical review of role and gender effects. *Psychol Bull*. 2008;134(1):1–30. [PubMed: 18193993]

4. Hodges LJ, Humphris GM, Macfarlane G. A meta-analytic investigation of the relationship between the psychological distress of cancer patients and their carers. *Soc Sci Med*. 2005;60(1):1–12. [PubMed: 15482862]
5. Litzelman K, Yabroff KR. How are spousal depressed mood, distress, and quality of life associated with risk of depressed mood in cancer survivors? Longitudinal findings from a national sample. *Cancer Epidemiol Biomarkers Prev*. 2015;24(6):969–977. [PubMed: 26033755]
6. Dorros SM, Card NA, Segrin C, Badger TA. Interdependence in women with breast cancer and their partners: An interindividual model of distress. *J Consult Clin Psychol*. 2010;78(1):121–125. [PubMed: 20099957]
7. Boehmer U Breast cancer in lesbian and bisexual women In: Boehmer U, Elk R, eds. *Cancer and the LGBT Community: Unique Perspectives from Risk to Survivorship*. Cham: Springer; 2015:141–157.
8. Bazzi AR, Clark MA, Winter M, Tripodis Y, Boehmer U. Recruitment of breast cancer survivors and their caregivers: Implications for dyad studies. *Transl Behav Med*. 2017;7(2):300–308. [PubMed: 27154790]
9. Boehmer U, Freund KM, Linde R. Support providers of sexual minority women with breast cancer: Who they are and how they impact the breast cancer experience. *J Psychosom Res*. 2005;59(5):307–314. [PubMed: 16253621]
10. Regan TW, Lambert SD, Kelly B, Falconier M, Kissane D, Levesque JV. Couples coping with cancer: Exploration of theoretical frameworks from dyadic studies. *Psychooncology*. 2015;24(12):1605–1617. [PubMed: 26059915]
11. Lazarus RS, Folkman S. *Stress, appraisal, and coping*. New York: Springer; 1984.
12. Meyer IH. Prejudice, social stress, and mental health in lesbian, gay, and bisexual populations: Conceptual issues and research evidence. *Psychol Bull*. 2003;129(5):674–697. [PubMed: 12956539]
13. Fobair P, O'Hanlan K, Koopman C, et al. Comparison of lesbian and heterosexual women's response to newly diagnosed breast cancer. *Psychooncology*. 2001;10(1):40–51. [PubMed: 11180576]
14. Kenny D Models of non-independence in dyadic research. *J Soc Pers Relat*. 1996;13(2):279–294.
15. Boehmer U, Glickman M, Milton J, Winter M. Health-related quality of life in breast cancer survivors of different sexual orientations. *Qual Life Res*. 2012;21(2):225–236. [PubMed: 21660650]
16. Cohen S, Williamson G. Perceived stress in a probability sample of the United States In: Spacapan S, Oskamp S, eds. *The social psychology of health: Claremont Symposium on applied social psychology*. Newbury Park, CA: Sage; 1988.
17. Stuber J, Galea S, Ahern J, Blaney S, Fuller C. The association between multiple domains of discrimination and self-assessed health: A multi level analysis of Latinos and blacks in four low-income New York City neighborhoods. *Health Serv Res*. 2003;38(6p2):1735–1760. [PubMed: 14727795]
18. Ganz PA, Kwan L, Stanton AL, et al. Quality of life at the end of primary treatment of breast cancer: First results from the moving beyond cancer randomized trial. *J Natl Cancer Inst*. 2004;96(5):376–387. [PubMed: 14996859]
19. Northouse LL. Mastectomy patients and the fear of cancer recurrence. *Cancer Nurs*. 1981;4(3):213–220. [PubMed: 6909039]
20. Cohen S, Hoberman H. Positive events and social supports as buffers of life change stress. *J Appl Soc Psychol*. 1983;13(2):99–125.
21. Arena PL, Carver CS, Antoni MH, Weiss S, Ironson G, Durán RE. Psychosocial responses to treatment for breast cancer among lesbian and heterosexual women. *Women Health*. 2006;44(2):81–102. [PubMed: 17255060]
22. Zimet GD, Dahlem NW, Zimet SG, Farley GK. Multidimensional scale of perceived social support (MSPSS) In: Corcoran K, Fischer J, eds. *Measures for Clinical Practice*. 2. Adults. 3rd ed New York: The Free Press; 2000:502–503.
23. Spanier GB. Measuring dyadic adjustment: New scales for assessing the quality of marriage or similar dyads. *J Marriage Fam*. 1976;38(1):15–28.

24. Dorval M, Guay S, Mondor M, et al. Couples who get closer after breast cancer: Frequency and predictors in a prospective investigation. *J Clin Oncol*. 2005;23(15):3588–3596. [PubMed: 15908669]
25. Zellner A, Theil H. Three-stage least squares: Simultaneous estimation of simultaneous equations. *Econometrica*. 1962;30(1):54–78.
26. Boehmer U, Tripodis Y, Bazzi AR, Winter M, Clark MA. Fear of cancer recurrence in survivor and caregiver dyads: Differences by sexual orientation and how dyad members influence each other. *J Cancer Surviv*. 2016;10(5):802–813. [PubMed: 26899851]
27. Johnson DR, Young R. Toward best practices in analyzing datasets with missing data: Comparisons and recommendations. *J Marriage Fam*. 2011;73(5):926–945.
28. Golden-Kreutz DM, Thornton LM, Wells-Di Gregorio S, et al. Traumatic stress, perceived global stress, and life events: Prospectively predicting quality of life in breast cancer patients. *Health Psychol*. 2005;24(3):288–296. [PubMed: 15898865]
29. Golden-Kreutz DM, Browne MW, Frierson GM, Andersen BL. Assessing stress in cancer patients: A second-order factor analysis model for the perceived stress scale. *Assessment*. 2004;11(3):216–223. [PubMed: 15358877]
30. Otis MD, Rostosky SS, Riggall EDB, Hamrin R. Stress and relationship quality in same-sex couples. *J Soc Pers Relat*. 2006;23(1):81–99.
31. Mellon S, Northouse LL, Weiss LK. A population-based study of the quality of life of cancer survivors and their family caregivers. *Cancer Nurs*. 2006;29(2):120–131. quiz 32–3 [PubMed: 16565621]
32. Lengacher CA, Shelton MM, Reich RR, et al. Mindfulness based stress reduction (MBSR (BC)) in breast cancer: Evaluating fear of recurrence (FOR) as a mediator of psychological and physical symptoms in a randomized control trial (RCT). *J Behav Med*. 2014;37(2):185–195. [PubMed: 23184061]
33. Stenberg U, Ruland CM, Miaskowski C. Review of the literature on the effects of caring for a patient with cancer. *Psychooncology*. 2010;19(10):1013–1025. [PubMed: 20014159]
34. Kent EE, Rowland JH, Northouse L, et al. Caring for caregivers and patients: Research and clinical priorities for informal cancer caregiving. *Cancer*. 2016;122(13):1987–1995. [PubMed: 26991807]

Characteristics of the sample

TABLE 1

	Survivors		Sexual Minority	P Value	Caregivers to		Sexual Minority	P Value	Range
	Heterosexual				Heterosexual				
Demographic characteristics									
Gender n; %									
Female	43; 100		124; 100		7; 16.3		116; 93.5		
Male	0		0		36; 83.7		8; 6.5		
Sexual orientation n; %									
Heterosexual	43; 100		0		43; 100		18; 14.5		
Sexual minority	0		124; 100		0		106; 85.5		
Age at interview M (SD)	60.8 (8.4)		56.3 (8.6)	<.01	62.4 (8.0)		55.8 (9.3)		29-81
Race n; %				0.54					0.10
White	38; 88.4		114; 91.9		42; 97.7		111; 89.5		
Other	5; 11.6		10; 8.1		1; 2.3		13; 10.5		
Having a partner/spouse n; %				0.78					
No	7; 16.3		18; 14.5						
Yes	36; 83.7		106; 85.5						
Lives alone n; %				0.43					
No	37; 86.0		100; 80.6						
Yes	6; 14.0		24; 19.4						
Education n; %				0.52				0.15	
High school/less/technical training	3; 7.0		3; 2.4		3; 7.0		3; 2.4		
Some college	4; 9.3		9; 7.3		6; 14.0		14; 11.3		
Graduated college	16; 37.2		49; 39.5		15; 34.9		31; 25.0		
Completed grad school	20; 46.5		63; 50.8		19; 44.2		76; 61.3		
Currently employed n; %				0.13					<.01
Yes	24; 55.8		85; 68.5		20; 47.6		90; 73.2		
No	19; 44.2		39; 31.5		22; 52.4		33; 26.8		
Health insurance n; %				1.00					
Yes	43; 100		122; 98.4						
No	0		2; 1.6						

	Survivors		Caregivers to			
	Heterosexual	Sexual Minority	P Value	Heterosexual	Sexual Minority	P Value
Individual income n; %			0.88			0.41
Less than \$30 K	8; 20.0	27; 22.3		5; 12.5	27; 22.1	
\$30 K–\$70 K	14; 35.0	45; 37.2		18; 45.0	47; 38.5	
\$70 K or more	18; 45.0	49; 40.5		17; 42.5	48; 39.3	
Census poverty level n; %			0.78	--	--	
<5%	19; 44.2	58; 46.8				
5%–<10%	12; 27.9	36; 29.0				
10%–<20%	10; 23.3	21; 16.9				
20%+	2; 4.7	9; 7.3				
Census median household income n; %			0.23	--	--	
Low \$43 846 or less	12; 27.9	31; 25.0				
Mid \$43 847–\$74 313	20; 46.5	74; 59.7				
High >\$74 313	11; 25.6	19; 15.3				
Discrimination M (SD)	0.8 (1.1)	1.5 (1.6)	<.01	0.5 (0.8)	1.5 (1.5)	<.01
Clinical characteristics						0–7
Years since diagnosis M (SD)	5.8 (3.9)	7.3 (3.6)	0.03	NA	NA	1.1–18.3
Cancer stage at diagnosis n; %			0.93	NA	NA	
In situ (ductal carcinoma)	8; 19.0	26; 21.0				
Stage I	18; 42.9	46; 37.1				
Stage II	12; 28.6	40; 32.3				
Stage III	4; 9.5	12; 9.7				
Surgical treatment n; %			0.14	NA	NA	
Lumpectomy	41; 95.3	105; 84.7				
Mastectomy only	0;	10; 8.1				
Mastectomy and reconstruction	2; 4.7	9; 7.3				
Radiation n; %			0.23	NA	NA	
No	11; 25.6	44; 35.5				
Yes	32; 74.4	80; 64.5				
Antiestrogen treatment n; %			0.89	NA	NA	
No	12; 27.9	36; 29.0				

	Survivors		Caregivers to		P Value	Range
	Heterosexual	Sexual Minority	Heterosexual	Sexual Minority		
Yes	31; 72.1	88; 71.0				
Comorbidities M (SD)	2.5 (1.6)	2.5 (1.7)	2.5 (1.7)	2.2 (1.5)	0.27	0–14
Number of comorbidities n; %					0.34	
0	3; 7.1	13; 10.7	5; 11.6	15; 12.4		
1	11; 26.2	18; 14.8	8; 18.6	31; 25.6		
2	8; 19.0	33; 27.0	7; 16.3	29; 24.0		
3+	20; 47.6	58; 47.5	23; 53.5	46; 38.0		
Psychosocial characteristics						
Fear of recurrence M (SD)	73.9 (15.4)	70.9 (16.4)	75.2 (13.6)	71.8 (16.5)	0.23	22–110
ISEL-SF M (SD)	22.3 (2.0)	22.5 (2.3)	21.7 (2.6)	22.5 (1.9)	0.07	6–24
Multidimensional perceived						
Social support scale: M (SD)	6.0 (0.5)	6.0 (0.8)	5.8 (0.8)	6.0 (0.6)	0.25	1–7
Ever cancer support group n; %					0.27	
No	30; 69.8	60; 48.4	39; 90.7	104; 83.9		
Yes	13; 30.2	64; 51.6	4; 9.3	20; 16.1		
Counseling to deal with breast cancer n; %					0.05	
No	32; 74.4	73; 58.9	41; 95.3	103; 83.7		
Yes	11; 25.6	51; 41.1	2; 4.7	20; 16.3		
Counseling before breast cancer n; %					<.01	
No	24; 55.8	34; 27.4	30; 69.8	45; 36.6		
Yes	19; 44.2	90; 72.6	13; 30.2	78; 63.4		
Dyadic						
Relationship to survivor n; %					0.02	
Spouse/partner			36; 83.7	106; 85.5		
Child			3; 7.0	0		
Sibling			2; 4.7	3; 2.4		
Parent			1; 2.3	3; 2.4		
Friend			1; 2.3	12; 9.7		
Spouse/partner caregiver n; %			36; 83.7	106; 85.5	0.78	
Survivor-caregiver co residence n; %			36; 83.7	97; 78.2	0.44	

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

	Survivors		Caregivers to		P Value	Sexual Minority	P Value	Sexual Minority	Range
	Heterosexual	Sexual Minority	Heterosexual	Sexual Minority					
Years in relationship with survivor M (SD)			31.6 (13.1)	18.6 (12.0)	<.01				0.5–66
Proportion of life with survivor M (SD)			0.5 (0.2)	0.3 (0.2)	<.01				0–1
Dyadic cohesion M (SD)	17.5 (2.6)	18.1 (3.0)	17.5 (2.9)	18.2 (2.5)	0.2840				5–30
Change because of cancer n; %					0.38				0.75
Brought you closer	29; 69.0	88; 72.7	33; 76.7	94; 77.7					
Distanced you or	1; 2.4	8; 6.6	2; 4.7	3; 2.5					
Had no effect on relationship	12; 28.6	25; 20.7	8; 18.6	24; 19.8					

The sample consists of 43 heterosexual women and caregivers and of 124 sexual minority women and their caregivers.

TABLE 2
Simultaneous equation models (SIM) concerning survivors' and caregivers' perceived stress (N = 167 dyads)

Predictors of Interest	Model 1		Model 2		Model 3	
	Survivor Stress B (SE)	Caregiver Stress B (SE)	Survivor Stress B (SE)	Caregiver Stress B (SE)	Survivor Stress B (SE)	Caregiver Stress B (SE)
Survivor stress	-	-	-	0.08 (.10)	-	0.32 (.20)
Caregiver stress	-	-	0.03 (.14)	-	-0.06 (.19)	-
Survivor sexual orientation ^a	1.01 (.94)	0.61 (.99)	1.02 (.94)	-0.31 (.88)	0.83 (.92)	0.60 (1.03)
Interaction terms						
Caregiver stress × survivor sexual orientation ^a	-	-	-	-	0.56 ^{**} (.21)	-
Survivor stress × survivor sexual orientation ^a	-	-	-	-	-	-0.001 (.22)
Survivor covariates						
Survivor fear of recurrence	0.21 ^{***} (.03)	-	0.22 ^{***} (.03)	-	0.18 ^{***} (.03)	-
Survivor employment ^b	-1.89 [†] (.98)	-	-1.89 [†] (1.02)	-	-1.34 (.94)	-
Survivor college degree ^c	-	-2.67 [*] (1.16)	-	-2.43 [*] (1.20)	-	-2.15 [†] (1.19)
Survivor graduate degree ^c	-	-0.12 (1.12)	-	0.03 (1.15)	-	0.03 (1.14)
Caregiver covariates						
Caregiver fear of recurrence	-0.08 [*] (.03)	-	-0.08 [*] (.03)	-	-0.08 [*] (.03)	-
Caregiver breast cancer counseling	4.46 ^{**} (1.53)	-	4.56 ^{**} (1.55)	-	3.90 ^{**} (1.46)	-
Caregiver employment ^b	2.84 ^{**} (1.03)	2.25 ^{**} (.85)	2.78 ^{**} (1.06)	2.04 [*] (.93)	2.77 ^{**} (1.06)	0.99 (.99)
Caregiver ISEL	-	-0.85 ^{***} (.16)	-	-0.75 ^{***} (.15)	-	-0.83 ^{***} (.18)
Caregiver 1 comorbidity ^d	-	0.38 (1.20)	-	0.45 (1.23)	-	0.56 (1.43)
Caregiver 2 comorbidities ^d	-	3.57 ^{**} (1.28)	-	3.60 ^{**} (1.30)	-	3.85 ^{**} (1.30)
Caregiver 3+ comorbidities ^d	-	5.46 ^{***} (1.12)	-	5.32 ^{***} (1.15)	-	5.42 ^{***} (1.19)
Caregiver discrimination	-	0.70 [*] (.33)	-	0.69 [*] (.33)	-	0.39 (.33)

^aReference group is heterosexual.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

- ^bReference group is not employed.
- ^cReference group is less than college degree.
- ^dReference group is no comorbidities.
- ^eP < .10.
- ^{*}P < .05.
- ^{**}P < .01.
- ^{***}P < .001.