Development and Validation of the

Breast Cancer Survivors Resilience Scale

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ABSTRACT

This study aimed to develop a breast cancer survivor resilience scale (BCRS) and verify its reliability and validity. We constructed subscales based on the results of a conceptual analysis of resilience and analysis of factors that promote resilience. We verified the internal validity of the subscales by enlisting the opinion of nursing experts and conducting a preliminary survey. This process yielded a draft scale consisting of 64 items. We then conducted the main study on 230 respondents and a re-test on 37 respondents. The results yielded a scale with two factor classes – "individual protective" factors and "social protective" factors – and 16 items. Cronbach's alpha was 0.93 and the re-test correlation coefficient was 0.89, indicating that the scale has internal consistency and stability. Confirmatory factor analysis indicated statistically significant results for construct validity, criterion-related validity, and discriminant validity, thus confirming that these types of validity were sufficiently present in the scale. The BCRS has sound reliability and validity, and that with clinical application, it can become an effective scale for measuring resilience in breast cancer survivors.

INTRODUCTION

In 1999, breast cancer became the most prevalent cancer among women in Japan, and the incidence rate has increased by 5% every year since then. The five-year relative survival rate for breast cancer is 93.6%, which is very high relative to the 64% survival rate for cancer as a whole[1]. Advances in cancer research have contributed to the higher survival rate while also significantly prolonging survivor lifetimes. Although breast cancer has a high survival rate, the period for which the patient is deprived of her well-being is the longest among other cancers[2]. This trend reflects the fact that those with breast cancer have their lives disrupted for many years by the array of complex problems and procedures to undergo. The range of primary care options for breast cancer, in particular, has expanded significantly, increasing the scope for patient decision-making. Patients decide their treatment beginning with the pre-operative chemotherapy, through to surgery type, breast reconstruction, and post-operative adjunct therapies. Endocrine therapy tends to continue for as long as five to ten years, and the costs of continuing treatment, even after surgery, can be high[3-4]. In the case of breast cancer, relapse or metastasis can occur even after ten years, meaning that the patient must undergo follow-up examinations over a long period and endure uncertainty and unease.

Data from 2012 reveal that one out of every 11 women in Japan are at risk of developing breast cancer, which is a rate that now approaches those in Western countries, where one out of every eight women is at risk. The incidence of breast cancer has a bimodal distribution, which peaks first at age 45–50 years and again at age 60–64 years. The first peak at 45–50 years old can negatively affect roles at home and/or in the workplace, as working issues for women with breast cancer manifest more often compared with those in women with other types of cancer. As part of a support plan, survivors need help in playing active roles in society while also considering their daily life challenges after treatment; for example, job assistance, support in the aftermath of physical side effects caused by treatment and transformation of the body image caused by surgery, support for reproductive medicine, and discussions on hereditary cancer[5]. Thus, for breast cancer nursing care,

support based on highly specialized cancer survivorship soon after diagnosis is important, as is support based on multimodal therapy and care.

Survivors must cope with and overcome various difficulties in the process of long-term survivorship. Although people typically exhibit adaptability and perseverance when faced with difficulties, their reactions and coping mechanism may differ when faced with a cancer diagnosis[6]. In view of this situation, we focused on the concept of "resilience." Resilience connotes the flexible yet unbreakable strength of a willow as opposed to the brittle strength of steel. A resilient person is one who experiences failure and setbacks, but then bounces back and uses the experience to grow. According to Ogiwara, this conception of resilience describes "a particularly Japanese kind of strength"[7]. People around the world are impressed at how the Japanese people have rebuilt their lives stoically and resolutely in the wake of the 2011 Tohoku earthquake and tsunami. Many have offered praise, saying things like "the Japanese people are amazingly resilient." In recent years, the concept of resilience has been discussed in relation to protective and buffering factors in individuals who are unavoidably exposed to stress[8]. Although resilience is a power necessary to overcome difficulties, it may become activated only when facing a crisis, and this activation affects individuals' will to survive in the long term[9]. Therefore, if a more precise understanding of resilience can be obtained, then more effective support that is based on individual recovery can be provided.

The number of resilience scales has increased since 2000[10-15]. Many of these scales are intended for psychiatric patients, PTSD sufferers, individuals with chronic disorders (such as heart disease), and childhood cancer patients. Many of the Japanese-specific scales focus not on a particular type of hardship but rather on hardships that can occur on a daily basis[16], developed by surveying university students or the public. Recently, however, the number of developed resilience scales for use by nurses, nursing students, and occupational therapists has also increased. Resilience has attracted attention as an important concept that affects aspects of mental health, education, and social life[16].

The incidence rate of breast cancer is high, and even many early-stage breast cancer

patients succumb to maladaptive behavior or clinical depression[17]. Further, as endocrine therapy continues over many years, it is far from rare for patients to experience depression as a side effect of the treatment[18]. Given the above, by using a resilience scale to measure more effectively patients' experience of difficulties caused by breast cancer, measuring these survivors' resilience may reveal strategies for more targeted screening or effective nursing interventions for those who require early intervention through understanding the characteristics of individual resilience.

Purpose

The study aimed to develop a scale for measuring breast cancer survivor resilience and verify the scale's reliability and validity.

METHODS

Design

This study developed a quantitative questionnaire based on a qualitative study, using an inquisitive design proposed by J.W. Cresswell and V.L. Plano-Clark called mixed methods research[19].

Subjects

We conducted surveys at two facilities in the prefecture. The subjects were women aged 65 years or under who had received a breast cancer diagnosis and undergone surgery for breast cancer, who had received outpatient care for periods ranging from three months to five years following their surgery, and who had not experienced relapse or metastasis at the time of the study. All of the subjects were physically and mentally stable and could understand Japanese.

The postoperative period for the participants was defined according to the following criteria: by avoiding the period of unstable psychosomatic condition shortly after surgery, by allowing for the five-year ambulatory period necessary for hormonal therapy, and by considering that the reliability of patients' memory of those five years (or more) might decrease over time.

The authors asked the site personnel who agreed to cooperate in the study

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(outpatient breast cancer specialists, outpatient head nurses, and assistant head nurses) to refer individuals who fulfilled the participation criteria. We then distributed questionnaires to those individuals who provided their consent to participate in the study. The recruitment method of pilot study and main survey are the same.

Study Period

The pilot study was conducted from March to April, 2015, whereas the main survey was completed between May 2015 and October 2016.

Definition of terms

Resilience is a concept similar to coping and sense of coherence (SOC). Coping, as a restrictive definition in this study, refers specifically to stress-related coping, whereas resilience may expand through experience as well as recovery from a temporary maladjustment[20]. The foundation of SOC is coherency, whereas that of resilience is flexibility and diversity; however, there is a similarity between SOC and resilience: both are an individual's ability to deal with critical situations. In this study, resilience is defined as "an ability to maintain psychological health condition even if exposed to a stressor; alternatively, even after being maladaptive temporarily, it is an ability to overcome such a status and recover toward a healthy condition"[8].

Theoretical Framework of Resilience (Figure 1)

The study developed a model of breast cancer survivor resilience based on the conceptual models of resilience in adolescents with cancer developed by Woodgate[21] and Haase[22]. Breast cancer survivors' responses to stressors, such as cancer examinations, surgery to treat cancer, and side effects caused by treatment, vary depending on vulnerability factors, such as negative emotions and negative coping skills; protective (defense) factors, such as inner strength, positive coping skills, and trait characteristics; and social support or other external factors.

In this study, the fighting spirit (FS) aspect of the Mental Adjustment to Cancer scale (MAC) is included in positive coping for protective factors; the helplessness/hopelessness (H/H), anxious preoccupation (AP), and fatalism (FA) aspects of

MAC are included in negative emotion and negative coping; the Medical Outcomes Study (MOS) 8-Item Short-Form Health Survey (SF-8) is included in quality of life (QOL) improvement for adaptation.

Developing the Breast Cancer Survivors Resilience Scale

1. Extracting constructs and formulating question items

1) A previous study[23] analyzed the conceptual components of resilience in individuals with cancer experiences using Rodgers's conceptual methodology[24]. This previous work extracted three antecedent factors: "cancer-related stressor," "inner strength," and "person's surrounding environment"; two types of affiliation: "positive change" and "coping strategy"; and four outcomes: "positive response," "well-being acquisition," "improved QOL," and "improved empowerment."

2) A qualitative study was conducted to develop a scale that considers certain characteristics of breast cancer survivors[25], from which the following eight components were extracted: "treatment preferences," "ability to adopt coping behaviors to prevent recurrence and complications," "believing that the cancer can be cured," "having hope and goals," "being able to live one's own life," "accepting the status quo and switching between feelings," "being able to receive support from family or from others with the same condition," and "recognizing the significance of the existence of the self in society and one's role to." After combining these components with the results of a concept analysis, the following elements were defined as subscales: "treatment preferences," "coping skills," "belief," "hope and goals," "own individuality," "control of emotions," "social support," and "significance of the self in society."

3) In developing the item pool, the study also used items from existing resilience scales, scales of similar concepts (such as coping, SOC, and stressors), and middle-range theories related to resilience.

2. Enlisting experts to verify the scale's content validity

Nursing experts were enlisted to verify that the scale has content validity and thus can measure breast cancer survivor resilience. A total of 11 nursing experts were recruited:

six oncology-certified nurse specialists, three breast cancer nursing-certified nurses (two of whom were also oncology-certified nurse specialists), and four breast cancer nursing researchers. The experts were asked to arrange the 98 question items into subscales. After they had done so, the concordance rate between the experts was calculated. The standard concordance rate was set at >60%, and a total of 32 items were deleted: those with a low concordance rate (29 items), those with similar content (2 items), and those with problems in expression (1 item). After the subjects were limited and the items that might be missing a value (4 items) were revised, the original draft of the Breast Cancer Survivors Resilience Scale (BCRS) was developed, consisting of 70 items.

Pilot Study

BCRS was used to survey 25 breast cancer survivors who met the criteria for participation. The response rate and effective response rate were both 100%. The study examined the adequacy of expression in the question items, time needed to complete the questionnaire, and feelings of burden. Subsequently, six items that seemed to pose issues in the subjects' ability to respond were deleted. The final questionnaire consisted of 64 items under 8 subscales: 5 items for "treatment preferences," 7 items for "coping skills," 8 items for "belief," 8 items for "hope and goals," 6 items for "own individuality," 12 items for "control of emotion," 11 items for "social support," and 7 items for "significance of the self in society."

Main Study

1. Questionnaire format and distribution

The researchers conducted the study at two medical sites using the revised BCRS with a four-point Likert scale for each of the 64 items (1=Strongly disagree, 2=Somewhat disagree, 3=Somewhat agree, 4=Strongly agree). Two other scales were used as well: MAC and MOS SF-8™. We also referred to face sheets to collect information on the respondents' basic attributes (e.g., age, family composition, occupational background) and their clinical background (time since surgery, type of surgery, whether or not they received pre- or

post-operative adjuvant therapy, and other details). This information was classified as basic data.

The questionnaires were sent by post or distributed in a hospital room, whichever was most convenient for the participants. We adopted an anonymous self-administered survey format.

1) MAC

Developed by Watson et al. (1988)[26], MAC is a 40-item self-administered scale for measuring adjustment to cancer. The scale comprises five subscales, each scored on a four-point Likert scale. The subscales are "fighting spirit (FS)" (16 items), "anxious preoccupation (AP)" (9 items), "fatalism (F)" (8 items), "helplessness/hopelessness (H/H)" (6 items), and "avoidance (A)" (1 item). A Japanese version of the scale was adapted by Akechi et al. in 1997, and its reliability and validity have been confirmed[27].

The study assumed that FS of MAC to be effective in cancer examination and that there would be a high association with breast cancer relative survival (BCRS) rates because it was an attribute of resilience. It was also considered that H/H would have a strong association with psychiatric problems, including anxiety and depression, and that the AP, F, and A would show unfavorable psychiatric responses. Therefore, MAC was considered suitable for verification of the criterion-related validity. Written permission for its use was obtained from the person who developed the scale.

2) SF-8 ™

Developed in the 1980s in the U.S. as part of MOS, SF-8 has become the most widely used measure of QOL. It measures QOL across eight domains using general health concepts rather than focusing on specific health conditions, such as diseases or symptoms. The eight domains, each of which are ranked on a five- or six-point Likert scale, are "physical functioning (PF)," "physical role (PR)," "bodily pain (BP)," "general health (GH)," "vitality (VT)," "social functioning (SF)," "emotional role (ER)," and "mental health (MH)." Respondents are scarcely encumbered; it takes only a minute or two to complete the questions. SF-8 can be a useful tool when combined with other surveys. The

Japanese version of the SF-8 has been demonstrated to possess sound reliability and validity[28].

As SF-8 is a health-related QOL scale and that the QOL results are determined from the consequence of resilience, the association with BCRS was assumed to be high. In addition, as the number of items on BCRS and MAC questionnaires is significantly higher, SF-8, using only eight items, was available for assessment, with respect to the subjects' perceived burden.

The study obtained a license to use the survey from iHope International.

Re-test

During the main study briefing, the authors explained the purpose and method of the re-test, and then distributed the re-test questionnaires among those who provided their consent. The re-test participants completed the re-test questionnaire in their homes between one week and one month after the main study, and then returned the questionnaire forms by post. The questionnaire used was the revised BCRS. The re-test period was defined by considering the following: memory during the main test might remain for about one week (which might influence the re-test); there was a high probability that the re-test itself might be forgotten after as little as one month, owing to major changes in patients' mental and physical conditions.

Data analysis

1) Selecting question items

The study conducted an item analysis focusing on ceiling and floor effects, and then corrected item-total and inter-item correlations.

2) Verifying reliability

Internal consistency was confirmed by calculating the Cronbach's alpha for the scale as a whole and each factor therein. To confirm the scale's stability, we conducted a re-test and calculated Spearman's rho. To verify internal consistency-reliability, we calculated the Spearman-Brown reliability coefficient.

3) Verifying validity

(1) Construct validity: The study used factor analysis to confirm model goodness-of-fit.

An explorative factor analysis with Promax Rotation was performed using the principal factor method for all of the items that were not eliminated after the item analysis. After exploratory factor analysis, confirmatory factor analysis was used to develop the model, followed by a confirmatory factor analysis based on covariance structure analysis[29]. This analysis confirmed the model's goodness-of-fit. The measures used for goodness-of-fit were the goodness-of-fit index (GFI), adjusted GFI (AGFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA).

The study then performed a Kolmogorov-Smirnov test using the overall score; the test confirmed a Gaussian distribution. For the validity of the factor analysis, a measure of sample validity of KMO was used.

(2) Criterion-related validity: We calculated Spearman's correlation coefficient for verification of the criterion-related validity, wherein this coefficient was calculated to confirm a correlation between MAC and SF-8.

(3) Discriminant validity: For discriminant validity, the study divided BCRS scores into two groups (high scoring group and low scoring group) and performed a t-test with MAC and SF-8. We then performed multi-dimensional scaling (MDS)[30], which visually confirmed the scale's similarity to subscales of the MAC and SF-8. Regarding the statistical software, we used IBM SPSS Statistics for Windows (version 23.0) and IBM SPSS Amos (version 23.0).

Ethical considerations

This study was authorized by the Gunma University Ethics Committee for Medical Research involving Human Subjects (No. 14-81) and Gunma Prefectural Cancer Center's Medical Research Ethics Committee (No. 405-27038). The participants provided their consent after receiving a written and oral explanation detailing the following: content and methods of the study, method for recruiting participants, privacy protection, respect for free-will, the fact that they could withdraw their participation at any time, the fact that they

would not suffer any disadvantage in terms of treatment or nursing, and the fact that the study results will be published.

Regarding the method for obtaining consent, we drew a shortlist of candidates who met the criteria for participation through the study coordinators, and then confirmed their viability for investigation. We then asked the coordinators to introduce the study team to the candidates at the completion of their outpatient treatment. The study team then briefed the willing candidates. After the briefing, those candidates who were willing to participate provided their signature on the consent form. The participant and the study team each kept a copy of the signed consent form.

RESULTS

Of the 253 participants in the main test at the time during which consent was requested and explanation of the study provided, 233 participants provided their consent for participation in the study (response rate, 92%), and 230 of these were effective responses (effective response rate: 98.7%). For the re-test, we distributed questionnaires to 40 participants, and 37 of the participants returned the questionnaires (response rate: 92.5%). All of these responses were effective (effective response rate: 100%).

1. Participants' characteristics

Table 1 lists the participants' characteristics. The mean age of the participants was 49.9±7.7 years. The mean number of months elapsed since surgery was 29.1±16.6. Additionally, 80% of the participants were married, and 64% were employed. Regarding type of surgery, 49% had breast-conserving surgery, 45% had a mastectomy, and 13% had reconstructive mammoplasty. Regarding adjuvant therapy, 81% had endocrine therapy, 54.3% had radiation therapy, and 43% had chemotherapy (respondents could select multiple answers). Regarding treatment at the time of the study, most of the participants (77.7%) were undergoing endocrine therapy. As for cancer stage, 67% were in stage 1.

2. Item analysis

We found 29 items that exhibited a ceiling effect, but none of the items had a floor effect. Two of these items had a corrected item-total correlation of .3 or less, but they both

had a ceiling effect. Accordingly, these 29 items were removed, leaving 35 items for the analysis. The correlation coefficients between total scale score and scores for each question item ranged from 0.33 to 0.71.

3. Verifying reliability

The Cronbach's alpha for the scale as a whole was 0.88, and for the factor classes, it ranged between 0.84 and 0.88, confirming the internal consistency of the model. The Spearman's rho between the re-test and main study was 0.891 (p <0.01), which confirmed the stability of the scale. As for internal consistency-reliability, the Spearman-Brown reliability coefficient was 0.934, indicating a high degree of internal consistency-reliability.

4. Verifying validity

1) Construct validity

(1) Exploratory factor analysis

An exploratory factor analysis was conducted for the 35 items using the principal factor method, specifically, Promax Rotation. The results are provided in Table 2. On a scree plot, the slope significantly leveled off at factors 2 and 3, and so we narrowed the factor range down to between 2 and 5, where the eigenvalue was ≥1. Defining commonality as ≥ 0.3, we removed items with a loading on other factors of ≥ 0.3 to produce a simple structure free from the influence of multiple common factors. The cumulative contribution ratio was 51.4%. We then selected the question items while checking for any changes in the alpha coefficient between the scale as a whole and the factors therein. Ultimately, BCRS consisted of 16 items and two factors. The Kolmogorov-Smirnov test was conducted using the overall score, and the test confirmed a Gaussian distribution (p = 0.200). The KMO measure of sampling adequacy, which indicates the validity of the factor analysis, was 0.88.

The interpretation/naming of each factor proceeded as follows. The first factor class comprised an individual's internal attributes, including ability to control and change one's mood, hopes for the future/belief in cure, accepting the reality and living courageously, and optimism. The first factor class was interpreted as the factor as describing the individual's

strength (or internal strength) as part of a resilience model. Accordingly, the study named the factor class "individual protective" factors. The second factor class comprised the individual's social situation, including fellow survivors' encouragement and deriving meaning in life from helping fellow survivors. The second factor class was interpreted as the factor class describing social strength, including social and peer support, as part of a resilience model. Accordingly, the second factor class was named "social protective" factors.

(2) Confirmatory factor analysis

Figure 2 shows a hypothetical model developed based on the results of exploratory factor analysis. The items of the two factor classes were affected by each of the extracted two factors. Accordingly, we performed an analysis using a version of the model with a hypothetical covariance between all factors. The GFI was 0.914, AGFI 0.885, CFI 0.947, and RMSEA was 0.057. All path coefficients, other than for paths between factor classes, were ≥ 0.5. These results indicated that the hypothetical model fulfilled the statistical acceptability criteria, thus corroborating the exploratory factor analysis.

(3) Relationship between resilience constructs and the two factor classes

BCRS was summarized roughly into two factors: individual protective and social protective factors. The subscale items "treatment preferences" and "coping skills" showed a high ceiling effect and were deleted when the items were analyzed. The following four subscales were integrated into individual protective: "belief," "hope and goals," "own individuality," and "control of emotion." The social protective factor, then, consisted of the subscales "social support" and "significance of the self in society."

In the items of social protective, those focusing on family (e.g., "Helps me by doing housework and child care" and "Helps me continue receiving treatment") were not used; only the items in which the nominative form was a person with the same disease were used (e.g., "Exchanging information with a person with the same disease" and "Being encouraged by a person with the same disease").

(4) Relationship between conceptual model and the two factor classes in the study

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As shown in the conceptual model (Figure 1), to enhance resilience, the existence and degree of the protective factor were considered indicators. Individual protective and social protective factors are derived from a factor analysis and equivalent to the protective factor in the theoretical framework of this study.

2) Criterion-related validity

Table 3 gives the findings for criterion-related validity. Regarding BCRS's relationship with MAC subscales, the study identified a weak positive correlation with FS, at 0.283, and weak negative correlations with H/H and F, at -0.399 to -0.252 and -0.220 to -0.159 ($p < 0.01$), respectively. Regarding BCRS's relationship with SF-8 domains, analysis revealed a moderate positive correlation with MH, GH, and VT, at 0.469 to 0.388, 0.433 to 0.371, an 0.426 to 0.308 ($p < 0.01$), respectively. Meanwhile, a weak positive correlation was found with the RE and SF domains, at 0.312 to 0.266 and 0.305 to 0.266 ($p < 0.01$), respectively.

3) Discriminant validity

In the verification of the discriminant validity, the study divided X into two groups with BCRS scores (mean ± SD), and then performed a t-test with MAC and SF-8. The results are presented in Table 4 and Figure 3. Significant differences were observed between BCRS and MAC subscale FS and between BCRS and SF-8 domains MH, GH, and VT. We calculated the effect size (ES) of the items for which we identified a significant difference to verify the size of the difference. GH, MH, FS, and VT each had an effect size of ≥0.80, denoting that these items have a large difference. MDS was employed to identify the similarity with BCRS in terms of distance and distribution. The MAC subscale FS and SF-8 domains MH, GH, and VT were found to be located in the same region as BCRS, as well as proximal to BCRS. Meanwhile, the subscales H/H, F, A, and AP were oppositely positioned from BCRS with a large amount of distance, indicating that they can be differentiated from BCRS.

Kurskal's stress value was 0.06, and the square of the correlation coefficient was 0.994, indicating validity under our interpretation and an explanatory power of ≥ 99%.

DISCUSSION

1. Reliability and validity of BCRS

1) Reliability

The Cronbach's alpha for BCRS as a whole and that for its sub-factors were all $\geq$ 0.84, confirming the soundness of the scale's internal consistency. Compared with existing resilience scales, there were no major differences in our scale: Cronbach's α of the scale for mental resilience, which was assessed as a resilience scale in Japan[15], was 0.77–0.81; that of the S-H-type resilience scale[31] was 0.77–0.85; that of the Connor-Davidson resilience scale[11], which has been used in other countries, was 0.89; that of the Five-by-Five Resilience Scale[10] was 0.93; and that of the Resilience Style Questionnaire[12] was 0.90.

Spearman's rho between the re-test and main test was 0.891 ($p < 0.01$), confirming stability. The Spearman-Brown reliability coefficient was 0.934, confirming high internal consistency-reliability. These results suggest that BCRS is reliable.

2) Validity

During the preparation of the draft scale, we asked 11 nursing experts to arrange the items into the subscales and then calculated the concordance ratio. Items were amended or removed according to the following criteria: poor concordance rate, ambiguous wording, similarity to other items, and potential for creating missing values when limited to certain respondents. This process reduced the 98 items to 70 items. Using these 70 items, we conducted a pilot study among 25 breast cancer survivors. After confirming the appropriateness of the wording, we produced the draft BCRS. The scale identified concordance between the constructs of breast cancer survivors' resilience and sub-factors of the scale, thus confirming the internal validity of the scale.

For the construct validity, the eight-factor structure was hypothesized based on previous studies; however, through I-T correlation and factor analyses, the original eight-factor structure showed a strong association among the factors but was not able to be classified as one definitive factor. This resulted in a summarization into two factors (unified form as a similar factor). As these two factors are protective factors under the conceptual

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model, this scale may be used to measure protective factors.

The criterion-related validity was evaluated by BCRS's correlations with MAC and SF-8. A positive correlation was observed between BCRS and MAC subscale FS. Given that FS describes an effective coping strategy, BCRS score is related to effective coping. Meanwhile, a negative correlation was seen between BCRS and SF-8 domains H/H and F. H/H is closely related to psychological disorders, such as anxiety and depression, whereas F describes an undesirable stress response. We therefore concluded that the psychometric properties described by these domains are in direct contrast to those described by BCRS. There was a positive correlation between BCRS and the following SF-8 domains: MH, GH, VT, ER, and SF. These domains are related to the positive components of BCRS. A previous report indicated that the value of association between resilience and health-related QOL is not high[8], even if a positive correlation is shown. This outcome is attributed to the low correlation with health-related QOL, particularly PF and MH. Resilience typically has a strong association with mental health, so numerically, it is not high[8]; however, other reports have shown that resilience affects patients' health indirectly rather than directly, through its interaction with other factors to promote resilience.

The discriminant validity was evaluated using t-tests of BCRS scores in two groups. The tests revealed that the high scoring group had significantly higher scores on MAC subscale FS and SF-8 domains MH, GH, and VT. This finding corroborates the understanding that resilience promotes courage and psychological health. The MDS visually revealed BCRS's similarity to the positive subscales/domains of MAC and SF-8. The fact that negative domains were positioned at the opposite end confirmed that BCRS has a high degree of discriminability. Meanwhile, a confirmatory factor analysis revealed that the scale has strong goodness-of-fit and that it has statistical explanatory power. Thus, BCRS is considered to have high discrimination.

2. Psychometric Properties of BCRS

In the adolescence resilience model[22], "individual protective" factors include courageous coping, willingness to confront difficulties, optimism, and derived

meaning/hope. Likewise, the first factor class in the present study, "individual protective" factors, consisted of subscales that measure "control" (ability to have control over emotions and daily life), "optimism" (approaching things in a positive manner and feeling hopeful about the future), and "courage." Many existing resilience scales follow a similar trend in that they feature subscales such as emotional adjustment, control, positive acceptance, and competence. Optimism is commonly featured as well[10-12]. The second factor class, "social protective" factors, comprises subscales on the support a person can derive from fellow survivors and the experience-derived support they can give to fellow survivors. Through a relationship with peers, a survivor can ease their psychological burden and reaffirm the meaning of their own existence and role.

Existing scales include such factors as social ability, social support, and sociability, as well as items to measure the way in which a person felt degrees of support and cooperation from surrounding people, such as family members, friends, and colleagues. However, in the social protective factor in our study, this existing trend limited relationships with other people who have the same condition. The items focusing on only family were deleted because all of them showed a ceiling effect during analysis of the items, which indicates that support from family is essential for breast cancer survivors who continued treatment while also continuing to function in their roles, such as working and providing child care. This finding also indicated that many survivors were able to receive this type of support. Further, adult breast cancer survivors may regard "family" as an important presence that may not have changed even after they developed cancer. Prior studies have revealed that the presence of another person with the same condition provides positive meaning to the cancer experience as "power and support to live" and that it influences the switching of survivors' sense of values[32]. Other people with the same cancer condition are positioned as persons in whom survivors can confess their thoughts, particularly those thoughts and feelings that they do not feel comfortable sharing with their family, thereby enhancing their desire to live.

3. **Suggestions for Clinical Application of BCRS**

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Resilience may be promoted by the interplay between external support from parties like medical professionals, family, and the social environment and internal competence, such as personal attributes and cognitive appraisal. Therefore, using BCRS to identify any low-scoring items can enable intervention with respect to these items. In cases where problems are predicted with regard to treatment or progress of the disease, the scale could be useful for formulating an approach for assessment or preventive intervention.

BCRS is a convenient scale. Consisting only 16 items, it does not take long to complete, and its lack of reverse score items makes the questions easy to answer, while also allowing researchers to evaluate the responses easily based on score totals. The development of BCRS will provide a simple measure to understand the psychometric properties of resilience in individuals. Thus, it will offer various suggestions in clinical practice, such as for how medical professionals, who work in the complicated environment of outpatient breast cancer care, can identify those patients requiring early intervention, and how to provide effective nursing care.

LIMITATIONS AND SUGGESTION FOR FUTURE RESEARCH

This study was based on surveys distributed at two sites: a university hospital and a facility specializing in cancer. We cannot rule out the possibility that there may have been bias in the respondents' cognizance of their disease and treatment, as well as in the facility's system of support, such as their support for patient decision-making. To expand the scale's clinical application and increase its accuracy/precision, it will be necessary to conduct further research on a larger sample, one that includes general hospitals and relatively small-scale medical facilities.

CONCLUSION

We developed a 16-item breast cancer survivor resilience scale composed of two factor classes: "individual protective" and "social protective" factors. It was confirmed that the scale has sound reliability and validity. BCRS will be further improved with clinical application, and it can be expected to contribute toward effective support for breast cancer survivors.

ACKNOWLEDGEMENT

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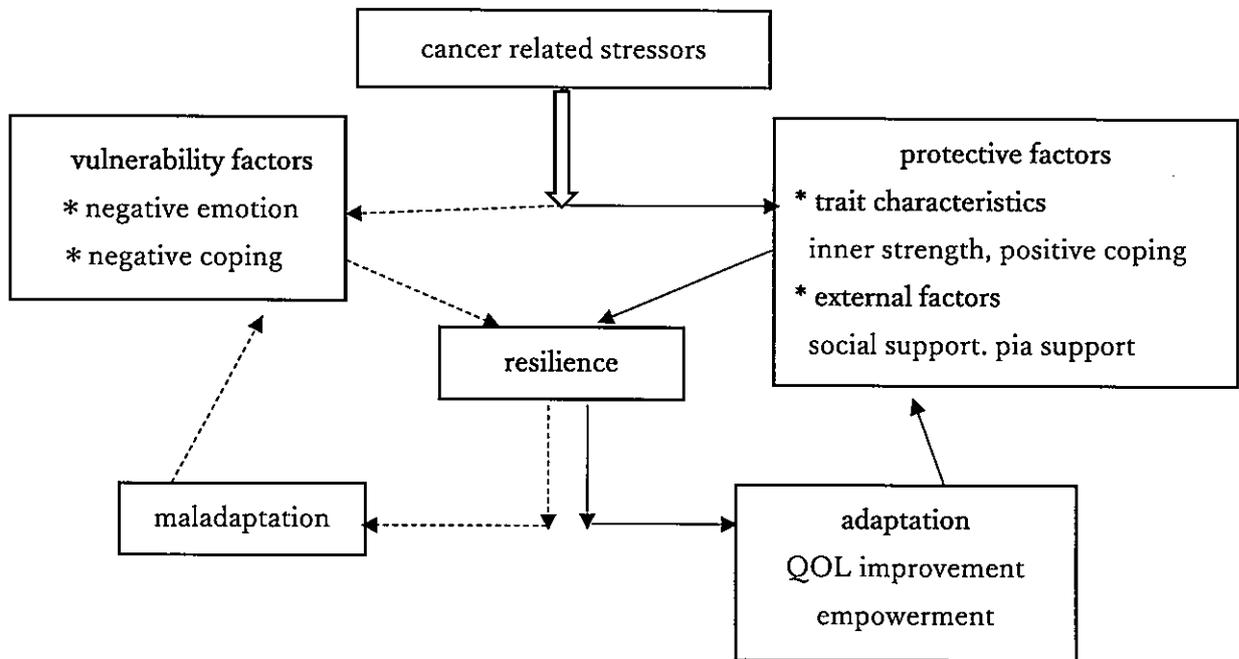
Figure 1 : **Conceptual Model of Resilience in This Study**

　　　The solid line shows the connection to adaptation

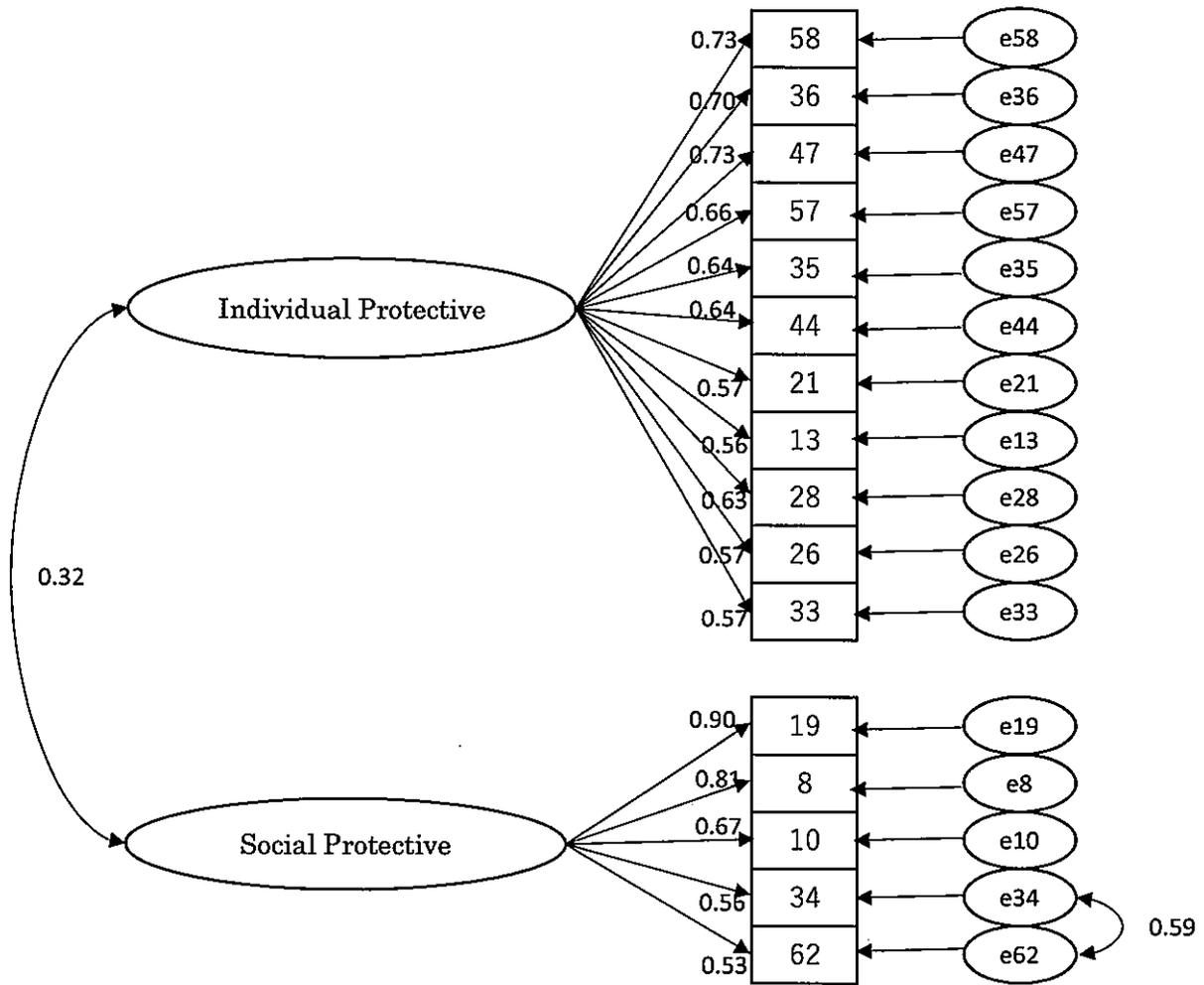　　　The dashed line shows the connection to maladaptation

Figure 2: Standardized Estimates Based on Covariance Analysis of Hypothetical BCRS Model

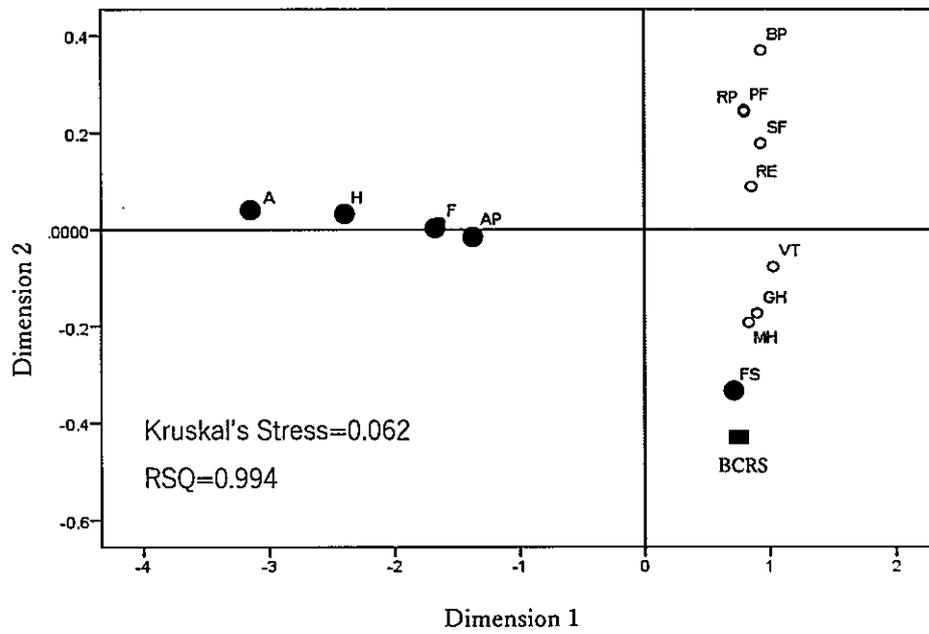The numbers in the boxes represent the survey question numbers(see Table 2 for items).

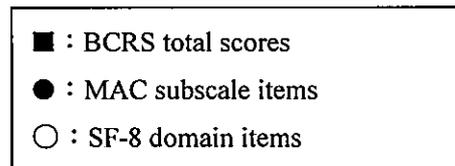**Figure 3: Multi-Dimensional Scaling of BCRS Factors and MAC/SF-8 Subscales/Domains**

■ ： BCRS total scores
● ： MAC subscale items
○ ： SF-8 domain items

Table1: Participants' Caractaristics   n=230

		n	%
Marital status	Married	183	80.6
	Single	44	19.4
Occupation	Worker	144	64.0
	Unemployed	81	36.0
Operation type	Breast conservation surgery	112	48.7
	Mastectomy	103	44.8
	Other	15	6.5
Adjuvant therapy	Endcrine therapy	186	80.9
	Radiation therapy	125	54.3
	Post-operative chemothrapy	99	43.0
	Pre-operative chemothrapy	51	22.2
Current treatment method	Endcrine therapy	179	77.8
	Chemotherapy	10	4.3
	Radiation therapy	9	3.9
	No treatment	32	13.9
Cancer Stage	Stage 0	10	4.3
	Stage I A	96	41.7
	Stage I B	51	22.2
	Stage II A	44	19.1
	Stage II B	26	11.3
	Stage III A	2	0.9
	Stage III B	1	0.4

	Mean±SD
Age (years)	49.9±7.7
After operation (months)	29.1±16.6

*SD:standard deviation

Table 2: Factor Analysis of the Breast Cancer Survivor Resilience Scale

Principal factor method: Promax Rotation   n=230

No	Factor/item name Cronbach's alpha for scale as a whole=0.879	Factor loading Factor class 1	Factor class 2	Commonality
Factor class 1: Individual protective factors (α=0.882)				
58	Ability to control emotions	0.763	-0.077	0.545
36	Belief in self	0.726	-0.041	0.507
47	Ability to change mood	0.708	0.053	0.532
57	Belief that the future is bright	0.651	0.021	0.434
35	Optimistic personality	0.650	-0.023	0.412
44	Looking at the positive side of things	0.649	-0.022	0.411
21	Living life in an easy-going manner	0.581	-0.043	0.321
13	Accepting the circumstances	0.579	-0.058	0.314
28	Resolving to live with one's disease	0.575	0.137	0.409
26	Willingness to do anything one can	0.558	0.023	0.322
33	Being honest about one's feelings	0.517	0.144	0.343
Factor class 2: Social protective factors (α=0.839)				
19	Being encouraged by fellow survivors	-0.059	0.897	0.768
8	Finding solace in talking to fellow survivors	-0.150	0.834	0.625
10	Exchanging information with fellow survivors	-0.002	0.648	0.418
34	Sharing experiences with fellow survivors	0.140	0.604	0.448
62	Being useful to fellow survivors	0.164	0.566	0.416
	Factor contribution ratio (%)	36.181	15.213	
	Cumulative contribution ratio (%)		51.395	
	Factor correlation Factor class 1	—		
	Factor class 2	0.371	—	

Table 3: Correlations Between Breast Cancer Survivor Resilience Scale and Mental Adjustment to Cancer Scale /MOS 8-Item Short-Form Health Survey

		BCRS		
		Total	Individual protective factors	Social protective factors
BCRS	Individual protective			
(n=230)	Social protective		0.350 **	
MAC	Fighting Spirit(FS)	0.283 **	0.273 **	0.178 **
(n=222)	Helpless / Hopeless (H / H)	-0.252 **	-0.399 **	-0.018
	Anxious Preoccupation (AP)	-0.073	-0.151 *	0.073
	Fatalism(F)	-0.159 *	-0.220 **	-0.001
	Avoidance(A)	-0.105	-0.084	-0.091
SF-8	General Health(GH)	0.371 **	0.443 **	0.121
(n=230)	Physical Functioning(PF)	0.021	0.118	-0.144 *
	Role Physical(RP)	0.074	0.143 *	-0.074
	Bodily Pain(BP)	0.073	0.125	-0.028
	Vitality(VT)	0.308 **	0.426 **	0.004
	Social Functioning(SF)	0.222 **	0.305 **	0.021
	Mental Health(MH)	0.388 **	0.469 **	0.123
	Role Emotional(RE)	0.266 **	0.312 **	0.081
	Physical component summary(PCS)	0.014	0.093	-0.122
	Mental component summary(MCS)	0.354 **	0.476 **	0.157 *

$**p<0.01$ $*p<0.05$

Table 4: Mean Differences Between BCRS Scores and MAC/SF-8 Scores

	BCRS score	mean	SD	t- score	df	p
【MAC】FS	High scoring group	50.27	6.883	-3.253 **	75.57	0.002
	Low scoring group	46.17	4.392			
H/H	High scoring group	9.60	3.222	1.938	79	0.056
	Low scoring group	11.03	3.385			
【SF-8】GH	High scoring group	52.95	5.515	-4.938 ***	79	0.000
	Low scoring group	45.81	7.495			
VT	High scoring group	54.38	3.671	-3.743 ***	47.875	0.000
	Low scoring group	49.19	7.630			
SF	High scoring group	51.54	6.391	-2.252 *	57.905	0.028
	Low scoring group	47.31	9.715			
RE	High scoring group	50.71	4.940	-2.663 *	51.248	0.010
	Low scoring group	46.23	9.081			
MH	High scoring group	52.24	4.683	-4.352 ***	48.51	0.000
	Low scoring group	44.72	9.487			

***p<0.001 **p<0.01 *p<0.05

High scoring group：mean＋SD （n=45） ，Low scoring group：mean－SD （n=36）

BCRS：mean=48.3, SD=7.2

Breast Cancer Survivors Resilience Scale(BCRS)

Please indicate to what extent you agree or disagree with each item by circling the numbers 1 to 4.

> 1. Strongly disagree
> 2. Somewhat disagree
> 3. Somewhat agree
> 4. Strongly agree

【Individual protective factors】

1	Ability to control emotions	1	2	3	4
2	Belief in self	1	2	3	4
3	Ability to change mood	1	2	3	4
4	Belief that the future is bright	1	2	3	4
5	Optimistic personality	1	2	3	4
6	Looking at the positive side of things	1	2	3	4
7	Living life in an easy-going manner	1	2	3	4
8	Accepting the circumstances	1	2	3	4
9	Resolving to live with one's disease	1	2	3	4
10	Willingness to do anything one can	1	2	3	4
11	Being honest about one's feelings	1	2	3	4

【Social protective factors】

12	Being encouraged by fellow survivors	1	2	3	4
13	Finding solace in talking to fellow survivors	1	2	3	4
14	Exchanging information with fellow survivors	1	2	3	4
15	Sharing experiences with fellow survivors	1	2	3	4
16	Being useful to fellow survivors	1	2	3	4

Thank you for your cooperation.

Please contact the following person if you need assistance when using the scale:

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