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Associations of dyadic appraisal of cancer cachexia symptoms with psychological distress and quality of life in dyads of palliative care patients: a longitudinal mixed-methods study protocol

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Abstract

Background Cancer cachexia (CC) is a fatal syndrome most prevalent in palliative care patients and is typically characterized by a progressive increase in weight loss and anorexia. The inability to detect and accurately appraise CC symptoms early can lead to a delayed diagnosis of CC and late initiation of symptom management, subsequently resulting in shorter survival. Research has shown that both patients and primary family caregivers are burdened by worsening CC symptoms, making them susceptible to reduced quality of life (QOL) and increased psychological distress in particular, and necessitating an exploration of ways to improve their well-being. Guided by the Theory of Dyadic Illness Management supplemented by the Symptom Appraisal Pathway Model, the study will be the first to provide a comprehensive understanding of the role of dyadic appraisal of patients' CC symptoms on psychological distress and QOL of palliative care patients and their primary family caregivers over an eight-week follow-up period.

Methods This study will adopt a longitudinal mixed-methods design, combining both quantitative and qualitative data collection at baseline and eight weeks after baseline. 281 dyads of patients with CC and caregivers will be recruited from palliative care units of three hospitals in Hong Kong. Both patients and caregivers will complete a set of questionnaires measuring appraisal of patients' CC symptoms and own psychological distress, and QOL, separately. Semi-structured joint interviews will also be conducted with the same dyads. Quantitative data will be analyzed using the actor-partner interdependence model and the polynomial regression with response surface analysis, while qualitative data will be subjected to qualitative content analysis and trajectory analysis. The findings of the two datasets will be integrated via joint displays.

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Discussion Findings of this study are expected to advance the emerging science on dyadic symptom management by testing the utility of the theory of Dyadic Illness Management and the Symptom Appraisal Pathway Model, but also to inform the design and content of a theory- and evidence-based CC management intervention to reduce psychological distress and to achieve optimal QOL in CC dyads.

Keywords Cachexia, Anorexia, Cancer, Palliative care, Psychological distress, Mixed methods, Longitudinal study

Background

Cancer cachexia (CC) is a multifactorial syndrome defined by Fearon's international diagnostic consensus as an ongoing skeletal muscle loss with or without fat loss driven by disease-induced systematic inflammation and metabolic disorder [1]. This syndrome is highly prevalent (up to 96%) in advanced cancer patients, particularly those in palliative care settings [2]. Patients with CC often experience a progressive increase in weight loss and anorexia, which have been identified as significant prognostic predictors of survival [3, 4]. Additionally, CC is increasingly viewed a continuum based on severity of weight loss and is classified into three stages: pre-cachexia, cachexia, and refractory cachexia [1]. Evidence has shown that incurable cancer patients with substantial weight loss (> 15%) and anorexia had a median survival time of less than four months compared to 407 days among non-cachexia counterparts [5]. Given the current lack of effective treatments, the clinical management of CC symptoms primarily involves supportive care, with a focus on nutrition support [6]. Therefore, early detection and intervention of CC symptoms could offer an opportunity to slow the progression of CC, potentially leading to improved survival.

Two decades of research have consistently found that both patients and primary family caregivers are burdened by worsening CC symptoms, making them susceptible to reduced quality of life (QOL) and increased psychological distress in particular, pertaining to anxiety and depression [3, 7–9]. The distress can stem from various factors, such as the patients' inability to eat and enjoy food as usual, caregivers' perceived inability to increase the patients' weight, and food-related family tensions [3, 10]. A systematic review has shown that cancer patient-caregiver dyads' QOL was mutually affected, with strong evidence supporting the interdependence of psychological morbidity [11]. Some qualitative studies have also captured the experiences of CC from a dyadic perspective, revealing that psychological distress in one family member was related to that of another [12, 13]. This evidence suggests the need for optimizing the well-being of CC dyads as a whole, necessitating the exploration of ways to improve the dyadic condition.

For palliative cancer patients at home, family caregivers shoulder significant responsibilities in assessing, monitoring, and managing CC symptoms [14]. However, a small body of quantitative evidence suggests that caregivers often perceive anorexia and weight loss as more severe and distressing than the patients themselves do, with the degree of congruence ranged from fair to moderate [15–17]. Qualitative studies have further revealed that patients and caregivers often lacked knowledge about CC, which was a major barrier hindering early and accurate appraisal of CC symptoms [3, 14, 18]. For instance, although weight loss is frequently under-recognized by both patients and caregivers, caregivers appear to be concerned about substantial weight loss when changes in the patient's appearance becomes visible [18]. Anorexia also presents detection challenges as it is often perceived as a fickle experience, which patients may attempt to manage by consuming tasty food [19]. Furthermore, contradictory dietary beliefs can contribute to inconsistent ratings of CC symptoms among dyads, as caregivers tend to focus on food's nutritional value and push patients to eat, while some patients prioritize food enjoyment over nutritional value [3, 10]. In addition to these factors, other factors such as dyadic communication and caregiver self-efficacy may influence the discrepancy between patients' and caregivers' assessment of CC symptoms. However, these aspects have only been sporadically reported in the literature [12, 13].

Despite the importance of understanding patients' and caregivers' appraisals of CC symptoms and their impact on psychological distress and QOL, research in this area remains limited. Some quantitative findings have identified incongruent appraisals of the severity and/or interference of CC symptoms among dyads, but the extent and direction of this incongruence are less clear due to a limitation of a traditional analytical method to compute the difference scores in CC symptoms between patient and caregiver assessments. Qualitative findings have shed some light on the incongruent appraisals of dyadic CC symptoms, but the ways in which patients and caregivers systematically appraise CC symptoms remain unclear. More importantly, the available empirical data on dyadic appraisal of CC symptoms and its impacts on psychological distress and QOL have been derived from either quantitative or qualitative investigations at a single time point, making it impossible to detect changes over time. To date, no published longitudinal work has been found addressing this topic, combining quantitative and qualitative approaches to capture the dynamics of the same phenomenon in great depth and width. This research gap is timely and clinically important, as without this explanatory longitudinal information, future interventions targeting the reduction of incongruent dyadic appraisal of CC symptoms may not effectively improve the well-being of patient-caregiver dyads.

Study aim and objectives

This study aims to provide a comprehensive understanding of the role of dyadic appraisal of CC symptoms on psychological distress and QOL in palliative care patients and their primary family caregivers over an eight-week follow-up period. Three objectives are as follows:

1. To investigate the associations between patients' and caregivers' appraisal of CC symptoms at baseline and their own and each other's levels of psychological distress and QOL at eight weeks;
2. To examine the degree and direction of congruence or incongruence in the appraisal of CC symptoms between patients and caregivers at baseline and the extent to which this congruence or incongruence predicts their own and each other's psychological distress and QOL after eight weeks; and.
3. To qualitatively explore changes over time in how patients and caregivers appraise CC symptoms and the ways in which these evaluations affect their daily lives.

Theoretical framework

This study is underpinned by the Theory of Dyadic Illness Management, complemented by the Symptom Appraisal Pathway Model [20, 21]. In contrast to traditional symptom theories that primarily focus on individual symptom perception, the Theory of Dyadic Illness Management views symptom management as a dyadic phenomenon, positing that dyadic appraisal of symptoms has a significant impact on dyadic health [20]. The theory's ultimate goal is to optimize dyadic QOL that is achieved by maximizing symptom congruence between patients and caregivers [14]. Empirical evidence has validated this theory within advanced cancer patient-caregiver dyads, indicating that incongruent dyadic appraisal of the severity and/or interference of pain, dyspnea and fatigue can hamper symptom management, subsequently deteriorating their QOL [22, 23]. The theory has broadened its perspective to advocate for a collaborative appraisal of symptoms, going beyond the mere assessment of symptom severity and/or interference.

The Symptom Appraisal Pathway Model is incorporated to enhance the operationalization of dyadic symptom appraisal by examining how dyads detect, interpret and respond to symptoms [21]. Symptom detection, the initial stage of symptom appraisal, emphasizes identifying bodily changes as symptoms when they attain a certain severity or interference level. Symptom interpretation involves attaching meaning to these symptoms. Following the detection and interpretation of symptoms, a response may be generated, resulting in specific actions for symptom relief. A meta-analysis has supported this model, demonstrating the role of late recognition and wrong interpretation of cancer symptoms in predicting in delayed help-seeking [24]. Nevertheless, a limitation of this model lies in its conceptualization of symptom appraisal as an individual journey, which may overlook the shared and unique aspects of symptom appraisal within a family context. By integrating these two theories or models, a theoretical framework (see Fig. 1) is proposed for this study to explore the dynamics of symptom appraisal at both individual and family levels, and how these complex interactions influence each other's QOL and psychological distress.

Methods

Study design

This study will adopt a prospective longitudinal mixed-methods design [25], in which quantitative and qualitative data will be collected at the same two timepoints: baseline (T0) and eight weeks after baseline (T1). The priority of the study will be given to the quantitative phase, with qualitative data collected to complement quantitative data [26]. Analysis of each dataset will be conducted separately and integrated through side-by-side joint displays to achieve the overall aim of the study. Longitudinal quantitative data on appraisal of CC symptoms, QOL and psychological distress from patients and caregivers will be analyzed to achieve the objective 1 and 2, while longitudinal qualitative data via joint interviews will be obtained from patient-caregiver dyads for the realization of objective 3. Figure 2 depicts the diagram of this longitudinal mixed-methods study.

Settings

The study will be conducted in the palliative care units of three hospitals under the Hospital Authority in Hong Kong. According to internal report, the total number of newly registered patients is about 300 to 400, with around 1,500 to 1617 patient visits in each hospital in 2023.

Participants and sampling

The study population will be palliative care patients with CC and their primary family caregivers recruited from the three hospitals using convenience sampling, which will be the same for both quantitative and qualitative data collection. Although there is no well-validated definition for clinical use, CC in this study is operationalized based on Fearon's framework as this is the most commonly used practical method worldwide including Asia [1, 27, 28]: (1) weight loss > 5% during the past six months; or (2) weight loss > 2% and BMI < 20 kg/m^2, or (3) weight loss > 2% and

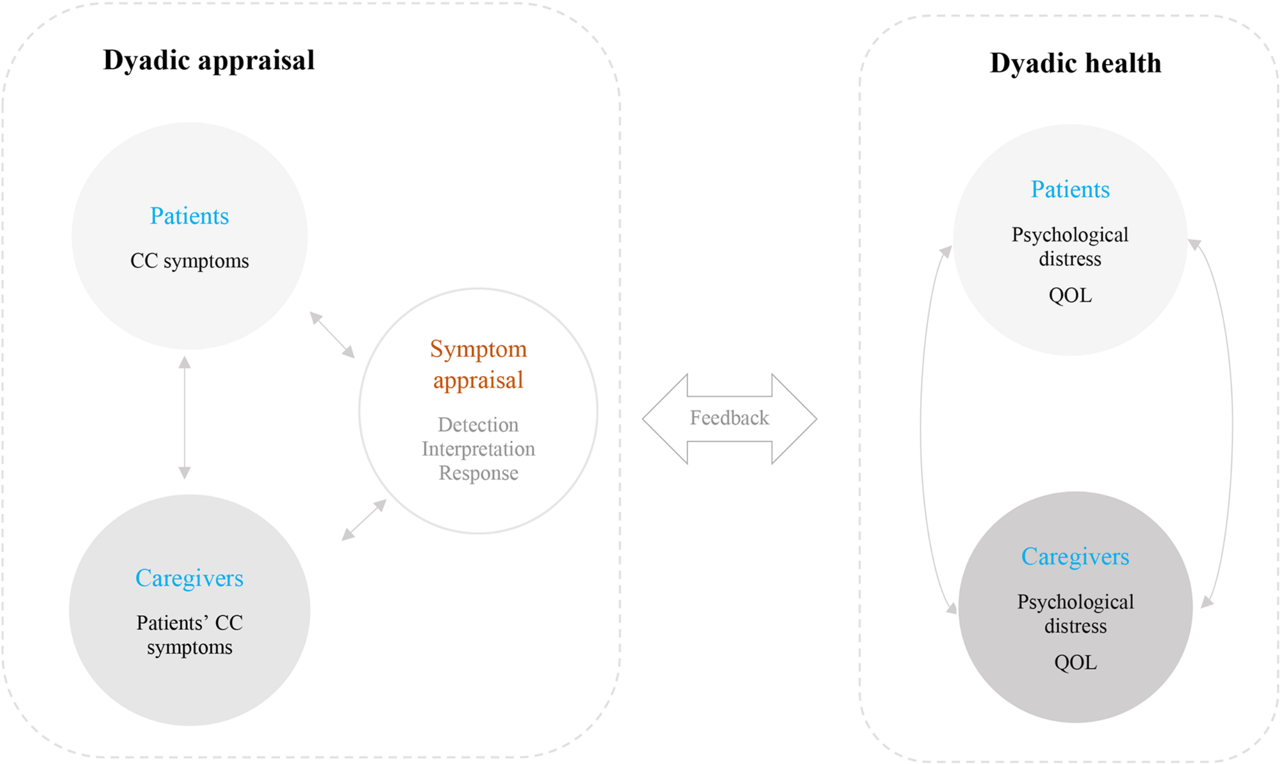


Fig. 1 Theoretical framework guided by the theory of dyadic illness management and the symptom appraisal pathway model

sarcopenia (mid-upper arm circumference measured by a tape measure: men < 32 cm, women < 18 cm).

Patient inclusion criteria will be: (1) aged ≥ 18 years; (2) receiving palliative care; (3) with CC; (4) life expectancy ≥ three months as estimated by prognostic tools [29]; and (5) ability to communicate in Chinese. Patients will be asked to indicate primary family caregivers for participating in the study. Primary family caregivers will be eligible if they are: (1) aged ≥ 18 years; (2) spouse, children, relatives, or someone who is designated to take care of the patient at least three days per week; and (3) ability to communicate in Chinese.

Exclusion criteria for patients will be severe cognitive impairment (e.g., dementia and delirium) or psychiatric disorders (e.g., schizophrenia, bipolar disorder, affective disorder, major depressive disorder) diagnosed by physicians and inability to give informed consent and complete the questionnaires and interviews (e.g., too sick to participate). Domestic workers will be excluded for family caregivers.

Recruitment

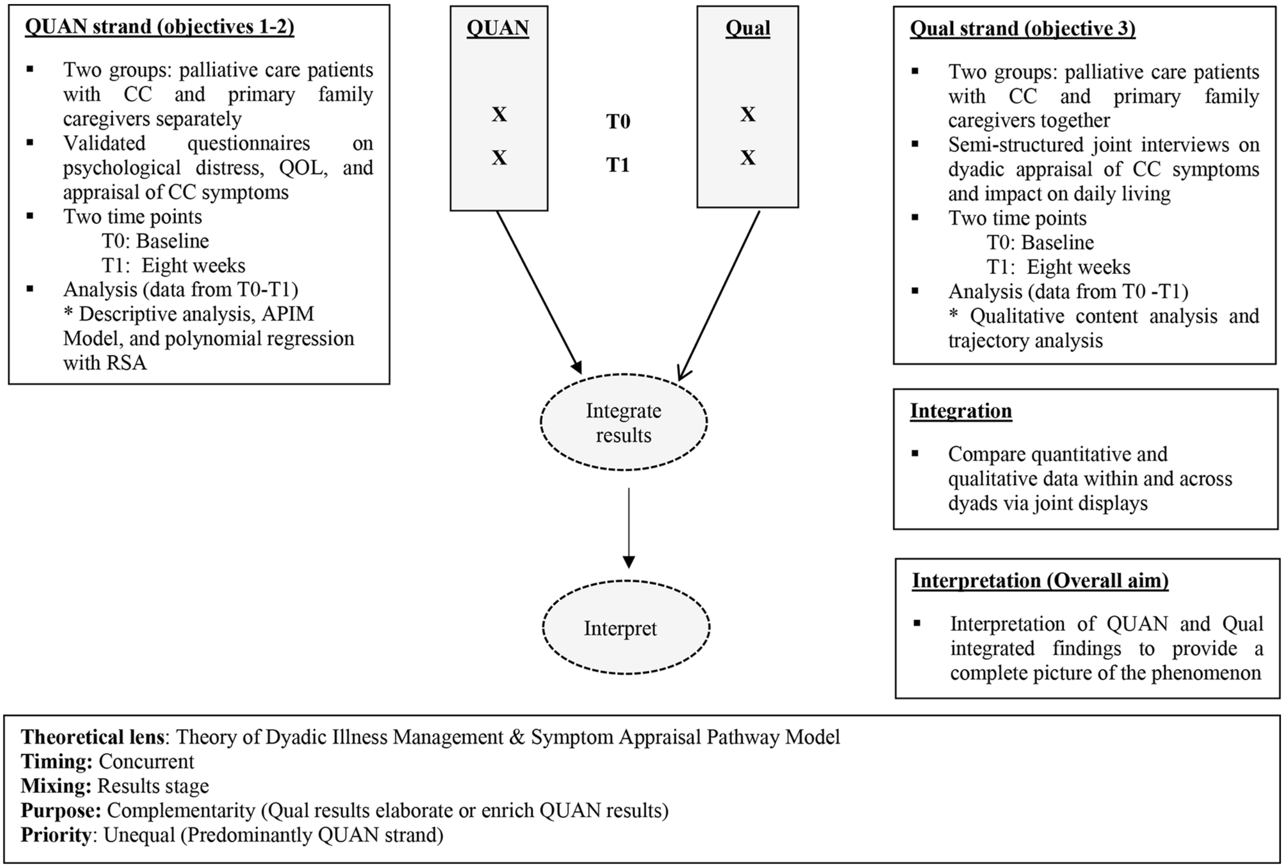
Trained research assistants (RAs) will conduct participant screening and recruitment in collaboration with the palliative care teams of the three hospitals. Patients will be initially identified from patients records at each hospital. The RAs will directly approach dyads when patients attend medical consultations in outpatient units or visit them in inpatient units during visiting hours. Potential dyads will be confirmed for eligibility against a screening checklist. Once both patients and caregivers are eligible, RAs will invite them to participate, briefly explain the study and obtain their signed written consents. Those who consent to participate will proceed with data collection on the same day or a scheduled date within one week.

Quantitative data collection

Patients and caregivers will be assessed with a set of questionnaires measuring psychological distress, QOL, and appraisal of CC symptoms, separately. The instruments are short in length to reduce respondent burden considering the patients' frail status, which have been previously validated and utilized in local studies [8, 30–38]. They will also be required to complete questionnaires, separately. The patients' clinical data will be collected from medical records, while nutrition status will be measured for each patient.

Appraisal of CC symptoms

The 12-item Chinese version of the anorexia-cachexia subscale (A/CS) of the Functional Assessment of Anorexia/Cachexia Therapy (FAACT) scale will be used to measure patient and caregiver appraisal of the patient' CC symptoms [8, 30]. The scale is rated using a 5-point Likert scale, from 0 (not at all) to 4 (very much). The total



QUAN strand (objectives 1-2)

- Two groups: palliative care patients with CC and primary family caregivers separately
- Validated questionnaires on psychological distress, QOL, and appraisal of CC symptoms
- Two time points
  T0: Baseline
  T1: Eight weeks
- Analysis (data from T0-T1)
  * Descriptive analysis, APIM Model, and polynomial regression with RSA

Qual strand (objective 3)

- Two groups: palliative care patients with CC and primary family caregivers together
- Semi-structured joint interviews on dyadic appraisal of CC symptoms and impact on daily living
- Two time points
  T0: Baseline
  T1: Eight weeks
- Analysis (data from T0 -T1)
  * Qualitative content analysis and trajectory analysis

Integration

- Compare quantitative and qualitative data within and across dyads via joint displays

Interpretation (Overall aim)

- Interpretation of QUAN and Qual integrated findings to provide a complete picture of the phenomenon

Theoretical lens: Theory of Dyadic Illness Management & Symptom Appraisal Pathway Model
Timing: Concurrent
Mixing: Results stage
Purpose: Complementarity (Qual results elaborate or enrich QUAN results)
Priority: Unequal (Predominantly QUAN strand)

Fig. 2 Procedural diagram of the longitudinal mixed-methods study design

score ranges from 0 to 48, with a high score representing severe symptoms. The Cronbach alpha of this scale was 0.90 [8].

Psychological distress

The Hong Kong Chinese versions of the Generalized Anxiety Disorder (GAD-7) and the Patient Health Questionnaire-9 (PHQ-9) will be used to measure anxiety and depression of patients and caregivers [31–33]. The GAD-7 consists of seven items and each item is rated using a four-point Likert scale (0 = not at all, 3 = nearly every day). The total score is up to 21 and a higher score represents severe anxiety. While the PHQ-9 is a nine-item self-report questionnaire, with each item being rated from 0 (not at all) to 3 (nearly every day). The total score ranges from 0 to 27, with a higher score indicating severe depression. According to meta-analysis, a cut-off point of ≥ 10 is recommended for detecting anxiety and depression [34,35].

QOL

The two palliative care-specific instruments, including the 16-item McGill Quality of Life Questionnaire-Hong Kong version (MQOL-HK) and the 16-item Quality of Life in Life-Threatening Illness-Family Carer Hong Kong version (QOLLTI-F) will be used to measure QOL of patients and caregivers, respectively [36–38]. The MQOL-HK has five domains and consists of physical, psychological, existential, support, and sexuality, while the QOLLTI-F assesses seven dimensions, encompassing environment, patient condition, your own condition, your outlook, quality of care, relationships, and financial worries. The rating scale of each tool ranges from 0 to 10, and the total scores are 190 and 160 respectively, with a higher total score indicating better QOL. Cronbach's alpha values for the two scales were 0.75 and 0.74, respectively [36, 37].

Sociodemographic, clinical, and nutrition-related data

Socio-demographic and clinical data for patients will include age, gender, marital status, income, education level, palliative care setting, cancer diagnosis, cancer stage, metastatic sites, comorbid condition, and performance status (as measured by the Palliative Performance Scale) [39]. We will collect patients' clinical data on types of nutritional interventions (including dietary counseling, nutritional supplements, enteral and parental feeding), the drugs used for CC symptoms (such as prokinetics, corticosteroid and progestogens) and biological parameters (including hemoglobin level, albumin, pre-albumin,

Table 1 Data collection procedures according to type of data and assessment time points

Type of variables	Name	QUAN/Qual data collection tools	Patient		Caregiver		Dyad	
			T0	T1	T0	T1	T0	T1
Dependent	Psychological distress (anxiety and depression)	GAD-7 & PHQ-9	√	√	√	√		
	QOL	MQOL-HK	√	√				
		QOLLTI-F			√	√		
		Joint interviews					√	√
Independent	Appraisal of CC symptoms	FACCT A/CS	√	√	√	√		
		Joint interviews					√	√
Contextual	Socio-demographic data	Self-developed questionnaire	√		√			
	Clinical data	Medical records	√					
	Nutritional data	Weight, body mass index and food intake	√	√				

T0 = baseline; T1 = 8 weeks after baseline; GAD-7 = Generalized Anxiety Disorder; PHQ9 = Patient Health Questionnaire-9; MQOL-HK = McGill Quality of Life Questionnaire-Hong Kong version; QOLLTI-F = Quality of Life in Life-Threatening Illness-Family Carer version; FACCT A/CS = Anorexia-cachexia subscale of the Functional Assessment of Anorexia/Cachexia Therapy Scale

neutrophil to lymphocyte ratio, and C-reactive protein) if applicable. Nutritional status including weight and body mass index will be assessed or calculated for each patient, while food intake estimated by each patient through comparing the current meal with usual meal pattern (e.g., 100%, 75%, 50%, 25%, 0%) [40]. For caregivers, socio-demographic data will include age, gender, marital status, income, employment status, education level, living status with the patient, number of days eating with the patient per week, presence of other caregivers, caregiving time and relationship to the patient.

Qualitative data collection

Joint interviews will be conducted with both patients and caregivers together. This interview method is appropriate for uncovering individual and dyadic ways of responding to the same topic, while considering the influence of dyadic interactions on response patterns [41]. The semi-structured interview schedules are used to guide the interview with each dyad, which are developed based on the Symptom Appraisal Pathway Model and the team's content and methodological expertise. Interview questions at baseline will include "have you experienced weight loss and/or anorexia?", "how does these symptoms affect your everyday life"? "how did you detect these symptoms?", "what are your explanations for the symptoms?", and "what actions did you take for symptoms?". Topics covered in subsequent interview schedule are similar but are intended to capture dynamics or stability of detection, interpretation and responses of CC symptoms. Interviews will be conducted in Cantonese or Mandarin. Follow-up probes will be used if appropriate, for example, "Could you give an example?", "can you elaborate a little more?" The interviews will be audio-recorded and transcribed verbatim for data analysis.

Data collection procedures and time points

Quantitative (including nutritional status) and qualitative data will be concurrently collected at baseline (T0) and eight weeks after baseline (T1). The eight-week follow-up period is chosen to allow changes in CC symptoms and it is commonly used in comparing outcomes after cachexia interventions [42]. Collecting quantitative and qualitative data will be carried out by trained RAs. Quantitative data will be collected from patients and caregivers, separately, via in-person or structured face-to-face interviews at hospitals. Joint interviews will be conducted with patient-caregiver dyads in a quiet place of the hospital. The interval between quantitative and qualitative data collection at each time point should be no longer than one week in order to reduce the recall bias. Owing to collecting both quantitative and qualitative data at the same timepoint, it would be potentially burdensome for participants. Hence, we allow some flexibility in data collection tailoring to preferred method and place of some participants. Table 1 shows data collection procedures and time points.

Data analysis and sample size

Quantitative data analysis will be entered in SPSS 28.0 for subsequent dyadic analyses including the Actor-Partner Interdependence Model (APIM) and the polynomial regression with response surface analyses (RSA) in R software [43–45], while qualitative data will be analyzed through qualitative content analysis and trajectory analysis using NVivo 14.0. For quantitative data, patients and caregivers' socio-demographic and clinical characteristics, independent variables (appraisal of CC symptoms), and outcome variables (psychological distress and QOL) will be summarized using descriptive statistics. Missing data will be handled by full information maximum likelihood before inferential analyses. A p value < 0.05 indicates statistical significance.

For objective 1 The APIM [43] will provide estimates of the effects of patients' and caregivers' own (actor effects) scores of CC symptom appraisal at baseline on their own scores (actor effects) and their partners' scores (partner effects) for psychological distress and QOL at eight-week follow-up, while controlling for the dyads' baseline data on outcome variables and eight-week follow-up data on independent variables, as well as identified sociodemographic and clinical covariates. The APIM will be performed using structural equation modeling with maximum likelihood estimation for distinguishable dyads using an online APIM_SEM package in R [46]. Three separate APIM models will be computed for each outcome variable, including psychological distress (anxiety and depression) and QOL; the parameter k will be calculated to detect patterns of dyad members' influence on the dependent variables in the APIM.

For objective 2 The RSA will be performed to examine the degree and direction of congruence or incongruence in the appraisal of CC symptoms between patients and caregivers at baseline and the extent to which this congruence or incongruence predicts their own and each other's psychological distress and QOL at eight-week follow-up [44]. Data analysis will follow Shanock et al.'s analytical steps [45]: (1) center predictors; (2) run polynomial regression models in SPSS 28.0; (3) calculate the surface values in Excel; and (4) generate the response surface graphs using an online RSA package in R.

For objective 3 Qualitative content analysis followed by trajectory analysis will be employed to analyze the interview data [47, 48]. Qualitative content analysis will involve inductive coding at within-dyad and across-dyad levels in an interactive process [49]. For within-dyad analysis, texts particularly pertaining to dyadic symptom appraisal (identification, interpretation, and responses) and impacts on daily lives will be condensed and coded to identify areas suggesting incongruency or congruency. For cross-dyad analysis, codes will be compared for common patterns, which will be grouped into categories and subcategories. Trajectory analysis refers to a within-dyad longitudinal analysis of changes in symptom perception and impact on daily living of dyads who have completed two interviews [50]. After creating a coding matrix for each dyad, similarities or differences will be identified across dyads for understanding how symptom perceptions and life experiences change over time.

Sample size

Sample size calculation will be estimated using the APIM model and performed using an online power analysis calculator [51]. Taking prior studies in cancer-caregiver dyadic populations as references [11, 23], it will assume a partial correlation coefficient of 0.25 for the actor effects and 0.15 for the partner effects, as well as a medium correlation of $r = 0.3$. With a significance level of 0.05 and a power of 90%, a sample of 211 dyads will be required. Assuming a drop-out rate of 25% (as common in longitudinal studies in palliative care) [52] during the eight-week follow-up, at least 281 dyads will be required at the stage of grant application.

Integrating quantitative and qualitative data

To achieve the overall aim of this study, quantitative and qualitative findings will be integrated via joint displays [25, 53]. Specifically, we will compare and contrast each dyad's qualitative descriptions of symptom appraisal experience with quantitative results based on congruent or incongruent (patient > caregiver or caregiver < patient) symptom appraisal type. For example, if both quantitative and qualitative data from a dyad show a similar (dissimilar) appraisal of CC symptoms, this case is considered convergent data. If quantitative data show a similar dyadic appraisal, but qualitative data reveal a dissimilar dyadic appraisal, this case is viewed as divergent data. Next, convergent or divergent cases will be re-examined for qualitative findings (categories and subcategories) to identify factors in explaining patterns of dyadic symptom appraisal.

Ethics and dissemination

The study has been approved by the ethics committees of the Hong Kong Polytechnic University (HSEARS20220523004) and Hospital Authority (CIRB-2-24-050-4). The purpose, methods, procedures, and possible benefits and risks of participating in this study will be explained to the dyads before the study. Dyads will be reminded of the importance of follow-up but they have rights to withdraw from the study anytime. Once they agree, they will be asked to sign written informed consent sheets. The questionnaires and joint reviews will be tested for any distressing questions in a pilot study of 10 dyads. During the study, a clinical psychologist will be referred to patients or caregivers presenting with negative emotions if desired. In addition, the issue of confidentiality will be solved by recording the data in a manner that does not allow the participants to be identified (i.e. using a non-recognizable code for each patient. All participants' personal identifiable information will be kept confidential. All questionnaires will be kept in locked office cabinets by the involved researchers. The transcripts of recorded interviews will be kept anonymously. The final results of this protocol will be presented at local or international conferences and published in peer-reviewed journals.

Discussion

To the best of our knowledge, this study will be the first longitudinal mixed-methods study that aims at providing a comprehensive understanding of whether and how dyadic appraisal of CC symptoms plays an important role in influencing psychological distress and QOL in advanced cancer patients and their primary family caregivers over time. The addition of qualitative data collection to the traditional prospective longitudinal study is particularly valuable in identifying changes in symptom perceptions and associated factors for explaining areas of consistent or inconsistent symptom perceptions among patient-caregiver dyads. Furthermore, the study includes multiple centers and incorporates larger sample size in order to increase the generalizability of study findings for large populations. In addition, the study is designed based on the theory of Dyadic Illness Management and the Symptom Appraisal Pathway Model, ensuring that the study is grounded theoretically to explore the underlying mechanisms of symptom appraisal pattern in influencing the well-being of both patients and their caregivers.

Despite these strengths, this study is subjected to several limitations. Firstly, patients in this study receiving palliative care have a short life expectancy, loss to follow-up due to death or disease progression maybe be high, resulting in insufficient statistical power. Secondly, the study will only include one family caregiver due to resource and manpower considerations, and the inclusion of multiple family caregivers would yield a vivid perspective of symptom perception within a family context. Thirdly, this study relies heavily on self-report data through questionnaires and qualitative interviews. lacking of objective data, such as skeletal muscle loss through bioelectric impedance analysis or CT may introduce bias to dyadic ratings of symptoms. Lastly, this study may be limited to not capturing other possible confounding factors within the study period, for example, changes in other symptoms, recent hospitalization and life events within a family (e.g., changes in living environment), which may influence the interpretation of results.

In addition to strengths and limitations, this longitudinal mixed-methods study has significant implications for future practice and research. As a deadly and costly syndrome in clinical practice, CC remains underdiagnosed and undertreated by healthcare professionals [54]. Findings of this study are expected to advance emerging science on dyadic symptom management by testing the utility of the theory of Dyadic Illness Management and the Symptom Appraisal Pathway Model, but also to inform the design and content of a theory- and evidence-based CC management intervention to reduce psychological distress and to achieve optimal QOL in CC dyads. It is hoped from this study that by intervening incongruent dyadic appraisal of CC symptoms as early as possible, CC management can be improved in the long term.

Abbreviations

CC	Cancer cachexia
QOL	Quality of life
APIM	Actor-partner interdependence model
RSA	Response surface analyses

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No.

Author contributions

C.H.L., W.K.H., S.C.N, and S.K.L. designed the study and equally contributed to the study, CHL drafted the manuscript. All authors reviewed the manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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