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Original Article

Comparison of the Distress Thermometer, Hospital Anxiety and Depression Scale, Depression and Somatic Symptom Scale for Screening Psychiatric Disorders in Hospitalized Cancer Patients

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Purpose: This study assesses the sensitivity and specificity of the distress thermometer (DT), the hospital anxiety and the depression scale (HADS), and depression and somatic symptoms scale (DSSS) for screening psychiatric disorders in hospitalized cancer patients by comparing with the clinical interview.
Methods: DT, HADS, and DSSS were evaluated in 160 hospitalized cancer patients prior to the psychiatric interview. Each scale was tested against clinical psychiatric diagnoses based on the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition for sensitivity and specificity.
Results: The receiver operating characteristic (ROC) analysis identified a DT score of 5 as the optimal cut-off point versus clinical psychiatric diagnoses, with sensitivity and specificity of 77% and 100%, respectively. The area under the ROC curve (AUC=0.93) was the largest for DT. HADS and DSSS have similar AUC (0.84 vs 0.84, p=0.90). Among all subscales, the DSSS-depression scale had an AUC of 0.86, which yielded a sensitivity and specificity of 82% and 80%, respectively.
Conclusion: DT, DSSS, and HADS had acceptable screening efficacy for psychiatric disorders in cancer patients. We recommend the use of DT and DSSS as an optimal two-step psychiatric screening tool in cancer patients. More studies are needed to verify the value of DSSS in evaluating the treatment response of cancer patients comorbid with psychiatric diagnosis.

Keywords: Cancer. Anxiety. Depression. DT. DSSS. HADS

1. Introduction

Cancer patients are likely to suffer from anxiety or depression in the turmoil of cancer diagnosis and the impact on physical, psychological, and social functioning [4]. Almost half of adult hospitalized cancer patients were diagnosed with psychiatric disorders, among them, adjustment disorder with depressed and/or anxious mood was by far the most common [6]. Recent studies found that depression and anxiety range between 22% and 34% of cancer

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patients [15, 24]. Psychological distress not only affects cancer progression but is also associated with increased cancer mortality [1], and could be significantly reduced by a proper psychooncology service [2]. However, even in patients with advanced cancer, more than 50% of them were not referred for psychological evaluation [14]. Cancer patients may suffer from physical pain or side effects of treatment and are unable to physically complete the lengthy evaluation [26]. To correctly identify cancer patients who need further psychosocial intervention, timely implementation of validated psychological stress screening tools is crucial to better treatment.

Distress thermometer (DT) is a one-item tool originally invented in 1998 [20] to detect psychological distress among cancer patients and has been translated into different languages. For its simple use and less stigmatizing language, DT is a handy and effective tool to detect distress in cancer patients [28]. The International Psycho-oncology Society (IPOS) recommends DT as a routine screening tool for cancer patients. NICE (National Institute for Health and Care Excellence) also uses DT in evaluating the effectiveness of psycho-oncology intervention [2]. The DT score ranges from 0-10, indicating the level of distress from no stress to extreme stress. The NCCN (National Comprehensive Cancer Network) guideline suggests that those who score 4 or more in DT require further assessment. However, in a meta-analysis which pooled several studies that applied DT to detect cancer-related mood disorders [16], these findings emphasized that DT cannot be used alone to diagnose depression, anxiety, or distress in cancer patients, but can be considered as a first-stage screening to rule out cases of depression. A second step is needed to further clarify who is the true case through a clinical interview or a more comprehensive instrument.

The hospital anxiety and depression scale (HADS) is a self-report questionnaire that contains anxiety and depression subscales (HADS-D and HADS-A), each subscale contains seven items, and each item could be rated as 0, 1, 2, 3 based on clinical situations [30]. HADS is widely used to detect emotional distress in cancer patients. HADS precludes somatic symptoms of emotional distress (eg, headache, weight loss, insomnia) while cancer patients often have a greater burden of somatic symptoms. Although the threshold varied, the diagnostic accuracy of HADS was consistently better for the detection of depression than for the detection of any mental disorder [27].

The Mandarin version of HADS reached a sensitivity of 81.0% and a specificity of 63.3%, with a cutoff point of 7 for depression in cancer patients [28]. However, its validity in screening anxiety or somatic symptoms in such patients was not tested.

In addition to emotional and physical distress, pain is one of the most common symptoms seen in cancer patients, occurring in 50% to 90% of patients with advanced malignancies [23]. However, pain is not evaluated in DT and HADS. Depression and somatic symptoms scale (DSSS), a screening tool that is less discussed in the field of psychooncology and contains more domains related to physical and pain. DSSS is a 22-item screening tool that includes the depression subscale (DS), the somatic subscale (SS), and the pain subscale (PS). DSSS-DS contains 12 items that cover all symptoms of major depressive disorder, and an additional item covers anxiety or nervousness. DSSS-SS has 10 items that assess pain from different parts of the body and somatic symptoms such as dizziness, muscle tension, or chest tightness. DSSS-PS is not an independent subscale, but an adaptation of five pain assessment items from DSSS-SS. Pain or somatic symptoms not only worsen the economic burden of people with depression [9], but also make diagnosing depression in oncological settings more difficult [10]. Evaluation of pain and somatic symptoms is important in the screening and treatment of depression in cancer patients.

We applied three screening tools including DT, HADS and DSSS in 160 hospitalized cancer patients. By comparing with a clinical interview based on DSM-IV TR criteria, the purposes of this study were twofold: to identify optimal cut-off point of each tool and to compare the ability of DT, HADS and DSSS in screening anxiety and depression in hospitalized cancer patients.

2. Methods

2.1 Study design and participants

Hospitalized cancer patients were consulted by

treating physicians or nurses for psychiatric evaluation due to clinical concerns at Changhua Christian Hospital between 2017 June and 2018 May. Eligible cancer patients were routinely consulted if they met the following requirements: (1) history of self-harm or suicide, (2) newly diagnosed cancer. Patients were excluded if they met the two conditions: (1) impaired consciousness (2) had been tested with DT, HADS or DSSS within 3 months. After signing an informed consent, the patient was evaluated with DT, HADS, and DSSS by the psychologist. Psychiatric interview was performed by a board certified psychiatrist using Mini-International Neuropsychiatric Interview [21]. The psychiatric diagnosis was based on the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM IV). The psychiatrist was blind to the scoring results of DT, HADS, and DSSS. Patients diagnosed with adjustment disorder, anxiety disorder or depressive disorder were identified as 'cases'. We also collected the following data: age, sex, cancer type, age of cancer onset. The study was reviewed and approved by the Research Ethics Committee of Changhua Christian Hospital, Changhua, Taiwan, under No.170410.

2.2 Statistical analysis

Categorical variables were expressed as numbers and percentages and continuous variables as means

Table 1. Basic demographics (n = 160), types of cancer, and psychiatric diagnosis

	Men	Women	All
Age (years)	56.08 ±12.77	54.43±13.93	55.53±13.15
Gender	106 (66.2%)	54 (33.8%)	160
Marital status			
Single	12 (11.3%)	5 (9.3%)	17 (10.6%)
Married	94 (88.7%)	49 (90.7%)	143 (89.4%)
Onset age of cancer	54.53±12.76	52.37±13.98	53.80±13.18
Cancer type			
Lung	22 (20.8%)	5 (9.3%)	27 (16.9%)
Breast	0	22 (40.7%)	22 (13.8%)
Head & neck	52 (49.1%)	2 (3.7%)	54 (33.8%)
GI & liver	10 (9.4%)	5 (9.3%)	15 (9.4%)
Colon_rectum	5 (4.7%)	8 (14.8%)	13 (8.1%)
GU& GYN	4 (3.8%)	7(13.0%)	11 (6.9%)
Others	13 (12.3%)	5 (9.3%)	18 (11.3%)
Psychatric diagnosis			
No diagnosis	31 (29.2%)	9 (16.7%)	40 (25.0%)
Adjustment disorder	33 (31.1%)	23 (42.6%)	56 (35.0%)
Depressive disorder	30 (28.3%)	13 (24.1%)	43 (26.9%)
Anxiety disorder	12 (11.3%)	8 (14.8%)	20 (12.5%)
Others	0 (0%)	1 (1.9%)	1 (0.6%)

GI: gastrointestinal tract
GU: genitourinary
GYN: gynecology

Table 2. AUC, sensitivity, and specificity of DT, DSSS, and HADS

	Cutoff value	AUC (95% CI)	p	Sensitivity	Specificity	PPV	NPV
DT	5	0.93 (0.88 – 0.97)	<0.0001	77%	100%	100%	93%
DSSS-DS	6	0.86 (0.79- 0.91)	<0.0001	82%	80%	56%	94%
DSSS-SS	5	0.76 (0.68- 0.82)	<0.0001	61%	88%	60%	88%
DSSS-PS	3	0.69 (0.61- 0.76)	<0.0001	43%	93%	64%	84%
DSSS total	14	0.84 (0.77– 0.89)	<0.0001	75%	88%	65%	92%
HADS-a	5	0.78 (0.71-0.84)	<0.0001	72%	77%	49%	90%
HADS-d	8	0.84 (0.77-0.89)	<0.0001	65%	97%	89%	90%
HADS total	13	0.84 (0.77-0.89)	<0.0001	71%	92%	74%	91%

AUC: area under curve
CI: confidence interval
DT: distress thermometer
DSSS: depression and somatic symptoms scale
HADS: hospital anxiety and depression scale
PPV: positive predictive value
NPV: negative predictive value

and standard deviations. Continuous variables were compared using the Mann-Whitney U test. Categorical variables were analyzed using the χ^2-test or Fisher's exact test. DT, DSSS, and HADS were used to assess psychological stress among patients. Patients were identified as cases if they were diagnosed with adjustment disorder, anxiety disorder or depressive disorder. The sensitivity and specificity of each screening tool were determined compared to the psychiatric diagnosis made by the interviewing psychiatrists to identify 'cases'. The highest value on the Youden index (sensitivity +specificity-1) is recognized to determine optimal cut-off scores.

For each receiver operating characteristic (roc) curve, the area under the curve (AUC) was determined as an indicator of overall precision to determine positive cases of distress. The AUC values range from 0 to 1, with values of 0.80 or more indicating good discrimination. The association between the HADS-a (≥5 vs <5), HADS-d (≥8 vs <8), HADS-t (≥13 vs <13) and DT (≥5 vs <5) was examined by the Chi-square test or Fisher's exact test. Data were analyzed using SPSS 17 (SPSS, Chicago, IL, USA). A P value less than 0.05 was considered statistically significant.

3. Results

3.1 Sample characteristics

Of the 160 patients, the mean age was 55.53 (SD 13.15) years. The mean age of men (n=106, 66.2%) and women (n=54, 33.8%) was 56.08 (SD 12.77) and 54.43 (SD 13.93) years, respectively. The onset age of cancer was 54.53 (SD 12.76) years in men and 52.37 (SD 13.98) years in women. Head and neck cancer (n=52, 49.1%) ranked first in men, followed by lung (n=22, 20.8%), others (n=13, 12.3%), gastrointestinal and hepatic (n=10, 9.4%), colorectal (n=5, 4.7%) and genitourinary cancer (n=4, 3.8%). In women, cancer diagnoses were: breast (n=22, 40.7%), colorectal (n=8, 14.8%), gynecology (n=7, 13.0%), lung (n=5, 9.3%), gastrointestinal and hepatic (n=5, 9.3%), others (n=5, 9.3%), and head and neck cancer (n=2, 3.7%). 120 participants (75%) had anxiety, depression, or adjustment disorders. Psychiatric diagnoses were led by adjustment disorders (n=56, 35%), then depressive disorders (n=43, 26.9%), without diagnosis (n=40, 25%), anxiety disorder (n = 20, 12.5%) and others (n=1, 0.6%) (Table 1).

3.2 The optimal cut-off score of each scale

Table 3. Relationships between distress thermometer, depression and somatic symptoms scale, hospital anxiety and depression scale cutoffs, and gender

	DT<5	DT≧5	P value
Gender, n (%)			0.59
Male	16 (64.0%)	44 (57.95%)	
Female	9 (36.0%)	32 (42.1 %)	
DSSS-DS			<0.001
DSSS-DS<6	13 (52.0%)	0 (0%)	
DSSS-DS≧6	12 (48.0%)	76 (100%)	
DSSS-SS			<0.001
DSSS-SS<5	18 (72.0%)	21 (27.6%)	
DSSS-SS≧5	7 (28.0%)	55 (72.4%)	
DSSS-PS			0.005
DSSS-PS<3	21 (84.0%)	40 (52.6%)	
DSSS-PS≧3	4 (16.0%)	36 (47.4%)	
DSSS-t			<0.001
DSSS-t<14	16 (64.0%)	6 (7.9%)	
DSSS-t≧14	9 (36.0%)	70 (92.1%)	
HADS-a			0.002
HADS-a<5	13 (52.0%)	15 (19.7%)	
HADS-a≧5	12 (48.0%)	61 (80.3%)	
HADS-d			<0.001
HADS-d<8	23 (92.0%)	11 (14.5%)	
HADS-d≧8	2 (8.0%)	65 (85.5%)	
HADS-t			<0.001
HADS-t<13	19 (76.0%)	11 (14.5%)	
HADS-t≧13	6 (24.0%))	65 (85.5%)	

DT: distress thermometer,
DSSS-DS: depression subscale of depression and somatic symptoms scale
DSSS-SS: somatic subscale of depression and somatic symptom scale
DSSS-PS: pain subscale of depression and somatic symptoms scale
DSSS-t: total scale of depression and somatic symptoms scale
HADS-a: anxiety subscale of hospital anxiety and depression scale
HADS-d: depression subscale of hospital anxiety and depression scale
HADS-t: total scale of hospital anxiety and depression scale

We found a DT score of 5 to be the best cut-off value with the highest Youden index, which yielded an AUC of 0.93 (95% CI, 0.88-0.97), a sensitivity (Se) and specificity (Sp) of 77% and 100%, positive predictive value (PPV) and negative predictive value (NPV) of 100% and 93%, respectively.

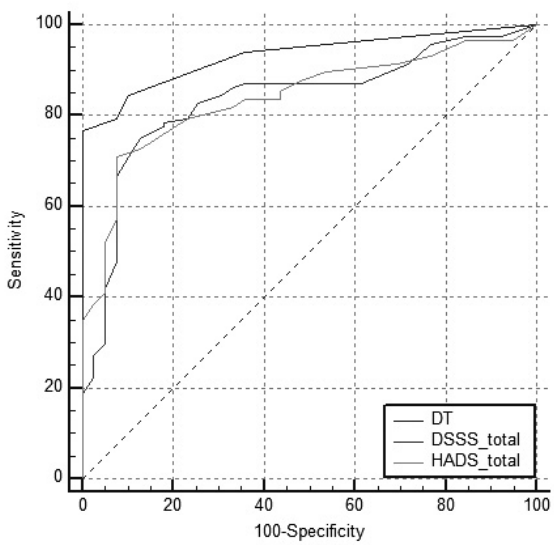
Based on the highest Youden index, the cutoff for DSSS-total was 14, which yielded an AUC of 0.84 (95% CI, 0.77-0.89), Se and Sp of 75% and 88%, PPV and NPV of 65% and 92%. The cut-off point for the total HADS was 13, which yielded an AUC of 0.84 (95% CI, 0.77-0.89), SE and SP of 71% and 92%, PPV and NPV of 74% and 91%. For the cut-off value, the AUC, SE and SP of the DSSS-DS, DSSS-SS, DSSS-PS, HADS-a, HADS-d subscales were listed in Table 2 to identify patients with psychologic distress.

The relationships between the DT cutoff score of 5 and DSSS, HADS, and sex are shown in Table 3. A DT cut-off score of 5 was highly correlated with the following. DSSS-DS cutoff of 6, DSSS-SS cutoff of 5, DSSS-PS cutoff of 3, DSSS-total cutoff of 14, HADS-a cutoff of 5, HADS-d cutoff of 8 and HDAS-total of 13. The DT score of 5 was not significantly related to sex (p=0.59).

3.3 Comparison of DT, DSSS, and HADS

The comparison of the ROC curves between DT and DSSS/HADS is shown in Figure 1. The areas under the ROC curves with 95% confidence intervals (CIs) are 0.93 (95% CI, 0.88-0.97) for DT, 0.84 (95% CI, 0.77-0.89) for DSSS-total and 0.84 (95% CI, 0.77-0.89) for HADS-total, respectively. Pairwise comparison between DT and DSSS/HADS are both significantly different (DT to HADS, difference between areas= 0.0924, standard error=0.029, p=0.0014; DT to DSSS, difference between areas= 0.0958, standard error=0.0317, p=0.0026). The AUC of DSSS and HADS did not differ significantly (p=0.9).

Figure 1. Comparison of ROC curves of DT, DSSS, and HADS



DT vs. DSSS and DT vs. HADS, p<0.05

4. Discussion

This study demonstrated the efficacy of DT, HADS, and DSSS in screening psychological distress in cancer patients. According to our results, cutoff score 5 of DT had the highest AUC (0.93, 95% CI 0.88-0.97), which holds the best discrimination ability among three screening tools with respect to psychiatric diagnoses of adjustment, anxiety, and depressive disorders as defined by psychiatric interview based on DSM IV criteria.

Given that NCCN suggests 4 as the cutoff point for DT, the cutoff point appropriate for the foreign language version may differ from that established for the English language version [7]. In a previous study, the optimal cut-off point of DT ranged from 3-5 with respect to different language version, clinical settings, and sample characteristics [8]. NCCN initially set the optimal cutoff of DT at 5 [19]. In a systemic review and meta-analysis, DT with a cut-off score of 4 was an effective screening tool in Asian patients with cancer [22]. However, the DT cutoff was reported to be 5 and is in optimal agreement with the HADS scores among Chinese lymphoma patients [29]. Another Indonesian study concluded that the DT cutoff was 5 among women with breast cancer compared to the HADS score [13]. Close to our study, a Dutch study validated DT among mixed cancer patients, in that study a score of 5 on DT was identified as the better cutoff with a sensitivity of 85%, a specificity of 67%, and the AUC was 0.80 (0.74–0.87) [25].

As shown in Table 3, the DT cutoff of 5 was not significantly related to sex. This may be contrary to some studies. Because our sample has more male patients (66.2%), we reviewed several studies focusing on male patients. Chiou and colleagues found that no valid cutoff DT score was sufficient to induce positive psychological distress in male cancer patients without chemotherapy [5], our patients were mainly

referred by treating physicians or nursing staff for clinical concerns (suicidal or newly diagnosed) and were clinically more severe. Another study similar in gender distribution (72% male) to our study by Hong et al. [11] found that if a sensitivity of 0.9 or more was used as the criterion for evaluating DT, no cutoff DT score can detect distress in long-term nasopharyngeal cancer survivors. Unlike our sample, their participants were outpatient nasopharyngeal cancer survivors who were clinically stable.

The optimal HADS cut-off point in our study is 5 for HADS-A, 8 for HADS-D and 13 for HADS-Total, all of which yield AUC more than 0.78. In one international meta-analysis that included 50 studies, all HADS scores (HADS-D, HADS-A, and HADS-Total) had a fair screening validity for depression. The optimal depression screening cut-off point is 8 for HADS-D and 15 for HADS-Total [18] in this meta-analysis study, which were similar to our results. This implies that both DT and HADS can be used simultaneously for screening anxiety and depression in cancer patients [4].

DSSS was less discussed in the field of psychooncology and no optimal cut-off score for cancer patients could be found. The sensitivity (0.75) and specificity (0.88) of DSSS was comparable to HADS (0.71 and 0.92, respectively) in our study and was slightly superior to that reported in a meta-analysis [18] of 16 studies on the screening of psychiatric disorders by HADS (0.73 and 0.81, respectively).

Despite the fact that DSSS and HADS had comparable validity to distinguish different depressive states [12], the depressive subscales of DSSS and HADS were significantly correlated with HAMD and DSSS-DS had the highest AUC for distinguishing depressive states, followed by HADS-D. The screening validity of DSSS among cancer patients has not been elucidated before. Our result reveals that DSSS is comparable to HADS in screening psychological distress among non-palliative cancer patients. DSSS performs similarly well to HADS in screening validity (AUC of DSSS: 0.84, 95% CI 0.77-0.89; AUC of HADS: 0.84, 95% CI 0.77-0.89).

Among all subscales of HADS and DSSS, the AUC value was highest for the DSSS-DS (AUC 0.86, 95% CI 0.79-0.91), followed by the HAD-D (AUC 0.84, 95% CI 0.77-0.89). This could result from the fact that DSSS-DS consists of criteria of major depression, such as fatigue, insomnia, poor appetite, and HADS-D excludes somatic symptoms of emotional distress (eg, headache, weight loss, insomnia).

Compared to DSSS-DS, the screening efficacy of DSSS-PS and DSSS-SS was less satisfactory (Table 2, AUC of DSSS-PS 0.69, 95% CI 0.61-0.76 versus AUC of DSSS-SS 0.76, 95% CI 0.68-0.82). Because DSSS pain and somatic subscales cover symptoms such as headache, back pain, chest pain, and these are not included in the diagnostic criteria of depression or anxiety disorders. Furthermore, the DSSS-PS and DSSS-DS subscale scores is the sum of symptoms score from several body parts and symptoms domains. For patients who have severe pain or discomfort from the localized cancer-affected body parts/symptoms domain, their PS/SS score would be low and could not perfectly reflect their stress level. However, the AUC of all subscales was more than 0.6, which meant that the discriminative ability of each subscale for psychiatric diagnoses in our study was acceptable.

4.1 Clinical implications

Mitchell et al. suggested using a two-step algorithm approach to identify patients: a very short screening question followed by a more detailed screening tool, to improve accuracy and save time by completing the full evaluation in a single meeting [17]. DT and HADS had been recommended to be used under such rationale by the Australian clinical pathway of adult cancer [4]. Therefore, it is also feasible to combine DT with DSSS as a two-step psychiatric screening tool in cancer settings.

The strengths of that it study include this is the first study to compare the screening efficacy of DSSS with DT and HADS in cancer settings. Besides, most previous studies only perform interscale comparisons. Although time consuming, our study used a 'gold standard' psychiatric diagnostic interview to examine optimal cutoff scores of DT, DSSS and HADS [3].

4.2 Limitations

Our study has several limitations. First, 66.2 % of the participants were men in our study, so gender

bias cannot be overlooked and generalization of our results to other types of cancer patients should be cautious. Second, we did not assess some important clinical information (ie, duration of cancer diagnosis, cancer staging, past history, and treatment of psychiatric disease), and these factors may impact patients' psychological well-being. Third, our sample size is modest with a cross-sectional design. A larger sample with longitudinal follow-up is needed to better understand the psychological change in cancer patients.

5. Conclusions

Based on our results, all three tools (DT, DSSS, and HADS) had acceptable screening efficacy. We recommend using DT and DSSS as an optimal two-step psychiatric screening tool in cancer patients. More studies are needed to verify the value of DSSS in evaluating the treatment response of cancer patients comorbid with psychiatric diagnosis.

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Author contributions

CCC conceived the research idea, designed the study, and wrote the results, TWL wrote the manuscript and assisted in the literature review and analysis, SSH, TGC and WYH revised the manuscript and proofread the manuscript. All authors read and approved the final manuscript.

Data availability statement

The data are currently used for other studies and manuscript development. The data that support the study may be available upon request with permission from the researchers who collected the data

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