

Peer Review File

Article Information: <http://dx.doi.org/10.21037/apm-20-803>

Responses to Review Comments A:

Comment 1: *In general, this manuscript is quite studied in caregiving situation. But, the previous studies are limited to compare the factors of CUBP and CLBP. So, the researcher should write the necessary and significance of these issues. Writing presentation is quite difficult to understand because they are several details and use a variety of statistics to test the objectives of examination associations and comparison differences between two groups.*

Response: We appreciate your thoughtful feedback. We have added some text to the Introduction section to address this issue (see Page 4-5, line 72-79):

“Back pain is widespread, and there is a limit to what can be regarded as a single site. For example, the physical tasks of family caregivers who must lift bedridden cancer patients are related to patients’ cancer severity. It is likely that caregiver back pain is affected more by such tasks than by subjective psychological stress, and that the lower back is more burdened than the thoracic spine. It is therefore important to identify back pain location as either the thoracic spine or lower back, and examine cancer caregiving-related factors that affect CBP in each location.”

We also state in the Introduction that although previous studies have shown that stress affects chronic back pain (see Page 4, line 67-68),

“few have differentiated between thoracic spine and lower back pain or assessed both in a single research project.”

Comment 2: *Moreover, the authors should check the correctness of typing and English language.*

Response: We have rechecked the accuracy of the text, and the manuscript has been edited again by a native English speaker from a professional academic editing company.

Comment 3: *Title: the word of “nursing” should be changed to “ cancer caregiving-related factors ” because the caregivers of this study are family member (not nurses).*

Response: We have changed our title to “Factors associated with chronic thoracic spine and low back pain in caregivers of cancer patients” to clarify this issue.

Comment 4: *Abstract: Methods part should be added the setting and statistics used. Results should be showed consistently with the objectives, the findings’ contents, and Tables of this study. The statistical values should be presented.*

Response: We have added the relevant text to the Abstract to provide this information (see Page 1-2, line 17-22, 25-31):

Methods: “Multivariate logistic regression analysis was conducted. The dependent variable was presence of thoracic spine/low back pain; the independent variables were care recipient performance status and duration from survey until death, and caregiver scores on the Hospital Anxiety and Depression Scale-Depression, Hospital Anxiety and Depression Scale-Anxiety, Pittsburgh Sleep Quality Index-J, and Zarit Caregiver Burden Interview-J.”

Results: “Logistic regression analysis showed that depression score was associated with chronic thoracic spine pain (both pain intensity \leq personalized pain goals and pain intensity $>$ personalized pain goals) ($P = 0.001$ and $P = 0.027$) and sleep score with chronic thoracic spine pain (pain intensity $>$ personalized pain goals) ($P = 0.018$). Performance status and time from survey until death were associated with chronic lower back pain (pain intensity $>$ personalized pain goals) ($P = 0.034$ and $P = 0.017$).”

Comment 5: *The suggestions should be mentioned the use of “significant factors” to reduce CUBP and CLBP rather than stated about “the cancer nursing care factors affecting CBP”.*

Response: We have added appropriate text to the Abstract section (see Page 2, line 33-35):

“To reduce chronic back pain, it is important to address subjective psychological stress and physical burden with reference to back pain location.”

Comment 6: *Keywords: should add the word “pain”*

Response: We have included “Back pain” and “Chronic pain” as keywords.

Comment 7: *Participants: should present inclusion criteria of participants (such as a primary caregiver, duration of caregiving, no mental health problems, other back bone diseases, the caregiving placement)*

Response: We appreciate your thoughtful feedback. We have described the inclusion criteria in the Methods section (see Page 7-8, line 120-122, 130-134):

“The inclusion criteria were family caregivers who directly provided care to a primary family member with cancer, had at least 1 month of caregiving experience at home, and had either non-specific chronic pain or pain from specific causes, such as a herniated disc.”

“We defined a family caregiver as a primary family member (including spouses) who directly provided care to a relative with cancer and had at least 1 month of caregiving experience at home.”

Comment 8: *Ethical committee approval process and data collection should be provided in this study.*

Response: We have added this information to the Methods section (see Page 7, line 113-115):

“The study received approval from the medical ethics committee of Kansai Medical University (reference number: 2015660).”

Comment 9: *Qualities of measurements should be described including validity and reliability.*

Response: We have added this information to the Methods section (see Page 10-11, line 168-169, 188-189):

“The sensitivity and specificity for both HADS-D and HADS-A were approximately 0.80 (26,27) ”

“The J-ZBI has high test–retest reliability ($r = 0.76$) and internal consistency (Cronbach’s $\alpha = 0.93$) (31).”

Comment 10: *Results: Some findings were not presented in texts, were questions in the Tables, and had inconsistency between texts and Tables. For example,*

1) More than 50% of patients were admitted in the hospital (Table 2-outpatients 47.2%). It is possibly described that that the caregivers of this study may little provided direct care for their patients during hospitalization. So, they may not the key or primary family caregivers.

Response: We have included this point in the discussion of the study limitations (see Page 19-20, line 342-345):

“Third, more than half of family caregivers were studied when their care recipients were hospitalized. These participants were directly caregiving at home, but were also indirectly caregiving (e.g., when visiting their care recipients in hospital), which might have affected some of the results.”

We have also double-checked the consistency between the text and tables.

Comment 11: *2) Obviously, the result showed that a number of outpatient factor was significantly differ among group of with out CBP and Group with CLBP ($p 0.039$)(Table 3). But, it is not explained in the result texts.*

Response: We have now explained this in the Results section (see Page 15, line 264-266):

“For outpatients, there was a significant difference between the three groups; the scores for the groups with CLBP ($PI \leq PPG$ and $PI > PPG$) were not significantly higher than those for the group without CLBP ($P = 0.248$ and $P = 0.086$).”

Comment 12: *3) In the Table 4-5, should test the correlation among CUBP and CLBP with $PPG > PI$ and $PPG < PI$ in order to relate to objectives of this study.*

Response: We have created Tables 5–8 to separately test the correlations for the thoracic spine and lower back pain groups with PPG > PI and PPG < PI.

Comment 13: *Moreover, some variables (HADS-A, PSA, J-ZBI, time from survey until death) that significantly related to CUBP and CLBP, but they were not used to test the logistic regression analysis (Tables 4-5). 4) Age and sex did not have significant relationship with CUBP and CLBP (Table 2,3, 4) were used to test the odd ratio (Table 5).*

Response: We appreciate your thoughtful feedback. We have revised the relevant text in the Methods section (and created Tables 7–8) to clarify these relationships (see Page 13, line 219-222):

“Finally, we carried out a multivariate logistic regression analysis using the forced entry method, with the presence of thoracic spine/low back pain as the dependent variable, and HADS-D score, HADS-A score, PSQI-J score, J-ZBI score, ECOG PS (care recipients), and duration from survey until death (care recipients), as the independent variables.”

Comment 14: *And the results of the table 5 were not showed in the abstract.*

Response: We have now added this information to the Abstract section (see Page 2, line 25-31):

“Logistic regression analysis showed that depression score was associated with chronic thoracic spine pain (both pain intensity \leq personalized pain goals and pain intensity > personalized pain goals) (P = 0.001 and P = 0.027) and sleep score with chronic thoracic spine pain (pain intensity > personalized pain goals) (P = 0.018). Performance status and time from survey until death were associated with chronic lower back pain (pain intensity > personalized pain goals) (P = 0.034 and P = 0.017).”

Comment 15: *Discussion: Make it concisely and relating to objectives and findings. Some explanations are questions/ not clear how they support the results such as therapeutic interventions (Line 229-238) and trigger points (Line 263-269)*

Response: We appreciate your thoughtful feedback. We have revised the Discussion section as suggested and have added some relevant text:

(Lines 229–238)

Added text (see Page 17, line 292-298):

“To reduce CTSP, it is important to address subjective psychological stress in family caregivers. In particular, it has been reported that symptoms of depression have a negative effect on physical health conditions, such as body pain, in family caregivers of cancer patients (9). To reduce CLBP, it is important to consider caregiving services according to cancer severity of care recipients. Many therapeutic interventions report pain improvement after exercise intervention for CBP (35,36).”

Deleted text:

“Factors relevant to cancer caregiving include subjective psychological stress in family caregivers and cancer severity in care recipients, but therapeutic interventions differ for each. Psychological care is prioritized for subjective psychological stress in family caregivers, but alleviation of physical burden to family caregivers through the use of caregiving services is prioritized for cancer severity in care recipients. Indications for therapeutic intervention are not obvious for psychological stress, and care is needed. However, there are many reports of pain improvement after exercise intervention for CBP (34,35). Family caregivers often feel guilty about taking care of themselves because they experience a sense of helplessness in their engagement with cancer patients (36). One study introduced mindfulness-based stress reduction to lung cancer patients and their family caregivers (37). It found that psychological distress among the patients was alleviated, but distress among family caregivers did not improve because caregivers prioritized patients' wellbeing over their own.”

(Lines 263–269)

Added text (see Page 18-19, line 321-323, 326-330):

“The second important finding of this study is that the association between HADS-D score and CTSP was stronger in the group with $PI \leq PPG$ than in the group with $PI > PPG$ (higher odds ratio) ... Although we cannot assume causality, these results may indicate that the presence of depression can affect the development or alleviation of mild thoracic spine pain. However, we cannot determine from these data whether the pain is caused by depression or whether the pain is prolonged by depression (depression affects whether the PPG has been achieved) and thereby becomes chronic.”

Deleted text:

“This study was cross-sectional, and therefore causation cannot be implied. If the presence of depression can potentially affect the development or alleviation of mild pain, the concept of latent trigger points makes it easier to think about it. Trigger points are classified into active and latent by the presence or absence of spontaneous pain (47,48). Latent trigger points may be found in many pain-free skeletal muscles and could be activated (become active trigger points) by continuous stimuli (49). It has been suggested that latent trigger points are associated with depression or alexithymia in the general population (39,42).”

Comment 16: *Although authors presented the limitations: in particular, the characteristics of participants of this study. (Line 277-278). However, They may not completely reflect that they are the primary family caregivers of cancer patients.*

Response: We have now mentioned this point in the discussion of the study limitations (see Page 19, line 340-342):

“Further, the data may not completely reflect the fact that participants were the primary family caregivers of cancer patients.”

Comment 17: *Moreover, the caregivers' traits or background of depression/ anxiety data were not collected that may influence on the factors' findings of the study.*

Response: We have now mentioned this as a study limitation (see Page 20, line 345-347):

“Fourth, data on caregiver traits and the background details of depression/anxiety were not collected; such data may have influenced the study findings.”

Responses to Review Comments B:

Comment 1: *Despite the title reflecting the content of the article and communicating the research design and goal to the reader, it left doubts about the regions of the pain being studied. At first, I thought it was the lumbar and cervical region. The term back pain is a broad term, used colloquially. Its importance is due to its high worldwide prevalence and its consequences such as functional disability and decreased quality of life. Some authors consider it to affect only the lumbar region, others use terms such as neck pain, thoracic spine pain and low back pain. Mech defines back pain as an acute or chronic pain that is located in the posterior regions of the thorax, the lumbosacral region or the adjacent regions. If the authors refer to thoracic spine pain and low back pain, they should specify it in the title to facilitate the reader's understanding. Studying thoracic spine pain is relevant and the data from this research is very significant since this region has attracted little attention in terms of clinical research, despite it being able to lead to significant functional disability and decreased quality of life, even if it has a lower prevalence than neck and low back pain.*

Suggestion: Factors associated with chronic thoracic spine and low back pain in caregivers of cancer patients

Response: We appreciate your thoughtful feedback. We have changed the title to “Factors associated with chronic thoracic spine and low back pain in caregivers of cancer patients” to clarify this issue. Further, we have added some relevant text to the Introduction section (see Page 4, line 68-72):

“The Medical Subject Headings (MeSH) database defines back pain as pain located in the posterior regions of the thorax, lumbosacral region, or adjacent regions. The thoracic spine is generally defined as the region above the costal margin and below the neck, and the lower back as the region below the costal margin and above the inferior gluteal folds (16).”

Comment 2: *Abstract: Include the period and place in which the research occurred and inform the statistical tests used.*

Response: We have added this information to the Abstract section as follows (see Page 1-2, line 10-11, 17-22):

“A cross-sectional survey was conducted among 320 family caregivers of advanced cancer patients from 2016 to 2018 at a single-unit university hospital.”

“Multivariate logistic regression analysis was conducted. The dependent variable was presence of thoracic spine/low back pain; the independent variables were care recipient performance status and duration from survey until death, and caregiver scores on the Hospital Anxiety and Depression Scale-Depression, Hospital Anxiety and Depression Scale-Anxiety, Pittsburgh Sleep Quality Index-J, and Zarit Caregiver Burden Interview-J.”

Comment 3: *Page 2, lines 20-22: “The aim of this study was to examine back the relationships between pain location, the achievement of pain improvement goals and cancer nursing care-related factors in family caregivers.”*

Suggestion: The aim of this study was to examine relationship between the location of pain and the factors related to nursing care of cancer patients by family caregivers.

Response: We have revised this text in the Abstract in response to your suggestion (see Page 1, line 7-9):

“The study aim was to examine relationship between pain location and the factors related to care of cancer patients by family caregivers.”

Comment 4: *Pages 2-3, lines 36-38: These lines refer to the results of the study. My suggestion is to keep only the last phrase in the conclusion: “Our results suggest that the factors related to nursing care in people with cancer differ according to the location of the back pain.”*

Response: We appreciate your thoughtful feedback. We have revised the relevant text in the Abstract section as follows:

Revised text (see Page 2, line 32-33):

“Our results suggest that the factors related to caregiving in cancer patients differ according to back pain location. To reduce chronic back pain, it is important to address subjective psychological stress and physical burden with reference to back pain location.”

Deleted text:

“Chronic upper back pain was associated with subjective psychological stress in family caregivers. In family caregivers who did not achieve their pain improvement goal, chronic lower back pain was associated with patients’ cancer severity.”

Comment 5: *Page 3, line 41: Keywords: Chronic back; family caregivers; cancer nursing care; psychological stress; physical burden.*

Decs and Mesh are useful tools to standardize terms, facilitate search and define keywords for academic publications. The correct use of the descriptors, together with the abstract of the article, serves as a means for retrieving documents in databases. Here are some suggestions of keywords that can be used: Back Pain. Chronic Pain. Caregivers. Oncology Nursing. Workload.

Response: We have revised the keywords in line with your suggestions:

Back pain; Chronic pain; Family caregivers; Oncology nursing; Workload

Comment 6: *Introduction: In the introduction, you should only identify the reasons for conducting the study and its objectives. Watch out for repetitive terms like “family caregivers”.*

Response: In the Introduction, we have mentioned the lack of research on different types of back pain in caregivers of cancer patients. We have also now clarified the reasons for conducting the study (see Page 4-5, line 72-79):

“Back pain is widespread, and there is a limit to what can be regarded as a single site. For example, the physical tasks of family caregivers who must lift bedridden cancer patients are related to patients’ cancer severity. It is likely that caregiver back pain is affected more by such tasks than by subjective psychological stress, and that the lower back is more burdened than the thoracic spine. It is therefore important to identify back pain location as either the thoracic spine or lower back, and examine cancer caregiving-related factors that affect CBP in each location.”

We have replaced “family caregivers of cancer patients” with “they” or “caregivers” in some sentences of the Introduction section.

Comment 7: *Page 3, lines 51-53: Which studies? Include the reference.*

Response: We have added these references.

Comment 8: *Page 3, line 53: What were the study’s findings?*

Response: We have revised several sentences here to more clearly describe previous study findings (see Page 3, line 44-49):

“However, previous studies have mainly focused on caregiving for people with dementia, or on heart-related diseases in cancer caregivers (1-3). For example, caregivers of relatives with cancer have a greater risk of cardiovascular disease (5). One cross-sectional survey conducted 5 years after cancer diagnosis found that 14.9% of family caregivers had heart-related disease, 28.3% arthritis, and 31.5% CBP (1). There are no individual studies of CBP in caregivers.”

Comment 9: *Some information should be included in the methods section and not in the introduction. Page 5, line 81: This definition should be included in the methods section. “The achievement of a pain improvement goal is defined as $PI \leq PPG$.”*

Response: We have moved this definition to the Methods section (Analytical parameters-PPG achievement) (see Page 9, line 160-162).

Comment 10: *Page 5, lines 84 -86: This should also be included in the methods section.*

Response: We have moved this sentence to the Methods section (Objective) (see Page 6, line 94-99).

Comment 11: *Page 5, lines 86-90: I suggest to finish the phrase with the research goals, as it was done in the abstract. More details at the methods section.*

Response: We appreciate your thoughtful feedback. We have revised the relevant text in the Introduction section to more clearly express the research goals:

Added text (see Page 5, line 88-90):

“Our research goal was to test the hypothesis that factors related to caregiving for cancer patients differ according to the family caregiver's back pain location and the achievement of pain improvement goals.”

Moved text (to the Methods section):

“A survey of CBP associated with cancer caregiving was conducted. Cancer caregiving-related factors associated with CBP in family caregivers of cancer patients were identified and categorized according to back pain location and achievement of pain improvement goals. We examined the association of cancer caregiving-related factors with the presence and absence of CBP in family caregivers of cancer patients.”

Comment 12: *Methods: The methods section needs to be more detailed to facilitate the reader's understanding. Clarify how pain was classified. How did the participants identify the location of their pain? Was it through a specific question (answering yes or no)? Or was it through a picture?*

Response: We have explained this point in the Methods section (CBP site), as follows (see Page 8, line 137-140):

“Study participants were asked whether they had CBP (possible responses: “yes” or “no”). If they had CBP, they were instructed to touch the CBP sites and were asked whether those sites were on the thoracic spine, low back, or both.”

Comment 13: *Participants with nonspecific chronic pain or participants with pain of specific causes, such as a herniated disc, for example, were considered? How the variables were measured? Numerically? By rating? What were the study inclusion criteria?*

Response: We have revised the relevant text in the Methods section to clarify these issues (see Page 7-8, line 120-122, 127-129):

“The inclusion criteria were family caregivers who directly provided care to a primary family member with cancer, had at least 1 month of caregiving experience at home, and had either non-specific chronic pain or pain from specific causes, such as a herniated disc.”

“Of these, 823 met the inclusion criteria. We obtained consent for participation from 351 caregivers. Of these, 31 met the exclusion criteria. A final total of 320 caregivers were included in the study.”

Comment 14: *And how was the site selection and data collection procedure?*

Response: We have added an explanation of this point to the Methods section (see Page 6-7, line 103-105, 109-110):

“Participants provided demographic information by completing questionnaires (age, sex, relationship with the patient, site of CBP, PI measure, and PPG) and completed self-report questionnaires on depression, anxiety, insomnia, and caregiver burden.”

“All dates were registered with the identification code to patient anonymity for each participant”

Comment 15: *How was the sample calculated? Which sample technique was used? Non-probability sample? By convenience?*

Response: We have now explained this in the Methods section (Sample size calculation) (see Page 11-12, line 197-202):

“The sample size was set as the size that could be achieved within the 2 years of the study period. The prevalence of CBP was assumed to be 40%, from earlier studies of the general population (13,18,33,34). To examine the degree of association between the presence or absence of CBP and other factors, the error was set at 5, the reliability at 95%, and the common standard deviation at 30 for the set number of cases.”

Comment 16: *Did you use any other criteria to define the chronicity of pain beyond time, such as the degree of pain intensity?*

Response: We did not use pain severity (e.g., NRS score ≥ 4) as a criterion for pain chronicity. The definition of chronic pain was based on definitions used in other studies. We have explained this as follows (see Page 8, line 132-134):

“A definition of chronic pain based on pain duration has not been clearly established, but duration of 3 or 6 months or more is generally used (21). We therefore defined chronic pain as any subjective pain lasting for more than 6 months.”

Comment 17: *Try to better describe the instruments used*

and how it were used to measure the variables being studied. On the 10-point Analog Pain Scale, what were the degrees of pain considered? Mild, moderate and severe?

Response: We have added this information to the Methods section (Pain intensity) (see Page 9, line 145-146):

“Pain scores of 1–4 were considered to indicate mild PI, 5–6 moderate PI, and 7–10 severe PI (23).”

Comment 18: *Explain the PPG better. What was the therapy used by caregivers to achieve personalized pain range?*

Response: We did not investigate therapies used by caregivers to achieve personalized pain goals. We have revised the relevant text in the Methods section to clarify this point (see Page 9, line 149-155):

“One way of ensuring that pain management goals are tailored to individual needs is to use a PPG, which relies on participants’ own criteria for meaningful pain relief. PPG is assessed in a similar way to PI. Family caregivers’ PPGs were assessed by asking participants “What is the maximum level of pain that would allow you to achieve comfort in physical, functional, and psychosocial domains?” Participants indicated their responses using an 11-point NRS ranging from 0 (I feel comfortable and at ease at the NRS of 0 points) to 10 (I feel comfortable even at the NRS of 10 points).”

Comment 19: *The J-ZBI description needs more details. How many items does this instrument have? What is the final score and what does the score mean?*

Response: We have added this information to the Methods section (see Page 11, line 184-189):

“The higher scores indicate caregiving burden. This contains 22 questions that assess the two components of personal strain and role strain. The total possible score ranges from 0 to 88.”

“The J-ZBI has high test–retest reliability ($r = 0.76$) and internal consistency (Cronbach’s $\alpha = 0.93$) (31).”

Comment 20: *Declare all dependent and independent variables used. Specify whether they were continuous or categorical variables. If they were categorical, which categories were included? How were they used? Describe the binary logistic regression, considering the significance and quality of the model adopted.*

Response: We have revised the text in the Methods section (Statistical analysis) to clarify these points (see Page 13, line 219-224):

“Finally, we carried out a multivariate logistic regression analysis using the forced entry method, with the presence of thoracic spine/low back pain as the dependent variable, and HADS-D score, HADS-A score, PSQI-J score, J-ZBI score, ECOG PS (care recipients), and duration from survey until death (care recipients), as the independent variables. ECOG PS and duration from survey until death were categorical variables (ordinal scale); the other variables were continuous.”

Comment 21: *What were the Spearman correlation values considered?*

Response: We have added to the Methods section (Statistical analysis) a definition of the strength of the correlations (see Page 13, line 217-218):

“As correlations are effect sizes, we described the strength of the effects as 0.00–0.19: very weak; 0.20–0.39: weak; 0.40–0.59: moderate; and 0.60–0.79: strong.”

Comment 22: *Results: Tables should be self-explanatory so the reader doesn’t need to consult the text. I suggest supplementing them with some data and reviewing the title of Tables 2 and 3, which*

are very long. Many researchers like to include the place and year in the title. The statistical analysis used must be added.

Response: We have revised the table titles as follows:

“Table 1.

Demographic characteristics of study participants (family caregivers) and advanced cancer patients (care recipients): 2016–2018 data from a single-unit university hospital

Table 2.

Clinical characteristics of study participants (family caregivers) and advanced cancer patients (care recipients): 2016–2018 data from a single-unit university hospital

Table 3.

The Kruskal–Wallis test for comparison of participants without chronic thoracic spine pain and with chronic thoracic spine pain (pain intensity \leq and $>$ personalized pain goal) by family caregiver and care recipient demographic and clinical characteristics

Table 4.

The Kruskal–Wallis test for comparison of participants without chronic lower back pain and with chronic lower back pain (pain intensity \leq and $>$ personalized pain goal) by family caregiver and care recipient demographic and clinical characteristics

Table 5.

Spearman’s rank correlations between chronic back pain and demographic/clinical characteristics for participants with chronic back pain (pain intensity \leq personalized pain goal)

Table 6.

Spearman’s rank correlations between chronic back pain and demographic/clinical characteristics for participants with chronic back pain (pain intensity $>$ personalized pain goal)

Table 7.

Multivariate logistic regression analysis of factors associated with chronic thoracic spine pain

Table 8.

Multivariate logistic regression analysis of factors associated with chronic lower back pain”

Comment 23: Table 1: I suggest dividing the table in two, one with the demographic characteristics and the other more detailed with the clinical characteristics. I suggest to include data such as the percentage of participants of the male gender and the percentage of participants who did not have

pain instead of it being implicit. I also suggest adding the percentage of participants with pain in the upper and lower back regions at the same time.

Response: We have revised Tables 1 and 2 to clarify the variables.

Comment 24: *Table 2: I suggest removing the data from the care recipients, because it can generate confusion. The p value considered is missing in the footer. Choose between “ $PI \leq PPG$ ” and “ $PPG \geq PI$ ” and stick to it throughout the article.*

Response: We would like to retain the care recipient data in Table 2, but we have revised this table to make it clearer.

We have standardized the expression for the two groups as $PI \leq PPG$ and $PI > PPG$ throughout the paper.

Comment 25: *Discussion: There is no need to repeat data from the results in the discussion (lines 212 to 216). You should make only a summary of the main findings and relate it to the literature and the objectives of the study.*

Response: We have revised the relevant text in the Discussion section to focus on the main findings:

Added text (see Page 16, line 279-280):

“There was a high proportion of women among the family caregivers in this study, particularly wives of care recipients, and they reported a high level of subjective stress.”

Deleted text:

“They were relatively young (mean age 59.2 years). Our assessment of caregiver burden showed that the J-ZBI score was high, above the cut-off score for family caregivers at risk for depression. The HADS scores for depression and anxiety were lower than or equal to the cut-off scores although the overall HADS scores were relatively high. The PSQI-J score for insomnia was higher than or equal to the cut-off score. These results suggest that family caregivers of cancer patients may have a high level of subjective stress.”

Comment 26: *As for the limitations of the study, it would include the non-inclusion of the cervical region which has a high prevalence of pain.*

Response: We have mentioned this point in the discussion of the study limitations (see Page 20, line 348-350):

“Furthermore, this study did not include data on pain in the cervical region which has a high prevalence of pain.”

Comment 27: *If possible, discuss other possibilities for explaining back pain in addition to myofascial pain since it would require a physical clinical examination of the caregiver for the diagnosis. You should add a conclusion with a summary of the main findings, strictly responding to the proposed goals of the research, the implications and benefits of the study to caregivers of cancer patients and guidelines for future studies.*

Response: We appreciate your thoughtful feedback. We have revised the text in the Discussion section to address these issues:

(Lines 229–238)

Added text (see Page 17, line 292-298):

“To reduce CTSP, it is important to address subjective psychological stress in family caregivers. In particular, it has been reported that symptoms of depression have a negative effect on physical health conditions, such as body pain, in family caregivers of cancer patients (9). To reduce CLBP, it is important to consider caregiving services according to cancer severity of care recipients. Many therapeutic interventions report pain improvement after exercise intervention for CBP (35,36).”

Deleted text:

“Factors relevant to cancer caregiving include subjective psychological stress in family caregivers and cancer severity in care recipients, but therapeutic interventions differ for each. Psychological care is prioritized for subjective psychological stress in family caregivers, but alleviation of physical burden to family caregivers through the use of caregiving services is prioritized for cancer severity in care recipients. Indications for therapeutic intervention are not obvious for psychological stress, and care is needed. However, there are many reports of pain improvement after exercise intervention for CBP (34,35). Family caregivers often feel guilty about taking care of themselves because they experience a sense of helplessness in their engagement with cancer patients (36). One study introduced mindfulness-based stress reduction to lung cancer patients and their family caregivers (37). It found that psychological distress among the patients was alleviated, but distress among family caregivers did not improve because caregivers prioritized patients' wellbeing over their own.”

(Lines 263–269)

Added text (see Page 18-19, line 321-323, 326-330):

“The second important finding of this study is that the association between HADS-D score and CTSP was stronger in the group with $PI \leq PPG$ than in the group with $PI > PPG$ (higher odds ratio) ... Although we cannot assume causality, these results may indicate that the presence of depression can affect the development or alleviation of mild thoracic spine pain. However, we cannot determine from these data whether the pain is caused by depression or whether the pain is prolonged by depression (depression affects whether the PPG has been achieved) and thereby becomes chronic.”

Deleted text:

“This study was cross-sectional, and therefore causation cannot be implied. If the presence of depression can potentially affect the development or alleviation of mild pain, the concept of latent

trigger points makes it easier to think about it. Trigger points are classified into active and latent by the presence or absence of spontaneous pain (47,48). Latent trigger points may be found in many pain-free skeletal muscles and could be activated (become active trigger points) by continuous stimuli (49). It has been suggested that latent trigger points are associated with depression or alexithymia in the general population (39,42).”

Added text (see Page 20, line 352-354):

“Our results suggest that the factors related to caregiving in cancer patients differ according to back pain location. To reduce chronic back pain, it is important to address subjective psychological stress and physical burden with reference to back pain location.”

Comment 28: *References: Update the references. Replace or remove, if possible, older references.*

Response: We have removed older references.