

The Role of Nurse in the Multidisciplinary Management of Cancer Cachexia

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ABSTRACT

Cancer cachexia is a complex syndrome for which multidisciplinary management through collaboration has the potential to improve patient outcomes and efficiency of care, through the integration of nursing into practice. These authors conducted a literature review of PubMed, EBSCO, OVID, and ProQuest for publications on the roles and responsibilities of nurses who are working in multidisciplinary teams for the management of cancer cachexia. We limited our search parameters for the literature review such that: (1) the included papers were published in the English language from January 2000 to February 2021 and (2) the included papers featured an adult patient population. Based on this review, cancer cachexia can be characterized as an involuntary loss of body weight that is combined with a dysregulation in the control of energy homeostasis and protein loss, which leads to poor clinical outcomes in patients. Cancer cachexia has been recognized as having multidimensional etiologies that are related to the nutritional and metabolic systems, as well as other physical and physiological systems, and to symptoms that manifest concurrently to the cachexia. While the clinical identification and taxonomic classification of cancer cachexia are usually associated with an observable degree of weight loss and muscular atrophy in a patient, clinical evidence of inflammation and related symptoms should be considered (in addition to the weight loss and muscular atrophy) in the diagnosis and evaluation of cancer cachexia, as will be argued in this paper. Early diagnosis, appropriate clinical assessment, and evaluation of cancer

cachexia are crucial to predicting the onset of the condition and managing its symptoms when it occurs. Various tools have been developed for the clinical evaluation and diagnosis of cancer cachexia which reflect the multitudinous manifestations of the condition. Due to the diversity of its manifestations, multimodal therapy has gained popularity for the management of cancer cachexia. Multimodal therapy includes combined pharmacologic intervention, nutrition supplements, nutritional consultation, physical exercise, and symptom control. As these authors will demonstrate in this paper, this mode of multidisciplinary team management is increasingly supported by scientific evidence and as such, can be seen as essential for high-quality cancer cachexia management. Nursing plays an important role in the multidisciplinary care team model for cancer cachexia management, as nurses are well situated to perform screening, referral, coordination, nutritional consultation, physical exercise consultation, direct nutritional nursing, psychosocial support, symptom control, and hospice care. However, an increased focus on education, skills training, and tool development (as well as adoption of tools) on the part of nurses and other multidisciplinary team members is required to meet the goal of efficient care and improved outcomes for patients with cancer cachexia. These authors demonstrate that increasing roles and responsibilities for nurses in the management of cancer cachexia is a valuable area to explore in the literature and to implement in clinical practice. Our review aims to summarize the etiology

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and epidemiology, mechanisms-of-action, and multitudinous manifestations of cancer cachexia, the therapies that are used in cancer cachexia care and the management approaches by which this care is organized. Finally, these authors emphasize nurses' responsibilities in this mode of cancer cachexia multidisciplinary

team management, which represents a fruitful benefit both in the research literature and in clinical settings.

Key words: Cancer cachexia, management, multidimension, multidisciplinary team, nurse

Introduction

Definition and epidemiology

Cachexia is a common syndrome that is associated with a variety of chronic illnesses, including chronic obstructive pulmonary diseases, chronic kidney diseases, heart failure, critical illnesses, neurological diseases, Acquired Immune Deficiency Syndrome, rheumatoid arthritis, and cancers.^[1] Cachexia was first described by Hippocrates in the 4th to 5th century B.C. as a condition where patients have their flesh “consumed” or “melt away,” which indicates that the illness was fatal. Although weight loss was initially considered to be the primary manifestation of cachexia, it is contemporarily and more accurately characterized by an involuntary loss of body weight in combination with a dysregulation in the control of energy homeostasis and protein loss. Cachexia leads to poor clinical outcomes, worsens quality of life (QOL), and shortens the length of survival in patients.

Cancer cachexia is one of the most complicated and serious types of cachexia; it has distinctive tumor-driven components that lead to progressive functional impairment, treatment-related complications, poor QOL, and cancer-related mortality.^[2] Cancer cachexia is usually associated with a multitude of symptoms that lead to weight loss, including anorexia, which can result in a decrease in oral intake. Other associated symptoms are changes in taste and smell.^[3] Cancer cachexia is a common syndrome in cancer patients. It is estimated that cancer cachexia may be present in 60%–80% advanced cancer patients^[4] and is the cause of death for up to 20% of cancer patients.^[5] As such, cancer cachexia is responsible for approximately two million deaths annually worldwide.^[6]

Incidence of cancer cachexia varies by tumor type and site. Certain types of cancer are more likely to develop cachexia, such as head-and-neck cancer, upper gastrointestinal track cancer, and lung cancer.^[7,8] The prevalence of cachexia is high in patients with gastric and pancreatic cancer (80%),^[9] thoracic cancer (50%),^[10] and newly diagnosed head-and-neck cancer (42%);^[8] whereas patients with breast cancer and leukemia have a lower prevalence of cachexia. Furthermore, men are more susceptible to this condition than women.^[11] Additional factors that contribute to the variable prevalence of cachexia in population groups include more-advanced

cancer stage, advanced age, genetic risk factors, genotype, comorbidities, and treatment-related catabolic effects.^[2] The high prevalence of cancer cachexia has made it an unavoidable issue for oncology nurses.

Etiology

Cancer cachexia is a syndrome associated with metabolic abnormalities and decreased food intake on the part of the patient. A primary indicator of cancer cachexia is negative protein and energy balance. After accounting for the cause of cachexia, the condition is classified into primary cachexia and secondary cachexia.

Primary cachexia is primarily induced by an abnormal metabolism. Primary cachexia stems from tumor-host interaction,^[12] and it results in major bodily changes in the patient. The first and the most important factor in the induction of primary cachexia is cytokine. Cytokine is produced by immune cells when they defend against cancer, trauma, or sepsis. The most common cytokines are tumor necrosis factor- α (TNF- α), interleukin-1 (IL-1), interleukin-6 (IL-6), interleukin-10, and interferon- α , β , γ . Cytokines are thought to facilitate the cachectic course.^[3] Furthermore, the effects of cytokines are linked to a relative shortage in muscle amino acids, as well as hypothalamic appetite decrease, akin to that which is found in anorexia. Cytokines also induce insulin resistance in the liver, which results in abnormal glucose and fat metabolism. These changes contribute to a negative balance in calorie and protein intake, which is demonstrated by a dramatic decline in skeletal muscle in the patient.^[13] Systemic inflammation not only leads to weight loss and poor physical functioning but also worsens symptom clusters, including anorexia, fatigue, pain, and depression,^[14] which are important targets for therapy in cancer nursing.

Secondary cachexia is caused by multiple factors, including the symptoms of tumor or anticancer therapy (e.g., surgical operations, radiotherapy, chemotherapy). These symptoms, such as anorexia, oral mucositis, dysphagia, pain, and depression, cause decreased oral intake. Symptom control is an important part of cancer nursing, as mentioned above. For instance, the severity of oral mucositis caused by radiotherapy or chemotherapy can be reduced by careful oral care. Simultaneously, decreased physical activities that are induced by muscular dystrophy and chronic disease (e.g., infection, diabetes mellitus, chronic

heart failure) can also contribute to secondary cachexia. Patients with secondary cachexia can benefit from additional symptom control, nursing consultation, and health education from nurses, as part of an interdisciplinary team effort.

Cancer cachexia is a multifaceted disorder that manifests on account of multiple factors. According to our study, a considerable portion of care for this condition can be or is performed by nurses, which includes roles in nutritional management, symptom-control, and metabolic management.

Diagnosis and classification

A constellation of definitions has been used to describe cancer cachexia in previous studies,^[15-17] and so, the standard methodology for diagnosis and taxonomic classification for cancer cachexia is variable. Well-known diagnostic criteria were developed by international experts in 2011 from the European Palliative Care Research Collaborative, the Society on Cachexia and Wasting Disorders, the National Cancer Research Institute, the Palliative Care Clinical Studies Group, and the European Society for Clinical Nutrition and Metabolism (ESPEN) Special Interest Group on Cachexia. These standards have been disseminated to wide clinical adoption.^[18] The diagnostic criteria for cancer cachexia include a weight-loss threshold which is >5% over a period of 6 months (with the absence of simple starvation); a body mass index (BMI) <20 kg/m² with any degree of weight loss that is >2%; or an appendicular skeletal muscle index that is consistent with sarcopenia (males <7.26 kg/m²; females <5.45 kg/m²) with any degree of weight loss that is >2%. The ESPEN emphasizes that the diagnostic and evaluative definition of cancer cachexia should include clinical evidence of inflammation as well as loss of muscle mass and physical functionality, which can be used by clinicians to recognize the signs of cachexia or its risk factors.^[14] A holistic evaluation should be considered in light of cachexia's nutritional, metabolic, and symptomatic underlying causes and potential comorbidities.

A standardized classification system for the progression of cachexia was approved in 2011 by the same census of international experts; this protocol describes the progression of cachexia as being divided into three subcomponents: precachexia, cachexia, and refractory cachexia.^[18] The progression of cachexia is classifiable according to its multitudinously-symptomatic nature, as well, which includes evidence of inflammation in the patient. According to these guidelines, precachexia can be defined as weight loss ≤5% with early clinical and metabolic changes (anorexia and impaired glucose tolerance) but no serious complications. Cachexia is defined as weight loss >5% over the past 6 months, a BMI of <20 kg/m²

with a weight loss of >2%, or sarcopenia with a weight loss of >2% and a comanifestation of poor food intake and systemic inflammation. Refractory cachexia is categorized as cachexia with active catabolism and poor performance status. When patients have refractory cachexia, the disease is no longer responsive to treatment, or the treatment benefits are outweighed by the potential burden of morbidity and risk to the patient; in these cases, expected survival is <3 months. Different management strategies are required depending on the stage of cachexia.

Clinical Approaches for Cancer Cachexia Treatment in Multidisciplinary Settings

Diagnosis and evaluation of cancer cachexia in a multidisciplinary setting

These authors argue that it is essential for nurses and other medical staff to monitor for and evaluate cancer cachexia risk during disease management. As described in the previous section, cancer cachexia is a multifaceted and multitudinous disorder, so there is a strong demand that is supported by the evidence to diagnose, evaluate, monitor, and manage cancer cachexia in a multidimensional way.

Diagnosis and evaluation of the nutritional indicators of cancer cachexia

To begin, cancer cachexia diagnosis and evaluation (D and E) can be improved by considering the nutritional dimension of the disorder that contributes to its onset and burden of morbidity.

Since weight loss is a typical diagnostic indicator for cancer cachexia, a routine monitoring of patient weight should be integrated into cancer care. BMI is a useful indicator for a one-time weight loss evaluation. However, monitoring the continuity of weight loss is more meaningful over time, as it gives clinicians comprehensive nutritional information, food intake, and other markers. Monitoring for weight loss is an effective and cost-efficient strategy, so it should be considered a mandatory procedure during cancer patient visits for medical staff, especially as it can be performed by nurses. While clinical evidence shows that patient self-report is reliable,^[19] a follow-up evaluation on the part of nurses with patients and their families can be performed to monitor cancer cachexia.

A comprehensive tool for nutritional evaluation that has demonstrated validity and reliability in cancer populations called the Patient-Generated Subjective Global Assessment (PG-SGA) has been recommended by professional societies^[14,20] and has been well accepted for the needs of cancer cachexia management. Using this

tool, both patients and medical staff conduct a holistic evaluation of the patient's condition; four aspects of the evaluation are completed by patients: weight change, food intake, symptoms, and functional capacity, and the remainder of the assessments, including scoring weight loss, metabolic stress, physical examination, and global assessment categories are determined by the medical staff. More recently, a brief version of the PG-SGA, a-PG-SGA, which can be completed by patients in <5 min, has also demonstrated its value for cancer patients. Considering the efficiency and reliability of this tool, wide usage should be encouraged for nursing staff in the management of cancer cachexia. Other nutritional tools are also used in evaluating cancer cachexia, such as the Mini Nutrition Assessment and Malnutrition Screening Tool, but these tools have lower specificity than PG-SGA.^[21]

An objective index of cancer cachexia symptoms measured by medical instruments can provide more accurate D and E of the condition. Published data have been collected from computed tomography images of lean muscle,^[22,23] since skeletal muscle atrophy is a significant problem in cachexia, and similarly, an indicator of it. A higher-sensitivity evaluation of body composition is made possible by bioelectrical impedance analysis measurements. Lean muscle mass and fat mass (i.e., in different body parts), intracellular or extracellular fluid volume, phase angle values, and other characteristics are detectable with this approach. These additional, and more precise, nutritional indexes may indicate pathogenic mechanisms in certain populations^[24] and can be used as an early index for nutrition improvement^[25] for nurses and other clinicians.

Diagnosis and evaluation of the inflammatory indicators of cancer cachexia

Cancer cachexia is a systemic inflammatory disease, as these authors have demonstrated; therefore, monitoring inflammatory biomarkers is essential to quality care. The most common markers that are used in cancer cachexia monitoring are C-reactive protein (CRP), albumin, prealbumin, TNF- α , and IL-6,^[25] as these are all thought to be involved in the process and progression of the syndrome. The modified Glasgow Prognostic score, which combines CRP and albumin level, has been developed on the hypothesis that systemic inflammation accounts for most of the effects of cancer cachexia.^[26] This tool is user-friendly, and moreover, it is highly predictive and reliable for the diagnosis, evaluation, and treatment of cancer cachexia. Simultaneously, there is a near-universal metabolic co-occurrence of elevated resting energy expenditure (REE) in cachexia patients compared to noncachexia patients, which expresses a higher level of energy expenditure for cellular and organ function during resting conditions in

cachexia patients. Indirect calorimetry can be used to measure REE and to identify personalized energy and protein nutritional needs.

Diagnosis and evaluation of comorbid symptoms

Cancer cachexia is associated with various symptoms that are described in the etiology and epidemiology sections above, especially with regard to secondary cachexia. As such, a holistic assessment of the patient's symptoms by the clinician or care team may be warranted for effective and patient-centered care.^[27] The Edmonton Symptom Assessment Scale is an example of a tool that can be used to assess nutrition-related symptoms. Other clinical assessment tools, such as the Functional Assessment of Anorexia/Cachexia Therapy,^[28] and the European Organization for Research and Treatment of Cancer QOL Questionnaire, are used for the same purpose. However, only some single items or subscales of these tools can be used for cancer cachexia assessment.^[10] Recently, a cancer cachexia-specific questionnaire, the QLQ-CAX24, was developed to assess the symptoms and biometrics of patients with cancer cachexia more comprehensively. This measurement tool contains five multi-item scales (food aversion, eating and weight loss worry, eating difficulties, loss of control, and physical decline) and four single items;^[29] it has been widely used by nurses and other medical staff where it is combined with objective measures (24-h recall collection of diaries of food consumption, 6-min walk test (6MWT), muscle strength, etc.) in clinical practice or in clinical trials.^[22,30-33] In short, nurses can benefit from using QLQ-CAX24 as a holistic, yet specialized symptomatic assessment for cancer cachexia; typically this is combined with objective measures that add quantitative rigor to the diagnosis or evaluation.

Multimodal therapy for the treatment of cancer cachexia

Cancer cachexia was initially thought to be a monofactorial nutritional problem, and as such, it was treated by monotherapy for several decades. Clinical trials of nutritional support and other single-component interventions have shown these interventions to be unsuccessful in stopping or reversing cachectic deterioration.^[34] Therefore, ESPEN strongly recommends a multimodal therapy and management approach,^[14] including pharmacologic and nonpharmacologic interventions.

For pharmacologic interventions, combined therapies are recommended which consider multiple interrelating properties of cancer cachexia. Some anti-inflammatory agents have been employed to alleviate cachexia (since systemic inflammation is the condition's driving mechanism) including nonsteroidal anti-inflammatory drugs, eicosapentaenoic acids (EPA), thalidomide, and

megestrol acetate. Another strategy for intervention is muscle stimulation. One such agent is enobosarm,^[35] which has demonstrated significant effects in increasing total lean body mass. Other types of agents aim to increase appetite, such as anamorelin, a ghrelin receptor agonist.^[36] Combination therapy with multiple anticachexia agents shows a greater benefit to the patient compared to a single agent in some studies,^[37-39] although it is not simply the case that more is better.^[40] No standard combination therapy has been recommended so far, so further study and careful evaluation of patient progress and care approaches are required in the context of multidisciplinary teamwork.

For nonpharmacological interventions, the multimodal approach has gained popularity in clinical literature and practice compared to other monostrategies. Key elements to this approach include nutritional supplements, nutritional consultation, physical exercises, and symptom control. Nurses can be involved in all of these interventions. Providing nutritional support is a vital aspect of a nurse's scope of work, and nurses can access energy and protein metrics through indirect calorimetry, which estimates REE.^[14] Successful nutritional support comes with an individualized, family-centered nutritional consultation,^[22,41] in which nurses are the recommended staff to do this work. Physical exercise may inhibit systemic inflammation and increase lean body mass in the patient. In the multicenter nutrition and exercise treatment for advanced cancer (NEXTAC) program, exercise intervention was combined with low-intensity resistance training and counseling with an eye to providing nutritional support. Remarkable compliance and safety-mindedness were observed in the population of elderly cachexia patients, and behavior change was observed as well.^[42] Other studies that combined exercise and nutritional support also reported improvements, especially in physical function and depression scores.^[43,44] Multimodal therapy includes active managements of symptoms (e.g., pain, nausea, dysphagia, fatigue) which decrease daily nutrition and exercise as well and thus promotes high-quality and holistic care for the part of nurses.^[45,46] Patients with cancer cachexia are typically impaired in physical and psychosocial functions, and so, previous treatment compliance was noted to be poor.^[22,44] To improve quality-of-life and increase patient compliance, psychosocial support should be emphasized as part of a multimodal team effort where nurses play a significant role. In short, the importance of multimodal therapy for cancer cachexia has been gradually recognized by nurses and other clinicians as efficacious and patient centered, and nurses have already taken part in cachexia-related work in the multidisciplinary team setting.

Clinical practice in a multidisciplinary setting

As these authors have described above, cancer cachexia is a multifactor-etiology disorder that requires multimodal therapy driven by an interdisciplinary team (which includes nurses). As such, teamwork through a multidisciplinary approach is an inevitability to produce high-quality and cost-effective care for cancer cachexia patients. A notable example of multidisciplinary clinical practice is the Cancer Appetite and Rehabilitation (CARE) clinic, which was developed in 2007 at the Joan Karnell Cancer Center at Pennsylvania Hospital in the United States.^[45] This clinic has been operational for over a decade. Its team members include a physician, nurses, a nutritionist, a physical therapist, a speech and swallowing therapist, a patient navigator, and a program assistant. These team members are divided into four different departments: a medical and nursing department, a nutrition department, a physical therapy department, and a speech and swallowing therapy department. CARE aims to diminish the effects of cancer cachexia and improve nutrition, function, symptom management, and QOL of patients with cancer. Nurses in CARE act as a nurse navigator, a nurse practitioner (NP), and a nurse administrator;^[47] they are involved in the jobs of assessment and symptom control, care coordination, follow-ups, and program administration. Nurses are essential to multimodal teamwork as their responsibilities are detecting nutrition and related symptom-expressions at an earlier time compared to the routine schedule. Nurses have enough availability to converse with the patients and their families such that they can make holistic family assessments and set goals. Direct and quick referrals can be made by nurses to their team members. The CARE nurse manager's exceptional job in administration guarantees the resource-availability and high-quality of care at this clinic.

Another example of multimodal, multidisciplinary care comes from Canada: the McGill Cancer Nutrition Rehabilitation Program clinic at the Jewish General Hospital (CNR-JGH).^[30] The CNR-JGH clinic team is composed of a physician, a nurse, a physiotherapist, and a dietitian. Patients are evaluated by each professional every 6 weeks, and a multidisciplinary intervention plan is thereby formulated. Clinically important improvements are observed and noted over subsequent visits, including changes in 6MWT and QOL assessments. Follow-up visits can be implemented based on the patient's needs. In nurse-led clinics, nurses take multidisciplinary teamwork for cachexia management from theory into practice as they make timely and family-oriented evaluations and assessments, confer management decisions, and provide comprehensive health care in collaboration with the multidisciplinary team.

Cancer cachexia may lead to psychosocial stress for patients, families, and care professionals. Some researchers have discussed the psychosocial consequences of reduced eating ability on the part of the patient. For patients recognizing onset weakness, loss-of-function, mobility, altered appearance, and appetite changes,^[48] these patients may experience a wide range of emotions including anger, anxiety, disappointment, grief, and sadness,^[49] and they may feel that their dignity is offended in the course of care.^[50] For families and caregivers, they may feel distressed, conflicted, and socially isolated. Their daily lives are significantly impacted or disrupted, and they may require external help, especially from medical staff, including nurses.^[51] For professionals, a discussion about this issue among patients and families may bother clinicians because their knowledge of cancer cachexia is limited. For this reason, psychosocial management ought to be integrated into teamwork. Cancer cachexia-related psychosocial function assessments are increasingly being implemented in some clinics, inpatient wards, and communities for both patients and families.^[32,45,52,53] Psychosocial support is provided in hospitals and communities to alleviate stress for both patients and caregivers and to improve therapy compliance; nurses can be involved in this effort as well.^[54-56]

The Role of Nurses in a Multidisciplinary Cancer Cachexia Care Team

Screening, referral, and care coordination

Screening is a major responsibility for nurses who are working with patients in the early stage of cancer cachexia as they aim to slow down deterioration. Nurses are the first-line staff who are capable of detecting the problem of cachexia, and they hold knowledge of nutrition and symptom management techniques. Berry *et al.* implemented a screening intervention for cancer anorexia and cachexia in the thoracic infusion services of the Cancer Institute.^[10] The nurses at this institute demonstrated that they have the ability to classify nutritional status so long as appropriate tools are provided to them; in this intervention, more than 50% of patients who were detected to be in a moderate-to-severe risk category for cancer cachexia were referred to for nutrition services. Furthermore, the multimodal therapy of cancer cachexia can be completed in collaboration with different departments and experts; therefore, it is difficult to determine who will be the next specialist to meet with the patient. Nurses are pivotal in providing referrals as they are accessible to both patients and medical staff. In the CARE clinic model, an oncology nurse-navigator made an initial comprehensive assessment, provided early education

and targeted referrals, and coordinated and managed care between cancer-care providers and patients.^[47] In another NP-led symptom management clinic, a patient's weight was monitored to assess for excessive weight loss. This effort was coupled with an assessment of the patient's activity, exercise, fatigue level, and laboratory results, which contain markers related to cachexia.^[57] In conclusion, nurses are the most appropriate persons to screen for cancer cachexia and related symptoms in each potential stage of cachexia. As they are the first care professionals who recognize or detect problems while having familiarity with medical resources, they are also essential for referral and coordination within the wider team. To ensure appropriate staffing and teamwork processes with the necessary supportive care protocols and funding-allocation, coordination with other entities should be taken on by nurse leaders, akin to the CARE clinic.^[47]

Nutritional consultation and physical-exercise consultation

Nutritional consultation is a long-term and usually individualized and home-based program. While initiating nutritional therapy is the priority for nutritional consultation, evaluation of the patient's progress and adaptation to health-related challenges is the only way to ensure continuity of optimal care.^[58] Re-emphasizing education for the patient is also recommended after adaptations are made. Although it is the dietitian who provides nutritional consultation, in the example of the PICNIC research study, home care nurses are strongly recommended for standard care by users of the PICNIC program, both in Chinese Hong Kong and Australia.^[54] In another program, called NEXTAC, clinical assessments and exercise consultations were provided by nurses and other staff, and improvement of QOL was noted through outcome measures.^[42] In many health-care systems around the world, nurses are the major contributor to continuity of care, including by performing family visits. Nurses make regular home visits, and they have the knowledge and expertise to talk with patients and families about nutrition and exercise. Moreover, the prevention of accidental harm, e.g., falling, is a basic nursing skill; this is why nurses are considered to be among the most suitable staff to perform the work of nutritional consultation.

Similar consultation has been ongoing at the Beijing Cancer Hospital since September 2020. These authors, in our clinical practice, have provided an online nursing consultation for nutritional and dysphagia assistance for cancer patients; this program runs every Thursday afternoon and it evaluates each patient's nutrition status and dysphagia concerns using assessment tools, and then, it provides e-counseling to assist with the patient's skills to

cope with cachexia and related symptoms. Consultation, as it is provided by skilled nurses, may be more comprehensive and personalized compared to what can be produced by other medical staff, since nurses are more familiar with the patients from day-to-day interactions. The development of new e-consultation technology may increase the number of potential populations nurses can serve for and affect their care.

Direct nutritional support

Nutritional support is one of the major clinical work areas of nurses. Nurses provide enteral and parenteral feeding for many patients, which is the patients' source of sustenance. Monitoring the patients' nutritional status and their potentially adverse reactions to food is also an important task that nurses perform. Nurses who are specifically trained for nutrition management are called nutrition nurse specialists (NNSs). NNSs are generally a core part of hospital nutrition support teams; these nurses give comprehensive assessments and consultations to the patients, monitor and resolve problems during enteral-feeding (such as abdominal distention, diarrhea, vomiting, and aspiration), and address complication of parenteral feeding. In Sutton's study, the overall sepsis rate fell significantly in the 4-year period after the NNSs were appointed, from 52% to 2.3%; this dramatic reduction was accompanied by a decrease in costs.^[59] Direct nutritional nursing requires more comprehensive skills beyond that of feeding. In particular, nurses place and manage the feeding tube in the patient,^[57] perform the role of educator for both patients and other medical staff, and even offer quality facilitation in the health-care setting,^[60] in addition to their initial screening and diagnostic responsibilities. As cachexia disturbs the metabolism of glucose in the patient, careful monitoring and controlling of blood glucose during nutritional support and consultation are also clinically beneficial.^[61] Services for outpatients and the community on the part of nurses are enhanced by the internet's role in facilitation; telehealth, in particular, has developed rapidly in many countries, including in the Chinese mainland. As cachexia is a chronic syndrome, direct nutritional nursing (including the management of nutritional support and the feeding tube) is in high demand in the community for outpatient services. Additional areas in nursing practice can explore telehealth considering the demand for these kinds of services in the community.

Psychosocial support

Emotions that are experienced by patients and their caregivers during cancer cachexia treatment can be overwhelming; these emotions include anger, anxiety, disappointment, grief, sadness, guilt, powerlessness, and

shame.^[49] Food is not only a source of energy for human beings but also occupies a symbolic place in people's relationships.^[62] Nurses are familiar with the health habits, socioeconomic statuses, and cultural mores of the patients they treat and their families, which helps nurses to facilitate efficient communication with patients. A clinical trial of Macmillan-trained nurses described an intervention where nurses provided psychosocial skills training to the patients after psychosocial training. They offered them informational leaflets about cachexia and then performed a psychointervention guided by the leaflet.^[55] Patients responded positively to this intervention; they had a better eating experience as they were able to eat what they wanted, and distress associated with eating was diminished. Hence, it seems that nurses may have the potential power to make psychosocial contribution for cancer cachexia, as long as provided necessary psychosocial skills. Obstacles to the effective delivery of multimodal treatment include psychosocial considerations, such as the attitudes, beliefs, and behaviors of patients, caregivers, and health-care professionals. Professional communication strategies that are included in the psychosocial intervention can promote a successful multimodal therapeutic approach.^[63] As cachexia-related nursing is explored in the literature, and in practice, psychosocial nursing will play an important role in cancer cachexia care as it prompts patients and their caregivers to be able to adapt to the changes or trauma that occurs on account of their experience of this condition.

Cachexia-related symptom management

Effective symptom management increases food intake and improves the nutrition status of patients. Head-and-neck cancer patients treated with chemoradiation, for instance, experienced significant changes in their nutritional status.^[64] Patients who received oral care from nurses may have been prevented from developing oral mucositis, and nurses can teach patients skills to modify food texture to avoid pain and dysphagia. As such, experts claim that nurses play an important role in symptom management for both physical and psychosocial symptoms.^[51,65] In the CARE clinic, the nurse navigator and NP both participate in symptom control.^[66] The nurse navigator assesses symptoms before multidisciplinary intervention and refers patients to an appropriate specialist. The NP in the CARE team takes part in direct symptom management. For instance, if the patient is bothered by oral mucositis, which induces a decrease in oral intake, the NP may give the patient intensive oral care followed by liquid morphine. To help with the patients' cachexia-related fatigue, the NP can educate them on fatigue management and energy conservation techniques; furthermore, the NP can prescribe a home-based exercise and walking program for the patient. One other example

of cancer cachexia-related symptom management is a nurse-led self-care program that includes relaxation training and education on how to reduce nausea and vomiting for the patient.^[67] In this instance, an NP prescribes symptom control medicine, such as an antiemetic. Therefore, symptom management (which is comprised of monitoring and evaluation, and the delivery of pharmacologic and nonpharmacologic strategies) is a primary consideration for clinical care related to the rehabilitation of cachexia.^[30,51]

End-of-life care services

Patients are more likely to refuse food at the end-of-life compared to nonend-of-life patients. However, caregivers are often convinced that cachexia indicates that death for the patient is inevitable, so they beg or even force patient to eat food sometimes, to alleviate anxiety. There is somewhat a food-related conflict that arises between them, as caregivers do not receive sufficient information on nutrition and hydration.^[68] The truth is that nutritional feeding has shown little benefit for end-of-life patient.^[19] Education for caregivers from nurses is required, that to persuade caregivers to stop feeding if the patients do not want to eat. Comfort is extraordinarily important for the patient experience. Nurses may help caregivers to offer basic nursing care to express their love, compassion, and affection for the patient; these types of interactions reduce anxiety and conflict among the patient and caregiver. Furthermore, nurses are required to monitor the nutritional status of patients such that they avoid inducing aspiration, abdominal distention, or fluid-overload in the patient when the nurse feeds them according to the patients' preferences. All the nurses' scope of work for the care of cancer cachexia patients, in different nursing levels, is demonstrated in Table 1.

Deficits in Nursing in a Multidisciplinary Team Setting

Although nurses have contributed to significant successes in the multidisciplinary team effort in the treatment of cancer cachexia, some nurses are not well prepared for the role of interdisciplinary care worker, as they have not mastered the appropriate knowledge, skills-training, familiarity with tools, or appreciation for the clinical evidence in the care of the condition.^[69]

Although nutritional care is a basic provision in regular nursing protocol, a focus on cancer cachexia care is not a compulsory area of study for most nurses in their degree programs. Nurses are not always knowledgeable of and confident in their ability to do nutritional care.^[70] Continuing education is warranted for nurses on how to screen for precachexia and existing cachexia. Meanwhile, cachexia

Table 1: Nurses' scope of work for the care of cancer cachexia patients

Nursing approaches	Nursing at two levels
Direct nursing	Primary level Screening with initial evaluation tools Basic nutritional support Follow-up care Advanced level Assessment with comprehensive evaluation tools Nutritional consultation Physical-exercise consultation Nutritional support-related problem resolution Cachexia-related symptom control Psychosocial support for patients, caregivers, and families Palliative care
Indirect nursing	Primary level Referral to other medical staff Advanced level Coordination within the multidisciplinary team Linking to resources outside of the multidisciplinary team Provision of education for patients and other medical staff Program management Cachexia-related clinical research

impacts the patient in both the physical and psychosocial dimensions which leads to a high burden of morbidity; this issue has not been addressed adequately in the medical literature or in practice. For instance, a cachexia-related dignity defense is not recognized by nearly 90% of medical staff, according to one study.^[50] Another study indicates that cachexia is a taboo topic in clinical settings, and nurses do not have the appropriate skills or training to discuss it productively with patients and their families.^[48] Furthermore, rapid changes in the treatment and therapeutic mechanisms for cachexia increase barriers to up-to-date communication. One example of this evolution in information is that the clinical outcomes of emerging anticancer therapies like programmed death-1 (PD1) and its ligand (PDL1) have been associated with cachexia itself; therefore, continued training and information dissemination is highly beneficial for nurses to make appropriate clinical decisions with patients.

Special tools for the D and E of cachexia are absent in clinical practice. Screening is a major area of responsibility for nurses, and a screening tool that distinguishes between malnutrition, cachexia, and sarcopenia is not yet available. The attempt to predict cachexia with a simplified tool was shown to be unsuccessful.^[71] Types of cytokines such as TNF- α , IL-1, IL-6 are used to monitor cachexia, however, they have not been identified as specific biomarkers for diagnosis.

Finally, high-level primary studies and/or meta-analyzed evidence for cachexia care are rare in the literature. One reason for this dearth of clinical research is that patients who are diagnosed with cachexia are usually in too poor status to adhere to therapies, and they often display high

rates of drop-out in clinical trials.^[25] In addition, refractory cachexia has been frequently excluded from research parameters, leading to the limited application of evidence to clinical treatment of the condition in the real world.

For the above reasons, nurses ought to be trained with specific knowledge and skills when they engage in multidisciplinary teamwork; what kind of knowledge and skills nurses must master is determined by their roles in the team. Granda-Cameron *et al.* developed the clinical interdisciplinary framework of CARE to guide nurses to explore their roles at each point in the clinical process.^[66] CARE highlights the diverse role of nurses as the intervention expands nursing responsibilities into dimensions beyond clinical practice: administration, research, and education. According to our study, further education and research for nursing in these fields are warranted.

Conclusions

Cancer cachexia is a multidimensional health issue related to abnormal metabolic function that leads to decreased food intake and a high degree of morbidity. Because of its multitudinous manifestations in a patient's nutritional system, metabolic function, and symptom presentation, a comprehensive evaluation for cancer cachexia is warranted to ensure high-quality cancer care. Contemporarily, multimodal therapy has been introduced as a care model for cancer cachexia; this model includes pharmacologic and nonpharmacologic therapies (nutrition consultation, nutrition supplements, physical exercises, and symptom control) which are performed by a multidisciplinary team, of which nurses are a crucial part. Nurses play an important role in cancer cachexia care in various ways, however, nurses are not well equipped with the knowledge and tools required for the delivery of nutritional, symptom-oriented, and psychosocial nursing services. Unfortunately, many nurses do not have the confidence to provide the advanced nursing patients benefit from. Nevertheless, skilled nurses are managing to expand the roles of nursing by providing patients with comprehensive and personalized care in a multidisciplinary care team, using new technologies. In the future, nurses may take even more responsibilities in cachexia-related management and treatment. Continued education for nurses and other care professionals also promotes the thesis of this paper that continued development of the clinical evidence will help with decision-making protocols for cancer cachexia care.

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Conflicts of interest

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