Psycho-Oncology
Psycho-Oncology **16**: 1046–1049 (2007)
Published online 15 May 2007 in Wiley InterScience (www.interscience.wiley.com). **DOI**: 10.1002/pon.1212

Brief Report

Screening adult survivors of childhood cancer with the distress thermometer: a comparison with the SCL-90-R

Christopher J. Recklitis[1]*, Ilana Licht[2], Jennifer Ford[3], Kevin Oeffinger[4,5] and Lisa Diller[1]

[1] *Perini Family Survivors' Center, Dana-Farber Cancer Institute, Boston, MA 02115, USA*

[2] *Department of Psychology, Suffolk University, Boston, MA, USA*

[3] *Department of Psychiatry & Behavioral Sciences, Memorial Sloan-Kettering Cancer Center, 1275 York Avenue, New York, NY 10021, USA*

[4] *Department of Pediatrics, Memorial Sloan-Kettering Cancer Center, 1275 York Avenue, New York, NY 10021, USA*

[5] *Department of Family Medicine, University of Texas Southwestern Medical Center, 11937 US Highway 271, Tyler, TX 75708-3154, USA*

**Correspondence to: Perini Family Survivors' Center, Dana-Farber Cancer Institute, 44 Binney Street, Boston, MA 02115 USA. E-mail: Christopher_Recklitis@dfci.harvard.edu*

Received: 21 September 2006
Revised: 7 March 2007
Accepted: 12 March 2007

Abstract

As the number of cancer survivors continues to grow, identification of brief, valid psychological screening measures will be a critical step in providing them with appropriate psychosocial care. The distress thermometer (DT) is a one-item distress screening that is recommended by the National Comprehensive Cancer Network (NCCN) for screening cancer patients, but has not been evaluated for cancer survivors. This study evaluated the validity of the DT compared to the Symptom Checklist-90-Revised (SCL-90-R) in a sample of 119 adult survivors of childhood cancer aged 18–45 (median = 23.5). Results indicated that when using the NCCN suggested cut-off score of 5, the DT only identified 20 of the 36 SCL-90-R-positive cases of psychological distress (sensitivity 55.6%; specificity 80.7%). Using an alternative DT cut-off score of 4 identified 23 of the 36 SCL-90-R-positive cases (sensitivity 63.9%; specificity 65.1%). Receiver operating characteristics analysis indicated that the DT had only fair diagnostic utility relative to the SCL-90-R (AUC = 0.72). Results do not support the validity of the DT in adult survivors of childhood cancer.

Keywords: cancer; oncology; pediatric; survivors; screening

Introduction

It is generally recognized that a significant proportion of cancer survivors will experience complications of their treatment [1] including psychological late-effects. While most investigators agree that the majority of survivors do not have significant psychological problems, several studies have reported that a significant minority of survivors have some psychological late-effects, with most studies finding evidence of maladjustment, but not necessarily a psychiatric diagnosis [2–6].

Unfortunately, studies show that psychological difficulties often go undetected in routine oncology care (e.g. [7]), suggesting that survivors' psychological problems may be under-diagnosed and under-treated. To adequately identify psychological problems, screening as a means of case identification is becoming more widely advocated for both cancer patients and cancer survivors (e.g. [8,9]).

Several brief measures, such as the 14-item Hospital Anxiety and Depression Scale and the 18-item Brief Symptom Inventory-18 (BSI-18), have been supported to screen cancer patients and survivors (e.g. [10,11]), but the time and effort needed to administer and score even these brief measures remain a barrier to their widespread use [12]. To incorporate psychological screening into routine survivor care, a very simple and rapid measure is required. The briefest measure developed to assess distress in the cancer population is the one-item distress thermometer (DT) [13]. Several studies have examined the validity of the DT by reporting its agreement with established distress measures [12–14] and the National Comprehensive Cancer Network (NCCN) promotes it as the initial screening tool for assessing distress in cancer patients [15].

This research indicates that the DT may have promise for screening cancer patients, but no studies have evaluated its utility for screening cancer survivors. While the application to survivors extends the DT beyond its initial intended design, the growing need for a rapid screening for survivors could be addressed if the DT could be validated in this population. This study addresses that question by examining the DT in a sample of adult survivors of childhood cancer. Childhood cancer survivors are of particular interest, as the

majority of pediatric patients are cured of their initial cancer and live on into adulthood, representing a group of patients at risk for a variety of late-effects over many years later in life [2]. In this study, screening properties of the DT were compared to the Symptom Checklist-90-Revised (SCL-90-R) [16], a widely used self-report measure of psychological symptoms. Analyses examined the overall classification agreement of the DT and the SCL-90-R, and the adequacy of the two proposed DT cut-off scores for detecting distress in this population.

Method

Participants

Participants were adult survivors of childhood cancer seen in a survivor clinic at one of three institutions. One hundred and twenty-two subjects were recruited and 119 (66 women and 53 men) agreed to participate. Age ranged from 18 to 45 (median = 23.5 years) and age at diagnosis ranged from birth to 19 years (median = 11.2). Time since diagnosis ranged from 2.6 to 30.3 years (median = 14.9 years). Ninety-four (79%) participants were White, and 38 (31.9%) had a college education. Participants' cancer diagnoses were: leukemias 35.3% (42), lymphomas 24.4% (29), sarcomas 21.8% (26), and other solid tumors 18.5% (22), including Wilms tumor 5.9% (7) and neuroblastoma 2.5% (3).

Procedure

This study was conducted as part of a larger study of computer administered psychological screening. During a clinic visit, consenting participants completed a screening battery including demographics and the distress thermometer on a laptop computer, before completing the SCL-90-R on paper. The institutional review boards of the medical centres approved the procedures.

Materials

Demographic information

Participants reported their demographic information into the computer program. Cancer diagnosis and time since diagnosis were obtained from medical records.

Distress thermometer (DT)

The DT is a single-item, self-reported measure of psychological distress. This visual-analogue scale has scores from 0 'no distress' to 10 'extreme distress'. Using the scale, patients were asked to rate how distressed they felt in the past week.

The Symptom Checklist-90-Revised (SCL-90-R)

The SCL-90-R is a 90-item self-report symptom checklist. Respondents rate items on a five-point scale reflecting their distress during the past 7 days. Scores are generated for nine symptom scales and an overall Global Severity Index (GSI). Using gender-specific normative data, scores are transformed into *T*-scores.

The SCL-90-R is the 'parent' measure from which both the 53-item BSI and the 18-item BSI-18 were derived. Unlike these measures, the SCL-90-R is not a screening instrument, but a more in-depth measure of psychopathological symptoms. It was chosen as the criterion measure against which to compare the DT because of its superior reliability and extensive validation in psychiatric, medical, and oncology samples [16,17].

Statistical analysis

Subjects were classified as clinical cases or non-cases based on the published SCL-90-R standard case rule (GSI *t*-score, or any two subscale *t*-scores $\geqslant 63$ = clinical case) which was used as the 'gold standard' against which the DT was compared. Each of two previously published DT cut-off scores, 4 [12,18] and 5 [13,15], was compared with the SCL-90-R classification with sensitivity and specificity used to quantify agreement. Sensitivity here reflects the DT's ability to accurately identify survivors classified as significantly distressed on the SCL-90-R. Specificity captures the DTs ability to correctly identify patients classified as not having significant distress. Sensitivity and specificity vary from 0 to 1.0, with higher values reflecting better agreement. Previous studies of depression and anxiety screening instruments have demonstrated sensitivities $\geqslant 0.90$ and specificities $\geqslant 0.75$ in studies with oncology samples [11,19]. Based on these reports we determined a DT cut-off score would need to demonstrate sensitivity $\geqslant 0.90$ and specificity $\geqslant 0.75$ to be recommended for use with this population.

Receiver operating characteristics (ROC) analysis was applied to the DT and SCL-90-R classification data. Area under the ROC curve (AUC) quantifies discrimination and summarizes the diagnostic utility of a screening test. AUC values vary from 0 to 1, with values $\geqslant 0.80$ reflecting good discrimination, and values $\geqslant 0.90$ reflecting excellent discrimination.

Results

Subjects reported DT scores across the range of possible responses (Figure 1). Sixty-seven survivors (56.3%) reported low levels of distress (DT scores 0–3), 34 survivors (28.6%) reported moderate levels of distress (DT scores 4–6), and 18 (15.1%)

DOI: 10.1002/pon

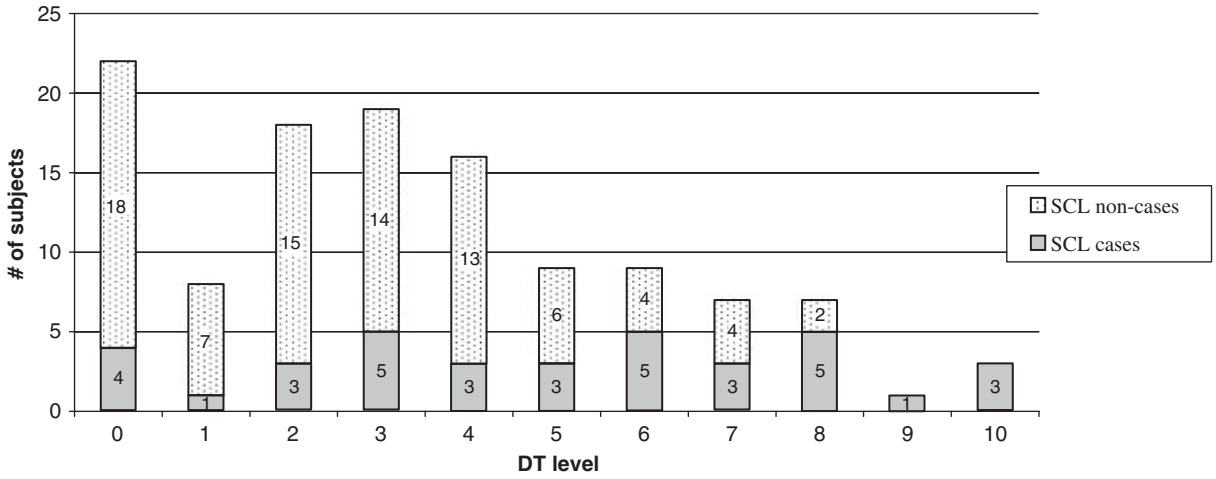

Figure 1. SCL-90-R case status by DT score

reported high levels of distress (DT $\geqslant$ 7). The SCL-90-R identified 36 participants (30.25%) as clinical cases, indicating they had significant distress. These SCL-90-R-positive subjects reported DT scores across the range, with 13 of these 36 cases having low DT scores, 11 having moderate scores and 12 reporting high levels of distress on the DT (Figure 1).

Using the NCCN recommended cut-off score of 5, the DT identified 20 of the 36 SCL-90-R cases. Sensitivity was 55.6%, specificity was 80.7%. Using the alternative cut-off score of 4 [12], the DT identified 23 of the SCL-90-R cases; Sensitivity improved to 63.9% and specificity dropped to 65.1%. In the ROC analysis AUC was 0.72, indicating the DT had only fair diagnostic utility relative to the SCL-90-R. Finally, each DT score was evaluated as a potential cut-off score by calculating its sensitivity and specificity with the SCL-90-R criterion (Table 1). No cut-off score met the criteria of sensitivity $\geqslant$0.90 and specificity $\geqslant$0.75 set for this study.

Table 1. Sensitivity and specificity values of distress thermometer (DT) cut-off scores

DT	Sensitivity (%)	Specificity (%)
$\geqslant$0	100	0
$\geqslant$1	88.9	21.7
$\geqslant$2	86.1	30.1
$\geqslant$3	77.8	48.2
$\geqslant$4	63.9	65.10
$\geqslant$5	55.6	80.7
$\geqslant$6	47.2	88.0
$\geqslant$7	33.3	92.8
$\geqslant$8	25.0	97.6
$\geqslant$9	10.8	100
$\geqslant$10	8.3	100

Discussion

The DT had limited agreement with the SCL-90-R in this sample of adult survivors of childhood cancer. The NCCN recommended DT cut-off score of 5 missed almost half of the distressed individuals. While the alternative cut-off score of 4 demonstrated improved sensitivity, it also missed more than a third of SCL-90-R cases. ROC analysis found the DT had only marginal ability to discriminate SCL-90-R cases from non-cases. No potential DT cut-off score had acceptable sensitivity and specificity as defined in the study.

Previous studies of the DT in cancer patients have concluded that the measure is clinically useful, though data on its psychometric properties have not been consistently strong. In one study, the DT yielded a sensitivity of only 59% (specificity = 71%) compared to the BSI criteria, and a sensitivity of 70% (specificity = 64%) against the BSI-18 [14]. Even in studies reporting the strongest results, the DT sensitivity has only been as high as 80% (specificity = 70%) [18]. Similarly, AUC analyses have shown fair to good discrimination at 0.74–0.80, but data have not provided a clearly preferable cut-off score, with scores of both 4 and 5 being proposed [12–15].

Though previous assessments of the DT in cancer patients have not consistently demonstrated a high degree of diagnostic accuracy, results reported here are weaker than in previous DT studies, suggesting that the DT is less valid as a screen for cancer survivors than it has previously been found to be in cancer patients. Differences between reports of the DT in cancer patients versus survivors may reflect important differences in the populations. Physical and emotional challenges of active cancer therapy may give patients more similar health states that serve as a more homogeneous basis of comparison from which to rate distress. Changes in quality-of-life several years post-treatment may alter survivors' experience and understanding of the meaning of 'distress' as reported on the DT.

DOI: 10.1002/pon

Limitations in the current study should be noted. First, only one criterion measure was used to validate the DT. A preferable design would have included additional measures such as a structured diagnostic interview against which to validate the DT. Second, past studies administered a pencil-and-paper version of the DT, while in this study the DT was completed on a computer. Different modes of administration could possibly bias the study toward underestimating agreement between the DT and SCL-90-R. Finally, only survivors of childhood cancers were included, and generalizability to adult cancer survivors cannot be assumed.

Clinical screening programs typically select measures and cut-off scores to maximize sensitivity [19] to ensure that most, if not all patients with the condition of interest are identified by screening. Given the importance of identifying significant distress, lack of sensitivity of the DT in this population is a serious concern. Future research on the DT should test its utility when combined with other items or brief distress measures and investigate how it operates in different survivor populations including those diagnosed in adulthood. Until there is more validation, practitioners should be cautioned against using the DT to screen cancer survivors, and may need to rely on less brief but more widely validated measures. Practitioners working with survivors of childhood cancers should consider the BSI-18, which has been specifically validated for this population in two recent studies [11,20].

Acknowledgements

This work was supported by a Survivorship Research Grant from the Lance Armstrong Foundation (C.R.). The authors are grateful for the assistance of Sandra Brooks, Alexandra Jacobs, and Veronica Sanchez-Varela for their assistance in conducting the study.

References

1. Aziz N, Rowland JH. Trend and advances in cancer survivorship research: challenge and opportunity. *Semin Radiat Oncol* 2003;**13**:248–266.
2. Hudson M, Mertens AC, Yasui Y, Hobbie W, Chen H, Gurney JG *et al*. Health status of adult long-term survivors of childhood cancer: a report from the Childhood Cancer Survivor Study. *J Am Med Assoc* 2003;**290**:1583–1592.
3. Deimling GT, Bowman KF, Sterns S, Wagner LJ, Kahana B. Cancer-related health worries and psychological distress among older adult long-term cancer survivors. *Psycho-Oncology* 2006;**15**:306–320.
4. Langeveld NE, Ubbink MC, Last BF, Grootenhuis MA, Voute PA, De Hann RJ. Educational achievement, employment and living situation in long-term young adult survivors of childhood cancer in the Netherlands. *Psycho-Oncology* 2003;**12**:213–225.
5. Loge JH, Abrahamsen AF, Ekeberg O, Hannisdal E, Kaasa S. Psychological distress after cancer cure: a survey of 459 Hodgkin's disease survivors. *Br J Cancer* 1997;**76**:791–796.
6. Recklitis CJ, O'Leary T, Diller L. Utility of routine psychological screening in the childhood cancer survivor clinic. *J Clin Oncol* 2003;**21**:787–792.
7. Carlson LE, Angen M, Cullum J *et al*. High levels of untreated distress and fatigue in cancer patients. *Br J Cancer* 2004;**90**:2297–2304.
8. National Institutes of Health State-of-the-Science Panel. National Institutes of Health State-of-the-Science Conference Statement: symptom management in cancer: pain, depression, and fatigue, 15–17 July, 2002. *J Natl Canc Inst Monogr* 2002;**32**:9–16.
9. Holland J, Reznik I. Pathways for psychosocial care of cancer survivors. *Cancer* 2005;**104**(11s):2624–2637.
10. Dahl AA, Haaland CF, Mykletun A, Bremnes R, Dahl O, Klepp O *et al*. Study of anxiety disorder and depression in long-term survivors of testicular cancer. *J Clin Oncol* 2005;**23**:2389–2395.
11. Recklitis CJ, Rodriguez P. Screening childhood cancer survivors with the brief symptom inventory-18: classification agreement with the symptom checklist-90 revised, *Psycho-Oncology*, DOI: 10.1002/pon.1069.
12. Jacobsen PB, Donovan KA, Trask PC, Felishman SB, Zabora J, Baker F *et al*. Screening for psychologic distress in ambulatory cancer patients: a multicenter evaluation of the distress thermometer. *Cancer* 2005;**103**:1494–1502.
13. Roth AJ, Kornblith AB, Batel-Copel L, Peabody E, Scher HI, Holland JC. Rapid screening for psychologic distress in men with prostate carcinoma: a pilot study. *Cancer* 1998;**82**:1904–1908.
14. Hoffman BM, Zevon MA, D'Arrigo MC, Cecchini TB. Screening for distress in cancer patients: the NCCN rapid-screening measure. *Psycho-Oncology* 2004;**13**: 792–799.
15. National Comprehensive Cancer Network (NCCN). Distress management clinical practice guidelines. *J Natl Compr Canc Netw* 2003;**1**:344–374.
16. Derogatis LR. *Symptom Checklist-90-R* (*SCL-90-R*): *Administration*, *Scoring and Procedures Manual* (3rd edn). National Computer Systems: Minneapolis, MN, 1994.
17. Derogatis LR, Morrow G, Fetting J, Penman D, Piasetsky S, Schmale AH *et al*. The prevalence of psychiatric disorders among cancer patients. *J Am Med Assoc* 1983;**249**:751–757.
18. Ransom S, Jacobsen PB, Booth-Jones M. Validation of the distress thermometer with bone marrow transplant patients. *Psycho-Oncology* 2005;**15**:604–612.
19. Katz MR, Kopek N, Waldron J, Devins GM, Tomlinson G. Screening for depression in head and neck cancer. *Psycho-Oncology* 2004;**13**:269–280.
20. Recklitis C, Parsons SK, Shih MC, Mertens A, Robison LL, Zeltzer L. Factor structure of the brief symptom inventory-18 in adult survivors of childhood cancer: results from the childhood cancer survivor study. *Psychol Assess* 2006;**18**:22–32.