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The impact of social-emotional context in chronic cancer pain: patient-caregiver reverberations: Social-emotional context in chronic cancer pain

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Supportive Care in Cancer

The impact of social emotional context in chronic cancer pain: Patient-caregiver reverberations

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Abstract:	Purpose. Pain is a multifactorial and subjective experience. Psychological and social factors can modulate it. This study analyzed whether and how prolonged cancer pain is related to the social-relational environment's characteristics. Specifically, we investigated whether the caregiver's emotional support, his/her compassion ability or, on the contrary - his/her personal distress, associates with the patient's pain level. Methods. The sample consisted of 38 cancer patients suffering from pain and 38 family caregivers. The patients completed the McGill Pain Questionnaire (MPQ), the Balanced Emotional Empathy Scale (BEES) referred to caregiver, and an interview concerning the patient's perception of the caregiver's compassion level. Caregivers completed the Distress Thermometer (DT), the BEES, and an interview assessment of their compassion level. Results. Caregiver's distress level correlated with patient's pain intensity ($r = .389$; $p = .028$). Exploratory linear regression confirmed this association ($R2 = .151$; $F(1,30) = 5.33$; $p = .028$; $\beta = .389$). The number of problems reported by caregivers correlated with the patients' pain level ($r = .375$; $p = .020$), which was verified in a regression analysis ($R2 = .140$; $F(1,36) = 5.88$; $p = .020$; $\beta = .375$). In particular, the caregiver's amount of emotional problems was related to patient's pain level ($r = .427$; $p = .007$); this result was reaffirmed in a regression ($R2 = .182$; $F(1,36) = 8.03$; $p = .007$; $\beta = .427$). Conclusions. Our results show an association between social suffering, as indicated by the caregiver's emotional distress and the patient's physical pain. The results also highlight high distress levels and emotional problems among caregivers. The work emphasizes the need of a bio-psychosocial approach in managing cancer pain, along with the necessity to find effective interventions to fight emotional distress in family caregivers. The recovery of the caregivers' emotional resources could have beneficial implications on the patients' pain.

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Response to Reviewers:	Please, see the attached file "Author responses to the comments 06.08.2018".

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Author's responses to the comments (Minor Revisions 11.07.18)

We would like to thank the reviewers for the time spent reading the first revision of the manuscript and the useful feedback to improve it, and to the editor of Supportive Care in Cancer for considering the article for publication. We have carried out the revisions accordingly; changes are marked red in the manuscript.

Reviewer #1

Author Response 1)
The limitations and the conclusions of the study are now addressed in two separate paragraphs in the Discussion section (Limitations: line 266 of page 10; Conclusions: line 298 of page 11).
Since the order of the paragraphs changed and some sentences were added, the reference numbers have been modified too. The modified numbers are also reported in red throughout the text.

Author Response 2)
The document has been carefully edited by an expert to eliminate minor problems with the English.

Reviewer #2

Author Response 3)
Given that the cross-sectional design allows us demonstrate association rather than causation, the words suggesting "prediction" and "contribution to explanation" have been eliminated throughout the text.

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The impact of social emotional context in chronic cancer pain: Patient-caregiver reverberations

Social emotional context in chronic cancer pain

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Abstract

Purpose. Pain is a multifactorial and subjective experience. Psychological and social factors can modulate it. This study analyzed whether and how prolonged cancer pain is related to the social-relational environment's characteristics. Specifically, we investigated whether the caregiver's emotional support, his/her compassion ability or, on the contrary - his/her personal distress, associates with the patient's pain level.

Methods. The sample consisted of 38 cancer patients suffering from pain and 38 family caregivers. The patients completed the McGill Pain Questionnaire (MPQ), the Balanced Emotional Empathy Scale (BEES) referred to caregiver, and an interview concerning the patient's perception of the caregiver's compassion level. Caregivers completed the Distress Thermometer (DT), the BEES, and an interview assessment of their compassion level.

Results. Caregiver's distress level correlated with patient's pain intensity (r = .389; p = .028). Exploratory linear regression confirmed this association (R^2 = .151; F (1,30) = 5.33; p = .028; β = .389). The number of problems reported by caregivers correlated with the patients' pain level (r = .375; p = .020), which was verified in a regression analysis (R^2 = .140; F (1,36) = 5.88; p = .020; β = .375). In particular, the caregiver's amount of emotional problems was related to patient's pain level (r = .427; p = .007); this result was reaffirmed in a regression (R^2 = .182; F (1,36) = 8.03; p = .007; β = .427).

Conclusions. Our results show an association between social suffering, as indicated by the caregiver's emotional distress and the patient's physical pain. The results also highlight high distress levels and emotional problems among caregivers. The work emphasizes the need of a bio-psychosocial approach in managing cancer pain, along with the necessity to find effective interventions to fight emotional distress in family caregivers. The recovery of the caregivers' emotional resources could have beneficial implications on the patients' pain.

Keywords. Cancer pain · Emotional support · Empathy · Compassion · Personal Distress · Caregiver · Bio-Psychosocial Model

Introduction

Cancer patients often experience pain. According to the National Institutes of Health, between 14% and 100% of the patients feel pain [1]. Higher prevalence rates are reported among patients under active treatments (50-70%) and among patients in advanced stage of disease (60-90%) [2]. The experience of pain is complex and multifactorial; it cannot be reduced to the perception of sensory qualities of the nociceptive stimulus. Psychological factors modulate pain and make it a strictly subjective event. Some of the most important cognitive and emotional aspects affecting pain are: stress level, anxiety, and depression [3, 4]; emotion awareness and expression [5]; evaluative processes, beliefs, and coping strategies [6-8]; expectancy and motivation [9-10]. The social and relational environment influence pain too, whereby important factors are *social connection* and *support*. *Social connection* is a fundamental human need and contributes to maintaining health and wellness [11]. Moreover, relational bonds play a critical role in mitigating the effects of life's most stressful experiences [8]. According to Zautra (2013), individual resilience depends on relations: the primary sources of positive emotions in the face of difficult events are beneficial social interactions [12]. *Social support* is defined as the degree of perceived satisfaction with social relationships [13] or as the resources, effective or perceived as being available, from others in the social network [14]. It is categorized into emotional, tangible, informal, and companionship support. Emotional support, specifically, is the offering of empathy, concern, affection, love, trust, acceptance, encouragement, and caring [15]. Some studies show how social support, ranging from tangible aid to emotional connection, has a positive influence on pain perception and adaptation. For example, a randomized factorial mixed design study by Montoya and colleagues (2004) showed that individuals with chronic pain report less severe pain and show less activation of the central nervous system under painful conditions when they are in the presence of their significant other [16]. A cross-sectional study with the applications of structural equation modeling (SEM) reports that chronic pain patients receiving higher levels of social support not only exhibit decreased depressive symptomatology, but also pain intensity, which, in turn, decreases functional impairment and increases functional status [14]. Social support has both direct effects on pain and health outcomes, as well as indirect effects that protect individuals from the negative influence of stress-related biological processes [e.g. 17, 18]. Conversely, the lack of social connection and caring may feel "painful" [19, 20]. Recent evidence suggests that social pain – the painful feelings following events of "social disconnection" such as rejection, isolation, social loss, or lack of support – and physical pain are processed, in part, by the same neural circuitry [20]. As a consequence of this physiological similarity, these two types of pain experience can influence each other: experimental and longitudinal studies have demonstrated that feelings of social

pain can increase physical pain sensitivity [21, 22], while physical pain can exacerbate feelings of social rejection, even without actual experiences of exclusion [23].

On the other side, however, providing a suffering person with social support can be a very demanding task. Family caregivers, people who take care of the patient for most of the time, assume increasingly more responsibility and frequently take on burdens for which they are not prepared. As a consequence, they often develop physical and emotional illnesses [24]. A recent review suggests that the most prevalent physical problems among caregivers include sleep disturbance, fatigue, pain, loss of physical strength, loss of appetite, and weight loss [25, 26]. However, the detrimental physical effects are generally less intensive than the psychological ones [27]. Emotionally, cancer patient caregivers face symptoms of anger, depression, mood disturbances, and anxiety [24, 25, 28]. Besides, caregivers often experience empathy through which they share pain and suffering with the patient. Evidence from experimental studies shows that empathizing with somebody else's pain activates brain regions involved in the first-hand experience of pain [29] and can also increase pain sensitivity in the observer [30]. Some research groups point out that the empathic involvement with another person's suffering evokes primarily two kinds of responses in the observer: *compassion*, which is also referred to as empathic concern or sympathy, or *empathic distress*, also called personal distress [31, 32]. *Compassion* is conceived as a feeling of concern for another person's suffering, which is associated with approach, prosocial motivation and behavior. *Empathic distress*, on the other hand, refers to a self-focused, strong aversive affective reaction to the suffering of another, accompanied by the desire to withdraw from the situation in order to protect oneself from excessive negative feelings, thereby decreasing the likelihood of prosocial behavior [32]. The term "compassion fatigue" is also used to refer to this state of distress, strain, and weariness from caring for another person's physical or emotional suffering [33]. Thus, individuals who experience high levels of empathy and involvement towards the patient's pain are vulnerable to the development of psychological symptoms such as distress, fatigue, and even an increased pain sensitivity. These disturbances also affect caregivers' emotional resources to support and connect with the patient.

To build upon previous work, the primary purpose of this study was therefore to assess the contribution of the social emotional dimension on prolonged pain in cancer patients. More specifically, we investigated whether and how the caregiver's emotional support, effective (the caregiver's actual compassion ability or, on the contrary, his/her personal distress level) or perceived (the patient's perception of emphatic concern received by the caregiver), was related to the patient's pain level. Additionally, this study investigated potential factors associated with "caregiver's burden" among the respective family caregivers.

Methods

Sample

Participants were recruited between October 2016 and December 2016 at Clinical and Oncological Psychology and Medical Oncology Units of San Giovanni Hospital "Molinette" in Turin. Each participant was tested with the Mini-Mental State Examination (MMSE) to assess his/her cognitive capacity to provide informed consent and to complete the questionnaires. The inclusion criteria were: 1) being diagnosed with cancer; 2) age > 18 years; 3) compliance with the basic criterion of chronic pain definition, which, according to the International Association for the Study of Pain (IASP) Task Force for the Classification of Chronic Pain in ICD-11, is: "Persistent or recurrent pain lasting longer than 3 months" [34]; 4) being accompanied by the main family caregiver, who was also willing to participate in the research. Exclusion criteria were a score lower or equal to 19 on the MMSE and the presence of psychotic mental disorders.

Procedure

The researchers approached potential participants in the waiting rooms of the aforementioned healthcare units, with an initial screening question: "Are you experiencing pain daily or almost daily for at least three months?". Respondents who answered 'yes' were considered compliant with the basic criterion of chronic pain and were consequently included in the study. Patients and caregivers were asked to read and complete two different test batteries independently. They were offered the possibility to fill out the tests in loco or at home. Participants were encouraged to ask questions in case of doubt about any of the items or otherwise. Finally, participants were briefed that all gathered data will be used for research purposes only and will be kept anonymous. Participants provided written informed consent following the protocols admitted by Ethics Committee of the City of Health and Science University Hospital of Turin that approved this study.

We asked a total of 85 cancer patients to participate; 35 were deemed ineligible for the study and were therefore excluded. Specifically, 18 cancer patients did not pass the screening question, i.e., reported no chronic pain; 12 patients did not have a caregiver; 5 patients had a caregiver who refused participation. Therefore, 50 patients with a primary caregiver were recruited. During the study, additional 5 dyads agreed to participate by completing the questionnaires at home but did not return the tests, 5 dyads withdrew their participation from the study, and another 2 patients passed away before returning the questionnaires. The final sample consisted of 38 dyads (76 participants).

Screening Tools

All participants completed a sheet collecting *socio-demographic information* (sex, age, marital status, children, educational level, occupational status, primary caregiver, eventual psychological therapy). Patients also completed a sheet collecting *clinical information* (tumor site, stage of the disease, treatment phase, type of therapy, presence of second tumor site, eventual psychopharmacological treatment).

The caregivers completed three tests. The *Distress Thermometer* (DT) is a self-report measure of psychological distress [35]. Responders are asked to rate their distress level using a thermometer visual analogue scale with scores ranging from 0 ("no distress") to 10 ("extreme distress"). The cut-off score is 4. The thermometer is accompanied by a problem list, which asks subjects to identify any of 34 issues (grouped into five categories: practical, relational, emotional, spiritual, and physical concerns) that have been a source of their general distress level. The *Balanced Emotional Empathy Scale* (BEES) [36] is a 30-item instrument scored on a 9-point Likert scale, which evaluates the level of affective empathy, i.e., the extent to which the respondent can emphatically share others' emotions (e.g., feel others' suffering or take pleasure in their happiness). Finally, to evaluate the caregivers' actual ability to experience compassion towards the patient, a brief interview of 10 questions on a 9-point Likert scale was conducted. The interview was based on the questions concerning relational empathy of the *Barrett-Lennard Relationship Inventory* (BLRI) – *Empathy Understanding subscale* [37]. The patients completed three additional tests. The *McGill Pain Questionnaire* (MPQ) is a multidimensional scale designed to measure different aspects of pain experience and pain intensity in adults suffering from chronic painful conditions with different etiology [38]. The MPQ contains 78 pain descriptor items categorized into 20 subclasses that fall into four major subscales: sensory, affective, evaluative, and miscellaneous [39]. The patients also completed the BEES in order to assess the perceived empathy level of the caregiver. In this case, the participants were instructed to read the sentences with reference to their caregiver and not to themselves. Finally, to investigate the patient's perception of the caregiver's compassion level, the same interview based on the BLRI was used. Similarly, the patients were told that the questions were referred to their caregiver and in answering them, they should think about their actual relationship with him/her.

Statistical Analysis

Statistical analysis was executed using SPSS Statistics Version 23.0 (IBM Corp. Armonk, NY, USA). Descriptive statistics including means, standard deviations, and frequencies were used to describe the sample's socio-demographic

and clinical characteristics. To assess variables distributions, measures of skewness and kurtosis were used. For the multivariate analysis, we used bivariate Pearson's correlations, exploratory linear regressions, and means comparisons through independent samples T-test. None of the test assumptions were found violated. The tests were two-sided and a p-value of less than .05 was considered statistically significant.

Results

Descriptive statistics

The 38 dyads were composed by the patients and their respective primary family caregivers. As shown in Table 1, cancer patients (65% female, *n* = 25) were at an average age of 58.5 years (*SD* = 13.4; range 30-78); male and female caregivers were balanced and at an average age of 54.4 years (*SD* = 14.8; range 20-79). 78% of the patients (*n* = 30) and 63% of the caregivers (*n* = 24) were married. The majority of the patients (65%, n = 25) reported their spouse as their "primary caregiver"; caregivers reported their spouse as "caregiver" (44%, *n* = 17) nearly as frequently as they reported "none" (34%, *n* = 13). The majority of both patients (65%, *n* = 25) and caregivers (84%, *n* = 32) reported that they were not receiving psychological therapy. Regarding illness, the majority of patients was under active treatment (89%, *n* = 34) of chemotherapy (84%, *n* = 32). As presented in Table 2, 60% of the patients (*n* = 23) reported a mild pain level, 29% (*n* = 11) reported a moderate pain level, and 11% (*n* = 4) – a severe pain level. The mean score of total pain in the patients' group was 21.87 (*SD* = 21.12), corresponding to 28% of the maximum score of the MPQ. This value is in line with the normative mean scores across chronic painful conditions that range from 24 to 50% of the maximum score of the MPQ [40]. Hence, cancer pain falls within the category of chronic pain. Regarding the patients' perception of the caregiver's empathy, almost all patients (97%, *n* = 37) reported a medium empathy level of the caregiver, whereas half of the patients (45%, *n* = 17) reported a medium compassion level and the other half (55%, n = 21) – a high compassion level. With regard to caregivers' characteristics, 39% of the caregivers (*n* = 15) had a moderate distress level, 37% of them (*n* = 14) a mild distress level, and 24% (*n* = 9) – a severe one. In total, 63% of the caregivers had a distress level above the cut-off. The majority of the caregivers reported having problems in the emotional (84%, *n* = 32) and in the physical sphere (78%, *n* = 30). In particular, the most common emotional problems among caregivers were "worry" (63%, *n* = 24), "sadness" (45%, *n* = 17), "irritability" (31%, *n* = 12), and "fears" (29%, *n* = 11). Most caregivers indicated a medium empathy level (81%, *n* = 31), while half of the caregivers reported a medium compassion level (50%, *n* = 19) and the other half (50%, *n* = 19) – a high compassion level.

Analysis of the associations between caregiver's emotional resources and patient's pain

Regarding the hypothesized contribution of the caregiver's emotional support to the patient's pain, an initial analysis did not show a significant association of empathy level (effective or perceived) and compassion level (effective or perceived) with patient's pain. Nevertheless, we observed a positive correlation between the caregiver's distress level and the patient's pain, which was subjectively reported in the evaluative subscale of the MPQ (r = .389; p = .028). This subscale describes the overall subjective intensity of pain experience [38]. Moreover, the total amount of problems reported by the caregiver was positively associated with all subcategories of the patient's pain: total pain (r = .375; p = .020), sensory (r =.340; p = .037), affective (r = .326; p = .46), evaluative (r = .386; p = .017), and miscellaneous (r = .389; p = .016). Specifically, we observed a precise correlation between the caregiver's total quantity of emotional problems and the patient's pain level (r = .427; p = .007); crucially, the total quantities of the caregiver's problems reported in the other domains (practical, relational, physical, and spiritual) were not correlated with patient's pain level. Exploratory simple linear regressions confirmed the relationship between caregiver's emotional distress and patient's pain showing that the caregiver's general distress level was significantly associated with the patient's pain intensity (R^2 = .151; F (1,30) = 5.33; p = .028; β = .389). The patient's pain level also linked to the caregiver's total number of problems (R^2 = .140; F (1,36) = 5.88; p = .020; β = .375), and, in particular, to the caregiver's total amount of emotional problems (R^2 = .182; F (1,36) = 8.03; p = .007; β = .427).

Analysis of the associations between caregiver's problems and distress level

To understand which factors were related to the caregivers' distress, we computed the correlations between caregiver's general distress level and number of problems reported in different domains (practical, relational, emotional, spiritual, and physical). Even though marginally significant associations were found between the number of relational problems and general distress level (r = .336; p = .060), and between the number of relational problems and the number of emotional problems (r = .309; p = .059), only the quantity of the caregiver's problems in the emotional sphere was significantly and highly correlated with the general distress level experienced by him/her (r = .687; p < .001). This relation was further established in a regression analysis (R^2 = .472; F (1,30) = 26.87; p < .001; β = .687). Finally, analyzing emotional problems one by one, multiple single t-tests revealed a significantly higher distress level when the problems "depression" (Δ *mean* = 3.56; t = -3.47; p = .002), "fears" (Δ *mean* = 2.23; t = -3.01; p = .005), "irritability" (Δ

mean = 2.72; *t* = -3.89; *p* = .001), "sadness" (*Δ mean* = 2.35; *t* = 3.57; *p* = .001), and "loss of interest in daily activities" (*Δ mean* = 3.13; *t* = -4.36; *p* < .001) were present compared to when these problems were not reported by caregivers.

Discussion

The aim of this study was to test the hypothesis that caregiver's emotional support, effective or perceived, was significantly associated with chronic cancer pain. Initially, we did not find support for the proposed hypothesis. In fact, the caregiver's effective or perceived empathy and compassion levels were not found related to the patient's pain level. These results could mean that the social-emotional support is not linked to chronic pain experience of cancer patients. Another possible interpretation, which is more congruent with existing literature and with the results from our follow-up analyses, is that empathy and compassion scores have been affected by social desirability and acquiescence [40]. Literature on the subject indeed suggests that there are substantial problems with relying solely on self-report measures to estimate empathy. These measures are often convoluted by the individual's concerns with their own evaluations or those of others. In other words, the extent to which participants report how they actually feel in empathy-inducing contexts cannot be disentangled from how respondents wish to be perceived in such settings on the basis of the self-reports [40, 29]. Furthermore, the assessment of empathy and compassion itself could make people feel "under accusation", as if one is not compassionate or empathic enough. Participants therefore tend to answer in, what they consider, the most "normal" way in order to not appear dissimilar from others. Moreover, acquiescence is a form of compliance, which is observed when individuals respond positively to all questions irrespective of the content. Together, these biases tend to cause average or higher scores without reflecting the actual empathy levels. Indeed, this appears to be the case in this study as all empathy and compassion scores collected with self-reports were clustered in the middle to high ranges of the distribution. As a consequence, it is difficult to draw conclusions about the absence of the hypothesized relationships and further investigations using more objective alternative measures are required.

Our results show that the caregiver's distress level, mainly pertaining to his/her emotional problems, correlates positively with the patient's pain perception. Personal distress, especially when associated with emotional problems, is able to adversely influence the effective resources and the capacity of an individual to provide another one in pain with compassion and prosocial behaviors, and it is often linked to fatigue and relational withdrawal [31, 32]. As a result, the caregiver's personal distress can indirectly lead to a lack of (or a worsening of the quality of) the emotional connection and support of the patient and may in turn increase the patient's perception of isolation. Thus, these data provide evidence in favor of the physical/social pain overlap theory [19-23]. In fact, suffering in the patient's relational sphere,

as reflected by the emotional distress of caregiver in this study, is significantly correlated with the patient's physical pain level. Alleviating the suffering in the patient-caregiver social environment could therefore play an important role in the effective management of prolonged pain.

The description of the caregivers' condition in this sample was critical: more than half of the caregivers (63%) reported a distress level above the cut-off, which indicates the necessity of an intervention [35], and 84% of them reported at least one emotional problem. Furthermore, emotional problems were the main source of the caregivers' distress. In spite of this, the majority of caregivers (84%) reported that they were not receiving any psychological therapy.

These results are in line with previous literature highlighting that the role of the cancer patient caregiver satisfies all criteria for chronic stress and, as such, primarily impacts the caregiver's psychological well-being leading to the development of emotional symptoms like depression and anxiety [27, 28]. Moreover, the detected positive associations between the patient's pain intensity and the caregiver's distress level, and between the patient's pain level and the caregiver's quantity of emotional problems, conform with existing literature pointing out that anxiety, tension, and depression are significantly higher among caregivers of cancer patients in pain than among caregivers of pain-free patients [41, 42]; they are also consistent with previous work showing that the patient's perceived pain plays an independent role in affecting the caregiver's emotional burden and distress [43].

Limitations

A limitation we already discussed was the difficulty of validly assessing empathy and compassion through self-report measures. Another issue was the experimental attrition our study suffered. The sample size was based on reviews studies [44, 45, 46], describing experiments that shared sample and design characteristics with our prospective study. The minimum reported sample size was 29 participants. Although the initial recruited sample was 50 dyads, we suffered an unforeseen participants dropout. A larger sample size would therefore yield more statistical power for assessing the presence of the hypothesized effects, which we will be opting for in future works. Third, the exclusion of the socio-demographic and clinical characteristics from the analyses. The sample was highly homogeneous in regard to patients' clinical characteristics. On the ground of this, we decided to leave aside the medical features from the analysis, assuming them as stable characteristics of the group. Regarding the socio-demographic aspects, we investigated the associations between age and pain level and between sex and pain level, but both resulted not significant. Therefore, we decided not to include these variables as co variate in the following regressions. Although this study design focused specifically on the assessment of selected social-emotional variables, we recognized that personal and medical

characteristics – such as cancer type, length and type of treatment, disease stage, cancer-related operations and/or infections, musculoskeletal complaints related to inactivity, and generalized fatigue – have an important impact on cancer pain. We therefore suggest a focused study analyzing also the contribution of these characteristics on chronic cancer pain in order to build a fuller picture of the phenomenon. Such a study will require a more heterogeneous sample with respect to those variables and a greater number of participants. Fourth, the cross-sectional design does not allow for causal inference about the relationships between the variables of interest but provides a descriptive account of the cancer patient-primary caregiver dyad. These preliminary results thus call for replication using more complex study designs. Longitudinal studies, for instance, taking multiple measures over an extended period, can be a useful tool for determining cause-effect relationships between the studied variables. Finally, by omitting patients without pain, we may have left out patients for whom the family caregivers' support has had the largest impact, i.e., we cannot assess the potential contributions of very strong caregiver emotional support to the absence of pain in cancer patients. Future studies should therefore consider also patients without chronic pain in order to assess whether and how psycho-social influences contribute to the absence of pain. Moreover, having excluded patients who were not accompanied by their main family caregiver, this study may have excluded patients for whom caregiver support is least effective with regard to the amelioration of pain. A replication including other types of caregiver and/or patients without caregiver would allow us to better understand how the different social-emotional environments surrounding patients affect chronic cancer pain experience.

Conclusions

This study shows that the cancer patient's physical pain is connected to his/her interpersonal sphere (as higher patient pain levels were found associated with poorer caregiver emotional well-being) and thereby supports the necessity of a bio-psychosocial approach to the treatment of prolonged cancer pain. In several healthcare settings, pain management still tends to take a biomedical approach, which often concentrates on the organic origin of pain, regarding it mostly as a potential diagnostic tool and therefore undervaluing its psychosocial and social influences [23]. Furthermore, several investigations have concluded that the bio-psychosocial model is being adopted only partially, with a focus on cognitive and behavioral factors but without a consideration of the social dimension of pain [e.g., 47]. The present work shows that the social-relational reality is clearly connected to the prolonged pain experience by cancer patients: the caregiver's emotional distress alone explains 18% of the variance in the overall patient's pain level.

Another fundamental issue highlighted by the results of this study is the necessity of developing effective interventions to support the family caregivers. The constant contact with suffering and pain exposes caregivers to emotional exhaustion and personal distress. Identifying those caregivers who manifest greater emotional distress and help them to improve their condition will be, firstly, beneficial for their psychological health and, secondly, will improve the patient's painful experience by restoring the emotional resources that can be dedicated to the patient's support. Some interesting studies [e.g., 31] describe a type of ability training named *Compassion Training* that could be useful in this context. It has been demonstrated that *Compassion Training*, by cultivating feelings of warmth and prosocial motivation, increases positive affective experiences, even in response to others' suffering, and it is associated with stronger activations in brain regions previously implicated in positive valuation, as well as love and affiliation [48, 49]. Future research could evaluate whether engaging caregivers suffering from emotional distress in a brief training program would impact positively the caregivers' psychological well-being and whether and how the recovery of emotional resources would in turn benefit the patients' pain.

Acknowledgements None

Compliance with ethical standards

Conflicts of interest The authors have no financial or other relationships that might lead to a conflict of interest.

Ethical approval All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

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Royalties	☒	☐	☐			Del ×
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The purpose of this form is to provide readers of your manuscript with information about your other interests that could influence how they receive and understand your work. The form has five parts.

1. Identifying information.

Each author should submit a separate form. Provide complete information and double-check the manuscript number. If you are NOT the corresponding author please insert his or her name.

2. The work under consideration for publication.

Please provide information about the work that you have submitted for publication. The time frame for this reporting is that of the work itself, from the initial conception and planning to the present. The idea is to provide for the reader information about resources that you received, either directly or indirectly (via your institution), to enable you to complete the work. If you check the "No" box it means that you did the work without receiving any financial support from any third party -- that is, the work was supported by funds from the same institution that pays your salary and that institution did not receive third-party funds to pay you. If you or your institution did receive funds from a third party to support the work, check "Yes" along with the appropriate boxes to indicate the type of support and whether you or your institution received it.

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Given Name: (or first) Riccardo

Surname: (or last) Torta

Effective Date: 05-February-2018

Format example: 07-August-2008

Are you the corresponding author? ☐ Yes ☒ No

Corresponding author's name: Martina De Laurentis

Manuscript Title: The impact of social emotional context in chronic cancer pain: patient-caregiver reverberations

Manuscript Identifying Number (if you know it): JSCC-D-17-01051R1

Section 2. Information about the support of the work under consideration for publication.

Did you or your institution at any time receive payment or support in kind for any aspect of the submitted work (including but not limited to grants, data monitoring board, study design, manuscript preparation, statistical analysis, etc...)?

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☐ Yes, specify nature of compensation

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						Add +
Consultancy	☒	☐	☐			Del ×
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Table 1 Patients' and caregivers' socio-demographic characteristics and patients' clinical characteristics.

	n (%)	M (SD) [a]
Patients' socio-demographic characteristics		
Sex		
Male	13 (35)	
Female	25 (65)	
Age		58.5+/-13.4
Educational level (years)		11.5 +/-3.7
Marital status		
Unmarried	3 (7.9)	
Divorced	1 (2.6)	
Partner cohabitant	2 (5.3)	
Married	30 (78.9)	
Widow	2 (5.3)	
Children		
Yes	31 (81.6)	
No	7 (18.4)	
Occupational status		
Employed	11 (28.9)	
Retired	15 (39.5)	
Student	0	
Unemployed	4 (10.5)	
Housewife	4 (10.5)	
Occasional worker	3 (7.9)	

Caregiver		
None	0	
Spouse	25 (65.8)	
Children	3 (7.9)	
Friend	1 (2.6)	
Partner	4 (10.5)	
Other relative	4 (10.5)	
Psychological therapy		
Yes	13 (34.2)	
No	25 (65.8)	
Caregivers' socio-demographic characteristics		
Sex		
Male	19 (50)	
Female	19 (50)	
Age		54.43+/14.84
Educational level (years)		12.6+/3.99
Marital status		
Unmarried	9 (23.7)	
Divorced	1 (2.6)	
Partner cohabitant	2 (5.3)	
Married	24 (63.2)	
Widow	1 (2.6)	
Children		
Yes	25 (65.8)	
No	13 (34.2)	

Occupational status	
Employed	16 (42.1)
Retired	14 (36.8)
Student	2 (5.3)
Unemployed	3 (7.9)
Housewife	1 (2.6)
Occasional worker	0
Caregiver	
None	13 (34.2)
Spouse	17 (44.7)
Children	5 (13.2)
Friend	0
Partner	2 (5.3)
Other relative	1 (2.6)
Psychological therapy	
Yes	2 (5.3)
No	32 (84.2)
Patients' clinical characteristics	
Tumor site	
Breast	14 (31.8)
Bones	1 (2.3)
Dermatologic	1 (2.3)
Gynecologic	1 (2.3)
Gastric	9 (20.5)
Genitourinary	1 (2.3)

Head/Neck	7 (16)
Hodgkin's	1 (2.3)
Lung	6 (13.6)
Presence of second tumor site	
Yes	6 (15.8)
No	32 (84.2)
Stage of the disease	
Under active treatment	34 (89)
In remission	4 (11)
Treatment phase	
Waiting for therapy	2 (5.3)
Active treatment	34 (89.5)
Follow-up	1 (2.6)
Type of therapy	
Chemotherapy	32 (84.2)
Radiotherapy	2 (5.3)
Pharmacotherapy	3 (7.9)
Psychopharmacological treatment	10 (26.3)

[a] n, cumulative absolute frequencies; %, percentage frequencies; M, means; SD, standard deviations.

Table 2 Descriptive statistics of patients' pain and patients' perception of caregiver's empathy and compassion; caregivers' distress, empathy and compassion.

	n (%)	M (SD) [b]
Patients' pain		
Total Pain		21.87+/-21.12
Pain subscales		
Sensory		12.68+/-11.87
Affective		3.45+/-3.89
Evaluative		1.34+/-1.59
Miscellaneous		4.39+/-5.11
Level of Pain		
Mild	23 (60.5)	7.7+/-8.32
Moderate	11 (28.9)	35.45+/-5.82
Severe	4 (10.5)	66+/-8.2
Patients' perceived empathy		
Total Perceived Empathy		135.86+/-13.18
Level of Perceived Empathy		
Low	0	
Medium	37 (97.4)	135.83+/-3.97
High	1 (2.6)	149.92+/-7,32
Patients' perceived compassion		
Total Perceived Compassion		55.53+/-9.6
Level of Perceived Compassion		
Low	0	

Medium	17 (44.7)	50.24+/-3.59
High	21 (55.3)	63.53+/-4.98
Caregivers' distress		
Total Distress		4.71+/-2.18
Level of Distress		
Mild	14 (36.8)	2.79+/-1.25
Moderate	15 (39.5)	5.73+/-0.88
Severe	9 (23.7)	8.67+/-1.15
Reported Problems		
In practical sphere	13 (34.2)	
In relational sphere	6 (15.8)	
In emotional sphere	32 (84.2)	
In spiritual sphere	3 (7.9)	
In physical sphere	30 (78.9)	
Emotional Problems		
Depression	3 (7.9)	
Fears	11 (28.9)	
Irritability	12 (31.5)	
Sadness	17 (44.7)	
Worry	24 (63.2)	
Loss of interest in daily activities	8 (21.5)	
Caregivers' empathy		
Total Empathy		145.28+/- 13.77
Level of Empathy		
Low	0	

Medium	31 (81.6)	137.73+/-4.17
High	7 (18.4)	159+/-8.97
Caregivers' compassion		
Total Compassion		53.78+/- 8.59
Level of Compassion		
Low	0	
Medium	19 (50)	46.5+/-4.34
High	19 (50)	60.68+/-5.15

[b] n, cumulative absolute frequencies; %, percentage frequencies; M, means; SD, standard deviations.