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Psychometric Properties of Assessment Tools for Depression, Anxiety, Distress, and Psychological Problems in Breast Cancer Patients: A Systematic Review

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Objective Various and accurate psychiatric assessments in patients with breast cancer who frequently suffer from psychological problems due to long-term survivors are warranted. This systematic review aimed to investigate the current evidence on psychometric properties of psychiatric assessment for evaluating psychological problems in breast cancer patients.

Methods This systematic review progressed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guideline. Four electronic databases such as Web of Science, PubMed, Embase, and Cumulative Index to Nursing and Allied Health Literature were searched. This study protocol was registered on Open Science Framework.

Results Of the 2,040 articles, 21 papers were finally included. Among them, only five studies showed the performance of psychiatric assessment tools. Among 13 assessment tools used in the selected articles, the Hospital Anxiety and Depression Scale (HADS), Distress Thermometer (DT), or Mini-Mental Adjustment to Cancer Scale was frequently used for the evaluation of psychological problems. The DT and Psychosocial Distress Questionnaire-Breast Cancer showed acceptable performances for the prediction of depression and anxiety assessed by the HADS.

Conclusion This systematic review found psychiatric assessment tools with acceptable reliability and validity for breast cancer patients. However, comparative studies on reliability and validity of various scales are required to provide useful information for the selection of appropriate assessment tools based on the clinical settings and treatment stages of breast cancer. Joint research among the fields of psychiatry and breast surgery is needed for research to establish the convergent, concurrent, and predictive validity of psychiatric assessment tools in breast cancer patients.
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Keywords Breast neoplasm; Psychiatry; Psychometrics; Systematic review.

INTRODUCTION

Psychological problems of cancer patients including depression, anxiety, or psychological distress can occur at any stage in diagnosis and treatment process of cancer. The prevalence of depression in cancer patients is about 8%–24%,[1] which is much higher than 4% in the general population. The prevalence of any mood disorder is approximately 38% (28%–49%).[2] With regard to anxiety, 19% of cancer patients showed anxiety symptoms.[3] Zhao et al.[4] reported that 6.6% of cancer survivors experienced serious psychological distress, which was significantly higher than cancer-free adults whose only have a prevalence of 3.7%.

When the psychological problems of cancer patients are not adequately treated, they may last chronically and may significantly degrade their quality of life by stopping them from returning to their normal daily lives.[5] This may also negatively affect recovery from cancer. Significant depression itself re-

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duces compliance with cancer treatment and negatively affects behavioral habits such as sleep, physical activity, and eating, which can decrease survival.[6] Cancer patients with unresolved psychological problems have increased medical costs, such as extended hospitalization and increased visits to medical periods.[7] Therefore, accurately screening the degree of psychological problems in cancer patients is one of the most important factors in cancer treatments. In particular, considering the long-term survivors and the psychological distress during the treatment period,[5] it is necessary to effectively evaluate psychological problems in breast cancer patients.

Systems based solely on referrals initiated by physicians or patients for depression in cancer patients could overlook a significant portion of patient's suffering.[8] To effectively evaluate psychological problems in breast cancer patients, reliable and valid psychiatric assessment tools in perspectives of screening time and psychological domain are required. At the beginning of the diagnosis, psychological problems such as depression, anxiety, and emotional distress experienced during the course of surgical treatment should be assessed. Considering the patient's physical condition, evaluation tools that need too much time may not be useful.[9] On the other hand, at the point of returning to daily life during chemotherapy after surgery, stress coping and adaptation problems need to be evaluated.[10] In addition, it is necessary to develop cancer-specific assessment tools to evaluate breast cancer-specific problems.[11] Furthermore, the results of psychiatric assessments might be changed according to ethnical, cultural, and linguistic states.[12-14] Therefore, reliable and valid psychiatric assessments in each clinical situation should be obtained. This systematic review aimed to investigate evidence on the reliability and validity of psychiatric assessment tools for evaluating psychological problems in breast cancer patients.

METHODS

We conducted a systematic review and reported its results to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guideline (Supplementary Table 1 in the online-only Data Supplement). The study protocol was registered on Open Science Framework (https://osf.io/j68k9/)

Key question

The purpose of this review was to investigate the reliability and validity of assessment tools for evaluating psychological problems in breast cancer patients.

Search strategies

To examine the status of research related to assessments on psychological problems in breast cancer patients, papers were explored using four search engines, Web of Science, PubMed, Embase, and Cumulative Index to Nursing and Allied Health Literature (CINAHL), for articles published in the past 11 years from 2011 to 2021. The search used these key terms ((anxiety OR depression OR distress OR psychologi*) AND (validation OR reliability) AND (assessment OR tool OR screening OR instrument)) AND breast cancer (Supplementary Table 2 in the online-only Data Supplement). All articles that were published from January 2011 to December 2021 were included. We applied no restrictions on languages.

Study selection

We deduplicated the articles electronically. The inclusion criteria included clinical studies measuring the validity and/or reliability of psychological problem evaluation tools. The exclusion criteria were 1) articles unrelated to this topic; 2) articles without new research data such as editorials, comments, letters, and reviews; and 3) books. To evaluate the inclusion and exclusion criteria, titles and abstracts of articles in a potential eligible list were read independently by two authors (HSP, KEK). Articles by both reviewers who met the exclusion criteria were removed from the potential eligibility list. The full text of the remaining articles on the potential eligibility list was read independently by two authors (HSP, KEK) to evaluate the article's eligibility. If there was a disagreement, a consensus meeting was held with the third and fourth reviewers (ESM, TWK).

Data extraction

To prevent bias or omission, two authors (HSP, KEK) independently extracted data from the included studies. When there were any disagreements on the extracted data, a consensus meeting with other reviewers (ESM, TWK) was held to solve the disagreements. We used structured data extraction on the author, year of publication, country, study type, age group, patients' stage, sample size, study aim and conclusion, reliability, and validity assessment related to numerical value key findings. Cronbach's alpha for internal consistency, model indices for validity, and the results of performance such as sensitivity, specificity, positive predictive value, and negative predictive value were extracted.

RESULTS

Study selection

As a result, 2,040 documents were searched, and duplicate documents were primarily excluded. After that, 42 papers studied based on the contents of screening and evaluation of psychological problems in breast cancer patients were finally selected by reviewing the abstract and title; after reading the

full text of the remaining articles, 21 articles were finally selected (Figure 1).

Characteristics of the included studies

Twenty-one studies included patients from various stages, and five studies included stage IV patients.[15-35] Article types, years of publication, assessment tools, psychological evaluation domains, ethnicities, participants' age, and research aims and conclusions of the included studies are summarized in Table 1. A total of 13 assessment tools were used in the final included study, among them, the Hospital Anxiety and Depression Scale (HADS) was most frequently used 12 times to evaluate directly or to evaluate the results of other assessment tools. Next, the Distress Thermometer (DT) was used in 5 studies and the Mini-Mental Adjustment to Cancer Scale (Mini-MAC) was used in 4 studies.

Results of reliability in included studies

The results of the reliability of the psychiatric assessment tools for psychological problems assessment tools were summarized in Table 2. Cronbach's alpha value of the study on the HADS was in the range of 0.74–0.87. The Mini-MAC was in the range of 0.78–0.90. In addition, the Cronbach's alpha values in other assessment tools were generally distributed in a similar range. For the reliability evaluation, Cronbach's alpha was used in most studies. It is also known as tau-equivalent reliability or coefficient alpha, is the most common test score reliability coefficient for a single administration.[36,37] In general, Cronbach's alpha is preferably 0.70 or above is good, 0.80 or above is better, and 0.90 or above is best.[38] All included studies met this criterion. Based on these criteria, the HADS, Mini-MAC, Center for Epidemiologic Studies Depression Scale (CES-D), Psychosocial Distress Questionnaire-Breast (PDQ-BC), Newly Diagnosed Breast Cancer Stress Scale (NDBCSS), Patient Health Questionnaire-9 (PHQ-9), State-Trait Anxiety Inventory (STAI), Brief Illness Perception Questionnaire (B-IPQ), and Psychological Adaptation Scale (PAS), whose reliability was investigated in this study, were considered acceptable and appropriate for use in breast cancer patients.

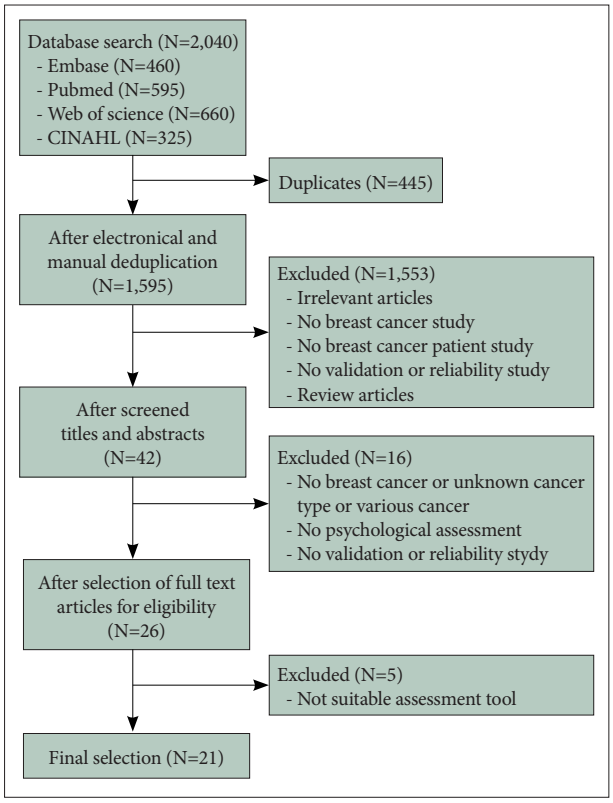

Figure 1. Flowchart of the search process and the number of selected studies. Initial searching retrieved 2,040 articles. After deduplication and screening of titles and abstracts, 42 articles were selected. After checking full-text articles and assess eligibility and the purpose of this study, 21 articles were finally selected.

Results of validation in included studies

The results of the validity of the psychiatric assessment tools for psychological problems assessment tools using factor analysis and correlation analysis were summarized in Table 2. The area under the curve (AUC) value was used to evaluate its validity. Validation indices such as root mean square error of approximation (RMSEA), comparative fit index (CFI), and Turker-Lewis index (TLI) were used for model suitability evaluation in confirmatory factor analysis. When the AUC value is closer to 1, it indicates the model is better, and usually 0.8 or higher, the model is considered to have an excellent performance, but most studies have confirmed a value of 0.8. RMSEA was frequently used to verify the validity of the structure, and it is judged that smaller value signifies a better model. If it is less than 0.08, it is considered a good model, and if it is less than 0.05, it is regarded as a very good model, and overall, it is found to satisfy good and very good. Based on these criteria, the validity of this study was acceptable. Since the value of RMSEA used for structural suitability evaluation also satisfied the criteria, it was judged that it would not be unreasonable to apply it to breast cancer patients. AUC was 0.81–0.95 (exception B-IPQ 0.39–0.55), RMSEA was 0.04–0.08, CFI was 0.92–0.97, and TLI was 0.096–0.097.

Among the included 21 studies, there were only five studies showing performance on sensitivity, specificity, positive predictive value, and negative predictive value.[16,18,20,25,34] The results on the performance of psychiatric assessment tools were summarized in Table 3. Of the five studies, three studies reported the results of receiver operating characteristics curve analyses on the DT scale. Bidstrup et al.[16] examined sensitivity, specificity, positive predictive value, and negative predictive value of the Danish version of DT in 333 women with newly

Table 1. Selected studies on the psychometric properties of the psychiatric assessment tools for psychological problems in breast cancer patients from 2011 to 2021

Study	Article type	Assessment scale (items)/ comparative measure scale (items)	Psychological assessment domain	Ethnicity	No. of participants	Age of participants	Stage of participants	Study's aim	Study's conclusion
Ashing-Giwa and Rosales[15] (2013)	Full	CES-D (20)	Depression	AA EP LEP	320 Breast cancer surgery 88 AA 95 EP 137 LEP	18 & older	0–III	Cross-cultural validation	The CES-D had very good internal consistency across ethnic and language groups
Bidstrup et al.[16] (2012)	Full	DT (1)/ HADS (14)	Distress	Danish	333	60±10.0	Newly diagnosed primary Breast cancer who were operated	Measures of the accuracy of the DT according to HADS	1. The DT performed satisfactorily relative to the HADS for detecting distress in Danish women with newly diagnosed BC 2. For screening to rule out distress, a cut-off score of 2 vs. 3 is recommended on the Danish DT
Bogaarts et al.[17] (2012)	Full	PDQ-BC (35)/ CES-D (20)	Distress	Netherlands	123	50.8±10.2 (29–73)	Early stage	To examine the psychometric properties of the PDQ-BC	1. The PDQ-BC has expected sufficient internal consistency. 2. The construct validity on the PDQ-BC subscales social support, sexual problems and financial problems was good.
Bogaarts et al.[18] (2014)	Full	PDQ-BC (35)/ DT (1), HADS (14)	Distress	Netherlands	154 Group 1 (54/64) Sensitivity to change & construct validity Group 2 (80/90) Group 3 (55/80)	51.4±8.0 (34–68) 51.3±8.6 (29–71)	Group 1: disease-free breast cancer patients who had completed their treatment with adjuvant chemotherapy Group 2: early-stage breast cancer who visited the outpatient clinic	1. The test–retest reliability and sensitivity to change of the PDQ-BC 2. The sensitivity and specificity of the subscales state anxiety and depressive symptoms (PDQ-BC) compared to the HADS-A and HADS-D for identifying psychological problems 3. The referral rate of the PDQ-BC to psychosocial health care professionals compared with the referral rate of a generic measure (the DT) 4. The construct validity of the PDQ-BC subscales body image, physical problems, and social problem	1. PDQ-BC has good test–retest reliability and a satisfactory sensitivity to change 2. PDQ-BC has a satisfactory sensitivity and specificity 3. PDQ-BC can be regarded as a useful, psychometrically sound instrument for selecting and referring those patients with BC who experience psychosocial problems
Charalampopoulou et al.[19] (2020)	Full	NDBCSS (17)/ PSS (14), HADS (14)	Stress	Greek	100	58.3±12.3	Stage 0–III 24%+37%+25%+14%	Validation of NDBCSS in the Greek population	The scale seems to have construct and criterion validity

Table 1. Selected studies on the psychometric properties of the psychiatric assessment tools for psychological problems in breast cancer patients from 2011 to 2021 (continued)

Study	Article type	Assessment scale (items)/ comparative measure scale (items)	Psychological assessment domain	Ethnicity	No. of participants	Age of participants	Stage of participants	Study's aim	Study's conclusion
De Vries et al.[20] (2013)	Abstract	PDQ-BC (35)/ CES-D (20), DT (1), HADS (14)	Distress	Not described	164 (98.8%)	Unavailable	Before the start of adjuvant chemotherapy	To examine the psychometric properties of the PDQ-BC, a BC specific screening list	PDQ-BC has good psychometric properties and takes only a few minutes to complete
De Vries et al.[21] (2013)	Full	STAI (20) → Short form (10)	Anxiety	Dutch Version Netherlands	118+158 (group 1) 139 (group 2) 119+413 (group 3)	54.5±11 (19–87) 56.6±11.4 (26–85) 53.1±11.7 (19–84)	Group 1: - Early BC+benign breast problems - Except locally advanced or proven systemic disease Group 2: - Disease free early-stage BC survivor Group 3: - Early BC+ benign breast problems	To develop a short form of the Dutch version of the STAI and to provide initial validation data in a sample of BC patients and survivors.	The 6-item Anxiety Present scale has even a better structure fit than the 10-item version and has similar reliability and validity, while reducing patient burden and facilitating implementation of the questionnaire even further.
Estapé et al.[22] (2013)	Abstract	HADS (14) & Mini-MAC (29)	Anxiety, depression	Not described	434	43.86±8.9		Establish the prevalence of psychological distress among a large sample of Spanish-speaking breast cancer patients recruited on-line	1. High reliability of distress measurement by internet 2. No significant results by age and medical status and analyze why this is different when comparing with "real" samples
Estapé and Estapé[23] (2017)	Abstract	Mini-MAC (29)	Coping	Not described	294	Not described	Not described	To ascertain if Mini-MAC scale is reliable by internet	1. Even reliability is good 2. Not sure about the coping strategies we are assessing.
Hajian-Tilaki and Hajian-Tilaki[24] (2020)	Full	HADS (14)	Anxiety, depression	Persian	305	49.58±10.1	Not described	To assess the psychometric properties of the Persian version of this scale in Iranian breast cancer survivors	1. The CFA and item reliability analysis have indicated an excellent psychometric property of the Persian version of HADS to measure depressive and anxiety symptoms in BC survivors. 2. HADS is an effective screening tool to identify post-BC anxiety and depressive disorders and to measure the impact of disease condition on depression and anxiety in Iranian BC survivors.

Table 1. Selected studies on the psychometric properties of the psychiatric assessment tools for psychological problems in breast cancer patients from 2011 to 2021 (continued)

Study	Article type	Assessment scale (items)/ comparative measure scale (items)	Psychological assessment domain	Ethnicity	No. of participants	Age of participants	Stage of participants	Study's aim	Study's conclusion
Iskandarsyah et al.[25] (2013)	Full	DT (1)/ HADS (14)	Distress Anxiety, depression	Indonesian	120	45.5±8.04 (28–66)	Stage I–IV 3/54/46/17	To translate the DT into Indonesian, test its validity in Indonesian women with BC and determine norm scores of the Indonesian DT for clinically relevant distress	The DT was found to be a valid tool for screening distress in Indonesian BC patients. → Recommend using a cutoff score of 5 in this population.
Kim et al.[26] (2016)	Full	PHQ-9 (9) by Mobile daily check	Depression	Korean	78 (5,792 set)	44.35±7.01	Unavailable	1. Evaluate the potential of a mobile mental-health tracker that uses three daily mental-health ratings (sleep satisfaction, mood, and anxiety) as indicators for depression. 2. Examine the impact of adherence on reporting using a mobile mental-health tracker and accuracy in depression screening.	1. Self-reported daily mental-health ratings obtained via a mobile phone app can be used for screening for depression in BC patients. 2. Adherence to self-reporting can improve the efficacy of mobile phone based approaches for managing distress in this population.
Lee et al.[27] (2013)	Full	NDBCSS (21→17)/ PSS (10) HADS (14)	Stress Stress	Taiwan	125	52.2±9.4	0 34 (38.2%) I 30 (33.75%) II 19 (21.3%) III 4 (4.5%) IV 2 (2.2%) Unknown 36 (28.8%)	To assess the reliability and validity of a developed instrument entitled NDBCSS	Acceptable reliability and good validity to measure stress in newly diagnosed patients with breast cancer
Neto et al.[28] (2021)	Full	PAS (20)/ DASS (21)	Coping/ Anxiety, depression	Portugues	98	53.03±9.33 (32–75)	Unavailable	The validation of the PAS, which assesses adaptation to the disease in specific domains	1. A new factorial structure of 3 subscales was obtained, with external validity and high reliability values. 2. The PAS appears as a valid instrument for the characterization of adaptation to cancer disease and for the identification of specific domains of adaptation that may need intervention
Ragala et al.[29] (2021)	Full	Mini-MAC (29→24)	Coping	Morrocan English → Arabic	EFA 158 CFA 203	49.01±11.38 (27–83) 48.86±11.65 (26–88)	EFA/CFA II 80 (50.63%)/ 102 (50.25) III 30 (18.99%)/ 38 (18.72) IV 48 (30.38%)/ 59 (29.06) Unknown 0/4	To validate the Mini-MAC, translated and adapted to the Arabic language and Moroccan culture, in women with BC	Reliability; and both convergent and discriminant validity tests indicated that the Arabic version of the Mini-MAC had a good performance and may serve as a valid tool for measuring psychological responses to cancer diagnosis and treatment.

Table 1. Selected studies on the psychometric properties of the psychiatric assessment tools for psychological problems in breast cancer patients from 2011 to 2021 (continued)

Study	Article type	Assessment scale (items)/ comparative measure scale (items)	Psychological assessment domain	Ethnicity	No. of participants	Age of participants	Stage of participants	Study's aim	Study's conclusion
Saboonchi et al.[30] (2013)	Full	HADS (14)	Anxiety, depression	Swedish	Prior BC 727 No prior BC 725→707	51.3±8.1 (20–63)	Recently had BC surgery	To examine the construct validity of the Swedish version of HADS in women with breast cancer.	The findings support the utility of scoring procedure based on the original bi-dimensional model, but add indication of co-occurrence of anxiety and depression in this patient population. The discriminant validity of a third factor of negative affectivity in a three-factorial model, however, remains unclear.
Tomljenović et al.[31] (2021)	Abstract	HADS (14)	Anxiety, depression	Croatian	325	59±10.95 (31–83)	Not described	To examine HADS's psychometric properties, including factor structure, reliability, and discriminant validity on a sample of Croatian BC patients	HADS has overall good psychometric validity and can be useful in adjuvant care of women with BC.
Torres et al.[32] (2013)	Abstract	PHQ-9 (9)/ HADS (14)	Depression/ Anxiety, depression	Portuguese	49	29.27±11.12 (30–80)	Not described	Evaluate psychometric characteristics of PHQ-9 in a Portuguese sample	The validation of the Portuguese PHQ-9 has good psychometric proprieties of internal consistency, test-retest reliability and concurrent validity. → PHQ-9 is useful and a valid scale.
Andreu Vaillo et al.[33] (2018)	Full	Mini-MAC (29)/ BSI (18)	Coping	Spanish	368	51±10.72 (27–78)	N=306 0 3 (1.0%) I 64 (20.9%) II 139 (45.4%) III 78 (25.5%) V 22 (7.2%) Unknown 62	1. To explore the factor structure, using CFA 2. Psychometric properties of the Mini-MAC in Spanish BC patients	The Spanish version of the Mini-MAC has a satisfactory overall performance and serves as a brief, reliable and valid tool measuring cognitive appraisals and ensuing reactions to cancer.
Yong et al.[34] (2012)	Full	DT (1)/ HADS (1)	Distress/ Anxiety, depression	Malay and Chinese language	150	49.11±7.10	I 64 (42.7%) II 86 (57.3%)	1. To validate the translated DT as a tool to determine the psychological distress level and assess the factors associated with distress among the working BC survivors 2. To compare with the HADS	The translated DT has good sensitivity and specificity for screening psychological distress among the Malaysian BC survivors.
Zhang et al.[35] (2017)	Full	B-IPQ (9)	Coping	Chinese	358	51.36±9.65	0/I 117 (32.7%) II 162 (45.3%) III/V 75 (20.9%) Missing 4 (1.1%)	Examined the validity and reliability of a traditional Chinese version of the B-IPQ in Hong Kong Chinese BC survivors.	B-IPQ 7 items appears to be a moderately valid measure of illness perception in cancer population, potentially useful for assessing illness representation in Chinese women with BC.

CES-D, Center for Epidemiologic Studies Depression Scale; AA, African-American; EP, English language proficient Latina-American; LEP, limited English language proficient Latina-American; DT, Distress thermometter; HADS, Hospital Anxiety and Depression Scale; BC, breast cancer; PDQ-BC, Psychosocial Distress Questionnaire-Breast Cancer; NDBCSS, Newly Diagnosed Breast Cancer Stress Scale; PSS, Perceived Stress Scale; STAI, State-Trait Anxiety Inventory; CFA, confirmatory factor analysis; PHQ-9, Patient Health Questionnaire-9; PAS, Psychological Adaptation Scale; DASS, Depression Anxiety Stress Scale; Mini-MAC, Mini-Mental Adjustment to Cancer Scale; EFA, exploratory factor analysis; BSI, Brief Symptom Inventory; B-IPQ, Brief Illness Perception Questionnaire

Table 2. Results of reliability and validity of psychiatric assessment tools used in the included articles

Assessment scales	Study	Ethnicity or language	Reliability (Cronbach's Alpha)	Validity
HADS	Bidstrup et al.[16] (2012)	Danish	-	AUC 0.86 (95% CI 0.82−0.90)
	Hajian-Tilaki and Hajian-Tilaki[24] (2020)	Persian	0.81 0.78	χ^2/df=2.83; NFI=0.88; RFI=0.82; IFI=0.92; CFI=0.92; and RMSEA=0.078
	Saboonchi et al.[30] (2013)	Swedish	Bi-dimensional Depression 0.871 Anxiety 0.881 Three-factorial model Depression 0.871 Anxiety 0.815 Negative affectivity 0.777	-
	Tomljenović et al.[31] (2021)	Croatian	Depression 0.74 Anxiety 0.75	The two-factor model CFI=0.96; RMSEA=0.04
	Yong et al.[34] (2012)	Malay and Chinese language	-	AUC Depression 0.92 Anxiety 0.94 Total 0.95
DT	Iskandarsyah et al.[25] (2013)	Indonesian	-	AUC 0.81 Pearson's correlation coefficient (r) between the DT scores and the HADS total was 0.58 ($p<0.01$)
Mini-MAC	Estapé et al.[22] (2013)	Not described	T-test of distress as two category was significant with labor situation, F=4.7, $p<0.031$; marital status, F=7.77, $p<0.006$ and maternity, F=9.04, $p<0.003$, and psychological measures	-
	Estapé and Estapé[23] (2017)	Not described	Helplessness-Hopelessness 0.78 Fighting spirit 0.77 Cognitive avoidance 0.79 Fatalism 0.81 Anxious preoccupation 0.79	-
	Ragala et al.[29] (2021)	Morrocan (English→Arabic)	-	KMO value 0.89 Composite reliability 0.93−0.97 Square root of the AVE 0.66−0.93
	Andreu Vaillo et al.[33] (2018)	Spanish	Helplessness-Hopelessness 0.82 Fighting spirit 0.60 Cognitive avoidance 0.80 Fatalism 0.70 Anxious preoccupation 0.90	1. "Hopelessness-Helplessness" and "Anxious preoccupation" had positive and moderate/strong correlations with all BSI-18 scores (between r=0.30 and r=0.55). 2. All BSI-18 scores were positively and modestly correlated with "Cognitive avoidance" (between r=0.17 and r=0.28) and negatively and modestly correlated with "Fatalism" (between r=-0.16 and r=-0.26). 3. The association of "Fatalism" with somatization, depression, and distress caseness was not found to be significant.

Table 2. Results of reliability and validity of psychiatric assessment tools used in the included articles (continued)

Assessment scales	Study	Ethnicity or language	Reliability (Cronbach's Alpha)	Validity
CES-D	Ashing-Giwa and Rosales[15] (2013)	AA EP LEP	0.92 (0.88–0.92)	-
	Bogaarts et al.[17] (2012)	Netherlands	-	r=0.80
PDQ-BC	Bogaarts et al.[17] (2012)	Netherlands	0.70–0.87	-
	Bogaarts et al.[18] (2014)	Netherlands	0.91 (state anxiety) 0.93 (depressive symptom)	-
	De Vries et al.[20] (2013)	Not described	0.69–0.88, except for social problems (0.42)	CFI=0.95; NNFI=0.91; RMSEA=0.073
NDBCSS	Charalampopoulou et al.[19] (2020)	Greek	Item deleted (0.85–0.87)	
	Lee et al.[27] (2013)	Taiwan	0.84	- PSS: r=0.46 (p<0.001) HADS: r=0.57 (p<0.001)
PHQ-9	Kim et al.[26] (2016)	Korean	-	Total 0.8012 Higher adherence group 0.8524 Lower adherence group 0.7234
	Torres et al.[32] (2013)	Portuguese	0.82 test-retest reliability rS=0.82 (p<0.001)	rS=0.60 (p<0.001) for anxiety rS=0.65 (p<0.001) for depression
STAI	De Vries et al.[21] (2013)	Netherlands (Dutch version)	Group 2 One factor short form 0.85 Two factors short form (Anxiety +/–) 0.81/0.80 Group 3 One factor short form 0.85 Two factors short form (Anxiety +/–) 0.82/0.83	- CFI=0.97; TLI=0.97; RMSEA=0.05 - CFI=0.97; TLI=0.96; RMSEA=0.05
B-IPQ	Zhang et al.[35] (2017)	Chinese	0.653 & 0.821 7 items: 0.783	- Physical symptom distress 0.392–0.442 Anxiety 0.422–0.552 Depression 0.429–0.494 RMSEA Two factor hierarchical model 0.090 (90% CI 0.065–0.117) Two factor correlated model 0.086 (90% CI 0.061–0.112)
PAS	Neto et al.[28] (2021)	Portugues	Total 0.96 (0.82–0.94)	-

HADS, Hospital Anxiety and Depression Scale; AUC, area under the curve; CI, confidence interval; χ^2/df, chi-sqaure/degree of freedom; NFI, normed fit index; RFI, relative fit index; IFI, incremental fit index; CFI, comparative fit index; RMSEA, root mean square error of approximation; DT, Distress thermometter; r, Pearson's correlation coefficient; Mini-MAC, Mini-Mental Adjustment to Cancer Scale; KMO, Kaiser-Meyer-Olkin; AVE, average variance extracted; BSI, Brief Symptom Inventory; CES-D, Center for Epidemiologic Studies Depression Scale; AA, African-American; EP, English language proficient Latina-American; LEP, limited English language proficient Latina-American; PDQ-BC, Psychosocial Distress Questionnaire-Breast Cancer; NNFI, non-normed fit index; NDBCSS, Newly Diagnosed Breast Cancer Stress Scale; PSS, Perceived Stress Scale; PHQ-9, Patient Health Questionnaire-9; rS, Spearman's rank correlation coefficient; STAI, State-Trait Anxiety Inventory; TLI, Tucker-Lewis index; B-IPQ, Brief Illness Perception Questionnaire; PAS, Psychological Adaptation Scale

Table 3. Results on the performance of the psychiatric assessment tools among included articles

Study	Assessment scale/ Comparative measure scale	Cutoff	Sensitivity	Specificity	PPV	NPV
Bidstrup et al.[16] (2012)	DT/HADS (≥15)	≥3	0.99	0.36	0.47	0.99
		≥4	0.97	0.42	0.49	0.96
		≥5	0.94	0.55	0.55	0.94
		≥6	0.87	0.69	0.62	0.90
		≥7	0.81	0.79	0.69	0.87
		≥8	0.71	0.86	0.74	0.84
Yong et al.[34] (2012)	DT/HADS (≥8)	≥3	0.517	0.946	0.88	0.75
		≥4	0.692	0.928	0.82	0.90
		≥5	0.909	0.898	0.61	0.98
		≥6	0.750	0.796	0.21	0.99
Iskandarsyah et al.[25] (2013)	DT/HADS (≥15)	≥3	0.92	0.40	0.62	0.82
		≥4	0.90	0.50	0.66	0.83
		≥5	0.81	0.64	0.70	0.76
		≥6	0.52	0.91	0.86	0.64
		≥7	0.42	0.95	0.90	0.60
		≥8	0.24	0.98	0.94	0.54
De Vries et al.[20] (2013)	PDQ-BC/CES-D, DT, HADS	-	0.786–0.875	0.730–0.811	-	-
Bogaarts et al.[18] (2014)	PDQ-BC/HADS-A (≥8) and HADS-D (≥8)	-	State anxiety 0.875 Depressive symptom 0.786	0.811 0.730	-	-

PPV, positive predictive value; NPV, negative predictive value; DT, Distress thermometter; HADS, Hospital Anxiety and Depression Scale; PDQ-BC, Psychosocial Distress Questionnaire-Breast Cancer; CES-D, Center for Epidemiologic Studies Depression Scale; HADS-A, Hospital Anxiety and Depression Scale Anxiety subscale; HADS-D, Hospital Anxiety and Depression Scale Depression subscale

diagnosed primary breast cancer. This study reported that a cutoff score of ≥3 on DT was optimal for screening with a sensitivity of 99% and a specificity of 36%. Meanwhile, Yong et al.[34] validated the Malaysian version of DT among 150 breast cancer survivors. A cutoff score of ≥5 on DT showed a sensitivity of 90.9% and a specificity of 89.8%. Iskandarsyah et al.[25] reported that the Indonesian version of DT showed a sensitivity of 81% and a specificity of 64% using a cuoff score of ≥5 in 120 breast cancer patients. Of the five studies, two studies reported the results of performance on the PDQ-BC scale. These studies were performed by the research group that initially developed the PDQ-BC.[17] The former study revealed a good sensitivity (0.786–0.875) and specificity (0.730–0.811) in 164 women with breast cancer before the start of adjuvant chemotherapy.[20] The later study also showed a sensitivity of 87.5% and a specificity of 81.1% for state anxiety and a sensitivity of 78.6% and a specificity of 73.0% for depressive symptoms in 80 women with early-stage breast cancer.[18]

DISCUSSION

This systematic review examined the evidence during the recent decade on reliability and validity of assessment tools for depression, anxiety, distress, and psychological problems in breast cancer patients. Given that the necessity of cancer-specific psychiatric assessment tools as well as reliable and valid scales in breast cancer patients, this systematic review provided useful information on the selection of proper assessment tools for screening and monitoring principal psychological problems such as depression, anxiety, and distress in patients with breast cancer. This systematic review finally included 21 studies that used various assessment tools (Table 1). Among 21 studies, 10 studies using the HADS, DT, Mini-MAC, CES-D, PDQ-BC, NDBCSS, PHQ-9, STAI, B-IPQ, and PAS reported the results on reliability or validity of psychiatric assessments for breast cancer patients (Table 2).

The most frequent assessment tool among the selected 21 studies was the HADS which was developed in 1983 by Zigmond and Snaith.[39] The HADS consisted of 14 items to measure the degree of anxiety and depression of patients visiting general hospitals in a short time waiting for medical treatment. This systematic review showed that the HADS could be an efficient assessment tool for patients with breast cancer, as well as those with other medical diseases.[40,41] The next most frequent scale was the DT which was developed by Roth et al.[42] for the distress screening of prostate cancer patients in

1998. The DT is a self-reported, single-item question using a visual analog scale rating 0 (no distress) to 10 (extreme distress) of emotional distress presented as a thermometer. The National Comprehensive Cancer Network pairs the DT with a 42-item problem list, to allow patients to identify their problems in five categories: social, family, emotional, spiritual/religious, and physical.[43] DT has been validated in several studies of different types of cancer patients and has shown excellent sensitivity and specificity.[44,45] This systematic review also found that the DT had good concurrent validity and good sensitivity for breast cancer patients. However, some studies reported low specificity. Therefore, when using the DT, it is recommended to use it for screening psychological distress. Otherwise, it is necessary to consider using the DT with other assessment tools showing high specificities. In addition to the HADS and DT, other psychiatric assessments such as the CES-D, PHQ-9, and STAI have been used in breast cancer patients.[15,21,26,32] Although studies on these scales were relatively small compared to the HADS or DT, they are expected to be useful in breast cancer patient.

Meanwhile, in case of breast cancer, it is important to accept and adapt to the disease because the survival rate is relatively high and long-term treatment is required.[5] For this reason, psychiatric assessments for coping responses,[22,23,29,33] illness perception,[35] and psychological adaptation[28] of breast cancer patients have been studied. In particular, the 29-item or 24-item Mini-MAC, a brief version of the Mental Adjustment to Cancer (MAC) scale to measure coping responses for cancer patients have been effectively used in brease cancer patients.[22,23,29,33,46-51] The Mini-MAC assesses five cognitive coping responses: helplessness-hopelessness (e.g., "I feel like giving up"), fighting spirit (e.g., "I see my illness as a challenge"), cognitive avoidance (e.g., "Not thinking about it helps me cope"), fatalism (e.g., "At the moment I take one day at a time"), and anxious preoccupation (e.g., "I am apprehensive").[52] In addition to the Mini-MAC, the 20-item PAS for evaluating psychological adaptation or the 9-item B-IPQ for illness perception can be used. Furthermore, the PDQ-BC or NDBCSS were developed and used to evaluate psychological distress and stress of breast cancer patients.[17,18,20]

This systematic review found various assessment tools to have good reliability and validity for breast cancer patients. However, there seems to be a lack of studies for comparison of the psychometric properties of psychiatric assessment tools for breast cancer patients. To provide useful information for the selection of appropriate assessment tools according to clinical settings and treatment stages of breast cancer, comparative studies on the reliability and validity of various scales are warranted. In perspectives of validity, convergent validity on each scale in breast cancer patients needs to be established. Additionally, for the application of psychiatric scales in real practice for breast cancer patients, more studies on the concurrent validity associated with various psychological problems or psychiatric symptoms need to be explored. Furthermore, the predictive validity related to the development into psychiatric illness or surgical prognosis of breast cancer needs to be investigated in future studies.

There were some limitations in this systematic review. Firstly, the previous studies published before 2011 were not included, because the search time frame for this systematic review was limited from 2011 to 2021. Unfortunately, a small portion of English-speaking studies among all studies was included, although there were not any language restrictions. The English-speaking studies might be performed before 2011 than non-English-speaking studies. Secondly, because this systematic review only used four databases, studies published in other databases were not included in this systematic review. However, because four databases such as Web of Science, PubMed, Embase, and CINAHL in this study were known as principal databases, most of the well-designed studies might be included.

This systematic review summarized the evidence on psychometric properties of psychiatric evaluation tools for breast cancer patients. This review identified 2,040 articles and showed the results of reliability and validity in 10 studies among included 21 articles. The HADS and DT for measuring depression, anxiety, and emotional distress were widely used. There have been studies to reduce the number of items in the MAC, which evaluate coping responses in cancer patients, to make it an easy-to-use tool. As well as breast cancer-specific tools such as the PDQ-BC and NDBCSS were being developed to evaluate distress focused on breast cancer patients. This systematic review found reliable and valid assessment tools to evaluate depression, anxiety, distress, and psychological problems for breast cancer patients. However, comparative studies on reliability and validity of various scales are required for selection of proper assessment tools according to clinical situations. Furthermore, convergent validity on each scale needs to be established, and concurrent or predictive validity on psychiatric symptoms, psychiatric illness or surgical prognosis should be explored for effective use in breast cancer patients.

Supplementary Materials

The online-only Data Supplement is available with this article at https://doi.org/10.30773/pi.2022.0316.

Availability of Data and Material

The datasets generated or analyzed during the study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

Author Contributions

Conceptualization: Eunsoo Moon, Taewoo Kang. Data curation: Heeseung Park, Kyoung-Eun Kim. Investigation: Heeseung Park, Eunsoo Moon, Taewoo Kang. Methodology: all authors. Project administration: Eunsoo Moon, Taewoo Kang. Resources: Heeseung Park, Kyoung-Eun Kim. Supervision: Eunsoo Moon, Taewoo Kang. Validation: Eunsoo Moon, Taewoo Kang. Visualization: Heeseung Park. Writing—original draft: Heeseung Park. Writing—review & editing: Kyoung-Eun Kim, Eunsoo Moon, Taewoo Kang.

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Supplementary Table 1. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	395
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	395
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	395-396
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	396
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	396
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	396
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	396
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	396-397
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	396
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Table 1-3
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Table 1 3
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Meta-analysis not performed
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Meta-analysis not performed
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Meta-analysis not performed
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Meta-analysis not performed
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Meta-analysis not performed
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Meta-analysis not performed
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	Meta-analysis not performed
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	Meta-analysis not performed
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Meta-analysis not performed
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Meta-analysis not performed
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Figure 1
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Figure 1
Study characteristics	17	Cite each included study and present its characteristics.	Table1-3
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Meta-analysis not performed
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Table1-3
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Meta-analysis not performed
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Meta-analysis not performed
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Meta-analysis not performed
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	Meta-analysis not performed
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Meta-analysis not performed
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Meta-analysis not performed
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	404-405
	23b	Discuss any limitations of the evidence included in the review.	405
	23c	Discuss any limitations of the review processes used.	405
	23d	Discuss implications of the results for practice, policy, and future research.	405
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	396
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	396
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	396
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	406
Competing interests	26	Declare any competing interests of review authors.	406
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	405

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

For more information, visit: http://www.prisma-statement.org/

Supplementary Table 2. Search strategies used in this systematic review

Search terms	((anxiety OR depression OR distress OR psychologi*) AND (validation OR reliability) AND (assessment OR tool OR screening OR instrument)) AND breast cancer.
Filters	from 2011/1/1 - 2021/12/31
Translations	1. Anxiety: "anxiety"[MeSH Terms] OR "anxiety"[All Fields] OR "anxieties"[All Fields] OR "anxiety's"[All Fields] 2. Depression: "depressed"[All Fields] OR "depression"[MeSH Terms] OR "depression"[All Fields] OR "depressions"[All Fields] OR "depression's"[All Fields] OR "depressive disorder"[MeSH Terms] OR ("depressive"[All Fields] AND "disorder"[All Fields]) OR "depressive disorder"[All Fields] OR "depressivity"[All Fields] OR "depressive"[All Fields] OR "depressively"[All Fields] OR "depressiveness"[All Fields] OR "depressives"[All Fields] distress: "distress"[All Fields] OR "distressed"[All Fields] OR "distresses"[All Fields] OR "distressful"[All Fields] OR "distressing"[All Fields] 3.validation: "valid"[All Fields] OR "validate"[All Fields] OR "validated"[All Fields] OR "validates"[All Fields] OR "validating"[All Fields] OR "validation"[All Fields] OR "validational"[All Fields] OR "validations"[All Fields] OR "validator"[All Fields] OR "validators"[All Fields] OR "validities"[All Fields] OR "validity"[All Fields] 4.reliability: "reliabilities"[All Fields] OR "reliability"[All Fields] OR "reliable"[All Fields] OR "reliablity"[All Fields] OR "reliably"[All Fields] 5.assessment: "assess"[All Fields] OR "assessed"[All Fields] OR "assessement"[All Fields] OR "assesses"[All Fields] OR "assessing"[All Fields] OR "assessment"[All Fields] OR "assessment's"[All Fields] OR "assessments"[All Fields] 6.screening: "diagnosis"[Subheading] OR "diagnosis"[All Fields] OR "screening"[All Fields] OR "mass screening"[MeSH Terms] OR ("mass"[All Fields] AND "screening"[All Fields]) OR "mass screening"[All Fields] OR "early detection of cancer"[MeSH Terms] OR ("early"[All Fields] AND "detection"[All Fields] AND "cancer"[All Fields]) OR "early detection of cancer"[All Fields] OR "screen"[All Fields] OR "screenings"[All Fields] OR "screened"[All Fields] OR "screens"[All Fields] 7.instrument: "instrument"[All Fields] OR "instrument's"[All Fields] OR "instrumentation"[Subheading] OR "instrumentation"[All Fields] OR "instruments"[All Fields] OR "instrumented"[All Fields] OR "instrumenting"[All Fields] 8.breast cancer.: "breast neoplasms"[MeSH Terms] OR ("breast"[All Fields] AND "neoplasms"[All Fields]) OR "breast neoplasms"[All Fields] OR ("breast"[All Fields] AND "cancer"[All Fields]) OR "breast cancer"[All Fields]