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## The eight-item modified Medical Outcomes Study Social Support Survey: psychometric evaluation showed excellent performance

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### Abstract

**Objective**—Evaluation and validation of the psychometric properties of the eight-item modified Medical Outcomes Study Social Support Survey (mMOS-SS).

**Study Design and Setting**—Secondary analyses of data from three populations: Boston breast cancer study ( $N = 660$ ), Los Angeles breast cancer study ( $N = 864$ ), and Medical Outcomes Study ( $N = 1,717$ ). The psychometric evaluation of the eight-item mMOS-SS compared performance across populations and with the original 19-item Medical Outcomes Study Social Support Survey (MOS-SS). Internal reliability, factor structure, construct validity, and discriminant validity were evaluated using Cronbach's alpha, principal factor analysis (PFA), and confirmatory factor analysis (CFA), Spearman and Pearson correlation,  $t$ -test and Wilcoxon rank sum tests.

**Results**—mMOS-SS internal reliability was excellent in all three populations. PFA factor loadings were similar across populations; one factor  $>0.6$ , well-discriminated two factor (instrumental/emotional social support four items each)  $>0.5$ . CFA with a priori two-factor structure yielded consistently adequate model fit (root mean squared errors of approximation 0.054–0.074). mMOS-SS construct and discriminant validity were similar across populations and comparable to MOS-SS. Psychometric properties held when restricted to women aged  $\geq 65$  years.

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### Appendix

#### Supplementary material

Supplementary data related to this article can be found online at doi:10.1016/j.jclinepi.2012.04.007

**Conclusion**—The psychometric properties of the eight-item mMOS-SS were excellent and similar to those of the original 19-item instrument. Results support the use of briefer mMOS-SS instrument; better suited to multidimensional geriatric assessments and specifically in older women with breast cancer.

### Keywords

Breast cancer; Cancer-specific geriatric assessment; Emotional social support; Instrumental social support; Older women; Psychometrics; Reliability; Social support; Social support assessment; Validity

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## 1. Introduction

Social support has been shown to provide many benefits to the overall health and well-being of older adults [1-7]. Social support drawn from a variety of sources (e.g., family, friends, community) has been associated with better outlook and better emotional health, especially among older adults with preexisting life stress such as cancer [8-12]. Studies have also shown that older adults with adequate social support are less likely to have negative long-term effects (e.g., poor emotional health, pessimistic attitude, hospitalization, poor survival) of life stressors [13-20].

Importantly, lack of social support is a potentially modifiable risk factor in older adults. But intervention requires adequate assessment of the social situation. Because of its potential for attenuating effects of life stressors, intervention, and relative ease of assessment, social support should be measured as part of the comprehensive geriatric assessment [21]. However, there are many available measures for assessing social support with little consensus on which measures are best suited to which contexts (e.g., older adults, cancer care) often leading to underassessment [19,22].

The Medical Outcomes Study Social Support Survey (MOS-SS) is a 19-item, self-administered social support survey developed for patients in the Medical Outcomes Study (MOS) [23]. It was originally designed as a self-administered measure of functional social support in community dwelling chronically ill persons. The 19 items cover four domains (emotional/informational support, tangible [also called instrumental] support, positive social interaction, and affection) recommend for both combined and individual use [24]. The questionnaire was carefully developed from previous instruments based on a sound theoretical formulation, has been demonstrated to be psychometrically sound, and is considered universally applicable [22]. The items are short, simple, and easy to understand thus easy to administer to chronically ill patients of all ages [22,25,26]. For nearly two decades, the MOS-SS and modified versions have been widely used as self- and interviewer-administered in many populations including persons with cancer [13,27-30].

To reduce respondent burden, several more recent studies have used an eight-item modified Medical Outcomes Study Social Support Survey (mMOS-SS) of the MOS-SS [13,27]. The mMOS-SS has two subscales covering two domains (emotional and instrumental [tangible] social support) composed of four items each designed to maintain the theoretical structure of the MOS-SS and identify potentially modifiable social support deficits [27,31,32]. Because

of its brevity, the mMOS-SS is a potentially valuable tool for use in geriatric assessment. However, to the best of the authors' knowledge, no psychometric evaluation of the mMOS-SS within a cancer setting and/or older population has been conducted comparing its performance to the original MOS-SS. Thus, the aim of this study was to examine and validate the psychometric properties of mMOS-SS in two populations of women with breast cancer, the original MOS population, and a subpopulation of older women.

## 2. Methods

### 2.1. Study population

This analysis included a total of 3,241 women with complete mMOS-SS and MOS-SS data (complete cases) from three individual study populations in the United States: The first sample (hereafter Boston sample, for Boston University Geriatrics Epidemiology and Health Care Research Unit), a longitudinal study of 660 women aged  $\geq 65$  years diagnosed in 1997–1999 with stages I–III breast cancer in four geographic regions (Los Angeles, California; Minnesota; North Carolina; and Rhode Island). Baseline data were collected 3 months after breast cancer diagnosis [32]. The second sample (hereafter UCLA sample, for University of California, Los Angeles and Jonsson Comprehensive Cancer Center), a cross-sectional survey study of 864 breast cancer survivors between 1 and 5 years after diagnosis (mean 3.01 years since diagnosis) with stages 0–II disease conducted in Los Angeles, CA and Washington, DC in 1994–1995 [33]. The third and final sample consisted of 1,717 women completing the baseline questionnaire of the MOS [23]. The MOS, a large-scale multiyear (1986–1992) multicity (Boston, MA; Chicago, IL; Los Angeles, CA) study of patients with chronic diseases was the original population for the development of the MOS-SS [34]. All study protocols and patient consent forms were approved by the institutional review boards of the primary research centers.

Additionally, a restricted subpopulation of women aged  $\geq 65$  years (Boston,  $N = 660$ ; UCLA,  $N = 216$ ; MOS,  $N = 373$ ) was used for sensitivity analyses examining the psychometric properties of the mMOS-SS exclusively in older women.

### 2.2. Analytic variables

Sociodemographic and health-related characteristics listed in Table 1 and described below were assessed at baseline by self-administered questionnaires, physician report, and/or medical record review according to individual study protocols, which are described elsewhere [32–34].

**2.2.1. Sociodemographic characteristics**—Age in years was categorized as <50, 50–64, 65–69, 70–74, 75–79, and 80+ years; ethnicity as white or nonwhite; education as <high school, high school, >high school; marital status as married (yes/no); have children (yes/no, Boston UCLA only); financial status as having adequate finances to meet needs (yes/no); and working full-time or part-time (yes/no).

**2.2.2. Health-related characteristics**—Self-rated health was assessed by a single question with five answers ranging from “excellent” to “poor.” Body mass index (BMI) in kilograms per meter squared ( $\text{kg}/\text{m}^2$ ) was classified as <20, 20–25, > 25–30, and > 30.

Comorbid conditions were measured by seven conditions, namely the presence of diabetes, asthma, arthritis, peptic ulcer, heart attack or having a heart disease, kidney problems, and psychological difficulties. Whether or not a woman had a cancer at or before study entrance was also defined (yes/no). General mental health was measured by the five-item Mental Health Inventory (MHI5) from the Medical Outcome Study—Short Form (MOS SF-36) [35]. Physical function by the 10-item Physical Function Index (PF10) was also measured from the MOS SF-36 [35]. MHI5 and PF10 scores were standardized from zero to 100 (see [http://www.rand.org/health/surveys\\_tools/mos/mos\\_core\\_36item\\_scoring.pdf.html](http://www.rand.org/health/surveys_tools/mos/mos_core_36item_scoring.pdf.html)) with higher scores indicating better emotional health or physical function, respectively.

**2.2.3. Breast cancer-related characteristics**—Breast cancer stages were categorized as 0–III by TNM classification [36]. Treatment characteristics were categorized as type of surgery (breast conserving, mastectomy, other), receipt of radiation or chemotherapy (yes/no), and tamoxifen prescribed (yes/no). A brief two-item measure of breast cancer-specific emotional health (BCSEH) [13,37] measuring feelings and worries because of potential problems associated with cancer progression and a modified 10-item version of Psychosocial Summary Scale of the Cancer Rehabilitation Evaluation System—Short Form (CARES-SF) [38] measuring cancer-specific quality-of-life captured aspects of breast cancer-specific psychosocial health [13]. MOS did not include either BCSEH or CARES-SF and UCLA only included a subset of items requiring the use of reduced item versions (2 vs. 4 BCSEH items and 10 vs. 17 CARES-SF items) herein.

**2.2.4. Social support**—In the UCLA and MOS samples, social support was measured by the self-administered original 19-item MOS-SS instrument. The mMOS-SS was scored by the corresponding eight subitems from the long instrument [23,24,27]. In Boston only, the interviewer-administered mMOS-SS was available for analyses [32]. The individual items of both measures and corresponding subscales are described in Table 2. Scores for both measures were calculated as the average score of subscale items transformed to a zero to 100 scale (see [http://www.rand.org/health/surveys\\_tools/mos/mos\\_socialsupport\\_scoring.html](http://www.rand.org/health/surveys_tools/mos/mos_socialsupport_scoring.html)), with higher scores indicating more support [24].

### 2.3. Analytic methods

The psychometric properties of the mMOS-SS were evaluated using complete case samples from all three-study populations and then compared with MOS-SS. Descriptive analyses on all study variables included count, percent, and mean with standard deviation (mean  $\pm$  SD). Internal reliability was measured by Cronbach's alpha and consistency by item-to-total score correlations. The mMOS-SS factor structure was assessed by factor analysis in two stages: principal factor analysis (PFA) with varimax rotation to examine the latent factor structure, and confirmatory factor analysis (CFA) with an asymptotically distribution-free method to test the a priori factor structure of former mMOS-SS investigations, suggesting social support can be measured in two subscales (instrumental and emotional social support, four items each) [13,27,39]. Cutoff values  $\geq 0.45$  of item factor loadings were considered factor-specific and factor solutions judged adequate by Kaiser's criterion (eigen values  $\geq 1$ ) and scree plot (number of factors on scree plot just before elbow) [40]. CFA goodness-of-fit measures for comparison to a one-factor solution included root mean squared errors of

approximation (RMSEA), Tucker-Lewis index, and standardized root mean square residual. Construct validity and correlation with health-related measures were assessed by Spearman's rank (ordinal variable) or Pearson's (continuous variable) correlations. Construct validity was based on a priori hypothesized relations with associated (convergent: marital status, having children, living alone) or unassociated (divergent: ethnicity, education, BMI) variables. Discriminant validity was assessed by Wilcoxon rank sum test of mean mMOS-SS and MOS-SS differences between subgroups stratified on non-mMOS-SS characteristics (marital status, having children, living alone). Construct and discriminant validity hypotheses were rejected/accepted based on the magnitude and statistical significance of tests. All analyses were performed using Stata V11.2 [41] except CFA using R V2.13.0 [42] and all *P*-values were two sided.

Sensitivity analyses were used to examine the psychometric properties of mMOS-SS in older women and potential effects of missing data. All aforementioned analytic methods were repeated in restricted populations of women aged  $\geq 65$  years. We conducted sensitivity analysis through multiple imputation (MI) by chained equations [43] where variables with missing values were imputed by models including sociodemographic, health-related characteristics and MOS-SS items. The missing at random assumption was not fulfilled because of possible nonresponse on similar types of personal questions. However, MI has been shown to perform well under the missing not at random condition with 10% missing proportion [44]. For each study population, 10 MI data sets were generated and reanalyzed for all psychometric properties. The averaged values from MI data sets and within-imputation SD were compared with complete case results.

### 3. Results

#### 3.1. Population characteristics

The sociodemographic, health- and breast cancer-related characteristics are listed by study population in Table 1. Most of the patients in the UCLA and MOS samples were of age  $< 65$  years, whereas the Boston sample included only women aged  $\geq 65$  years. Across populations, most of the women were white ( $> 76\%$ ), had at least a high school education ( $> 50\%$ ), did not live alone ( $> 60\%$ ), and had adequate financial resources ( $> 62\%$ ). As expected due to individual study age restrictions, there were differences in marital status and working full-time or part-time between study populations (Boston 46.1%, 9.8%; UCLA 62.3%, 71.6%; MOS 49.6%, 50.8%, respectively). More than three-quarters of all women rated their health as good, very good, or excellent. A minority had a BMI greater than  $30 \text{ kg/m}^2$  (Boston 21.3%, UCLA 12.0%, MOS 31.5%). Both Boston and UCLA included only women with breast cancer, whereas just 7.2% of MOS sample reported any type of cancer. Breast cancer surgery and receipt of radiation therapy were similar between Boston and UCLA. Mean mMOS-SS scores were lower in the MOS sample (Boston  $75.7 \pm 20.3$ , UCLA  $75.4 \pm 23.0$ , MOS  $65.9 \pm 25.5$ ). In UCLA and MOS samples, MOS-SS scores were minimally higher than mMOS-SS scores (UCLA  $77.1 \pm 21.4$ , MOS  $67.0 \pm 24.3$ ).

### 3.2. Internal consistency reliability

Internal reliability measured by Cronbach's standardized alphas and consistency by item-to-score correlations are listed in Table 3. Across populations, the internal reliability of the mMOS-SS measure was very good (Cronbach's alpha: Boston 0.88, UCLA 0.92, MOS 0.93, item-total correlations = 0.67). Measures for the MOS-SS were similarly constant but slightly higher (Cronbach's alpha: UCLA 0.97, MOS 0.97, item-to-total correlations = 0.70). The mMOS-SS had excellent internal consistency and showed that the items measured a similar construct dependably across all populations (including subpopulation of older women) comparable with MOS-SS.

### 3.3. Factorial analysis

PFA produced eigen values for one-factor solutions = 3.96 and two-factor solutions = 2.10. In all three populations, the two-factor solutions accounted for more overall variance than one-factor solutions (one-factor vs. two-factor: Boston 0.50 vs. 0.54, UCLA 0.61 vs. 0.70, MOS 0.63 vs. 0.73) and were supported by screen plots. Variance was equally distributed between factors (factor 1/factor 2: Boston 0.28/0.26, UCLA 0.37/0.33, MOS 0.38/0.35). All factor loadings were = 0.50 and consistent across populations (see Supplementary Table 1 at [www.jclinepi.com](http://www.jclinepi.com)).

Results of CFA analyses indicated that the a priori specified two-factor structure yielded an adequate model fit (RMSEA: Boston 0.054, UCLA 0.065, MOS 0.074) consistently across all three populations (see Supplementary Table 2 at [www.jclinepi.com](http://www.jclinepi.com)). Analogous to PFA, CFA results suggested a better model fit for the two- rather than one-factor solution (RMSEA: Boston 0.082, UCLA 0.112, MOS 0.113). In general, factor analyses confirmed the a priori mMOS-SS two subscale structure; demonstrating very good discriminatory ability between emotional and instrumental social support.

### 3.4. Construct validity

The psychometric analysis of mMOS-SS construct validity (Table 3) was similar across populations. Construct validity of the mMOS-SS was assessed by correlations with marital status (0.21 to 0.28), having children (0.06 to 0.08), and living alone (-0.31 to -0.13); divergent validity by ethnicity (-0.03 to 0.08), education (-0.08 to 0.05), and BMI (0.01 to 0.07). Overall, mMOS-SS showed good construct validity; moderate statistically significant correlations with associated characteristics and weak nonstatistically significant correlations with unassociated characteristics. One exception, weak correlations with having children, was in contrast to our a priori hypothesized association but held between mMOS-SS and MOS-SS in UCLA, with similar magnitude nonstatistically significant coefficient in Boston and UCLA. In addition, simple correlations of mMOS-SS and MOS-SS with other health- and breast cancer-specific measures (MHI5, PF10, BCSEH, CARES-SF) were statistically significant and very stable (see Supplementary Table 3 at [www.jclinepi.com](http://www.jclinepi.com)). Construct validity comparing mMOS-SS and MOS-SS showed a strong similarity (correlation coefficients differed maximally  $\pm 0.05$ ).

### 3.5. Discriminant validity

Table 3 lists mean mMOS-SS and MOS-SS scores stratified by characteristics expected to have an association with social support (being married, having children, and living alone). Results comparing mean mMOS-SS scores of women living alone or with others, married or not, having children or not showed consistently statistically significant differences between groups. The mMOS-SS and MOS-SS discriminated groups equally well.

### 3.6. Sensitivity analysis

Results of the restricted study population (women aged  $\geq 65$  years) analyses differed negligibly from all age analyses across populations (see Supplementary Tables 4–7 at [www.jclinepi.com](http://www.jclinepi.com)). Among study populations, the maximal missing proportion for one of the 19 items of the MOS-SS or other characteristics was 2.6% and 10.0%, respectively. Because of the low proportion of missing values, MI results remained stable differing minimally from complete case results.

## 4. Discussion

These findings demonstrate that the psychometric properties of the reduced eight-item mMOS-SS are excellent and very similar to those of the original 19-item MOS-SS. Moreover, the mMOS-SS performed consistently well across three independent study populations (including women with breast cancer) and among restricted populations of older women. Specifically, the mMOS-SS exhibited good internal reliability; consistent factor structure; and good convergent, divergent, and discriminate validity. These results extend previous MOS social support investigations not only to older women but also to populations of women with breast cancer [24,26,27,32,45]. Our psychometric evaluation indicates that the mMOS-SS is a valid and reliable measure of social support and supports its use especially in the context of geriatric assessments.

Despite excellent overall performance, there were unexpected psychometric findings worth noting. First, CFA revealed lower values in Boston compared with the other two populations. This may be explained by the sensitivity of particular mMOS-SS items to the response behavior of the homogenous Boston sample but unlikely related to interviewer-administered assessment; as evidenced by more similar results in the age-restricted populations. Item-to-total correlations showed lower correlations for items 2, 5, 7, and 8 compared with the other item correlations and other populations. These items provided less information in the explanation of the total variance and yielded smaller factor loadings and eigen values. Secondly, having children was an exception to our a priori convergent validity assumptions and we suspect the weak correlations are related to over 70% of UCLA/MOS populations being  $<69$  years of age and the predominantly healthy status of most of the Boston women (i.e., minimizing need for/effect of children as caregivers).

Many studies indicate that supportive social ties enhance physical and mental health among older adults (e.g., [1,6,8-18,20]). Yet despite recommendations from geriatric experts and international organizations social support is seldom regularly assessed in clinical settings [19,21,46-48]. The mMOS-SS has several benefits worth noting that might make it a practical assessment tool. First, the availability of a psychometrically valid brief social

support measure presents an opportunity to reduce respondent and/or assessor burden in geriatric assessment applications. Because it is proven as a self- or interviewer-administered instrument, mMOS-SS also provides flexibility in assessment technique. No less importantly, the two mMOS-SS subscales of emotional and instrumental support quickly identify potentially modifiable social deficits as points of intervention. Identifying and intervening on social deficits could improve older adults' ability to cope with a serious life stressor (e.g., cancer diagnosis). The very high response rates across all populations and stability of the measure demonstrated by sensitivity analyses for missing data also point to the feasibility and potential clinical utility of the mMOS-SS.

It is also conceivable, although not explored in these analyses, that mMOS-SS could play a role (alone or as part of multidimensional geriatric assessment) in predicting poor outcomes and guiding therapeutic decision making in older patients. This is underscored by previous research indicating that social support (measured by mMOS-SS) is predictive of emotional health, poor cancer treatment tolerance, and mortality in older women with breast cancer [13,49]. Social factors have also been shown to predict hospitalization in older frail patients and to reduce 1-year mortality in persons in long-stay nursing homes [4,5]. Moreover, previous work has also demonstrated that a comprehensive social assessment should include both social support as well as family and friend networks [50]. This differentiation is likely related to differences in social structures and personal characteristics not measured in this study. Further investigations of mMOS-SS predictive ability in a variety of settings and populations are needed including examination of differential associations with social networks (although challenging to measure). Despite the need for future research, the current results are supportive of its use in targeting clinical and research interventions to improve social support.

A major strength of our investigation is the comparison of the eight-item mMOS-SS with the original 19-item measure albeit in only two of our three populations. Our findings allowed direct comparison of the abbreviated instrument with the original longer version using the original data source plus breast cancer-specific populations. Our comprehensive analyses also examined the use in older populations and the potential effects of missing data (particularly problematic with self-administered instruments). Although other studies have shown missing data can be problematic, sensitivity analyses in this study showed no effect [51,52]. In addition, the subscales of mMOS-SS were purposely chosen as the dimensions of social support most amenable to modification, but additional investigations exploring the ability to modify social support dimensions are warranted.

A limitation of our results is that the study populations only included persons able to answer the questionnaire. Thus, alternate social support instruments specifically designed for use in cognitively impaired persons (of high relevance in this subgroup) should be further investigated. Another limitation is the evaluation of the mMOS-SS in three regional US populations, which does not allow generalizability to the greater US population or persons in other countries. Generalizability was further restricted by the distribution of sociodemographic characteristics; samples of mostly white, educated women with adequate financial resources not living alone. Additionally, mMOS-SS use for other cancer types besides breast cancer or limitations related to response bias of self-reported questionnaires



could not be examined by this study. Finally, this study was not able to test mMOS-SS ability to detect change, longitudinal performance, feasibility, and/or clinical utility alone or as part of a geriatric assessment.

In conclusion, these results support the use of the briefer mMOS-SS instrument; better suited to multidimensional geriatric assessments and specifically to older women with breast cancer. Future studies of mMOS-SS should be conducted in men, older populations outside the United States and for other cancer types to better understand its usefulness in broader clinical settings.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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### What is new?

- This study provides some of the first evidence that the eight-item modified Medical Outcomes Study Social Support Survey (mMOS-SS) measure (reduced respondent burden) is as valid and reliable as the original widely used 19-item, it's derived from.
- Social support, a potentially modifiable risk factor shown to provide many benefits connected to overall health and well-being, can be reliably measured using the mMOS-SS.
- These results support the use of mMOS-SS for targeting clinical and research interventions to improve social support and impact overall health, especially in older adults.
- The mMOS-SS is an easy to administer social support tool suited to busy clinical settings, multidimensional geriatric assessments, and specifically to older women with breast cancer.

**Table 1**

Sociodemographic, health- and breast cancer-related characteristics by study population

Characteristics	Study population, <i>n</i> (%) or mean $\pm$ SD		
	Boston ( <i>N</i> = 660)	UCLA ( <i>N</i> = 864)	MOS ( <i>N</i> = 1,717)
<i>Sociodemographic</i>			
Age category (yr)			
<50	–	293 (33.9)	718 (44.7)
50–64	–	355 (41.1)	515 (32.1)
65–69	172 (26.1)	88 (10.2)	185 (11.5)
70–74	213 (32.3)	82 (9.5)	140 (8.7)
75–79	159 (24.1)	28 (3.2)	43 (2.7)
80+	116 (17.6)	18 (2.1)	5 (0.3)
Ethnicity			
White	620 (93.9)	669 (77.4)	1,294 (76.7)
Other	40 (6.1)	195 (22.6)	394 (23.3)
Married	304 (46.1)	538 (62.3)	845 (49.6)
Have children	570 (86.4)	689 (79.9)	–
Education			
<High school	115 (17.4)	27 (3.1)	268 (16.1)
High school	228 (34.6)	345 (40.1)	553 (33.3)
>High school	316 (48.0)	488 (56.7)	840 (50.6)
Live alone	263 (39.8)	186 (21.5)	282 (17.2)
Adequate financial resources	587 (88.9)	541 (62.6)	1,433 (84.1)
Working full-time or part-time	65 (9.8)	616 (71.6)	839 (50.8)
mMOS-SS	75.7 $\pm$ 20.3	75.4 $\pm$ 23.0	65.9 $\pm$ 25.5
MOS-SS	–	77.1 $\pm$ 21.4	67.0 $\pm$ 24.3
<i>Health related</i>			
Self-rated health			
Excellent	134 (20.3)	201 (23.3)	100 (5.9)
Very good	255 (38.7)	363 (42.1)	464 (27.2)
Good	175 (26.6)	240 (27.8)	733 (42.9)
Fair	69 (10.5)	48 (5.6)	355 (20.8)
Poor	26 (3.9)	10 (1.2)	55 (3.2)
BMI (kg/m <sup>2</sup> )			
<20	43 (6.5)	89 (10.5)	154 (9.4)
20–25	254 (38.6)	478 (56.3)	521 (32)
>25–30	221 (33.6)	180 (21.2)	442 (27.1)
30 and more	140 (21.3)	102 (12.0)	513 (31.5)
Number of comorbid conditions			
0	386 (58.5)	352 (40.7)	495 (28.9)
1	186 (28.2)	309 (35.8)	730 (42.6)
2–3	85 (12.9)	185 (21.4)	462 (27.0)

Characteristics	Study population, <i>n</i> (%) or mean $\pm$ SD		
	Boston ( <i>N</i> = 660)	UCLA ( <i>N</i> = 864)	MOS ( <i>N</i> = 1,717)
4 or more	3 (0.5)	18 (2.1)	27 (1.6)
Cancer at/before study entry	660 (100.0)	864 (100.0)	112 (7.2)
PF10	79.5 $\pm$ 25.1	80.3 $\pm$ 21.4	70.8 $\pm$ 27.7
MHI5	80.7 $\pm$ 17.8	75.5 $\pm$ 17.6	69.6 $\pm$ 21.5
CARES-SF	80.1 $\pm$ 16.3	71.6 $\pm$ 12.1	–
<i>Breast cancer related</i>			
BCSEH	69.2 $\pm$ 22.7	65.8 $\pm$ 20.8	–
Type of breast cancer surgery			
Breast conserving	317 (48.8)	473 (54.8)	–
Mastectomy	316 (48.6)	390 (45.2)	–
Other	17 (2.6)	0 (0.0)	–
Received radiation	330 (50.8)	455 (52.7)	–
Received chemotherapy	145 (22.0)	326 (37.9)	–
Tamoxifen prescribed	498 (75.5)	406 (47.1)	–

*Abbreviations:* BMI, body mass index; BCSEH, two-item breast cancer-specific emotional health; CARES-SF, 10-item Cancer Rehabilitation Evaluation System–Short Form; MHI5, five-item mental health index; eight-item mMOS-SS, modified Medical Outcomes Study Social Support Survey; MOS, Medical Outcomes Study; 19-item MOS-SS, Medical Outcomes Study Social Support Survey; PF10, 10-item Physical Function Index; SD, standard deviation; UCLA, University of California Los Angeles.

**Table 2**

Individual items of the eight-item mMOS-SS and 19-item MOS-SS

Number	Question	mMOS-SS	MOS-SS
<i>Individual items</i> <i>If you needed it, how often is someone available...</i>			
Item 1	to help you if you were confined to bed?	X	X
Item 2	to take you to the doctor if you need it?	X	X
Item 3	to prepare your meals if you are unable to do it yourself?	X	X
Item 4	to help with daily chores if you were sick?	X	X
Item 5	to have a good time with?	X	X
Item 6	to turn to for suggestions about how to deal with a personal problem?	X	X
Item 7	who understands your problems?	X	X
Item 8	to love and make you feel wanted?	X	X
Item 9	you can count on to listen to you when you need talk?		X
Item 10	to give you good advice about a crisis?		X
Item 11	who shows you love and affection?		X
Item 12	to give you information to help you understand a situation?		X
Item 13	to confide in or talk to about yourself or your problems?		X
Item 14	who hugs you?		X
Item 15	to get together with for relaxation?		X
Item 16	whose advice you really want?		X
Item 17	to do things with to help you get your mind off things?		X
Item 18	to share your most private worries and fears with?		X
Item 19	to do something enjoyable with?		X
<i>Subscales</i>			
Subscale 1	Emotional/informational: Items 6, 7, 9, 10, 12, 13, 16, 18		X
Subscale 2	Tangible <sup>a</sup> : Items 1–4		X
Subscale 3	Affectionate: Items 8, 11, 14		X
Subscale 4	Positive social interaction: Items 5, 15, 19		X
Subscale 5	Instrumental <sup>a</sup> : Items 1–4	X	
Subscale 6	Emotional: Items 5–8	X	

*Abbreviations:* mMOS-SS, modified Medical Outcomes Study Social Support Survey; MOS-SS, Medical Outcomes Study Social Support Survey.

<sup>a</sup>Tangible support and Instrumental support are synonyms [22], subscale labels were chosen by original authors [24,27].

**Table 3**

Psychometric properties of the eight-item mMOS-SS and 19-item MOS-SS by study population

Psychometric property	Study population		
	Boston (N = 660)	UCLA (N = 864)	MOS (N = 1,717)
<i>Internal reliability: standardized Cronbach's alpha</i>			
mMOS-SS	0.88	0.92	0.93
MOS-SS	–	0.97	0.97
<i>Item-to-total correlations of mMOS-SS</i>			
Item 1	0.78	0.82	0.81
Item 2	0.67	0.78	0.79
Item 3	0.79	0.84	0.87
Item 4	0.82	0.86	0.88
Item 5	0.69	0.80	0.79
Item 6	0.74	0.76	0.81
Item 7	0.74	0.78	0.80
Item 8	0.72	0.81	0.80
<i>Factor structure of mMOS-SS</i>			
One factor			
Factor 1 item loadings range	Items 1–8: 0.61–0.79	Items 1–8: 0.74–0.85	Items 1–8: 0.74–0.87
Eigen value	3.96	4.89	5.04
Proportional variance	0.50	0.61	0.63
Cumulative variance	0.50	0.61	0.63
Two factor (factor 1/factor 2)			
Factor 1 item loadings range	Items 1–4: 0.50–0.76	Items 1–4: 0.66–0.83	Items 1–4: 0.66–0.84
Factor 2 item loadings range	Items 5–8: 0.51–0.69	Items 5–8: 0.69–0.81	Items 5–8: 0.66–0.84
Eigen value	2.26/2.10	2.97/2.66	3.00/2.76
Proportional variance	0.28/0.26	0.37/0.33	0.37/0.35
Cumulative variance	0.28/0.54	0.37/0.70	0.37/0.72
<i>Convergent validity: Spearman's rank correlation coefficient</i>			
Married			
mMOS-SS	0.26*	0.28*	0.21*
MOS-SS	–	0.25*	0.20*
Have children			
mMOS-SS	0.06	0.08***	–
MOS-SS	–	0.07***	–
Live alone			
mMOS-SS	–0.31*	–0.30*	–0.13*
MOS-SS	–	–0.25*	–0.10*
<i>Divergent validity: Spearman's rank correlation coefficient</i>			
Ethnicity			
mMOS-SS	0.08***	–0.03	0.03



Psychometric property	Study population		
	Boston (N = 660)	UCLA (N = 864)	MOS (N = 1,717)
MOS-SS	–	0.01	0.05***
Education			
mMOS-SS	0.05	–0.01	–0.08*
MOS-SS	–	–0.02	–0.05***
BMI			
mMOS-SS	0.02	0.07	0.01
MOS-SS	–	0.04	0.00
<i>Discriminant validity: mean ± SD (no/yes) Wilcoxon rank sum test</i>			
Married			
mMOS-SS	71.1 ± 21.0/81.2 ± 18.0*	66.3 ± 25.8/80.9 ± 19.1*	60.5 ± 25.8/71.3 ± 24.1*
MOS-SS	–	69.8 ± 23.5/81.5 ± 18.7*	62.4 ± 24.3/71.6 ± 23.5*
Have children			
mMOS-SS	71.7 ± 23.3/74.4 ± 19.8	70.6 ± 26.3/76.7 ± 21.9***	–
MOS-SS	–	73.2 ± 24.2/78.1 ± 20.6***	–
Live alone			
mMOS-SS	81.0 ± 17.7/67.9 ± 21.5*	79.4 ± 20.2/60.9 ± 26.6*	67.5 ± 25.1/59.2 ± 25.7*
MOS-SS	–	80.1 ± 19.5/65.9 ± 24.5*	62.3 ± 23.6/68.1 ± 24.2*

*Abbreviations:* BMI, body mass index; mMOS-SS, modified Medical Outcomes Study Social Support Survey; MOS, Medical Outcomes Study; MOS-SS, Medical Outcomes Study Social Support Survey; SD, standard deviation; UCLA, University of California Los Angeles.

\*  $P < 0.001$ .

\*\*  $P < 0.01$ .

\*\*\*  $P < 0.05$ .