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ORIGINAL ARTICLE

Correlates of elevated distress thermometer scores in breast cancer patients

Jayant Agarwal · Karen Powers · Lisa Pappas · Luke Buchmann · Layla Anderson · Lisa Gauchay · Anne Rich

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Abstract
Purpose Distress is prevalent in breast cancer patients and can be detrimental to quality of life, performance status, treatment adherence, and satisfaction with medical care. The National Comprehensive Cancer Network developed the distress thermometer (DT) as a self-assessment tool for screening distress in cancer patients. Given time and financial constraints, it is important to refine screening criteria to identify patients with elevated risk for distress. In this study, we identify clinical and epidemiological factors that are associated with an increased likelihood of elevated DT scores (≥4 and ≥7).
Methods We assessed 229 female patients with the DT at their initial consultation for breast cancer at the Huntsman Cancer Hospital between September 2007 and December 2008. Descriptive statistics and logistic regression models were used to analyze DT and patient data.
Results Patients undergoing their initial distress thermometer screening within 30 days of receiving a diagnosis of breast cancer had the highest likelihood of scoring ≥4 and ≥7 on the DT screening tool. Emotional and physical concerns were associated with scores ≥4 and scores ≥7. Spiritual concerns became significant in patients reporting scores ≥7. Patients who were non-Caucasian, unemployed, had a prior history of depression, presented for recurrent disease, or who had been recently diagnosed had a higher likelihood of scores ≥4 and scores ≥7.
Conclusions Four groups of patients should be targeted for aggressive screening; patients with a prior diagnosis of depression, patients presenting with recurrent disease, unemployed patients, and non-Caucasian patients. Interventions should address physical, emotional, and spiritual concerns.

Keywords Distress · Breast cancer · Distress thermometer

J. Agarwal (✉) · L. Buchmann · L. Anderson
Department of Surgery, University of Utah School of Medicine, 30 N 1900 E 3b400, Salt Lake City, UT 84132, USA
e-mail: jay.agarwal@hsc.utah.edu

K. Powers
Department of Plastic Surgery, University of Texas Medical Branch, 301 University Blvd, Galveston, TX 77555, USA

L. Pappas
Biostatistics Core, Huntsman Cancer Institute, Salt Lake City, UT, USA

L. Gauchay
Department of Patient and Family Support, University of Utah, Salt Lake City, UT, USA

A. Rich
Department of Psychiatry, University of Utah, Salt Lake City, UT, USA

Introduction

Breast cancer diagnosis and treatment, including the months following primary therapy, are stressful times for many women. Cancer is an emotionally distressing condition despite improvements in treatment and survival [1]. In recognition of the potential impact cancer can have on the quality of life of patients, the National Comprehensive Cancer Network (NCCN) chose a non-stigmatizing word, "distress," to encapsulate the broad range of psychological problems. Distress has been defined by the NCCN as "an unpleasant experience of an emotional, psychological, social, or spiritual nature that interferes with the ability to cope with cancer treatment. It extends along a continuum, from common normal feelings of vulnerability, sadness, and fears, to problems that are disabling, such as true depression,

anxiety, panic, and feeling isolated or in a spiritual crisis" [2]. While surveys estimate that between 20 and 40 % of patients with cancer have significant levels of distress, fewer than 10 % are identified and treated [3].

Distress can be detrimental to quality of life, performance status, treatment adherence, and satisfaction with medical care and interactions [4]. Due to these factors, the consensus-based guidelines from the Distress Management Panel of the NCCN suggested a self-reporting screening measure to enhance the detection and management of emotional distress in cancer patients. The NCCN developed the distress thermometer (DT) as a quick and efficient tool to screen for distress in cancer patients. In addition to the DT, NCCN created a problem list that allows patients to identify which areas of concern grouped in five categories (practical problems, family problems, emotional problems, spiritual or religious concerns, and physical problems) were possible reasons for the distress. Although the DT use has been validated in patients with breast cancer, our literature review found no analysis done to assess which variables are associated with levels of distress in this population [5].

Despite the DT being widely used to identify distress, it is unclear what score on the DT correlates with a more severe psychiatric disorder such as major depression. In 2008, Hagel et al. compared the DT with the Patient Health Questionnaire 9-Item Depression Module (PHQ-9) to determine the receiving operating characteristics of the DT in diagnosing depression. They found that a score of 7 represented the optimal tradeoff between sensitivity (0.81) and specificity (0.85) [5]. However, in another study by Akizuki et al., the score of 4/5 was found to indicate clinical depression when comparing the DT to an unstructured psychiatric interview of a mixed sample of Japanese cancer patients [6].

Though studies have been conducted to examine the incidence of depression among breast cancer patients, wide ranges (from 10 to 25 %) were observed [4]. In their 2005 paper, Burgess et al. examined the prevalence of and risk factors for depression and anxiety in women during the first 5 years after a diagnosis of breast cancer [7]. The authors found that of these women, nearly 50 % had depression, anxiety, or both in the year after diagnosis, 25 % in the second, third, and fourth years, and 15 % in the fifth year. Forty-five percent of those with recurrence experienced depression, anxiety, or both within 3 months of the diagnosis. Hegel et al. found similar findings when they used the DT in their assessment of 236 patients with newly diagnosed with breast cancer in order to assess the prevalence of distress in this population. Per their findings, 41 % of women with early breast cancer rated their distress in the clinically significant range on the DT while nearly one half (47 %) of patients met established thresholds for positivity on one or more screens for distress or psychiatric disorders [8]. Emotional symptoms markedly interfered with daily function in both groups. The authors concluded that based on their data future research to refine current screening procedures and develop interventions to better address emotional distress and psychiatric disorders in newly diagnosed breast cancer patients is needed. Many previous studies have indicated that the incidence of depression is higher in patients with cancer when compared to the general population [7–9]. However, studies have shown mixed results when investigating the effects of untreated clinical depression on length of survival and subsequent quality of life [10–13]. Nonetheless, most patients with breast cancer believe that psychosocial factors influence whether their cancer will return [12].

In this study, we identify clinical and epidemiological factors that are associated with an increased likelihood of an elevated score on the DT screening tool in patients with breast cancer.

Materials and methods

Study participants

Participants included consecutive female patients at the Huntsman Cancer Hospital, Salt Lake City, UT, from September 2007 to December 2008. In September 2007, Huntsman Cancer Hospital implemented the use of the DT screening tool for all initial patient visits. All potential participants (n=245) were new to our facility and all ultimately had a biopsy proving breast cancer. Patients were included in the study if they were women with breast cancer between the ages of 18–95, were new to the University of Utah Health System, and had completed a distress thermometer screening tool at their first visit. Exclusion criteria included male gender, established patient within our health care system, diagnosis other than breast cancer, and incomplete DT screening tool. The University of Utah Institutional Review Board approved this study.

Procedure

From September 2007 to December 2008, 229 out of a possible 245 breast cancer patients completed a DT screening tool at their initial outpatient consultation with a specialist at the Huntsman Cancer Hospital. All patients were new to our facility and presented to us with a known diagnosis of breast cancer or a pending diagnosis. Patients previously treated for breast cancer at an outside facility who presented with recurrent disease were included. A chart review was performed and each patient's DT screening tool as well as demographic, psychosocial, and clinical data was obtained. Patients that scored ≥4 were referred for a social work evaluation at which time the social worker further assessed the emotional and psychosocial needs of the patient. Those who scored ≥7 were referred directly to the psychiatry clinic at Huntsman Cancer

Hospital for evaluation. Treatment, if any, was based on the recommendations of the psychiatrist.

Measures

Distress thermometer

The DT screening tool measures a global level of distress using a visual analogue scale from 0 to 10 in the shape of a thermometer, with zero identified as "no distress" and ten labeled as "extreme distress." The DT screening tool also includes a checklist of common emotional, family, physical, practical, and spiritual concerns with instructions for the patient to indicate which of those concerns contributed to the distress they experienced within the past week (see Fig. 1). Both the DT and the problem list are validated screening tools approved by the NCCN. At our institution, we have labeled the combined tools the "Emotional Needs Questionnaire." These validated tools have not been altered in any way. We chose a score ≥4 as our cutoff for a positive screen for "distress" and a score ≥7 as our cutoff for a positive screen for "extreme distress/depression" based on previous studies [3, 5]. Each of the five areas of concern itemized by the patient on the screening tool (practical, family, emotional, spiritual, and physical) was individually analyzed.

Time from diagnosis to administration of distress thermometer

For the logistic regression analyses, time from diagnosis to administration of the initial distress thermometer screen was divided into discrete groups. New patients presented to us at different times, either after having received a diagnosis of breast cancer or pending diagnosis. Patients were thus divided into the following groups based on when they received their initial screen: (1) before their diagnosis of breast cancer; (2) on the day they received their diagnosis; (3) between 1 and 30 days after receiving their diagnosis; (4) between 30 and 350 days after receiving their diagnosis; and (5) greater than 350 days after receiving their diagnosis. Additionally, patients with recurrent disease that were new to our institution received an initial distress thermometer screen. They were divided into the aforementioned groups based on when they received their initial screen relative to the diagnosis of their recurrence.

Variables included in the analyses

Once a complete list of the 229 patients was compiled, a chart review was performed to obtain demographic, clinical, and patient characteristics. The history and physical exam closest to the date of administration of the DT screening tool was used to extract the following information: age, employment status, race/ethnicity, personal history of depression, family history of breast cancer, and marital status. Once a diagnosis of breast cancer was confirmed, histopathologic reports coinciding with the current event of breast cancer were evaluated to identify the following breast cancer characteristics: estrogen and progesterone receptor status, stage of cancer, and recurrence. Data from the DT screening tool included the DT score and any of a possible 20 concerns listed by the patient.

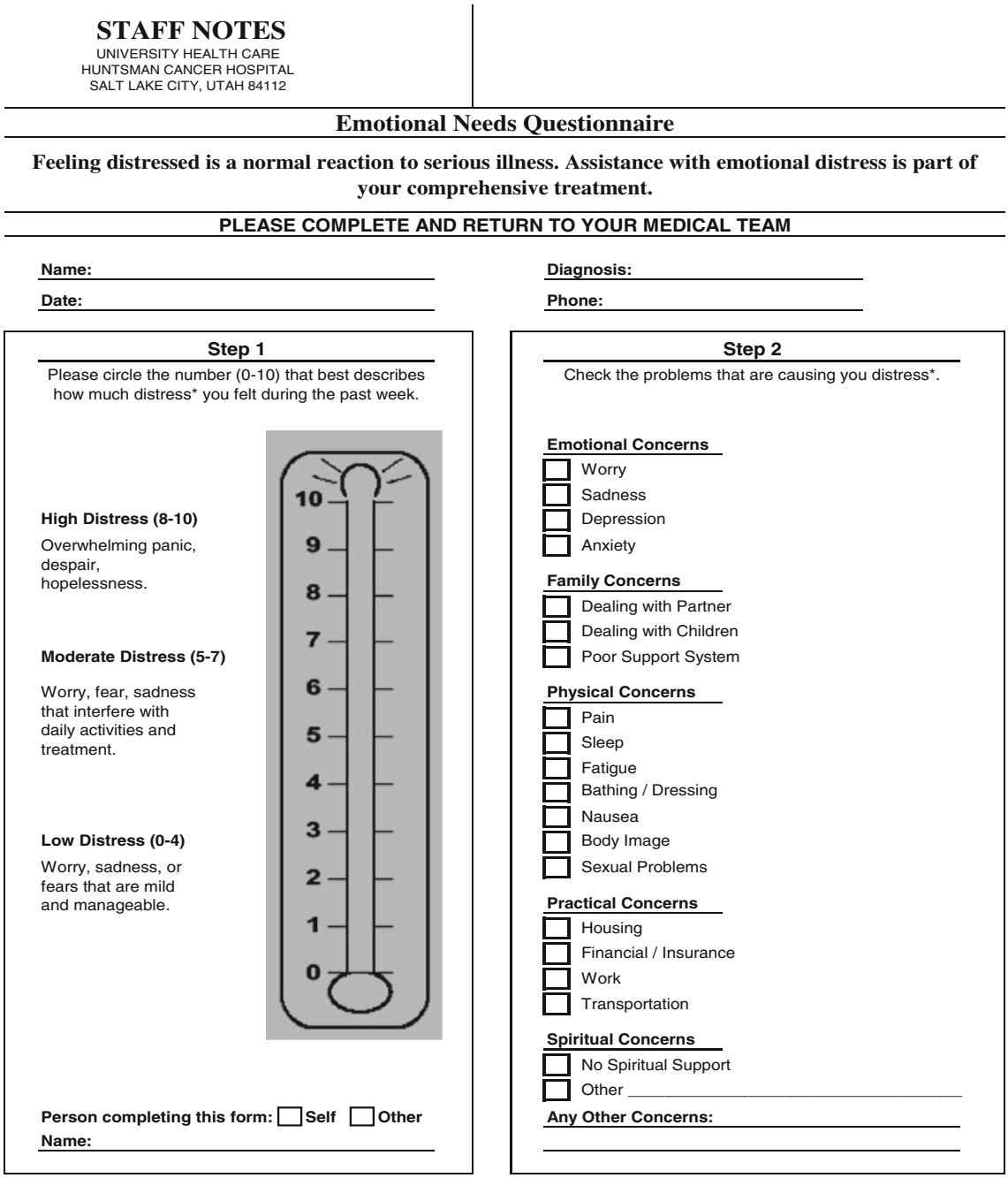
Description of statistical analysis

Descriptive statistics were used to compare the three defined levels based on the DT screening tool (score <4, score 4 to <7, and score ≥7). The Kruskal–Wallis test was used to determine if the distribution of age and time since diagnosis where different between DT groups. The Pearson test was used to determine if the categorical variables where independently associated with DT group. Univariate and multivariate logistic regression models were used to determine variables associated with having a DT score ≥4 and separately associated with having a DT score ≥7. Variables were considered for inclusion in the multivariate model if the univariate association was statistically significant. Variables remained in the model if the inclusion improved the overall fit, as determined by the Akaike information criterion [14] and/or changed the effect of time since diagnosis. Lowess smoothing was used to investigate the relationship between elapsed time and odds of a score ≥4 or a score ≥7. Based on these plots it was determined that a linear association was not a valid assumption and appropriate cut points were determined for creating a categorical elapsed time variable to be used in the logistic models.

Results

Demographic, clinical, and patient characteristics

Our study population (n=229) was all female (100.0 %) with an average patient age of 56 years (SD ±11 years). Patients were primarily non-Hispanic white (76.0 %), employed (54.6 %), and married (67.7 %) and most were stage II or lower (75.5 %) with a tumor that was positive for estrogen receptors (69.9 %) and/or progesterone receptors (64.2 %). Only 23.1 % of patients had a prior personal history of depression and 40.2 % of patients had a family history of breast cancer, and only 12.7 % of women presented with a breast cancer recurrence. However, 41 % (P=0.019) of patients who reported a score of ≥7 on the DT had a prior personal history of depression. The median



STAFF NOTES
UNIVERSITY HEALTH CARE
HUNTSMAN CANCER HOSPITAL
SALT LAKE CITY, UTAH 84112

Emotional Needs Questionnaire

Feeling distressed is a normal reaction to serious illness. Assistance with emotional distress is part of your comprehensive treatment.

PLEASE COMPLETE AND RETURN TO YOUR MEDICAL TEAM

Name: **Diagnosis:**

Date: **Phone:**

Step 1

Please circle the number (0-10) that best describes how much distress* you felt during the past week.

High Distress (8-10)
Overwhelming panic, despair, hopelessness.

Moderate Distress (5-7)
Worry, fear, sadness that interfere with daily activities and treatment.

Low Distress (0-4)
Worry, sadness, or fears that are mild and manageable.

10 9 8 7 6 5 4 3 2 1 0

Person completing this form: ☐ Self ☐ Other
Name:

Step 2

Check the problems that are causing you distress*.

Emotional Concerns
☐ Worry
☐ Sadness
☐ Depression
☐ Anxiety

Family Concerns
☐ Dealing with Partner
☐ Dealing with Children
☐ Poor Support System

Physical Concerns
☐ Pain
☐ Sleep
☐ Fatigue
☐ Bathing / Dressing
☐ Nausea
☐ Body Image
☐ Sexual Problems

Practical Concerns
☐ Housing
☐ Financial / Insurance
☐ Work
☐ Transportation

Spiritual Concerns
☐ No Spiritual Support
☐ Other _____

Any Other Concerns:

*Distress is a normal part of having a serious illness. Certain signs or symptoms may indicate that distress is becoming excessive. These may include feeling overwhelmed by fears to the point of panic or an overpowering sense of dread; feeling despair and hopelessness, or having constant thoughts about the illness.

Fig. 1 Distress thermometer screening tool

elapsed time from diagnosis to administration of the DT screening tool was 13 days for those scoring ≥7, 25 days for patients scoring 4 to <7, and 45 days for patients scoring <4 ($P<0.001$). One hundred ten patients (48 %) received the DT screening tool within the first 30 days of their diagnosis. The distribution of demographic and oncologic characteristics of patients is included in Table 1.

Distress thermometer

The mean DT score at intake for all patients ($n=229$) was 4.09 (SD ±2.43) with a range of 0.0–10. Forty-two percent ($n=97$) of our population scored <4, 42 % ($n=95$) scored ≥4 to <7, and 16 % ($n=37$) scored ≥7. While most patients with a DT score ≥4 to <7 listed no family, practical, and spiritual

Table 1 Descriptive statistics by DT score: demographic and oncologic data

	<4 *N*=97	4 to <7 *N*=95	≥7 *N*=37	Test statistic
Age	47.0 58.0 68.0	46.5 57.0 65.0	44.0 53.0 63.0	$F_{2,226}$=0.98, *P*=0.378[a]
Ethnicity				
African American	1 % (1)	0 % (0)	0 % (0)	$\chi^2_{14} = 17$, *P*=0.256[b]
American Indian	0 % (0)	1 % (1)	0 % (0)	
Asian	2 % (2)	2 % (2)	5 % (2)	
Caucasian	78 % (76)	78 % (74)	68 % (25)	
Hispanic	3 % (3)	1 % (1)	0 % (0)	
Multiracial	1 % (1)	2 % (2)	8 % (3)	
Other	0 % (0)	0 % (0)	3 % (1)	
Unknown	14 % (14)	16 % (15)	16 % (6)	
Education/employment				
Employed	57 % (55)	55 % (52)	49 % (18)	$\chi^2_8 = 8.61$, *P*=0.376[b]
Homemaker	11 % (11)	13 % (12)	8 % (3)	
Retired	20 % (19)	20 % (19)	19 % (7)	
Unemployed	6 % (6)	12 % (11)	19 % (7)	
Unknown	6 % (6)	1 % (1)	5 % (2)	
ER status				
Negative	27 % (26)	35 % (33)	19 % (7)	$\chi^2_4 = 4.9$, *P*=0.298[b]
Positive	72 % (70)	63 % (60)	81 % (30)	
Unknown	1 % (1)	2 % (2)	0 % (0)	
PR status				
Equivocal	2 % (2)	0 % (0)	0 % (0)	$\chi^2_6 = 4.63$, *P*=0.592[b]
Negative	32 % (31)	37 % (35)	30 % (11)	
Positive	65 % (63)	61 % (58)	70 % (26)	
Unknown	1 % (1)	2 % (2)	0 % (0)	
Stage				
0	12 % (12)	13 % (12)	5 % (2)	$\chi^2_{10} = 12.32$, *P*=0.264[b]
I	39 % (38)	26 % (25)	22 % (8)	
II	33 % (32)	32 % (30)	38 % (14)	
III	10 % (10)	18 % (17)	22 % (8)	
IV	4 % (4)	7 % (7)	11 % (4)	
Unknown	1 % (1)	4 % (4)	3 % (1)	
Personal history of depression				
No	97 % (76)	82 % (78)	59 % (22)	$\chi^2_2 = 7.89$, *P=0.019*[b]
Yes	22 % (21)	18 % (17)	41 % (15)	
Marital status				
Divorced	12 % (12)	13 % (12)	16 % (6)	$\chi^2_8 = 5.81$, *P*=0.668[b]
Married	67 % (65)	71 % (67)	62 % (23)	
Single	7 % (7)	9 % (9)	14 % (5)	
Unknown	0 % (0)	1 % (1)	0 % (0)	
Widowed	13 % (13)	6 % (6)	8 % (3)	
Family history of breast cancer				
No	54 % (52)	58 % (55)	73 % (27)	$\chi^2_4 = 5.36$, *P*=0.252[b]
Unknown	1 % (1)	1 % (1)	3 % (1)	
Yes	45 % (44)	41 % (39)	24 % (9)	
Recurrence				
No	90 % (87)	87 % (83)	81 % (30)	$\chi^2_2 = 1.8$, *P*=0.408[b]
Yes	10 % (10)	13 % (12)	19 % (7)	
Status				
NED	2 % (2)	0 % (0)	0 % (0)	$\chi^2_4 = 4.43$, *P*=0.351[b]

Table 1 (continued)

	<4 *N*=97	4 to <7 *N*=95	≥7 *N*=37	Test statistic
S/P diagnosis	91 % (88)	97 % (92)	95 % (35)	
Suspicious	7 % (7)	3 % (3)	5 % (2)	
Elapsed time	21.0 45.0 89.0	13.5 25.0 50.0	6.0 13.0 37.0	$F_{2,226}= 7.76, P< 0.001$[a]

Numbers after percents are frequencies. $P<.05$ is considered significant. Significant values are presented in italics

For continuous variables Age and Elapsed time, the three values indicate lower, median and upper quartile respectively, *NED* no evidence of disease, *ER* estrogen receptor, *PR* progesterone receptor

[a] Kruskal–Wallis test

[b] Pearson test

concerns, 37 % of patients with a DT score ≥4 to <7 listed one emotional concern and 29 % listed two physical concerns. Similarly, 30 % of patients with a DT score ≥7 listed one emotional concern and 27 % listed two physical concerns. The frequency and distribution of patient concerns is listed in Table 2.

Table 2 Descriptive statistics by DT score and patient concerns

	<4 *N*=97	4 to <7 *N*=95	≥7 *N*=37	Test statistic
Emotional concerns				
0	40 % (39)	8 % (8)	8 % (3)	$\chi^2_8 = 76.8, P< 0.001$
1	51 % (49)	37 % (35)	30 % (11)	
2	6 % (6)	35 % (33)	22 % (8)	
3	1 % (1)	13 % (12)	16 % (6)	
4	2 % (2)	7 % (7)	24 % (9)	
Family concerns				
0	82 % (80)	62 % (59)	54 % (20)	$\chi^2_4 = 16.69, P= 0.002$
1	13 % (13)	28 % (27)	27 % (10)	
2	4 % (4)	9 % (9)	19 % (7)	
Physical concerns				
0	56 % (54)	23 % (22)	19 % (7)	$\chi^2_{12} = 62.95, P< 0.001$
1	29 % (28)	24 % (23)	11 % (4)	
2	9 % (9)	29 % (28)	27 % (10)	
3	3 % (3)	15 % (14)	16 % (6)	
4	3 % (3)	5 % (5)	14 % (5)	
5	0 % (0)	2 % (2)	14 % (5)	
7	0 % (0)	1 % (1)	0 % (0)	
Practical concerns				
0	74 % (72)	64 % (61)	59 % (22)	$\chi^2_6 = 13.17, P= 0.04$
1	22 % (21)	20 % (19)	24 % (9)	
2	3 % (3)	14 % (13)	8 % (3)	
3	1 % (1)	2 % (2)	8 % (3)	
Spiritual concerns				
0	96 % (93)	98 % (93)	86 % (32)	$\chi^2_2 = 7.75, P= 0.021$
1	4 % (4)	2 % (2)	14 % (5)	

Numbers after percents are frequencies. Test used: Pearson test. $P<.05$ was considered significant. Significant values are presented in italics

Variables associated with a DT score ≥4

Univariate logistic regression analysis indicates that emotional concerns (Odds ratio=3.58, CI=2.41–5.31, $P<0.001$), family concerns (Odds ratio=2.34, CI=1.44–3.80, $P=0.0006$), physical concerns (Odds ratio=2.19, CI=1.67–2.87, $P<0.0001$), and practical concerns (Odds ratio=1.65, CI=1.11–2.44, $P=0.0125$) were independently associated with a greater odds of having a DT score ≥4. Additionally, those patients who received their initial DT screen between 31 and 350 days after receiving their breast cancer diagnosis had a lower odds (OR=0.26, CI=0.14–0.47, $P=0.0338$) of having a DT score ≥4 when compared to patients who received their initial screen within the first 30 days after receiving their diagnosis (Table 3).

Multivariate logistic regression analysis also indicates that emotional concerns (Odds ratio=2.71, CI=1.77–4.14, $P<0.0001$) and physical concerns (Odds ratio=1.82, CI=1.35–2.44, $P<0.0001$) were associated with a greater odds of reporting a DT score ≥4. Additionally, being unemployed was associated with a greater than fourfold increased odds of reporting a DT score ≥4 (OR=4.27, CI=1.22–14.88, $P=0.0228$; Table 4).

Variables associated with a DT score ≥7

Univariate logistic regression analysis predicts that having family concerns (OR=1.89, CI=1.16–3.07, $P=0.102$) and physical concerns (OR=1.70, CI=1.33–2.17, $P<0.0001$) were associated with an increased odds having a DT score ≥7. Spiritual concerns had a significant association in this group with a greater than fourfold increased odds of having a DT score ≥7 (OR=4.84, CI=1.40–16.82, $P=0.0130$). Additionally, patients with a prior personal history of depression had a 2.76 times higher odds of reporting a DT score ≥7 (CI=1.31–5.83, $P=0.0076$; Table 3).

When controlling for other variables in the multiple logistic regression model, emotional concerns (OR=1.59, CI=1.09–2.33, $P=0.0168$) and physical concerns (OR=

Table 3 Univariate analysis of variables associated with a DT score ≥4 or a DT score ≥7

Effect	Odds of having a Therm score ≥4			Odds of having a Therm score ≥7		
	Odds	Lower CL	Upper CL	Odds	Lower CL	Upper CL
Pre-diagnosis vs first 30 days	*0.12*	*0.02*	*0.61*	0.46	0.05	3.96
At diagnosis vs first 30 days	1.74	0.19	15.64	0.65	0.72	5.82
First 30 days	1.00	NA	NA	1.00	NA	NA
31–350 days vs first 30 days	*0.26*	*0.14*	*0.47*	*0.34*	*0.15*	*0.75*
>350 days vs first 30 days	0.77	0.24	2.43	0.75	0.19	2.85
Emotional concerns	*3.58*	*2.41*	*5.31*	*1.95*	*1.45*	*2.64*
Family concerns	*2.34*	*1.44*	*3.80*	*1.89*	*1.16*	*3.07*
Physical concerns	*2.19*	*1.67*	*2.87*	*1.70*	*1.33*	*2.17*
Practical concerns	*1.65*	*1.11*	*2.44*	1.42	0.94	2.15
Spiritual concerns	1.30	0.37	4.58	*4.84*	*1.40*	*16.82*
Age 50–60	1.00	NA	NA	1.00	NA	NA
Age <50 vs 50–60	0.92	0.48	1.79	1.87	0.77	4.55
Age >60 vs 50–60	0.77	0.41	1.47	1.16	0.46	2.95
Caucasian	1.00	NA	NA			
Other vs. Caucasian	1.21	0.65	2.25	1.71	0.79	3.70
Employed	1.00	NA	NA	1.00	NA	NA
Homemaker vs employed	1.07	0.46	2.52	0.78	0.21	2.85
Retired vs employed	1.08	0.54	2.14	1.10	0.42	2.83
Unemployed vs employed	2.36	0.88	6.34	2.45	0.89	6.73
Unknown vs employed	0.39	0.09	1.64	1.70	0.33	8.83
ER positive	1.00	NA	NA	1.00	NA	NA
ER negative vs positive	1.20	0.67	2.15	0.51	0.21	1.24
ER unknown vs positive	1.56	0.14	17.50	0.00	0.00	inf
PR positive	1.00	NA	NA	1.00	NA	NA
PR negative vs positive	1.15	0.66	2.01	0.79	0.37	1.70
PR unknown vs positive	1.55	0.14	17.44	0.00	0.00	inf
Stage I	1.00	NA	NA	1.00	NA	NA
Stage II vs I	1.58	0.83	3.04	1.78	0.70	4.54
Stage III vs I	*2.88*	*1.21*	*6.87*	2.33	0.79	6.86
Stage IV vs 1	3.17	0.92	10.90	2.86	0.73	11.16
Stage unknown	4.61	0.49	43.28	0.00	0.00	inf
Personal history of depression	1.16	0.62	2.17	*2.76*	*1.31*	*5.83*
Married	1.00	NA	NA	1.00	NA	NA
Other vs married	1.25	0.66	2.40	1.54	0.69	3.42
Widow vs married	0.50	0.20	1.24	0.91	0.25	3.31
No family history of breast cancer	1.00	NA	NA	1.00	NA	NA
Family history of breast cancer unknown vs none	1.27	0.11	14.34	1.98	0.17	22.67
Family history of breast cancer vs none	0.69	0.40	1.18	*0.43*	*0.19*	*0.96*
Recurrence	1.46	0.65	3.31	1.80	0.71	4.59
Status S/P diagnosis	1.00	NA	NA	1.00	NA	NA
Status NED	0.00	0.00		0.00	0.00	
Status suspicious	0.49	0.15	1.61	1.03	0.22	4.90

Significant values are presented in italics

NED no evidence of disease, *NA* referent group, *inf* approaching infinity, *CL* confidence level

Table 4 Multivariate analysis of variables associated with a DT score ≥4 or a DT score ≥7

Effect	Odds of having a Therm score ≥4				Odds of having a Therm score ≥7			
	Odds	Lower CL	Upper CL	*P* value	Odds	Lower CL	Upper CL	*P* value
Pre-diagnosis vs first 30 days	0.36	0.06	2.27	0.2757	0.85	0.08	9.04	0.8924
At diagnosis vs first 30 days	1.15	0.10	13.54	0.9128	0.64	0.06	6.64	0.7047
First 30 days	1.00	NA	NA	NA	1.00	NA	NA	NA
31–350 days vs first 30 days	0.35	0.17	0.73	*0.0050*	0.40	0.16	1.02	0.0557
>350 days vs first 30 days	0.91	0.24	3.50	0.8943	0.68	0.13	3.53	0.6427
Emotional concerns	2.71	1.77	4.14	*<0.0001*	1.59	1.09	2.33	*0.0168*
Physical concerns	1.82	1.35	2.44	*<0.0001*	1.54	1.14	2.08	*0.0051*
Spiritual concerns					5.76	1.39	23.94	*0.0160*
Personal history of depression					3.49	1.44	8.45	*0.0057*
Unemployed	4.27	1.22	14.88	*0.0228*	3.01	0.91	9.94	0.0713
Other vs Caucasian					2.78	1.08	7.18	*0.0347*

P<.05 is considered significant. Significant values are presented in italics

NA referent group, *CL* confidence level

1.54, CI=1.14–2.08, *P*<0.0051) were associated with an increased odds of reporting a DT score ≥7. Again, having spiritual concerns was highly associated with reporting a DT score ≥7 (OR=5.76, CI=1.39–23.94, *P*=0.0160). As with the univariate analysis, this model also predicts that patients reporting a prior personal history of depression have an increased likelihood of reporting a DT score ≥7 (OR=3.49, CI=1.44–8.45, *P*=0.0057). Race/ethnicity was categorized as Caucasian or Other (non-Caucasian) in the logistic regression models, and it was found that non-Caucasian patients were 2.78 times (CI=1.08–7.18, *P*=0.0347) more likely to report a DT score ≥7 than Caucasian patients (Table 4).

Variables associated with a DT score ≥4 within the first 30 days

Emotional concerns (OR=2.92, CI=1.51–5.65, *P*=0.0014) and physical concerns (OR=2.40, CI=1.40–4.13, *P*=0.0015) were associated with an increased odds of having a DT score ≥4 for those patients receiving their initial DT screen within the first 30 days after diagnosis (*n*=110; Table 5). These associations were also found to be significant in the multiple logistic regression model (see Table 6).

Variables associated with a DT score ≥7 within the first 30 days

Again, emotional concerns (OR=1.71, CI=1.10–2.6405, *P*=0.0164) and physical concerns (OR=1.51, CI=1.07–2.1270, *P*=0.0178) were found to be significantly associated with an increased odds of having a DT score ≥7 when initially screened within the first 30 days after diagnosis (Table 5). This model also indicates a relationship between days elapsed from time of diagnosis to initial screening in the 30-day time period and odds of a score ≥7 (OR=0.90, CI=0.84–0.9698, *P*=0.0053). Finally, patients who presented with recurrent disease were almost four times more likely to report a DT score ≥7 (OR=3.88, CI=1.01–14.9662, *P*=0.0488) than those patients who were not presenting for recurrent disease (Table 5).

The multivariate model also predicts that as time elapses within the first 30 days from diagnosis to initial screening, those patients receiving their initial DT screen later had a decreased odds of reporting a DT score ≥7 (OR=0.89, CI=0.82–0.9580, *P*=0.0023). The association between physical concerns and a score ≥7 was also found to be significant in the multiple logistic regression model (see Table 6).

Locally weighted scatterplot smoothing (LOWESS)

Patients receiving their initial screen after a recent diagnosis of breast cancer (within 30 days) had the highest likelihood of scoring ≥4 and ≥7 on the DT screening tool (Fig. 2). There is a general decline in the likelihood of reporting a DT score ≥4 or a DT score ≥7 as time elapses in the first 30 days after receiving a diagnosis of breast cancer (Fig. 3). There is also an increased likelihood of reporting an elevated DT score in those patients receiving their initial screen more than 1 year after receiving a diagnosis of breast cancer (Fig. 2).

Discussion

Our study examined the clinical and epidemiological factors that are associated with an elevated DT score in patients

Table 5 Univariate analysis of the association between variables during the first 30 days post-diagnosis and a DT score ≥4 or a DT score ≥7

Effect	Odds of having a DT score ≥4				Odds of having a DT score ≥7			
	Odds	Lower CL	Upper CL	*P* value	Odds	Lower CL	Upper CL	*P* value
Elapsed time (days)	0.97	0.91	1.02	0.2586	0.90	0.84	0.9698	*0.0053*
Emotional concerns	2.92	1.51	5.65	*0.0014*	1.71	1.10	2.6405	*0.0164*
Family concerns	1.53	0.76	3.10	0.2338	1.31	0.69	2.4814	0.4087
Physical concerns	2.40	1.40	4.13	*0.0015*	1.51	1.07	2.1270	*0.0178*
Practical concerns	1.34	0.74	2.42	0.3354	1.07	0.61	1.8581	0.8171
Spiritual concerns	1.42	0.15	13.32	0.7615	5.45	0.85	34.9832	0.0741
Age 50–60	1.00	NA	NA		1.00	NA	NA	
Age <50 vs 50–60	1.35	0.35	5.17	0.6575	1.66	0.44	6.3140	0.4550
Age >60 vs 50–60	0.65	0.19	2.16	0.4811	1.23	0.33	4.6089	0.7548
Caucasian	1.00	NA	NA		1.00	NA	NA	
Other vs. Caucasian	1.51	0.45	5.06	0.5051	2.08	0.71	6.1316	0.1833
Employed	1.00	NA	NA		1.00	NA	NA	
Homemaker vs employed	1.30	0.31	5.42	0.7221	0.64	0.12	3.3517	0.6017
Retired vs employed	1.24	0.38	4.04	0.7161	1.11	0.33	3.7032	0.8678
Unemployed vs employed	1.94	0.21	18.16	0.5596	1.77	0.29	10.9904	0.5385
Unknown vs employed	0.78	0.07	9.27	0.8425	7.09	0.59	85.6068	0.1235
ER positive	1.00	NA	NA		1.00	NA	NA	
ER negative vs positive	1.24	0.45	3.42	0.6760	0.25	0.07	0.9313	*0.0388*
ER unknown vs positive	38879.45	0.00	>999.999	0.9885	0.00	0.00	inf	0.9887
PR positive	1.00	NA	NA		1.00	NA	NA	
PR negative vs positive	1.03	0.39	2.70	0.9491	0.39	0.13	1.1826	0.0965
PR unknown vs positive	36755.78	0.00	>999.999	0.9886	0.00	0.00	inf	0.9887
Stage I	1.00	NA	NA		1.00	NA	NA	
Stage 0 vs I	1.29	0.28	5.89	0.7842	1.00	0.17	6.0275	0.8242
Stage II vs I	0.90	0.30	2.75	0.8601	1.36	0.37	5.0938	0.6446
Stage III vs I	44106.94	0.00	>999.999	0.9291	3.75	0.90	15.6563	0.0699
Stage IV vs 1	0.57	0.11	3.09	0.5159	3.75	0.63	22.2020	0.1452
Stage unknown	44106.94	0.00	>999.999	0.9697	0.00	0.00	inf	0.9848
Personal history of depression	0.63	0.24	1.69	0.3613	0.84	0.29	2.4219	0.7403
Married	1.00	NA	NA		1.00	NA	NA	
Other vs married	1.15	0.33	3.97	0.8287	2.14	0.68	6.8005	0.1959
Widow vs married	0.88	0.16	4.96	0.8869	1.57	0.28	8.9675	0.6110
No family history of breast cancer	1.00	NA	NA		1.00	NA	NA	
Family history of breast cancer unknown vs none	32161.31	0.00	>999.999	0.9737	>999.999	0.00	inf	0.9625

Table 5 (continued)

Effect	Odds of having a DT score ≥4				Odds of having a DT score ≥7			
	Odds	Lower CL	Upper CL	*P* value	Odds	Lower CL	Upper CL	*P* value
Family history of breast cancer vs none	0.69	0.26	1.85	0.9724	1.47	0.53	4.0534	0.9642
Recurrence	0.79	0.19	3.34	0.7488	3.88	1.01	14.9662	*0.0488*

$P<.05$ is considered significant. Significant values are presented in italics

NA referent group, *inf* approaching infinity, *CL* confidence level, *ER* estrogen receptor, *PR* progesterone receptor

with breast cancer. Routine screening of breast cancer patients at intake found that 42 % of the patients reported a DT score ≥4 to <7 and 16 % reported a DT score ≥7. Given this level of positive screening for distress as well as time and monetary constraints, it is important to refine distress screening procedures to better target those populations most likely to have elevated DT scores. Our study identifies three key points when screening breast cancer patients for distress: (1) time of initial screening should be targeted to capture when patients are most likely to report an elevated DT score; (2) interventions should be targeted to address specific patient concerns; and (3) certain patient characteristics are associated with elevated DT scores.

Patients in our study presented at different time points relative to their diagnosis of breast cancer. Logistic regression models and Lowess smoothing demonstrate that the likelihood of reporting an elevated DT score is highest in those patients receiving their initial screen during the first 30 days after receiving a diagnosis of breast cancer. We found that as time elapses, those patients receiving their initial screen further from the time of diagnosis had a decreased likelihood of an elevated DT score. This is contrary to what other studies have found. For example, Dabrowski et al. did not find that time since diagnosis predicted elevated levels of distress in a univariate analysis of DT results from breast cancer patients [15]. Our study suggests that initial screening should occur within the first 30 days since diagnosis as this is a time when patients are most likely to report distress. Receiving a diagnosis of breast cancer is known to be stressful to women [8]. The time between diagnosis and subsequent staging and treatment is often a time of heightened anxiety and distress about the unknown impact this diagnosis may have on the patient's quality of life. Targeting this time period for initial screening and intervention may help lessen distress and better prepare these patients to handle their upcoming treatment. We also found that there is an increased likelihood of reporting an elevated DT score in those patients receiving their initial screen more than 1 year after receiving a diagnosis of breast cancer. The reason for this is unclear but could signify a stressful landmark for patients battling breast cancer. This study did not evaluate the effect of time on an individual's distress level. Nevertheless, based on the finding of elevated distress in patients receiving their initial screening greater than 1 year after diagnosis, perhaps when designing distress screening protocols, screening should again be performed 1 year after diagnosis.

Univariate and multivariate logistic regression models indicate that patients reporting emotional and physical concerns had an increased likelihood of screening positive. These results are not unexpected. Emotions such as fear and sadness are common responses to a new diagnosis of cancer and women with breast cancer often voice their concern about

Table 6 Multivariate analysis of the association between variables during the first 30 days post-diagnosis and a DT score ≥4 or a DT score ≥7

Effect	Odds of having a DT score ≥4				Odds of having a DT score ≥7			
	Odds	Lower CL	Upper CL	P value	Odds	Lower CL	Upper CL	*P* value
Elapsed time (days)	0.96	0.90	1.03	0.2462	0.89	0.82	0.9580	*0.0023*
Emotional concerns	2.264	1.139	4.498	*0.0197*				
Physical concerns	2.014	1.141	3.554	*0.0157*	1.697	1.17	2.461	*0.0053*

P<.05 is considered significant. Significant values are presented in italics

CL confidence level

the potential physical deformity that can result with the treatment for breast cancer. In fact physical concerns are a topic that has received much attention with physicians through research in outcomes of breast conservation surgery and utilization of reconstructive resources. Interventions designed to treat distressed and depressed breast cancer patients should focus on addressing and alleviating specific emotional and physical concerns that a patient may express. Our study also found that spiritual concerns were highly associated (four to five times increased odds) with reporting a DT score ≥7. Several previous studies have demonstrated a positive relationship between spirituality and well-being [16–18]. This suggests that spirituality or a lack thereof is an issue experienced by many patients in the extremes of distress or when depressed. Resources for spiritual guidance should be made available to breast cancer patients, particularly to those scoring ≥7 on the distress thermometer.

This study identifies four specific groups of patients who should be targeted for aggressive screening; patients with a prior diagnosis of depression, patients presenting with recurrent disease, unemployed patients, and patients of a race/ethnicity other than Caucasian. Each of these groups had a higher likelihood of reporting a score of ≥4 and a score ≥7 using the DT screening tool. This is not to say that these are the only patients who may report elevated scores, but when designing a screening and treatment protocol, institutions should be aware of these groups and their predilection for elevated DT scores.

Our study is not without limitations. Our analyses have found variables associated with reporting an elevated DT score in the breast cancer population, however this data is unable to define a cause and effect relationship between these variables and the elevated score. Additionally, we were limited by a single institutions' patient population. For example, our analysis did not find any correlation between marital status and an elevated score. This may be due to underpowering as the majority of our patients were married. With a larger patient sample, we may have reached statistical significance. On the other hand, it is possible that marital status does not play a significant role and that patients who are unmarried or divorced have alternate support mechanisms. Another limitation to consider is that only subjects who filled out the DT and problem list questionnaire were analyzed. Sixteen patients chose not to fill

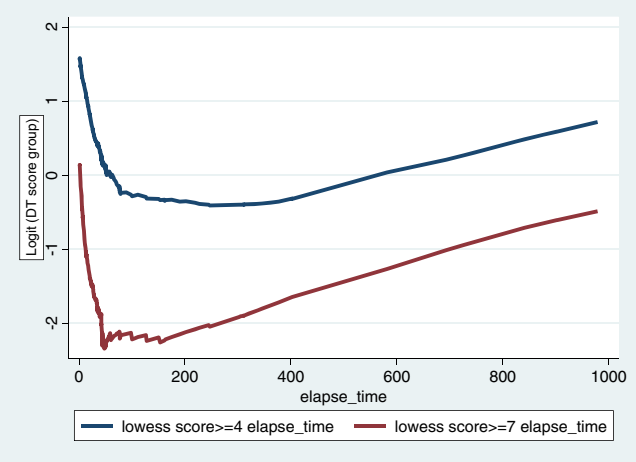


Fig. 2 LOWESS curve indicates that the likelihood of reporting a DT score ≥4 or a DT score ≥7 is highest in those patients receiving their initial screen during the first 30 days post-diagnosis. There is also an increased likelihood of reporting an elevated DT score in those patients receiving their initial screen more than 1 year after receiving a diagnosis of breast cancer

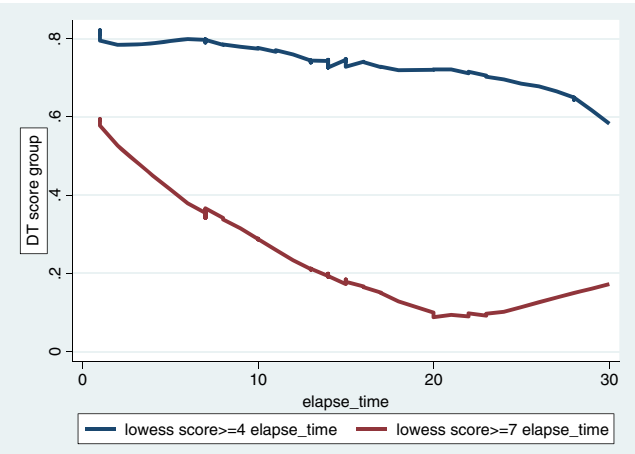


Fig. 3 LOWESS curve indicates that the likelihood of reporting a DT score ≥4 or a DT score ≥7 generally decreases over time for those patients receiving their initial screening within the first 30 days post-diagnosis

out the form and therefore they provided no data for analysis. This could have introduced some bias in the analysis, however all new patients were given the questionnaire.

At our institution, the initial distress screening is performed by a trained medical assistant. If a patient scores 4 or greater, our team's designated social worker evaluates the patient and determines whether further treatment or referral to psychiatry is warranted. If a patient scores 7 or greater, they are directly referred to a psychiatrist for further evaluation and treatment as necessary. While these protocols may vary from institution to institution, it is likely that patients with breast cancer are at risk for distress and depression regardless the institution. Therefore, future research should focus on outcomes of treatment for patients reporting elevated DT scores. If certain patient populations are targeted for more intense screening, research should be conducted to assess outcomes of the screening. Future research should also focus on whether psychosocial treatment of breast cancer patients who report an elevated DT score conveys a survival benefit.

Conclusion

Our study found that the likelihood of reporting an elevated DT score is highest in those patients receiving their initial screen during the first 30 days after receiving a diagnosis of breast cancer. Univariate and multivariate logistic regression models indicate that patients reporting emotional and physical concerns had an increased likelihood of screening positive on the DT screening tool. This study also identifies four specific groups of patients who should be targeted for aggressive screening: patients with a prior diagnosis of depression, patients presenting with recurrent disease, unemployed patients, and patients of a race/ethnicity other than Caucasian.

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