

Predictive Value of the Distress Thermometer Score for Risk of Suicide in Patients with Cancer

Yung-Chih Chiang

Kaohsiung Veterans General Hospital

Jeremy Couper

Monash University

Jing-Wen Chen

Chung Hwa University of Medical Technology

Ke-Jui Lin

Kaohsiung Veterans General Hospital

Han-Ping Wu (✉ arthur1226@gmail.com)

China Medical University <https://orcid.org/0000-0002-0069-4183>

Research Article

Keywords: cancer, Distress Thermometer score, suicidal ideation, suicide, death

Posted Date: May 27th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-417957/v1>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Version of Record: A version of this preprint was published at Supportive Care in Cancer on February 24th, 2022. See the published version at <https://doi.org/10.1007/s00520-022-06801-4>.

Abstract

Purpose: This study aimed to assess the association between the Distress Thermometer (DT) score and risk of suicide in patients with cancer. In addition, we aimed to determine the best cutoff score to predict patients at risk of suicide.

Methods: From 2015 to 2016, we retrospectively collected data on patients with cancer. DT scores were collected, and the association between DT score and risk of suicide (suicide ideation or death ideation) was analyzed. Furthermore, receiver operating characteristic (ROC) analysis was performed to identify the appropriate cutoff score for predicting risk of suicide.

Results: A total of 394 patients with cancer were included, and suicidal ideation was identified in 33 cases referred for psychological intervention. The DT scores of the patients with suicidal ideation were significantly higher than those of patients without suicidal ideation (6.30 ± 2.11 vs. 4.29 ± 1.72 , $p < 0.05$). In addition, the area under the ROC curve for predicting risk for suicide was 0.758. The cutoff DT score of 3 had the highest sensitivity of 1.00 to rule out suicidal ideation, while 9 had the highest specificity of 1.00 to rule in suicidal ideation. Moreover, the appropriate cutoff DT score to predict patients with suicidal ideation was 5, with a sensitivity of 0.52, specificity of .84, positive likelihood ratio of 3.24, and negative likelihood ratio of 0.58.

Conclusion: The DT score may be a helpful clinical tool to evaluate emotional distress and risk of suicide in patients with cancer. Clinically, for DT scores greater than 5 in patients with cancer, the risk of suicide greatly increases. In view of the DT's widespread use internationally by non-mental health clinicians in cancer to guide the need for specialist mental health interventions, its potential utility in also predicting suicide risk is of great interest.

Introduction

Cancer patients often experience significant distress and may be at a higher risk of suicide than the general populations and other patients [1-4]. Early detection of suicidal ideation may help primary caregivers to prevent suicide in patients with cancer. In addition, systematic screening for suicidal ideation is recommended; however, screening for suicidal ideation is not commonly implemented in routine clinical practice in the cancer setting [5].

It is known that suicidal ideation in patients with cancer may be related to their physical and psychological distress [6, 7]. The National Comprehensive Cancer Network (NCCN) recommends screening for distress in patients with cancer and thus developed the Distress Thermometer (DT) scoring system, a well-known tool using a 0–10 rating scale [8]. Although DT is widely used in screening distress in cancer patients, as far as our understanding, only one study examined the correlation between DT scores and suicide ideation, and revealed higher DT scores predict higher risk of suicidal ideation [9].

In this study, we aimed to identify whether the DT score may be helpful for initially screening the risk of suicide in patients with cancer, and we assessed the association between the DT score and risk of suicide (suicide ideation or death ideation) in a sample of patients with cancer. Furthermore, we identified a recommended cutoff score for predicting patients at risk of suicide.

Methods

We retrospectively reviewed the medical records of patients with cancer referred to clinical psychologists for intervention at Kaohsiung Veterans General Hospital in Taiwan from January 2015 to Dec 2016. The exclusion criteria included patients who refused to undergo assessments and where cognitive status was unclear.

This study was approved by the Institutional Review Board and Ethics Committee of Kaohsiung Veterans General Hospital, and all procedures were performed in accordance with the relevant guidelines and regulations. Data were collected, reviewed, de-identified, and anonymized before analysis, and the Ethics Committee waived the requirement for informed consent because of the anonymized nature of the data and scientific purpose of the study.

Clinical information related to age, DT score, gender, initial diagnosis (versus recurrence), cancer type, and types of treatment were obtained from the medical records. For the referred patients with cancer, the psychologists evaluated and recorded routinely their DT scores and suicide risk, including suicidal ideation and death ideation. Suicidal ideation was defined as the patient's idea or plan to take their own life by certain means; while death ideation indicated that patients made clear their desire of not wanting to live, hoping their life would end sooner but not mentioning the idea of taking their own life by certain means. Based on the assessments of psychiatrists regarding patients' suicide risk, patients were divided into the three groups: 1) suicidal ideation; 2) death ideation (without suicidal ideation), and 3) neither suicidal ideation nor death ideation ("no risk").

Statistical analysis

The association of patient characteristics and DT score with risk of suicide was analyzed. The chi-square test, Fisher's exact test, Student's t-test, Mann-Whitney U test, and analysis of variance (ANOVA) were used as appropriate. In the descriptive analysis, values were presented as means \pm standard deviations (SDs). Differences between groups were presented with 95% confidence intervals.

In addition, receiver operating characteristic (ROC) curve analysis was used to identify the appropriate cutoff score to predict risk of suicide. The test characteristics of the different cutoff values, namely sensitivity, specificity, area under the ROC curve (AUC), positive likelihood ratio (LR⁺), and negative likelihood ratio (LR⁻), were also examined. The AUC, calculated using the trapezoidal rule, was considered to be a standard measure of the diagnostic value of the parameter. An optimal test result had a value of

1.0, while 0.5 was not considered to be useful. The LR^+ and LR^- were calculated for the best cutoff values. The criterion value indicated the value corresponding to the highest accuracy (minimal false negative and false positive results). Statistical significance was set at $p < 0.05$. All statistical analyses were performed using SPSS software (version 22.0; SPSS Inc., Chicago, IL, USA).

Results

A total of 394 patients with cancer were referred to the psychologists for evaluation during the study period; however, 134 patients were excluded because of incomplete data (lacking DT scores or suicide assessment data) or unclear consciousness. Therefore, a total of 260 patients with cancer were included in the analysis.

Among the 260 patients, 33 had suicidal ideation, and 20 had death ideation. The mean age was higher in the death ideation group compared with the suicidal ideation and no-risk groups ($p < 0.05$) (Table 1). The average DT score was 6.3 ± 2.1 for the 33 patients with suicidal ideation, and 5.2 ± 1.4 for the 20 patients with death ideation. However, the average DT score of the 207 no-risk patients was 4.3 ± 1.7 , which was lower than that of the other two groups. The average DT score was highest in the suicidal ideation group compared to the death ideation and no-risk groups ($p < 0.05$). According to the results of ANOVA analysis, the DT scores between the three groups showed significant differences ($p < 0.05$).

Among the different cancer types, the proportion of patients with death and suicidal ideation was higher in those with head and neck cancers, and lower in patients with lymphoma and leukemia. Moreover, among the types of treatment, most patients with suicidal ideation and death ideation were receiving chemotherapy.

Based on the ROC analysis for predicting patients with suicidal ideation, the AUC was 0.75 (Figure 1). The appropriate cutoff DT score to predict patients with suicidal ideation was 5, with a sensitivity of 0.52, specificity of .84, LR^+ of 3.24, and LR^- of 0.58 (Table 2). In addition, for patients with death ideation, the AUC was 0.72 (Figure 2), and the appropriate cutoff DT score to predict patients with death ideation was 4, with a sensitivity of 0.70, specificity of 0.58, LR^+ of 1.64, and LR^- of 0.53 (Table 3).

We further determined two cutoff points for the DT score to 'rule in' or 'rule out' suicidal ideation and death ideation. The cutoff DT score of 3 had the highest sensitivity of 1.00 to rule out both suicidal ideation and death ideation, while 9 had the highest specificity of 1.00 to rule in both suicidal ideation and death ideation.

Discussion

Suicide risk factors in patients with cancer includes the patient's mental health, socio-demographic status, type of illness, site of cancer, physical functioning, and prognosis [10]. Because of the heterogeneity of suicidal behavior, it is still challenging for clinical staff to detect high-risk groups and provide early interventions. Asking about suicide can be difficult for staff other than mental health

professionals. The literature reports the use of several screening tools to identify suicide risk in patients with cancer, including the Columbia-Suicide Severity Rating Scale (C-SSRS), National Institute of Mental Health Ask Suicide-Screening Questions (ASQ) Toolkit, the Distress Assessment and Response Tool (DART), Brief Symptom Inventory-18, and Patient Health Questionnaire-9 (PHQ-9) [2, 11, 12]. However, using these suicide screening tools may not be feasible for widespread use in routine clinical care.

Some studies have evaluated the relationship between depression and suicide in cancer patients and showed that depression is an important risk factor of suicide in patients with cancer [2, 13, 14]. Therefore, screening for depression is important in patients with cancer to reduce risk of suicide, and the Beck Depression Inventory, PHQ-9, and Hamilton Depression Rating Scale have been identified as reliable screening tools in this context [13]. In addition, demoralization was also proved to be highly related to suicide in patients with cancer and may also predict suicidality [15, 16]. Thus, identifying depression and demoralization in this patient population could help to screen for risk of suicide.

Although the DT is not a tool originally designed for assessing suicide risk, in our study, we found that it may be useful for preliminary screening suicide risk in patients with cancer. In this study, patients with death ideation or suicide ideation had higher DT scores compared with those without death and suicide ideation. Thus, we intended to gain insight into the sensitivity and specificity of DT scores for both suicidal and death ideation using ROC analysis. We further found that a cutoff DT score of 3 had the highest sensitivity of 1.00 to rule out both suicidal ideation and death ideation, while 9 had the highest specificity of 1.00 to rule in both suicidal ideation and death ideation. Our findings suggest that clinicians need to pay more attention to patients with cancer where there is a DT score ≥ 9 because it indicates the highest risk of suicide. In contrast, patients with a DT score ≤ 3 may have very little risk of suicide. However, patients with a DT score between 4 to 8 should be closely followed and monitored by clinicians because of the uncertainty regarding suicide risk.

In this study, we also determined a DT score of 5 as the optimal cutoff point to identify patients with suicidal ideation, and a DT score of 4 for death ideation. Clinically, once patients with cancer have a DT score greater than 4, the risk of death ideation will increase; while for a DT score greater than 5, the suicidal ideation risk will also increase.

Conclusion

The DT score may serve as a practical tool to screen for suicide risk in patients with cancer which can be incorporated easily into routine clinical care in all cancer settings. For a DT score greater than 5 in patients with cancer, the risk of suicide could increase. Most importantly, a cutoff DT score of 3 had the highest sensitivity of 1.00 to rule out both suicidal and death ideation, while 9 had the highest specificity of 1.00 to rule in both suicidal and death ideation.

Declarations

Funding

This study was not supported by any grant funding agency or organization.

Conflicts of interest/Competing interests

The authors declare that there are no conflict of interest/ Competing interests.

Availability of data and material (data transparency)

Patient data was got through the information systems of Kaohsiung Veterans General Hospital.

Code availability (software application or custom code)

Not applicable

Authors' contributions

All authors contributed to the study conception and design. Data collection was performed by Yung-Chih Chiang and Ke-Jui Lin. Data analysis and interpretation were performed by Jing-Wen Chen and Han-Ping Wu. The first draft of the manuscript was written by Yung-Chih Chiang and revised by Jeremy Couper and Han-Ping Wu. All authors read and approved the final manuscript.

Ethics approval

The Institutional Review Board (IRB) at t Kaohsiung Veterans General Hospital reviewed and approved the study in 2021 (IRB No.: KSVG21-CT2-06).

Consent to participate (include appropriate statements)

The Ethics Committee waived the requirement for informed consent because of the anonymized nature of the data and scientific purpose of the study.

Consent for publication (include appropriate statements)

Not applicable

References

1. Carlson LE, Zelinski EL, Toivonen KI, Sundstrom L, Jobin CT, Damaskos P, Zebrack B (2019) Prevalence of psychosocial distress in cancer patients across 55 North American cancer centers. *J Psychosoc Oncol* 37:5–21. <https://doi.org/10.1080/07347332.2018.1521490>
2. McFarland DC, Walsh L, Napolitano S, Morita J, Jaiswal R (2019) Suicide in Patients With Cancer: Identifying the Risk Factors *Oncology*. (Williston Park) 33:221–226

3. Hultcrantz M, Svensson T, Derolf AR, Kristinsson SY, Lindqvist EK, Ekbohm A, Granath F, Bjorkholm M (2015) Incidence and risk factors for suicide and attempted suicide following a diagnosis of hematological malignancy *Cancer Med* 4:147–154. <https://doi.org/10.1002/cam4.316>
4. Leung YW, Li M, Devins G, Zimmermann C, Rydall A, Lo C, Rodin G (2013) Routine screening for suicidal intention in patients with cancer *Psychooncology* 22: 2537–2545. <https://doi.org/10.1002/pon.3319>
5. Anguiano L, Mayer DK, Piven ML, Rosenstein D (2012) A literature review of suicide in cancer patients *Cancer Nurs* 35: E14-26. <https://doi.org/10.1097/NCC.0b013e31822fc76c>
6. Choi YN, Kim YA, Yun YH, Kim S, Bae JM, Kim YW, Ryu KW, Lee JH, Noh JH, Sohn TS (2014) Suicide ideation in stomach cancer survivors and possible risk factors. *Support Care Cancer* 22:331–337. <https://doi.org/10.1007/s00520-013-1975-4>
7. Filiberti A, Ripamonti C (2002) Suicide and suicidal thoughts in cancer patients. *Tumori* 88:193–199
8. Riba MB, Donovan KA, Andersen B, Braun I, Breitbart WS, Brewer BW, Buchmann LO, Clark MM, Collins M, Corbett C, Fleishman S, Garcia S, Greenberg DB, Handzo RGF, Hoofring L, Huang CH, Lally R, Martin S, McGuffey L, Mitchell W, Morrison LJ, Pailler M, Palesh O, Parnes F, Pazar JP, Ralston L, Salman J, Shannon-Dudley MM, Valentine AD, McMillian NR, Darlow SD (2019) Distress Management, Version 3.2019, NCCN Clinical Practice Guidelines in Oncology. *J Natl Compr Canc Netw* 17:1229–1249. <https://doi.org/10.6004/jnccn.2019.0048>
9. Chang DC, Chen AW, Lo YS, Chuang YC, Chen MK (2019) Factors associated with suicidal ideation risk in head and neck cancer: A longitudinal study *Laryngoscope* 129: 2491–2495. <https://doi.org/10.1002/lary.27843>
10. Robson A, Scrutton F, Wilkinson L, MacLeod F (2010) The risk of suicide in cancer patients: a review of the literature *Psychooncology* 19: 1250–1258. <https://doi.org/10.1002/pon.1717>
11. Brinkman TM, Zhang N, Recklitis CJ, Kimberg C, Zeltzer LK, Muriel AC, Stovall M, Srivastava DK, Sklar CA, Robison LL, Krull KR (2014) Suicide ideation and associated mortality in adult survivors of childhood cancer *Cancer* 120: 271–277. <https://doi.org/10.1002/cncr.28385>
12. Walker J, Hansen CH, Butcher I, Sharma N, Wall L, Murray G, Sharpe M (2011) Thoughts of death and suicide reported by cancer patients who endorsed the "suicidal thoughts" item of the PHQ-9 during routine screening for depression *Psychosomatics* 52: 424–427. <https://doi.org/10.1016/j.psych.2011.02.003>
13. M KH (2016) Suicide Screening in the Oncology Population. *J Adv Pract Oncol* 7:101–104
14. Xu K, Hu D, Liu Y, Han Y, Guo X, Teng F, Zhou Y (2019) Relationship of Suicidal Ideation With Demoralization, Depression, and Anxiety: A Study of Cancer Patients in Mainland China. *J Nerv Ment Dis* 207:326–332. <https://doi.org/10.1097/NMD.0000000000000974>
15. Fang CK, Chang MC, Chen PJ, Lin CC, Chen GS, Lin J, Hsieh RK, Chang YF, Chen HW, Wu CL, Lin KC, Chiu YJ, Li YC (2014) A correlational study of suicidal ideation with psychological distress, depression, and demoralization in patients with cancer. *Support Care Cancer* 22:3165–3174. <https://doi.org/10.1007/s00520-014-2290-4>

16. Vehling S, Kissane DW, Lo C, Glaesmer H, Hartung TJ, Rodin G, Mehnert A (2017) The association of demoralization with mental disorders and suicidal ideation in patients with cancer *Cancer* 123: 3394–3401. <https://doi.org/10.1002/cncr.30749>

Tables

Table 1. Demographics of cancer patients according to suicide risk

Variables	Suicidal ideation (n=33)	Death ideation (n=20)	No risk (n=207)	P value
Age (years) M±SD (95% CI)	58.1±17.1 (52~64.12)	61.4±12.4 (55.62~67.18)	53.3±13.9 (51.44~55.25)	0.018
DT score M±SD (95% CI)	6.3±2.1 (5.55~7.05)	5.2±1.4 (4.50~5.80)	4.3±1.7 (4.05~4.52)	<0.001
Gender (male), n (%)	17 (51.5)	9 (45)	98 (47.3)	0.877
Initial diagnosis, n (%)	30 (90.9)	17 (85)	193 (93.2)	0.397
Type of cancer, n (%)				
Gastric & esophageal	3(9.1)	1 (5)	17 (8.2)	
Breast	2 (6.1)	1 (5)	15 (7.2)	
Lymphoma	3 (9.1)	1 (5)	31 (15)	
Lung	3 (9.1)	2 (10)	15 (7.2)	
Gynecologic	4 (12.1)	3 (15)	17 (8.2)	
Colon	6 (18.2)	0	28 (13.5)	
Pancreatic	0	0	2 (1)	
Head and neck	4 (12.1)	4 (20)	21 (10.1)	
Leukemia	1 (3)	0	15 (7.2)	
Hepatoma	1 (3)	4 (20)	13 (6.3)	
Bladder	1 (3)	0	4 (1.9)	
Other	5 (15.2)	4 (20)	29 (14)	
Type of treatment, n (%)				
Nil	12 (36.4)	4 (20)	45 (21.7)	
Chemotherapy	17 (51.5)	13(65)	126 (60.9)	
Surgery	3 (9.1)	1 (5)	29 (14)	
Radiotherapy	0	1 (5)	4 (1.9)	
Hospice care	0	1 (5)	2 (1)	
Other	1 (3) ^a	0	1 (0.5) ^b	

^a Surgery + Chemotherapy; ^b Percutaneous ethanol injection (PEI).

Table 2. Predictive power of Distress Thermometer (DT) score for different cutoff points in suicidal ideation group

DT score	Sensitivity	Specificity	LR ⁺	LR ⁻	Youden index
0	1.00	0.04	1.05	0	0.044
1.0	1.00	0.07	1.07	0	0.066
2.0	1.00	0.10	1.11	0	0.10
3.0	1.00	0.19	1.23	0	0.19
4.0	0.79	0.57	1.81	0.38	0.36
5.0*	0.52	0.84	3.24	0.58	0.36
6.0	0.33	0.90	3.30	0.74	0.23
7.0	0.30	0.95	5.72	0.74	0.25
8.0	0.24	0.99	26.89	0.77	0.23
9.0	0.12	1.00	30.25	0.88	0.12
10.0	0	1.00	-	1.00	0.000

LR⁺: likelihood ratio for a positive test; LR⁻: likelihood ratio for a negative test;

* Best cutoff point.

Table 3. Predictive power of Distress Thermometer (DT) score for different cutoff points in death ideation group

DT score	Sensitivity	Specificity	LR ⁺	LR ⁻	Youden index
0	1.000	0.05	1.05	0	0.05
1.0	1.000	0.07	1.08	0	0.07
2.0	1.000	0.11	1.13	0	0.11
3.0	1.000	0.21	1.26	0	0.21
4.0*	0.70	0.58	1.64	0.53	0.28
5.0	0.43	0.86	3.00	0.66	0.29
6.0	0.28	0.91	3.08	0.79	0.19
7.0	0.23	0.95	4.71	0.81	0.17
8.0	0.15	0.99	15.10	0.86	0.14
9.0	0.08	1.00	15.00	0.93	0.07
10.0	0	1.00	-	1.00	0

LR⁺: likelihood ratio for a positive test; LR⁻: likelihood ratio for a negative test;

* Best cutoff point.

Figures

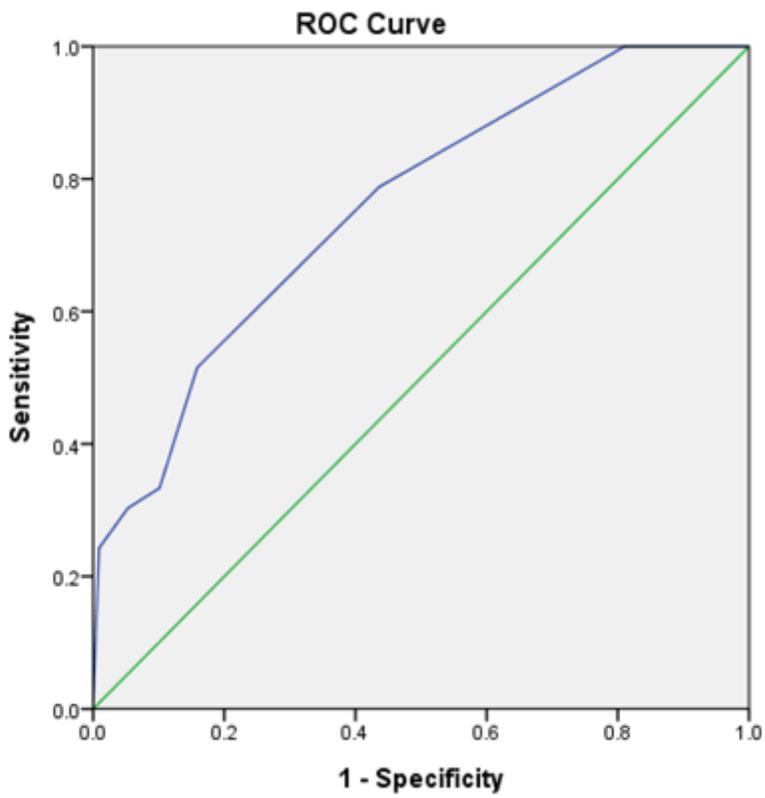


Figure 1

Receiver operator characteristic analysis of Distress Thermometer (DT) score for predicting suicidal ideation in patients with cancer

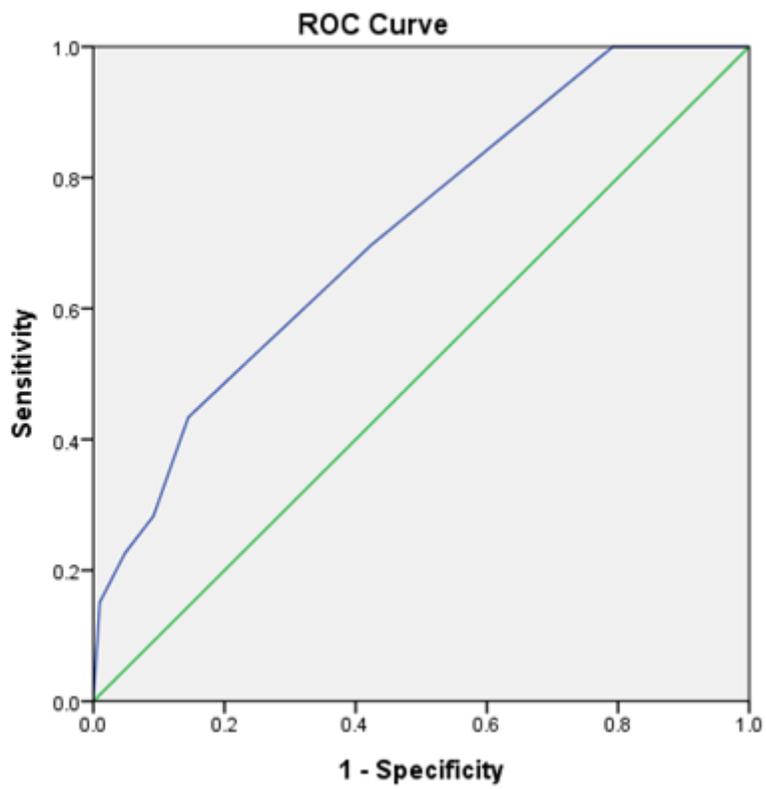


Figure 2

Receiver operator characteristic analysis of Distress Thermometer (DT) score for predicting death ideation in patients with cancer