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# Psychometric Evaluation of the Chinese Breast Cancer Prevention Trial Symptom Scale

## KEY WORDS

Breast cancer

Factor analysis

Psychometrics

Symptoms

**Background:** Women with breast cancer experience a wide spectrum of symptoms after diagnosis and treatment. Symptoms experienced by this specific population might not be fully assessed using available traditional Chinese-language symptom measures. **Objectives:** The aim of this study was to examine the latent constructs and psychometric properties of the Chinese Breast Cancer Prevention Trial (C-BCPT) Symptom Scale. **Methods:** Two hundred women with breast cancer were recruited in Taiwan. Psychometric properties, including construct validity, internal consistency, and test-retest reliability, of the C-BCPT Symptom Scale were tested after translating the original instrument. **Results:** A 21-item C-BCPT Symptom Scale, with 7 extracted factors accounting for 72.26% of the total variance, resulted from an exploratory factor analysis. Construct validity was confirmed by significant correlations between scores on the C-BCPT Symptom Scale and the Taiwan-version Short Form-36 Health Survey ( $r = -0.49$  to  $-0.53$ )/Greene Climacteric Scale ( $r = 0.81$ ). Reliability coefficients for the overall scale/6 extracted factors (Cronbach's  $\alpha = 0.72$ – $0.88$ ) and test-retest reliability (intraclass correlation coefficients =  $0.77$ – $0.94$ ) of the translated instrument were satisfactory, whereas 1 reliability coefficient for 1 extracted factor was inadequate (Cronbach's  $\alpha = 0.57$ ). **Conclusion:** An interpretable structure with preliminary acceptable psychometric properties of the C-BCPT Symptom Scale was

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obtained; the C-BCPT can help traditional Chinese-speaking healthcare professionals perform adequate assessments of the symptoms experienced by women with breast cancer. **Implications for Practice:** The C-BCPT Symptom Scale can be used in clinical practice and research to assess symptoms experienced by this specific population or effects of related interventions.

**B**reast cancer is the most common cancer among females worldwide and accounts for one fourth of new female cancers. In 2012, approximately 1.7 million new cases of breast cancer were diagnosed globally. Mortality from breast cancer has declined because of early diagnosis and treatment improvements.<sup>1</sup> The incidence peak age for breast cancer among women in western countries is older than 55 years, whereas the incidence peak age in Asian women is 40 to 49 years.<sup>2</sup> Survivorship and early onset of breast cancer in Taiwan indicate the need for long-term management of a wide range of consequences after diagnosis and treatment.

Major treatments for breast cancer include surgery, radiotherapy, chemotherapy/targeted therapy, and endocrine therapy. Most Taiwanese women with breast cancer receive combined therapy; approximately 95% of them undergo surgery (breast-conserving surgery or mastectomy), and approximately 87% of them receive surgery plus at least 1 type of 3 treatments (radiotherapy, chemotherapy/targeted therapy, and endocrine therapy).<sup>3</sup> Consequences derived from different treatments affecting women with breast cancer include lymphedema, arm/shoulder problems, neuropathy, infertility, premature menopause/menopause-related symptoms (eg, vasomotor symptoms, urogenital symptoms, musculoskeletal symptoms, and weight gain), adverse cardiovascular effects, sleep disturbances, cognitive problems, fatigue, and sexual health problems.<sup>4,5</sup> Women with breast cancer who experienced chemotherapy-induced menopause reported more severe menopause-related symptoms than healthy women undergoing natural menopause.<sup>6</sup> Menopause-related symptoms in women with breast cancer are prevalent.<sup>7</sup> Healthcare professionals need to pay special attention to symptoms experienced by women with breast cancer and provide adequate management because unrelieved symptoms have adverse effects on women's health conditions and health-related quality of life (HRQL).<sup>8</sup>

Symptom assessment instruments are essential for assessing the presence of symptoms and evaluating the effects of provided management. Individuals with cancer frequently experience multiple concurrent symptoms. Symptom assessment instruments generated for individuals with cancer include the Symptom Distress Scale (SDS), Rhodes Adapted SDS, Rotterdam Symptom Checklist, Symptom Experience Tool, Memorial Symptom Assessment Scale, Edmonton Symptom Assessment System, MD Anderson Symptom Inventory, Symptom Experience Index (SEI), Therapy-Related Symptoms Checklist, and Canberra Symptom Scorecard.<sup>9–18</sup> None of these instruments is specifically designed for women with breast cancer, and all of them contain limited symptoms related to menopause (eg, vasomotor, urogenital, and musculoskeletal symptoms) or cognitive and sexual health problems commonly experienced by women with breast cancer.

Two symptom assessment instruments specifically designed for women with breast cancer are the Breast Cancer and Lymphedema SEI and Breast Cancer Treatment Response Inventory.<sup>19,20</sup> Urogenital and musculoskeletal symptoms, cognitive problems, and weight or sexuality concerns are also not fully assessed by Breast Cancer and Lymphedema SEI nor by Breast Cancer Treatment Response Inventory. Thus, symptoms experienced by women with breast cancer might not be fully assessed using currently available instruments.

Three instruments (the Breast Cancer Prevention Trial [BCPT] Symptom Scale, Shortened BCPT Symptom Checklist, and BCPT Eight Symptom Scale [BESS])<sup>21–23</sup> were derived from the BCPT Symptom Checklist<sup>24</sup> to assess common adverse effects related to treatments in women at risk for or who received a diagnosis of breast cancer. The BCPT Symptom Checklist and its derivatives were generated to allow discrimination between adverse effects and symptoms attributable to treatment versus those that would have occurred without treatment in a healthy aging population of midlife women. The BCPT Symptom Checklist and its derivatives have been applied to assess the presence of symptoms in women at risk for or who received a diagnosis of breast cancer receiving various treatments (eg, surgery, radiotherapy, chemotherapy/targeted therapy, and endocrine therapy).<sup>21–25</sup> Compared with symptom assessment instruments that were or were not specifically designed for women with breast cancer, instruments derived from the BCPT Symptom Checklist contain more aspects of symptoms experienced by women with breast cancer. Psychometric properties, including the internal consistency and content/construct validities, of the BCPT Symptom Checklist and instruments derived from it (the BCPT Symptom Scale, Shortened BCPT Symptom Checklist, and BCPT Eight Symptom Scale) were examined in previous studies. The underlying constructs of the BCPT Symptom Checklist and its derivatives were examined by exploratory/confirmatory factor analyses (EFA/CFA). Reported EFA/CFA results showed that the underlying constructs of the BCPT Symptom Checklist and its derivatives were not fully identified and might need further examination.<sup>21–23,25</sup>

A Chinese-language symptom assessment instrument would help Chinese-speaking healthcare professionals perform adequate assessments of symptoms experienced by women with breast cancer. Symptom assessment instruments using traditional Chinese characters specifically designed for women with breast cancer are not available. Although traditional Chinese versions of the SDS, Memorial Symptom Assessment Scale, and MD Anderson Symptom Inventory are available, symptoms experienced by women with breast cancer cannot be fully assessed using these 3 instruments. We selected the BCPT Symptom Scale proposed by

Stanton et al<sup>21</sup> for translation and testing because of its ease of administration, brevity, psychometric properties, and coverage of numerous aspects of symptoms. The objective of this study was to examine the latent constructs and psychometric properties of the Chinese BCPT (C-BCPT) Symptom Scale after we translated the English version into a traditional Chinese version.

## ■ Methods

### Study Design and Ethical Approval

This study was a prospective, psychometric testing study. Ethical approval was obtained before the study commenced.

### Setting and Participants

This study was conducted at the oncology outpatient department of a hospital in Taipei. The subjects were women with a confirmed diagnosis of breast cancer (stage 0–III) for 6 months or longer. Inclusion criteria included having received breast cancer–related treatment(s), being aged 20 years or older, having cognitive clarity, having no mental disorder history, being able to communicate, and being aware of their cancer diagnosis. Exclusion criteria included major cognitive impairment or an inability to provide informed consent. Reasons for excluding women with a confirmed diagnosis of stage IV breast cancer were (1) women included in previous studies using the BCPT Symptom Checklist and its derivatives were those at risk for or who received a diagnosis of stage 0 to III breast cancer<sup>21–23,25</sup> and (2) symptoms experienced by women with stage IV breast cancer would be more intricate because the treatment of stage IV breast cancer is highly complex. General recommendations for a factor analysis are a minimum ratio of 5 individuals per variable and a total of no fewer than 100 individuals.<sup>26,27</sup> In this study, the total sample size of 200 participants and case-variable ratio (200:18 or 25≈8 or 11) met the general recommendations.<sup>26,27</sup>

### Study Questionnaire

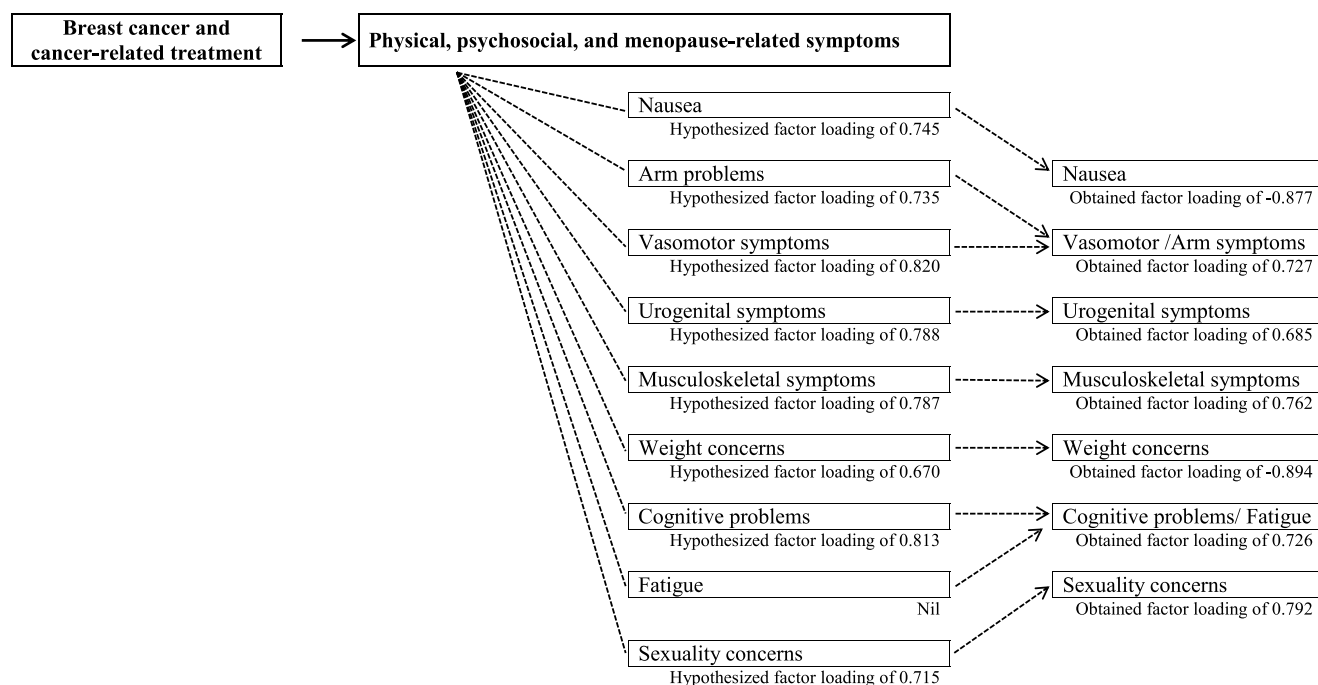
The study questionnaire included 4 sections: individual characteristics, the C-BCPT Symptom Scale, Taiwan-version Short Form-36 Health Survey (SF-36), and Taiwan-version Greene Climacteric Scale. Information collected by the SF-36 and Greene Climacteric Scale was used to examine the construct validity of the C-BCPT Symptom Scale. We collected information on participants' age, body height/weight, reproductive aging status, and disease-related information (time since diagnosis of breast cancer, cancer stage, treatments received, and treatment status). The body mass index (BMI; kilogram per square meter) was calculated by the body weight and height, with a BMI of 24.0 kg/m<sup>2</sup> or higher indicating overweight.<sup>28</sup> The classification method used in this study for BMI was appropriate for Taiwanese women but differed from the ranges commonly used in Western countries (overweight, BMI≥25.0 kg/m<sup>2</sup>). Criteria proposed by the Stages of Reproductive Aging Workshop 10 were used to classify participant's reproductive aging status.<sup>29</sup> Each participant's cancer stage

was confirmed by her primary oncologist(s) using the labels of stage 0, I, II, III, or IV. Each stage was based on the tumor-node-metastasis cancer staging system developed and maintained by the American Joint Committee on Cancer. Treatments received included surgery, radiotherapy, chemotherapy/targeted therapy, and endocrine therapy. The participants were classified into 3 groups based on their treatment status: active treatment, posttreatment for 6 months or shorter, and posttreatment for more than 6 months. Women receiving endocrine therapy only at the time of data collection were classified as being under active treatment.

### C-BCPT SYMPTOM SCALE

Our research team included investigators with expertise in oncology care, instrument development/validation, and statistics. Approval to generate the C-BCPT Symptom Scale and test its psychometric properties was obtained. The original BCPT Symptom Scales (16 or 18 items) were designed to measure physical, psychological, and menopause-related symptoms for women at risk for or who received a diagnosis of breast cancer. The 7 factors included in the 16-item BCPT Symptom Scale were hot flashes (2 items), nausea (2 items), bladder control (2 items), vaginal problems (2 items), musculoskeletal pain (3 items), cognitive problems (3 items), and weight problems (2 items). The 18-item BCPT Symptom Scale contains an additional factor of arm problems (2 items). Psychometric properties, including the internal consistency and construct validity, of the BCPT Symptom Scale were established. Women are requested to rate the extent to which they had been troubled by a symptom during the past 4 weeks using a 5-point Likert-type scale ranging from “0, not at all” to “4, extremely.” A total symptom score is derived by summing the ratings of all items; a higher total symptom score indicates a greater degree of symptom-related annoyance. A factor score is derived by summing item scores respective to that factor.<sup>21</sup>

We obtained 18- and 25-item BCPT Symptom Scales from Stanton et al<sup>21</sup> when we requested approval to translate/validate the instrument. Of the 7 items not included in the 18-item BCPT Symptom Scale, 3 items (vaginal discharge, vaginal bleeding or spotting, and genital itching/irritation) were previously reported as composing a weak factor, and 4 items were added to provide a preliminary assessment of 2 constructs: fatigue (2 items) and sexual interest (2 items). At Stanton et al's<sup>21</sup> suggestion, we translated the 25-item BCPT Symptom Scale for this study. The conceptual framework used for testing the C-BCPT Symptom Scale is presented in the Figure. We used a factor of “urogenital symptoms” to replace the 2 factors (“bladder control” and “vaginal problems”) proposed by Stanton et al<sup>21</sup> because a new terminology, “genitourinary syndrome of menopause” (GSM), has been proposed to accurately describe symptoms/signs related to menopause, and urogenital symptoms are prevalent after chemotherapy/targeted therapy or endocrine therapy.<sup>30</sup> We hypothesized that symptoms experienced by women with breast cancer might contain 9 major dimensions: nausea, arm problems, vasomotor symptoms, urogenital symptoms, musculoskeletal symptoms, weight concerns, cognitive problems, fatigue, and sexuality concerns.<sup>21,25</sup> Based on the factor loadings reported in previous studies,<sup>21,25</sup> we listed 8 hypothesized factor loadings for the corresponding



**Figure ■** Conceptual framework of the Chinese Breast Cancer Prevention Trial (C-BCPT) Symptom Scale.

factors (Figure). A hypothesized factor loading for “fatigue” could not be provided because no information was available to estimate a value.

The translation process proposed by Bullinger et al<sup>31</sup> was modified for the translation. First, 2 bilingual experts with expertise in oncology/medicine areas independently translated the original English instrument into Chinese. Second, the 2 forward-translated Chinese versions were reviewed by a panel composed by the 2 forward-translation experts, the data collector, and the principal investigator. All possible discrepancies were resolved in a panel discussion, and a consensus Chinese version was generated. Third, 2 different bilingual experts with expertise in oncology/medicine areas independently translated the consensus Chinese version back into English. Fourth, conceptual equivalence among the 2 back-translated English versions and the original English version was reviewed and confirmed by the 2 back-translation bilingual experts. Criteria for achieving conceptual equivalence were considered during the translation process.

#### SF-36

The SF-36 was used to measure participants' HRQL. Eight specific HRQL aspects in the SF-36 include physical functioning, role limitations caused by physical health problems, bodily pain, general health, vitality, social functioning, role limitations caused by emotional problems, and mental health. The physical component summary (PCS) and mental component summary (MCS) scores summarize the 8 HRQL aspect scores into 2 summary scores, which respectively provide an overall assessment of the physical and mental HRQL. The PCS/MCS and 8 HRQL aspect scores range from 0 to 100, with a higher score representing a better HRQL.<sup>32</sup> Reliability and validity of the Taiwan-version SF-36 satisfied most conventional psychometric criteria.<sup>33</sup> We

obtained approval to use the Taiwan-version SF-36 before the study commenced.

#### GREENE CLIMACTERIC SCALE

The Greene Climacteric Scale is an instrument that measures 21 physical/psychological symptoms associated with the menopause transition. The Greene Climacteric Scale includes 4 subscales: psychological subscale (11 items), somatic subscale (7 items), vasomotor subscale (2 items), and a probe of sexual dysfunction (1 item). Each item is rated on a 4-point Likert-type scale from “0, not at all” to “3, extremely.” The total Greene Climacteric score ranges from 0 to 63, with a higher score indicating more severe menopause-related symptoms. Subscale scores are derived by summing item scores respective to that subscale.<sup>34</sup> Psychometric properties of the Taiwan-version Greene Climacteric Scale are satisfactory.<sup>35</sup> Approval to use the Taiwan-version Greene Climacteric Scale was obtained.

#### Data Collection

The data collection was completed by 1 data collector trained by the principal investigator. The data collector possesses a bachelor's degree in nursing and has 20 years of clinical experience in oncology/medical-surgical care. Before the main study, 10 women with breast cancer were invited to participate in a pilot study. The 10 women were requested to complete the study questionnaire to examine possible problem areas (eg, difficulty interpreting phrases/statements) with the study questionnaire and adequacy of the data collection process. No modification was made to the study questionnaire because participants in the pilot study reported no problems in understanding the phrases/statements in the study questionnaire. The adequacy of the data collection process was also confirmed in the pilot study.

Each participant took 15 to 20 minutes to complete the study questionnaire. Of the 200 participants, 75 agreed to complete the C-BCPT Symptom Scale twice at a 7- to 10-day interval. A general recommendation of a 1- to 2-week interval was used to tap only the random measurement errors and not the true changes.<sup>36</sup> The data collected from the 75 participants were used to examine the test-retest reliability of the C-BCPT Symptom Scale. Each participant received a small gift when she returned a completed questionnaire.

## Statistical Analysis

Statistical Package for Social Sciences (SPSS) 19.0 software (IBM Corp, Armonk, New York) and SPSS R-Menu ver.2.0 (Free Software Foundation, Boston, Massachusetts) were used to analyze the collected information. A 2-tailed *P* value of <.05 was considered statistically significant. Descriptive statistics were used to demonstrate participants' individual characteristics and scores on the C-BCPT Symptom Scale, SF-36, and Greene Climacteric Scale.

A factor analysis can be used as an approach of construct validation to examine an instrument's internal structure.<sup>36</sup> It provides insights into the latent constructs underlying instrument items so that estimation of internal consistency reliability (eg, Cronbach's  $\alpha$ ) can be correctly performed.<sup>37</sup> Latent constructs of the C-BCPT Symptom Scale were examined with an EFA using principal component extraction with quartimin rotation, because the 25-item C-BCPT Symptom Scale was initially applied to a population in Taiwan, and the underlying constructs of the BCPT Symptom Scale were examined in limited studies. We examined the Kaiser-Meyer-Olkin (KMO) coefficient and Bartlett test of sphericity to ensure the suitability of performing an EFA. A KMO coefficient of more than 0.80 and a Bartlett test of sphericity with a *P* value of less than .05 are considered adequate.<sup>38</sup> We used 4 rules to determine factor retention: the scree test, Kaiser's eigenvalue-greater-than-one rule, Horn's parallel analysis (PA), and Velicer's minimum average partial (MAP) test. With a sample size of 200 participants, a factor loading of 0.40 or higher was considered salient.<sup>27</sup> To obtain a distinct factor structure of the translated instrument, items with factor loadings of 0.40 or higher on 1 factor and of 0.30 or lower on all others were retained. The factor model was reanalyzed each time an item was removed.

Construct validity concerns the inference about unobserved variables (the constructs) on the basis of observed variables (the construct's presumed indicators).<sup>36</sup> One method of construct validation is to test hypothesized relationships. Such hypothesized relationships often are based on a theory or previous research.<sup>36,37</sup> Two hypothesized relationships were examined to test the construct validity of the C-BCPT Symptom Scale: (a) the C-BCPT Symptom Scale score would be negatively correlated with the HRQL score because unrelieved symptoms have adverse effects on the HRQL,<sup>8</sup> and (b) the C-BCPT Symptom Scale score would be positively correlated with the Greene Climacteric Scale score because the C-BCPT Symptom Scale contains some aspects of menopause-related symptoms (eg, vasomotor/musculoskeletal symptoms and cognitive problems/

fatigue), and menopause-related symptoms are prevalent in women with breast cancer.<sup>7</sup> Pearson correlation coefficients were calculated between scores on the C-BCPT Symptom Scale and Taiwan-version SF-36/Greene Climacteric Scale.

The internal consistency reliability is concerned with the homogeneity of items within a construct or an instrument.<sup>37</sup> The internal consistency reliability of the C-BCPT was estimated based on our EFA results. Cronbach's  $\alpha$  values of the C-BCPT Symptom Scale were calculated, with an acceptable  $\alpha$  value of higher than 0.70.<sup>37</sup> Test-retest reliability concerns the stability of an instrument. A stable instrument can obtain similar scores on separate occasions.<sup>37</sup> The intraclass correlation coefficient (ICC) was calculated to examine the test-retest reliability of the C-BCPT Symptom Scale,<sup>39</sup> with an acceptable ICC value of 0.70 to 0.80 or higher.<sup>36</sup>

## Results

The mean age of our participants was  $52.3 \pm 8.9$  (range, 25.7–78.6) years. Participants' individual characteristics are listed in Table 1. Participants' mean C-BCPT Symptom Scale score, PCS/MCS scores, and Greene Climacteric Scale score were  $12.3 \pm 10.1$  (range, 0–70),  $49.6 \pm 9.5$  (range, 21.1–62.4)/ $48.7 \pm 10.8$  (range, 15.0–65.9), and  $10.5 \pm 9.9$  (range, 0–56), respectively. Participants' mean HRQL aspect scores ranged from 48.7 to 51.1: bodily pain ( $51.1 \pm 2.7$ ), vitality ( $50.9 \pm 2.0$ ), physical functioning ( $50.0 \pm 3.1$ ), social functioning ( $49.7 \pm 2.2$ ), general health ( $49.6 \pm 2.5$ ), role limitations caused by emotional problems ( $49.4 \pm 4.9$ ), role limitations caused by physical health problems ( $49.0 \pm 4.0$ ), and mental health ( $48.7 \pm 4.2$ ).

## Latent Constructs of the C-BCPT Symptom Scale

With a KMO coefficient of 0.804 and Bartlett's test of sphericity having a significance value of  $P < .001$ , the collected information was acceptable for an EFA. The scree test and Kaiser's eigenvalue-greater-than-one rule revealed a 7-factor solution, whereas Horn's PA suggested a 5-factor solution, and Velicer's MAP test suggested a 2-factor (MAP<sup>2</sup>) or 4-factor (MAP<sup>4</sup>) solution. Pearson et al<sup>40</sup> suggested that the MAP test is prone to underestimate the number of factors when the ratio of items to factors is less than 8 and when the sizes of the major component loadings are evenly spread among loaded factors, as it was in our case. Therefore, based on the EFA results reported in previous studies<sup>21–23,25</sup> and solutions recommended by the scree test, Kaiser's eigenvalue-greater-than-one rule, and Horn's PA, we tested the 5- and 7-factor models. We report on the 7-factor solution here because the interpretability of the 7-factor model was better than that of the 5-factor model.

In total, 4 items (general aches and pains, decreased range of motion in the arm on the surgery side, vaginal discharge, and vaginal bleeding or spotting) with factor loadings of less than 0.40 or comparable factor loadings of more than 0.30 on other factors were discarded. An interpretable 7-factor solution with an acceptable total explained variance of 72.26% was obtained. Twenty-one items retained in the C-BCPT Symptom

**Table 1 • Individual Characteristics of Women in the Sample Cohort (n=200)**

Variable	n	%
Age, range, 25.7–78.6; 52.3 (8.9), y		
26–40	15	7.5
41–50	77	38.5
51–60	71	35.5
>60	37	18.5
Marital status		
Married	156	78.0
Single (separated, divorced, or widowed)	20	10.0
Single, never married	24	12.0
BMI, range, 15.82–38.45; 22.94 (3.58), kg/m <sup>2</sup>		
<18.5, underweight	11	5.5
18.00–23.99, normal	126	63.0
24.00–26.99, overweight	36	18.0
≥27.00, obese	27	13.5
Reproductive aging status		
Premenopause, regular cycles	12	6.0
Perimenopause, 1 cycle length change ≥7 d, 2–11 mo of amenorrhea	23	11.5
Postmenopause, ≥12 mo of amenorrhea	143	71.5
Temporary amenorrhea caused by cancer-related treatment	22	11.0
Time since diagnosis of breast cancer, range, 0.5–15.22; 3.82 (2.90), y		
0.5–1	31	15.5
>1–2	35	17.5
>2–3	31	15.5
>3–5	46	23.0
>5	57	28.5
Cancer stage		
0	29	14.5
I	88	44.0
II	59	29.5
III	24	12.0
Surgery		
No	4	2.0
Yes, modified radical mastectomy	72	36.0
Yes, breast-conserving surgery	76	38.0
Yes, simple mastectomy	48	24.0
Treatment(s) received		
Surgery	6	3.0
Surgery with radiotherapy	3	1.5
Surgery with chemotherapy/targeted therapy	16	8.0
Surgery with endocrine therapy	37	18.5
Surgery with radiotherapy and chemotherapy/targeted therapy	9	4.5
Surgery with radiotherapy and endocrine therapy	20	10.0
Surgery with chemotherapy/targeted therapy and endocrine therapy	63	31.5
Surgery with radiotherapy, chemotherapy/targeted therapy, and endocrine therapy	42	21.0
≥1 of the following therapies: radiotherapy, chemotherapy/targeted therapy, and endocrine therapy	4	2.0
Treatment status		
Active treatment	147	73.5
Endocrine therapy only	126	63.0
Posttreatment≤6 mo	5	2.5
Posttreatment>6 mo	48	24.0

Scale were grouped into 7 factors named factor 1, “cognitive problems/fatigue” (5 items); factor 2, “sexuality concerns” (4 items); factor 3, “urogenital symptoms” (3 items); factor 4, “weight concerns” (2 items); factor 5, “nausea” (2 items); factor 6, “musculoskeletal symptoms” (2 items); and factor 7, “vasomotor/arm symptoms” (3 items) (Table 2). The proposed conceptual framework was modified with the factor “cognitive problems” integrated with the factor “fatigue” and the factor “arm problems” integrated into with the factor “vasomotor symptoms.” Factor loadings obtained from the current study for the 7 extracted factors are presented in the Figure.

## Construct Validity of the C-BCPT Symptom Scale

The construct validity of the C-BCPT Symptom Scale was analyzed by examining correlations of the C-BCPT Symptom Scale with the Taiwan-version SF-36 and Taiwan-version Greene Climacteric Scale. Significant negative correlations were found between the 21-item C-BCPT Symptom Scale overall/factor scores and PCS/MCS scores ( $r = -0.154$  to  $-0.570$ ,  $P < .05$ ). Significant positive correlations were found between the 21-item C-BCPT Symptom Scale overall/factor scores and Greene Climacteric Scale overall/subscale scores ( $r = 0.153$ – $0.810$ ,  $P < .05$ ). Strong correlations were found between (a) the factor of “cognitive problems/fatigue” and the psychological subscale in the Greene Climacteric Scale ( $r = 0.763$ ), (b) the factor of “sexuality concerns” and sexual dysfunction in the Greene Climacteric Scale ( $r = 0.769$ ), and (c) the factor of “vasomotor/arm symptoms” and the vasomotor subscale in the Greene Climacteric Scale ( $r = 0.772$ ) (Table 3).

## Reliability of the C-BCPT Symptom Scale

Cronbach's  $\alpha$  values of the overall 21-item C-BCPT Symptom Scale and factors 1 to 7 were 0.88, 0.86, 0.84, 0.57, 0.81, 0.80, 0.72, and 0.77, respectively. The ICC values (test-retest reliability) of the 21-item C-BCPT Symptom Scale ranged from 0.77 to 0.94: 0.93 overall, 0.94 for “cognitive problems/fatigue,” 0.93 for “sexuality concerns,” 0.90 for “urogenital symptoms,” 0.91 for “weight concerns,” 0.77 for “nausea,” 0.85 for “musculoskeletal symptoms,” and 0.91 for “vasomotor/arm symptoms” ( $P < .001$ ).

## ■ Discussion

### Latent Constructs of the C-BCPT Symptom Scale

Table 4 shows the factor analysis results and psychometric properties of the instruments associated with the BCPT Symptom Scale. Discrepancies between our EFA result and results reported in previous studies<sup>21–23,25</sup> might have been related to the different rules/methods used for factor retention and factor extraction/rotation. The total explained variance of our EFA solution (72.26%) was similar to the value reported by Alfano et al<sup>22</sup> (72.1%) and was higher than those reported by Stanton et al<sup>21</sup> (61.8%) and Terhorst et al<sup>25</sup> (50.1%–2.6%). Stevens<sup>38</sup>

**Table 2 • Factor Loadings for Exploratory Factor Analysis of the C-BCPT Symptom Scale (n=200)**

C-BCPT Symptom Scale		Factor/Factor Loading						
Item	Content	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
Factor 1: cognitive problems/fatigue (5 items)								
16	Easily distracted	0.825	-0.056	0.035	-0.123	-0.066	-0.104	0.140
15	Difficulty concentrating	0.789	-0.072	0.057	-0.050	-0.112	-0.157	0.240
23	Tiredness	0.709	0.021	0.180	0.122	0.126	0.146	0.097
13	Forgetfulness	0.675	0.101	0.015	-0.251	0.006	0.032	-0.005
22	Lack of energy	0.630	0.159	-0.037	0.070	-0.116	0.247	-0.089
Factor 2: sexuality concerns (4 items)								
25	Low sexual enjoyment	0.030	0.904	-0.118	0.040	-0.029	0.131	-0.074
24	Lack of interest in sex	0.089	0.879	-0.067	0.027	0.000	0.170	-0.170
7	Pain with intercourse	-0.107	0.746	0.149	-0.111	-0.038	-0.135	0.181
6	Vaginal dryness	0.013	0.639	0.165	-0.087	0.016	-0.273	0.252
Factor 3: urogenital symptoms (3 items)								
4	Difficulty with bladder control when laughing or crying	0.100	-0.002	0.755	-0.010	-0.076	0.049	-0.164
21	Genital itching/irritation	0.200	-0.015	0.719	-0.044	0.108	0.034	-0.021
5	Difficulty with bladder control at other times	-0.168	0.052	0.582	0.022	-0.211	0.018	0.092
Factor 4: weight concerns (2 items)								
12	Unhappy with the appearance of my body	0.128	0.049	-0.018	-0.903	-0.003	0.014	-0.129
11	Weight gain	-0.080	-0.026	0.004	-0.885	-0.056	0.088	0.105
Factor 5: nausea (2 items)								
2	Nausea	0.100	-0.017	-0.007	-0.050	-0.882	0.067	-0.044
3	Vomiting	-0.047	0.031	0.117	-0.015	-0.871	-0.023	0.045
Factor 6: musculoskeletal symptoms (2 items)								
9	Joint pains	-0.050	0.013	0.018	-0.145	-0.001	0.842	0.090
10	Muscle stiffness	0.113	0.064	0.156	0.034	-0.098	0.682	0.181
Factor 7: vasomotor/arm symptoms (3 items)								
1	Hot flashes	0.168	0.057	-0.149	0.054	-0.122	0.109	0.752
14	Night sweats	0.186	0.020	-0.129	-0.044	-0.122	-0.018	0.745
17	Arm swelling (lymphedema)	0.002	0.008	0.173	-0.115	0.178	0.206	0.684
Eigenvalue		6.26	2.25	1.63	1.49	1.31	1.15	1.09
Explained variance, %		29.83	10.70	7.75	7.08	6.25	5.47	5.18
Cumulative percent of explained variance, %		29.83	40.53	48.28	55.36	61.61	67.08	72.26
Cronbach's $\alpha$ (overall 0.88)		0.86	0.84	0.57	0.81	0.80	0.72	0.77

Abbreviation: C-BCPT, Chinese Breast Cancer Prevention Trial.

An exploratory factor analysis of the C-BCPT Symptom Scale was conducted using a principal components extraction with quartimin rotation. Four items with factor loadings of <0.40 or cross-loading (>0.30) on other factors were discarded: general aches and pains, decreased range of motion in the arm on the surgery side, vaginal discharge, and vaginal bleeding or spotting.

proposed that at least 70% of the total variance should be accounted for. In social sciences, a solution accounting for 60% of the total variance, and in some instances even less, is satisfactory.<sup>27</sup> The explained variances of the instruments associated with the BCPT Symptom Scale reported in previous studies<sup>21–23,25</sup> and the current study all accounting for 50% or more imply that the important constructs related to symptoms experienced by women with breast cancer were included in these instruments. We did not perform a CFA in the current study because of a lack of a strong theoretical/empirical base or hypotheses derived from the EFA results on previous Taiwanese samples.<sup>38</sup> In future psychometric testing studies, using a CFA to confirm the C-BCPT Symptom Scale's factor structure is suggested.

## EXTRACTED FACTORS

Compared with the 7- or 8-factor model proposed by Stanton et al.,<sup>21</sup> 2 new items related to fatigue were integrated with the

items related to “cognitive problems,” 2 new items related to sexual interest were integrated with 2 items related to “Vaginal problems,” 1 item (genital itching/irritation) was integrated with items related to “bladder control,” and 1 item (arm swelling) originally belonging to the factor of “arm problems” was integrated with the 2 items related to “hot flashes.” Six items classified into 3 factors (“weight concerns,” “nausea,” and “musculoskeletal symptoms”) were the same as items originally belonging to those corresponding factors (“weight problems,” “nausea,” and “musculoskeletal pain”).

Cognitive problems and fatigue are troubling adverse effects of systemic therapy.<sup>41</sup> Biological mechanisms associated with cancer-related cognitive problems (eg, reductions in estrogen and testosterone, cytokine dysregulation, and DNA damage) and cancer-related fatigue (eg, anemia, cytokine dysregulation, and hypothalamic-pituitary-adrenal axis dysregulation) were respectively proposed. Among those mechanisms, cytokine dysregulation is common across cognitive problems and fatigue. Cancer



**Table 3 • Relationship Between the C-BCPT Symptom Scale and Taiwan-version SF-36 Health Survey/Green Climacteric Scale (N=200)**

Scale/Score	SF-36 (HRQL)		Greene Climacteric Scale				
	PCS	MCS	Total	Psychological	Somatic	Vasomotor	Sexual Dysfunction
The C-BCPT Symptom Scale <sup>a</sup>							
Overall (21 items)	−0.486 <sup>d</sup>	−0.533 <sup>d</sup>	0.810 <sup>d</sup>	0.745 <sup>d</sup>	0.696 <sup>d</sup>	0.599 <sup>d</sup>	0.539 <sup>d</sup>
Cognitive problems/fatigue (5 items)	−0.495 <sup>d</sup>	−0.570 <sup>d</sup>	0.770 <sup>d</sup>	0.763 <sup>d</sup>	0.647 <sup>d</sup>	0.511 <sup>d</sup>	0.265 <sup>d</sup>
Sexuality concerns (4 items)	−0.196 <sup>d</sup>	−0.239 <sup>c</sup>	0.407 <sup>d</sup>	0.351 <sup>d</sup>	0.284 <sup>d</sup>	0.283 <sup>d</sup>	0.769 <sup>d</sup>
Urogenital symptoms (3 items)	−0.289 <sup>d</sup>	−0.296 <sup>d</sup>	0.438 <sup>d</sup>	0.397 <sup>d</sup>	0.472 <sup>d</sup>	0.153 <sup>b</sup>	0.184 <sup>c</sup>
Weight concerns (2 items)	−0.154 <sup>b</sup>	−0.179 <sup>b</sup>	0.322 <sup>d</sup>	0.287 <sup>d</sup>	0.277 <sup>d</sup>	0.273 <sup>d</sup>	0.216 <sup>c</sup>
Nausea (2 items)	−0.293 <sup>d</sup>	−0.333 <sup>d</sup>	0.392 <sup>d</sup>	0.376 <sup>d</sup>	0.341 <sup>d</sup>	0.229 <sup>c</sup>	0.228 <sup>c</sup>
Musculoskeletal symptoms (2 items)	−0.484 <sup>d</sup>	−0.403 <sup>d</sup>	0.596 <sup>d</sup>	0.531 <sup>d</sup>	0.646 <sup>d</sup>	0.251 <sup>d</sup>	0.227 <sup>c</sup>
Vasomotor/arm symptoms (3 items)	−0.264 <sup>d</sup>	−0.309 <sup>d</sup>	0.581 <sup>d</sup>	0.499 <sup>d</sup>	0.462 <sup>d</sup>	0.772 <sup>d</sup>	0.249 <sup>d</sup>

Abbreviations: C-BCPT, Chinese Breast Cancer Prevention Trial; HRQL, health-related quality of life; MCS, mental component summary; PCS, physical component summary; SF-36, Short Form 36 Health Survey.

<sup>a</sup>The 21-item C-BCPT Symptom Scale was a result of an exploratory factor analysis in the current study.

<sup>b</sup> $p < .05$ .

<sup>c</sup> $p < .01$ .

<sup>d</sup> $p < .001$ .

and its treatments can activate inflammation through tissue damage/destruction and/or psychological stress. The peripheral immune system with increased inflammatory responses can signal the central nervous system through several routes (eg, transport of peripheral cytokines across the blood-brain barrier and interactions of circulating cytokines with brain cytokine receptors) and lead to behavioral alterations (eg, cognitive dysfunction, fatigue, and sleep disturbances).<sup>42</sup> Integration of items related to cognitive problems and fatigue might be explained by the neuroendocrine-immune mechanism, in which activation of innate immune responses may contribute to the development of behavioral alterations. Studies conducted in women with breast cancer showed significant associations of cognitive problems with fatigue.<sup>43</sup> Cognitive problems and fatigue are common during adjuvant chemotherapeutic treatment of breast cancer, and recovery from these symptoms may take months or years. Fatigue is also associated with radiation therapy and can also occur with surgery alone. In this study, more than 70% of participants were under active treatment, and more than 65% of them had received chemotherapy/targeted therapy. Possible influences associated with cancer-related treatments or chemotherapy/targeted therapy need to be considered.

Sexual dysfunction is prevalent after breast cancer and treatment with a prevalence ranging from 30% to 100%. Dyspareunia, vaginal dryness, decreased sexual interest/arousal, pain during intercourse, difficulty achieving an orgasm, and lack of sexual pleasure are frequently reported disturbances related to sexual functioning by women with breast cancer after diagnosis and treatment.<sup>41</sup> There might be mismatched expectations and unmet needs related to communication about sexuality between healthcare professionals and individuals with cancer.<sup>44</sup> Healthcare professionals should pay special attention to this sensitive issue, obtain required education/training, and provide information or materials and/or individualized interventions/counseling for this specific population.<sup>41</sup>

Low levels of circulating estrogen after menopause might lead to physiological and biological changes in urogenital tissues.

Symptoms included in the GSM involve genital dryness, decreased lubrication with sexual activity, discomfort or pain with sexual activity, postcoital bleeding, decreased arousal/orgasm/desire, irritation/burning/itching of the vagina, dysuria, and urinary frequency/urgency.<sup>30</sup> For women with breast cancer, ovarian suppression or failure after chemotherapy/targeted therapy is related to early menopause. Hormone-related symptoms such as vasomotor and urogenital symptoms are prevalent after chemotherapy/targeted therapy or endocrine therapy.<sup>45</sup> Our study results support the conclusion proposed by Donovan et al's<sup>45</sup> *Urinary Symptoms in Breast Cancer: A Systematic Review*.

In this study, some symptoms (eg, genital dryness, pain with sexual activity, and decreased desire) included in the GSM were classified into the factor of "sexuality concerns," whereas genital itching/irritation and difficulties with bladder control were integrated into another factor of "urogenital symptoms." Previous studies conducted in women with breast cancer revealed that urinary incontinence, frequency, and urgency are common (30% to 50%) after cancer treatment.<sup>46</sup> Adding more items related to "urogenital symptoms" (eg, urinary frequency/urgency) is suggested to completely represent this important construct. Different treatment options for urogenital symptoms/GSM are available for this specific population (eg, low or ultralow doses of vaginal estrogens and oral selective estrogen receptor modulators).<sup>30</sup> Helping women with breast cancer overcome disturbances related to urogenital symptoms, and exploring effects of different treatment options are possible directions for future studies.


Item compositions for the factors of "weight concerns," "nausea," and "musculoskeletal symptoms" were the same as those for the 3 corresponding factors reported by Stanton et al.<sup>21</sup> Weight gain and nausea/vomiting are common adverse effects in women receiving adjuvant chemotherapy. A possible association between weight gain and menopause is proposed; weight gain in premenopausal women who had chemotherapy-associated amenorrhea was significant.<sup>41</sup> Musculoskeletal symptoms are common in postmenopausal women, and they are frequent adverse effects of therapy with aromatase inhibitors.<sup>41</sup>



Special attention needs to be paid to associations between cancer-related therapies and these aspects of symptoms, because a major proportion of women with breast cancer receive endocrine therapy (>80% in this study) or chemotherapy (>65% in this study). Integration of these 3 factors implies that these aspects of symptoms were essential concerns of our participants. However, a factor with fewer than 3 items might be unstable; 4 or 5 items with strong loadings are desirable.<sup>26,47</sup> Each of these 3 factors contained 2 items

only. Adding more items related to these factors/constructs could be considered to ensure the stability of these constructs.

In this study, 3 items (hot flashes, night sweats, and arm swelling [lymphedema]) comprised the factor of “vasomotor/arm symptoms.” Vasomotor symptoms are prevalent after chemotherapy/targeted therapy or endocrine therapy. Hot flashes and night sweats are common acute and long-term adverse effects of breast cancer-related treatment and may be secondary to

 **Table 4 • Factor Analysis Results of Instruments Associated With the Breast Cancer Prevention Trial (BCPT) Symptom Scale**

	Stanton et al <sup>21</sup>	Alfano et al <sup>22</sup>
	The BCPT Symptom Scale	The Shortened BCPT Symptom Checklist
Participants	Sample 1: 863 women with breast cancer (stage 0–II)/disease duration of 1–5 y, completed local and/or systemic adjuvant cancer therapy, currently considered disease-free, and not receiving cancer therapy other than tamoxifen (mean age: 56 y) Sample 2: 577 women with first breast cancer (stage 0–II) at age 50 y or younger/disease-free for 2–10 y (mean age: 50 y) Sample 3: 560 women with breast cancer (stage I–II) who received surgery and radiation, with or without chemotherapy (mean age: 57 y) Sample 4: 208 women at risk for but did not receive a diagnosis of breast cancer (mean age: 47 y)	803 women with breast cancer, who received surgery only or surgery plus radiation, chemotherapy, or radiation/chemotherapy (mean age: 55.5 y)
No. of factors	Sample 1 (16 items)	5 factors: vasomotor (3), urinary incontinence (2), cognitive/mood (5), vaginal symptoms (2), and weight/appearance (3 or 2)
Factor labels (number of items)	7 factors: hot flashes (2), nausea (2), bladder control (2), vaginal problems (2), musculoskeletal pain (3), cognitive problems (3), and weight problems (2) Samples 2 and 3 (18 items) 8 factors: hot flashes (2), nausea (2), bladder control (2), vaginal problems (2), musculoskeletal pain (3), cognitive problems (3), weight problems (2), and arm problems (2)	
Analysis → retained, items	Sample 1: 42 → 16 Samples 2 and 3: 44 → 18	16 → 15 or 14
Extraction and rotation/cumulative percentage of explained variance	Principal axis factoring with quartimin rotation/7-factor solution: 61.8%/8-factor solution: no mention	Principal factor analysis with promax rotation/72.1%
Rules determining the number of factors/factor loading and item elimination	Parallel analysis Factor loading > 0.60 on the item's respective factor and < 0.30 on all others	Eigenvalues/scree plot Factor loading > 0.30 on the item's respective factor and < 0.30 on all others
Psychometric properties	Confirmation of factor structure by CFA (TLI, CFI, RMSEA, and SRMR) after an EFA with 2 items (nausea/vomiting) were deleted/samples 2, 3 and 4 Internal consistency (Cronbach's $\alpha$ /8 factors, 18 items): Samples 2 and 3 overall 0.81/factors: 0.59–0.85 Validity: correlations with the PCS/MCS in the SF-36 $r = -0.40/-0.36$	Internal consistency (Cronbach's $\alpha$ ): factors 0.60–0.88. Validity: correlations with the PCS/MCS in the SF-36 $r = -0.26/-0.51$
Study site/instrument language	United States/English	United States/English

(continues)

Abbreviations: BCPT, Breast Cancer Prevention Trial; CFA, confirmatory factor analysis; CFI, Comparative Fit Index; EFA, exploratory factor analysis; MCS, mental component summary; PCS, physical component summary; RMSEA, root mean square error of approximation; SF-36, Short Form 36 Health Survey; SRMR, standardized root mean-squared residual; TLI, Tucker-Lewis Index.

**Table 4 • Factor Analysis Results of Instruments Associated With the BCPT Symptom Scale, Continued**

	Cella et al <sup>23</sup>	Terhorst et al <sup>25</sup>	The current study
	BESS	The BCPT Symptom Checklist	The C-BCPT Symptom Scale
Participants	11 064 women 35 years or older at risk for breast cancer (women with a history of lobular carcinoma in situ were included; mean age: 53.8 y)	278 women with breast cancer (stage I–IIIa), who received adjuvant therapy (chemotherapy, anastrozole, or both; mean age: 60.5 y)	200 women with breast cancer (stage 0–III) of 6 months or longer, who received breast cancer related treatment (mean age: 52.3 y)
Number of factors	8 Factors: cognitive symptoms (3), musculoskeletal pain (3), vasomotor symptoms (3), gastrointestinal symptoms (3), dyspareunia/sexual problems (2), bladder problems/control (2), weight concerns/body image (2), and gynecologic/vaginal symptoms (3)	8 Factors: cognitive symptoms (3), musculoskeletal pain (5), vasomotor symptoms (3), gastrointestinal symptoms (2), dyspareunia (2), bladder control (2), weight concerns (2), gynecologic symptoms (2)/baseline 7 factors: cognitive symptoms (4), musculoskeletal pain (5), vasomotor symptoms (3), gastrointestinal symptoms (3), dyspareunia (2), bladder control (2), weight concerns (2)/6 mo	7 Factors: cognitive problems/fatigue (5), sexuality concerns (4), urogenital symptoms (3), weight concerns (2), nausea (2), musculoskeletal symptoms (2), vasomotor/arm symptoms (3)
Factor labels (number of items)			
Analysis → retained, items	42 → 21	42 → 21	25 → 21
Extraction and rotation/ cumulative percentage of explained variance	Principal components analysis with varimax rotation/no mention	Principal axis factoring with varimax rotation/baseline data, 50.1%/6-mo data, 52.6%	Principal components analysis with quartimin rotation/72.26%
Rules determining the number of factors/factor loading and item elimination	Eigenvalues > 1/scree plot  Factor loading ≥ 0.40; percent agreement among analyses of different samples > 50%	Factor loading of an item was 3 times higher on its respective factor than on any other  The conceptual basis proposed by Cella et al <sup>23</sup> was considered	Eigenvalue > 1, scree plot and Horn's parallel analysis  Factor loading ≥ 0.40 on its respective factor and ≤ 0.30 on all others
Psychometric properties	Confirmation of factor structure by CFA (NFI, NNFI, and CFI) after an EFA  Validity: correlations with the (a) PCS/MCS in the SF-36 and (b) CES-D: baseline (a) $r = -0.44/-0.33$ , (b) $r = 0.43$ ; 12 mo (a) $r = -0.44/-0.36$ (tamoxifen group); $r = -0.42/-0.39$ (placebo group), (b) $r = 0.44$ (tamoxifen group); $r = 0.47$ (placebo group)  Content validity/analysis: possible symptom candidates (fatigue, back problems, abdominal pain, leg/foot cramps, or pain)	Confirmation of factor structure by CFA (RMSEA, CFI, NFI, and NNFI) after an EFA: 8-factor was superior  Internal consistency (Cronbach's $\alpha$ /8 factors, 21 items): baseline factors, 0.56–0.87; 6-mo factors, 0.69–0.92  Validity: correlations with the PCS/MCS in the SF-36: baseline, $r = -0.33/-0.28$ ; 6 mo, $r = -0.20/-0.21$	Internal consistency (Cronbach's $\alpha$ /7 factors): overall, 0.88; factors, 0.57–0.86  Intraclass correlation coefficients: 0.77–0.94  Validity: correlations with the PCS/MCS in the SF-36, $r = -0.49/-0.53$ ; correlation with the Greene Climacteric Scale, $r = 0.81$
Study site/language	United States/English	United States/English	Taiwan/traditional Chinese

Abbreviations: BCPT, Breast Cancer Prevention Trial; BESS, BCPT Eight Symptom Scale; C-BCPT Symptom Scale, Chinese BCPT Symptom Scale; CFA, confirmatory factor analysis; CES-D, Center for Epidemiological Studies Depression Scale; CFI, Comparative Fit Index; EFA, exploratory factor analysis; MCS, Mental Component Summary; NFI, Normed Fit Index; NNFI, Nonnormed Fit Index; PCS, Physical Component Summary; RMSEA, root mean square error of approximation; SF-36, Short Form 36 Health Survey.

chemotherapy-induced premature menopause, secondary to exposure to tamoxifen or raloxifene, or consequent to cessation of hormone replacement therapy after a breast cancer diagnosis.

The etiology of lymphedema may include (a) lymphatic obstruction resulting from obliteration of lymphatic pathways or removal of lymph nodes, (b) mechanical insufficiency resulting from faulty

lymphatic pumping or malfunction of lymphatic valves, or (c) loss of lymphatic vessel integrity.<sup>41</sup> Arm swelling/lymphedema is a main late effect of breast cancer treatment that affects 3% to 60% of women with breast cancer, yet it is a relatively underestimated and less-researched complication of cancer treatment.<sup>41,48</sup> Proposing a rational explanation for the integration of these 3 items is difficult. The factor of “hot flashes” or “vasomotor symptoms” was extracted in 4 studies.<sup>21–23,25</sup> The factor “arm problems” was only reported by Stanton et al,<sup>21</sup> whereas items related to “arm problems” were not included in the EFA in studies conducted by Alfano et al,<sup>22</sup> Cella et al,<sup>23</sup> or Terhorst et al.<sup>25</sup> In our EFA, the item of “decreased range of motion in the arm on the surgery side” originally belonging to the factor of “arm problems” was discarded. During the first 2 years after breast cancer–related surgery, an increase in limitations of shoulder functions is followed by a decrease in limitations of shoulder functions. One to 2 years after surgery, the influence of changes in shoulder functions declines.<sup>49</sup> Most participants received a diagnosis of breast cancer for more than 1 year ( $n = 169$ , 84.5%) which might be a possible explanation for the removal of the item “decreased range of motion in the arm on the surgery side.” For the construct “arm symptoms,” using a more homogeneous sample (eg, individuals receiving similar treatments and with similar disease durations) to further explore this construct might be a feasible approach.

In our EFA, another 3 items (general aches and pains, vaginal discharge, and vaginal bleeding or spotting) were discarded. The item “general aches and pains” originally belonged to the factor “musculoskeletal pain.” During the process of our EFA, this item showed comparable factor loadings on other factors. The meaning of this item may be complex in structure and lead to an impediment of item integration.<sup>26,47</sup> In future research, reclarifying the meaning of this item, reconfirming the adequacy of its Chinese translation, and confirming women's comprehension of its meaning are recommended. Compared with the prevalence of discomfort with intercourse or vaginal dryness, the prevalence of vaginal discharge or vaginal bleeding/spotting is less common in women with breast cancer.<sup>46</sup> Removal of these 2 items might imply that our participants were less likely to have been bothered by these symptoms because 71.0% and 97.5% of them, respectively, reported that they were not bothered by vaginal discharge or vaginal bleeding/spotting. Other explanations related to the discarded items need to be considered. If a factor/construct is not adequately defined or an insufficient number of items is used to represent a factor/construct, problems with interpreting such factors may arise.<sup>26,47</sup>

## Construct Validity of the C-BCPT Symptom Scale

The construct validity of the 21-item C-BCPT Symptom Scale was established by the significant negative correlations with the Taiwan-version SF-36 (Table 3). Of the significant correlations between the PCS/MCS in the SF-36 and 7 extracted factors, healthcare professionals might want to pay special attention to the moderate ones ( $r > 0.400$ ,  $P < .001$ ) for the factors “cognitive problems/fatigue” and “musculoskeletal symptoms.” Interventions useful in relieving disturbances related to these aspects

of symptoms (eg, cognitive behavioral therapy and physical activity) are recommended,<sup>41</sup> because the influences associated with these symptoms might be stronger than those of other symptoms. Correlations between the mean overall/factor scores on the C-BCPT Symptom Scale and overall/subscale scores on the Greene Climacteric Scale were all statistically significant. This finding further confirms the construct validity of the C-BCPT Symptom Scale, because it can appropriately measure women's menopause-related symptoms. Scores on similar constructs in the C-BCPT Symptom Scale and Greene Climacteric Scale should have strong correlations. The construct validity of 3 extracted factors in the C-BCPT Symptom Scale was further confirmed by the strong correlations ( $r > 0.760$ ,  $P < .001$ ) with 3 subscales of the Greene Climacteric Scale: “cognitive problems/fatigue” with the psychological subscale, “sexuality concerns” with the sexual dysfunction subscale, and “vasomotor/arm symptoms” with the vasomotor subscale.

Low to moderate correlations ( $r = -0.20$  to  $-0.53$ ) between the instruments associated with the BCPT Symptom Scale and SF-36 were obtained in previous studies<sup>21–23,25</sup> and the current study (Table 4). The SF-36, a general measure of the HRQL, was selected to measure our participants' HRQL because that would allow further comparisons with previous study results. However, cancer- or breast cancer–specific measures are available and well developed to assess the HRQL of women with breast cancer.<sup>50</sup> In future studies, using other HRQL assessment instruments specifically designed for this specific population (eg, European Organization for Research and Treatment of Cancer Quality of Life Questionnaire-Core questionnaire [EORTC QLQ-C30] and its breast cancer-specific complementary module [EORTC QLQ-BR23]) could be considered.<sup>50</sup>

## Reliability of the C-BCPT Symptom Scale

In the current study, the reliability of the overall 21-item C-BCPT Symptom Scale and 6 extracted factors was satisfactory (Cronbach's  $\alpha = 0.72$ – $0.88$ ) with the exception on the factor “urogenital symptoms” (Cronbach's  $\alpha = 0.57$ ). A limited number of items related to “urogenital symptoms” might be a possible explanation for the low Cronbach's  $\alpha$  value. The low Cronbach's  $\alpha$  value might reveal that a complex, multidimensional construct was measured because urogenital symptoms/GSM could involve various symptoms.<sup>30,45</sup> Adding more items related to “urogenital symptoms” is recommended to completely represent this construct. For the test-retest reliability of the 21-item C-BCPT Symptom Scale, satisfactory ICC values revealed that this instrument has stable traits.<sup>39</sup>

## ■ Limitations

The current study has several limitations. First, we did not examine the content validity of the BCPT Symptom Scale because the reported psychometric properties of the BCPT Symptom Scale and instruments associated with the BCPT Symptom Checklist seemed to be adequate.<sup>21–25</sup> Adding some items to reflect symptom dimensions specific to investigators'

research was suggested by Stanton et al.<sup>21</sup> As radiotherapy and chemotherapy might be associated with increased insomnia severity in women with breast cancer,<sup>4,5,41</sup> the lack of items related to insomnia in the BCPT Symptom Scale would limit the assessment of this common symptom. Quantitative and/or qualitative studies could be conducted to explore other possible symptoms of women with breast cancer in different ethnic groups or with different treatment statuses. Generating a more comprehensive list of symptoms before further testing the instrument's psychometric properties is recommended. Second, the concepts being investigated (symptoms and HRQL) are known to change over time and may be related to the treatments received. Developing a symptom assessment instrument, which can be applied to different treatment statuses or various treatment combinations, would be challenging. Future research with a longitudinal design and using cancer/breast cancer-specific HRQL measures<sup>50</sup> could be considered. Third, the construct validity of the C-BCPT Symptom Scale may need to be further established, because we only considered the possible association between symptoms and the HRQL. However, the HRQL might be affected by other factors, such as social support or emotional status, which were not investigated in the current study.

## Conclusion

Our EFA resulted in a 21-item C-BCPT Symptom Scale with 7 extracted factors. A simple structure that explained 72.26% of the total variance was identified. Acceptable preliminary psychometric properties of the C-BCPT Symptom Scale were obtained and can serve as a basis for further research. The C-BCPT Symptom Scale can help traditional Chinese-speaking healthcare professionals or researchers perform adequate assessments of symptoms in women with breast cancer. Information related to symptoms experienced by Asian women with breast cancer can be enriched. Different cancer-specific symptom assessment instruments are all potentially useful for specific populations or certain clinical and research goals. Healthcare professionals or researchers should undertake a comprehensive review to ensure that appropriate measures are selected before commencing their clinical practice or research. The C-BCPT Symptom Scale can be used in clinical settings and in research to assess the progress of symptoms experienced by this specific population and effects of related interventions. It can also be used as a part of routine symptom monitoring for women with breast cancer because of its brevity and specificity. The comprehensive identification of symptoms experienced by women with breast cancer may lead to implementation of adequate management.

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