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ORIGINAL RESEARCH ARTICLE

Causes and alleviation of distress in patients with benign and malignant bone and soft-tissue tumors before and after orthopedic surgery: An observational study

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Abstract

Introduction: Distress is common among cancer patients, especially in orthopedic oncology, but its perioperative course remains insufficiently explored.

Objective: This study aimed, first, to describe the emotional distress experienced by patients with benign and malignant bone and soft-tissue tumors before orthopedic oncologic surgery and, second, to examine how the level of distress varied during hospitalization.

Methods: A retrospective observational study was performed, and patients admitted to the orthopedic oncology department were enrolled. Distress was recorded before and after surgery. A reduction of at least one point in the Distress Thermometer (DT) score was considered an improvement. Potential causes of distress were systematically documented. Data required for the study were extracted from patients' medical records by a research nurse.

Results: During the study period, 319 patients were screened, of whom 119 were included in the analysis. The mean DT score was 5.2 at admission and 4.3 at discharge, with a statistically significant difference of 0.9 (95% confidence interval: 0.4–1.5; $p<0.001$). Pain was the main reported cause of distress at both admission and discharge. The presence of distress at admission, shorter duration of hospitalization, and receipt of psychological support were associated with a decrease in distress.

Conclusion: Perioperative distress in patients undergoing orthopedic oncologic surgery must be carefully monitored in clinical practice. Pre- to postoperative distress showed a favorable trajectory, with a significant reduction observed. Pain and emotional problems were identified as the main sources of distress, though with different trajectories: increasing for pain and decreasing for anxiety. Targeted pain management and psychological support pathways should be encouraged for these patients.

Keywords: Distress; Bone neoplasms; Sarcoma; Hospitalization; Orthopedic procedures

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1. Introduction

Cancer patients frequently experience distress during and after treatment. This distress can easily lead to a deterioration in mood and quality of life, thus making the treatment process itself more difficult.[1-6] The National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology recommend the assessment of distress not only in research settings but also in clinical practice,[5] in the same way that vital signs are routinely collected.[1,5] To measure distress in cancer patients, a simple and effective tool—the Distress Thermometer (DT)—has been developed. It measures the level of distress and its potential causes and has been used in different contexts and tumor types,[7-11] including patients with bone and soft-tissue tumors.[12,13] This scale enables patients not only to score their distress but also to identify its causes by choosing from a predefined list of items. For orthopedic oncology patients, studies report a prevalence of psychological distress ranging from 32% to 71%,[12-14] as well as a significant need for psychological support 1 year after orthopedic oncology surgery.[15] Bergerot *et al.*[16] highlight that patients affected by rare tumors have worse outcomes related to quality of life and psychosocial aspects than the general population of oncology patients. Soft-tissue and bone cancers are rare malignancies with specific characteristics that differentiate them from other cancers. Surgical treatment of the musculoskeletal system plays a significant role in the therapeutic pathway and often requires multiple hospitalizations owing to the complexity of the procedures and associated complications. Such treatment often results in functional limitations and reduced patient autonomy.

Relatively little emphasis has been placed on the impact of surgery and hospitalization on patients' mental health. The literature describes various support interventions during hospitalization, such as clown therapy, music therapy, and other forms of volunteer activity aimed at improving patients' perceptions and mitigating stress during hospitalization.[17]

Therefore, this study aimed, first, to describe the emotional distress experienced by patients with benign and malignant bone and soft-tissue tumors before orthopedic oncologic surgery. Second, it examined how the level of distress varied during hospitalization to identify predictive factors, based on patients' baseline characteristics and the supportive measures implemented.

2. Materials and methods

2.1. Materials

This was a retrospective observational study conducted as part of a quality improvement project initiated by healthcare professionals in the Orthopedic Oncology Unit of Rizzoli Orthopedic Institute. The study was approved by the Area Vasta Emilia Centro Ethics Committee (protocol number 412/2024). Patients admitted to the 30-bed orthopedic oncology department of a specialist orthopedic hospital in northern Italy were considered eligible. This ward is part of the Musculoskeletal Sarcoma Treatment Centers and the European Reference Network for Rare Adult Solid Cancers (bone and soft-tissue sarcomas).

2.2. Methods

The enrollment period started in October 2023 and ended in March 2024. The hospitalization period assessed ranged from the time of admission to the time of discharge. No follow-up was planned. During hospitalization, volunteer groups organized visits to patients and clown therapy sessions. All patients were given the opportunity to participate in or decline these activities, which were conducted weekly on different days. Patients were also offered psychological support. All patients with benign and malignant bone and soft-tissue tumors who were admitted for surgery were eligible for enrollment.

The present study included patients diagnosed with bone and soft-tissue tumors of both benign and malignant origin. Although this approach introduced greater heterogeneity within the sample, it provided a more representative picture of real-world clinical practice and allowed the collection of exploratory data on psychological distress specifically related to hospitalization for orthopedic surgery. All types of surgery were considered, including excision, resection with reconstruction, and revision of a previous operation. There were no restrictions on age or gender. Patients hospitalized for fewer than 2 days or those undergoing surgery for a non-oncological diagnosis were excluded from the study.

2.2.1. Outcome

Patients' distress was assessed using the DT, which asks individuals to rate the amount of emotional distress they experienced in the past week or during their hospitalization by indicating a number from 0 (no emotional distress/no stress) to 10 (maximum emotional distress/maximum stress) on a thermometer drawn on a sheet of paper. The DT is a validated scale used in clinical practice.[18,19] The scale was administered at two time points: at admission (pre-surgical score) and at discharge (post-surgical score). To identify the baseline characteristics of the pre-surgical distress population, a DT cutoff score of 5 or higher was used to distinguish patients with clinical distress from those without.[20-22] A reduction of at least one point in the DT score was considered an improvement, whereas a stable or increased score was considered persistent distress.[23]

Patients were also asked to report, by ticking a yes/no box, the problems they encountered and any sources of distress. The possible causes were listed (Problem List) and grouped into five categories: practical problems (e.g., childcare, housing, economic issues); relationship problems (e.g., with partner, children); emotional problems (e.g., depression, fears); spiritual problems; and physical problems (e.g., pain, nausea).

2.2.2. Variables

Possible prognostic factors for pre-surgical distress were age, sex, education (elementary/middle school, high school/university degree), living conditions at home (alone/with someone), the presence of a medical diagnosis of depression, the surgical reason for hospitalization (removal of benign tumor, removal of malignant tumor, removal of local recurrence, revision of previous implant), and whether this was the patient's first hospitalization for orthopedic oncology care. For the analysis of differences in pre- and post-surgical distress, the length of hospitalization, administration of psychological support, and participation in a support activity provided by voluntary associations or clown therapy were also considered.

Support activities in the ward were carried out by various volunteer associations and therefore differed according to the specific characteristics of each organization. A clown therapy program was available, in which a clown visited the ward and provided entertainment such as magic tricks and riddles for both children and adults. In other cases, volunteers dressed as fairy-tale or fantasy characters visited patients, distributing sweets and small gifts. Activities could also include arts and crafts, crochet, or logistical support for patients' needs, such as assistance with laundry. Volunteer activities were conducted once a week, with visits taking place in patients' rooms. The purpose of these visits was to distract patients, identify any needs, and help transform negative thoughts into positive ones. Within the same week, two or three associations could alternate in visiting patients. Psychological support consisted of individual sessions between the patient and a psychologist. Support was offered to all patients and initiated either upon patient request or based on staff referral. Sessions took place during the hospital stay, typically once a day for 20–30 min. Frequency and duration were flexible, depending on the patients' needs and the professional's assessment. Meetings were held either in the patient's room or in a dedicated space, depending on the patient's ability to get out of bed and move independently.

Data required for the research were extracted from patients' medical records and collected by a research nurse. A specific data collection form was prepared and completed in a pseudo-anonymized digital format.

2.3. Statistical analysis

2.3.1. Sample size

To the best of the authors' knowledge, no established reference parameters are currently available to define the minimal clinically important difference for the DT. Several authors have reported that, for health-related quality-of-life instruments, a clinically meaningful change may correspond to a variation of 0.2, 0.3, or 0.5 times the observed standard deviation.[24,25] Uhlenbruch *et al.*,[13] in a cohort of patients with musculoskeletal tumors, reported a mean DT score of 5.0 with a standard deviation of 2.3. Based on this reference, in the present study, a pre-to postoperative change of at least one point on the DT scale was considered clinically significant, consistent with other studies employing the same instrument.[26-29] Assuming a mean variation of 1 point, a standard deviation of 3, a type I error of 5%, and a statistical power of 80%, a minimum sample size of 73 subjects was estimated to be required.

2.3.2. Data analysis

Data were analyzed using STATA v18 (StataCorp LLC, USA).[30] Age was described in terms of median and quartiles after examining its distribution, while sex, education, home living conditions, diagnosis of depression, oncological diagnosis, and first admission to orthopedics were described as absolute frequencies and percentages. These data were presented for all patients and stratified according to the distress screening using a DT cutoff score of ≥5. Missing data were analyzed to assess their distribution. If the proportion of missing data was below 10%, list-wise exclusion of these cases was considered acceptable for the analysis. The baseline characteristics of the two groups (distress present vs. distress absent) were compared using the chi-square test and the Wilcoxon–Mann–Whitney test. The DT score and associated problem list, measured pre-surgery and post-surgery, were described as mean and standard deviation or as absolute frequencies and percentages. Only items reported by at least 10% of patients were included in the table. Differences in pre- and post-surgery distress were analyzed using the paired *t*-test for continuous variables and the McNemar test for dichotomous variables. Statistical significance was set at $p<0.05$.

To identify predictors of distress variation, two comparison groups were created: one with improved distress and one with persistent distress. To identify variables independently associated with clinical improvement, both simple and multiple logistic regression analyses were conducted. All collected variables were initially included in a full logistic regression model. A stepwise backward elimination procedure was then applied, using the Wald

test with a *p*-value threshold of 0.1 for variable removal, in accordance with established recommendations aimed at balancing the inclusion of relevant predictors and the risk of overfitting. Variables were sequentially removed from the model based on their *p*-values, starting with those showing the weakest association with the outcome.

3. Results

3.1. Baseline characteristics

A total of 319 patients were screened during the study period. Of these, 134 completed the DT assessment at admission and discharge. From this group, 15 patients were excluded because they were not undergoing oncologic treatment. Therefore, the analysis was performed on 119 patients. The secondary analysis of DT-associated problems was conducted on 94 patients because 25 patients did not complete the second part of the scale. Among the collected variables, no missing data were observed except for educational level, which had seven missing values (5.8% of cases). Given the small number of missing values in a single variable, list-wise exclusion of these cases was considered acceptable for the analysis. The 25th, 50th, and 75th percentiles of age were 35.0, 55.6, and 69.9, respectively, and 45.4% of the sample was women. Using a DT cut-off of ≥5, 64.8% of patients had clinically significant distress. The baseline characteristics of patients at entry, stratified by distress screening, are summarized in Table 1. No significant differences in baseline characteristics were observed between hospitalized patients with and without clinical distress.

3.2. Distress variation

The mean DT scores at admission and discharge were 5.2 and 4.3, respectively, with a statistically significant mean difference of 0.9 (95% confidence interval [CI]: 0.4–1.5; $p<0.001$). The proportion of patients with clinically significant distress decreased from 64.7% pre-surgery to 51.3% post-surgery (odds ratio [OR] for improvement: 3.30; 95% CI: 1.40–9.10; $p=0.005$) (Table 2). The main cause of distress (problem list) reported on both admission and discharge was pain. The proportion of patients reporting pain increased significantly from the pre-surgical to the

Table 1. Baseline characteristics of patients and distress screening results at hospital admission

Variables	Total sample (*n*=119)	Patients without distress (*n*=42)	Patients with distress (*n*=77)	*p*-value
Age (year), percentiles (25th, 50th, 75th)	35.0, 55.6, 69.9	43.8, 58.1, 70.6	31.3, 53.5, 67.7	0.387
Sex, *n* (%)				
Male	65 (54.6)	25 (59.5)	40 (52.0)	0.428
Female	54 (45.4)	17 (40.5)	37 (48.1)	
Live alone, *n* (%)				
No	104 (87.4)	36 (85.7)	68 (88.3)	0.683
Yes	15 (12.6)	6 (14.3)	9 (11.7)	
Level of education[a], *n* (%)				
Primary and middle school	36 (32.1)	13 (34.2)	23 (31.1)	0.737
High school/university degree	76 (67.9)	25 (65.8)	51 (68.9)	
Diagnosis of depression, *n* (%)				
No	100 (84.0)	35 (83.3)	65 (84.4)	0.878
Yes	19 (16.0)	7 (16.7)	12 (15.6)	
First hospitalization, *n* (%)				
No	63 (52.9)	26 (61.9)	37 (48.1)	0.148
Yes	56 (47.1)	16 (38.1)	40 (51.2)	
Reason for admission, *n* (%)				
Benign tumor	25 (21.0)	8 (19.1)	17 (22.1)	0.780
Malignant tumor	38 (31.9)	14 (33.3)	24 (31.2)	
Tumor recurrence	30 (25.2)	9 (21.4)	21 (27.3)	
Surgery revision	26 (21.9)	11 (26.2)	15 (19.5)	
Length of stay (day), percentiles (25th, 50th, 75th)	4.0, 6.5, 9.0	4.0, 6.5, 9.0	4.0, 6.5, 9.5	0.812

Note: [a]Seven values were missing.

Table 2. Differences in pre-surgical and post-surgical distress scores and problem-list items

Variables	Pre-surgical	Post-surgical	Mean difference or odd ratio	95% CI	*p*-value
Distress score, mean (SD)	5.2 (3.3)	4.3 (2.9)	0.9	0.4–1.5	<0.001
Patients with distress, *n* (%)	77 (64.7)	61 (51.3)	3.3	1.4–9.1	0.005
Problem list, *n* (%)					
Pain	52 (51.0)	60 (63.8)	0.40	0.15–0.95	0.036
Sleep	31 (33.0)	37 (39.4)	0.65	0.27–1.47	0.345
Fatigue	23 (24.5)	26 (27.7)	0.83	0.39–1.75	0.728
Memory or concentration	10 (10.6)	7 (7.4)	2.50	0.41–26.25	0.453
Loss or change of physical ability	13 (13.8)	15 (16.0)	0.80	0.27–2.25	0.814
Worry or anxiety	61 (64.9)	44 (46.8)	3.43	1.43–9.42	0.003
Sadness or depression	24 (25.6)	22 (23.4)	1.29	0.43–4.06	0.803
Fear	21 (22.3)	26 (27.7)	0.75	0.35–1.54	0.500
Loneliness	10 (10.6)	7 (7.4)	1.75	0.44–8.15	0.549
Anger	15 (16.0)	8 (8.5)	3.33	0.86–18.85	0.092
Changes in appearance	10 (10.6)	11 (11.7)	0.80	0.16–3.72	1.000
Feeling of worthlessness or being a burden	13 (13.8)	14 (20.2)	0.57	0.21–1.46	0.286
Taking care of myself	27 (28.7)	38 (40.4)	0.35	0.11–0.94	0.035
Taking care of others	13 (13.8)	14 (14.9)	0.87	0.27–2.76	1.000
Work	16 (15.7)	8 (8.5)	5.00	1.07–46.9	0.039

Note: Continuous variables were analyzed using paired *t*-test (reported as mean difference).
Dichotomous variables were analyzed using McNemar's test (reported as odds ratios). Abbreviations: CI: Confidence interval; SD: Standard deviation.

post-surgical phase (51.0% vs. 63.8%; OR for reduction: 0.40; 95% CI: 0.15–0.95; p=0.036). Anxiety showed an opposite trend, decreasing by 18.1% points, from 64.9% to 46.8% (OR: 3.43; 95% CI: 1.43–9.42; p=0.003) (Table 2).

3.3. Multiple regression for distress improvement

A total of 64 patients (53.8%) showed an improvement in distress of at least one point on the DT. Eighty-seven patients (73.1%) participated in at least one support activity, such as visits from clowns or volunteers, while 22 patients (18.5%) received psychological support. Multiple logistic regression identified three factors associated with the likelihood of distress improvement: the presence of distress at admission, shorter duration of hospitalization, and receipt of psychological support (Table 3).

4. Discussion

Distress has been shown to be a key concern for patients with bone and soft-tissue tumors preparing for hospitalization for orthopedic oncologic surgery. The proportion of patients with distress at admission and discharge (64.8% and 51.3%, respectively) is consistent with values reported for sarcoma patients by other researchers, where prevalence ranges from 51% to 71%, even at different phases of the disease.[13,14] Certain studies have highlighted, especially for patients with sarcoma, the need to monitor distress from diagnosis through treatment and follow-up, noting a higher risk of anxiety and depression compared to the general population.[4,31]

The present study included patients with both benign and malignant tumors, as well as cases of recurrence and surgical revision. This inevitably introduces clinical variability, but it also increases the representativeness of our sample with respect to real-world orthopedic oncology practice. In our cohort, no significant differences in distress levels were observed among the various clinical conditions. In contrast, Ise *et al.*[12] reported that among hospitalized patients with bone and soft-tissue tumors, those with malignant diagnoses experienced significantly higher levels of psychological distress. One explanation is that, in our population, distress was more closely related to concerns about hospitalization and postoperative recovery rather than the disease trajectory itself. Supporting this interpretation, patients hospitalized for the first time were less likely to be free of distress (38.1%) than those with prior hospitalizations (61.9%), suggesting that familiarity with the surgical environment may influence emotional adaptation.

In the literature, only a few factors have been reported as significantly associated with elevated distress. Paredes *et al.*[31] identified female gender as a risk factor for

Table 3. Logistic regression analysis of predictors of distress improvement versus persistent distress

Variables	Univariable regression			Multivariable regression		
	OR	95% CI	*p*-value	OR	95% CI	*p*-value
Age	1.01	0.99–1.02	0.552	-	-	-
Female	1.14	0.55–2.35	0.724	-	-	-
Live alone	1.39	0.47–4.10	0.556	-	-	-
High school/university degree	0.71	0.32–1.59	0.400	-	-	-
Diagnosis of depression	0.95	0.35–2.53	0.913	-	-	-
First hospitalization	1.29	0.63–2.66	0.488	-	-	-
Reason for admission						
Benign tumor	-	-	-	-	-	-
Malignant tumor	0.69	0.25–1.96	0.491	-	-	-
Tumor recurrence	0.56	0.19–1.67	0.299	-	-	-
Surgery revision	0.48	0.16–1.48	0.203	-	-	-
Participation to support activities	1.46	0.65–3.3	0.361	-	-	-
Psychological support	2.72	0.98–7.54	0.054	3.61	0.88–14.86	0.075
Length of stay	0.97	0.92–1.03	0.409	0.93	0.85–1.01	0.091
Patients with pre-surgical distress	5.2	2.29–11.83	<0.001	4.80	2.00–11.54	<0.001

Abbreviations: CI: Confidence interval; OR: Odds ratio.

depression, while Ise *et al.*[12] found both gender and older age to be associated with psychological distress. In the present study, baseline characteristics were not associated with the presence of distress. Differences in the assessment scales used and the timing of distress measurement during the disease trajectory may explain these discrepancies. The moment of hospitalization for orthopedic oncologic surgery represents a distinct stage in the treatment pathway, and the distress observed at this time shows specific features. Paredes *et al.*[31] noted that major surgical procedures may lead to changes in lifestyle, physical and mental capabilities, and social roles, potentially increasing depressive symptoms. At the same time, several researchers[14,31,32] underline that high levels of distress are often recorded in the perioperative period and tend to decrease after surgery. This trajectory, toward reduced distress, is confirmed by the data of the present study, and the analysis of the problem list helps explain how patients' experiences changed over time.

First, it was observed that pain played a significant role as a source of distress. The proportion of patients reporting pain in the pre-surgical phase was 51%, and this increased at the time of hospital discharge. This trend may reflect characteristics of the early postoperative recovery phase, during which pain is a common and expected experience related to surgical trauma, inflammation, and functional limitations. Despite the physical discomfort, anxiety levels decreased after surgery, likely due to the relief associated with the completion of the surgery and the reduction of preoperative uncertainty. In this context, emotional distress related to anticipation and fear may be replaced by physical symptoms that are perceived as part of the recovery process. Pain management following orthopedic surgery is a central element that deserves special attention and a dedicated care pathway from the early postoperative phases. Pain is a major risk factor for distress in patients with cancer, as reported by Ise *et al.*[12] in patients diagnosed with sarcoma.[31,33] From a physical standpoint, sleep problems, fatigue, memory issues, and reduced physical abilities were also relevant. These symptoms were present in the early preoperative phase and did not appear to be modified by surgery in the short term. This finding is consistent with the results reported by Tang *et al.*,[34] who showed that reduced physical functioning was associated with distress even at 6 and 12 months after the preoperative evaluation.

Among the emotional symptoms evaluated, anxiety emerged as the most frequently reported issue in the pre-surgical phase. Notably, it also showed the most pronounced improvement over time. The likelihood of reporting anxiety significantly decreased from pre- to post-surgical assessment, with patients being approximately 3.4 times more likely to show a reduction rather than an increase in anxiety levels. This suggests that the perioperative experience may have contributed to alleviating anxiety in a substantial proportion of patients. However, several other emotional symptoms contributed to patient distress—including fear, sadness, loneliness, and concerns about

appearance—none of which showed statistically significant changes between pre- and postoperative phases. Similarly, feelings of worthlessness or being a burden showed a worsening trend from pre- to postoperative assessments (from 13.8% to 20.2%). Although this change was not statistically significant, it deserves consideration. These feelings are less influenced by the relief that may follow surgery and are more likely related to broader psychosocial factors associated with the disease and its interference with daily life. The postoperative period often entails a temporary loss of autonomy and increased dependence on caregivers, which may amplify feelings of burden. Regarding anger, a more marked variation was observed between admission and discharge, trending toward improvement, although this change was not statistically significant.

The multiple regression analysis comparing patients with improved distress to those with persistent distress further supports these observations. Psychological support initiated early during hospitalization was significantly associated with a higher probability of improvement in patients' emotional experience, even when controlling for length of hospitalization and initial distress levels. Emotional problems were the category that improved the most. The optimal methods for screening and the best timing for initiating distress-specific interventions in patients with sarcoma remain subjects of debate.[13,14,31] Future studies should consider using the DT not only for its overall score but also for its problem list, to better understand the sources of distress and how these evolve over time and throughout the disease trajectory.

The results of this study must be interpreted considering several limitations. First, the population studied was heterogeneous in terms of disease stage, and although this did not appear to have a significant effect on distress, it remains an important factor to consider when interpreting the results. Second, the number of patients for whom both admission and discharge assessments were available was limited. The retrospective nature of the study contributed to this issue, as the DT was available for only a subset of patients. The missing information is likely related to organizational factors, such as high nursing workload at admission or discharge, or unexpected changes in discharge timing that may have prevented DT administration. Therefore, the possibility of selection bias cannot be completely excluded. Furthermore, psychological support was used by only a small group of patients, who may also represent those most sensitive to change. Finally, to understand the trajectory of distress following orthopedic oncologic surgery, studies with longer observation periods are needed. Further research, including randomized controlled trials, is required to evaluate the effectiveness of different interventions implemented during hospitalization.

5. Conclusion

Perioperative distress in patients undergoing orthopedic oncologic surgery is an issue that must be carefully monitored in clinical practice, regardless of the patients' baseline characteristics. Pre- to postoperative distress shows a favorable trajectory, with a significant reduction observed. Pain and emotional problems were the main sources of distress, but their trajectories differed: pain increased, whereas anxiety and anger decreased. Targeted pain management and psychological support pathways should be encouraged for patients with bone and soft-tissue cancer to improve distress from the 1st day of hospital admission. Future studies are needed to better characterize the medium- and long-term trajectories of distress after surgery and to evaluate the effectiveness of targeted psychological and rehabilitative interventions in reducing distress and improving postoperative recovery through randomized controlled trials.

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Conflict of interest

The authors declare that they have no competing interests

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Ethics approval and consent to participate

The study was approved by the Ethics Committee of the Vast Area of Central Emilia (protocol no. 412/2024/Oss/IOR, 31/07/2024). Given the retrospective nature of the study, informed consent was not required.

Consent for publication

Consent for publication was not obtained because the study used fully anonymized retrospective data, and no identifiable information was collected or reported.

Availability of data

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Further disclosure

Part or all of the findings were presented at the "25th European Musculo-Skeletal Oncology Society Nurse and Allied Professions Group Meeting" on [28–30 April], in [Padova, Italy], with the title "Monitoring Distress in Hospitalized Patients: A Retrospective Study in the Orthopedic Oncology Department of the Rizzoli Orthopedic Institute."

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