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Malnutrition and Chemotherapy-Induced Nausea and Vomiting: Implications for Practice

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The systemic administration of chemotherapy agents can result in gastrointestinal toxicities, which in turn affect the nutritional status of patients. Chemotherapy-induced nausea and vomiting (CINV), anorexia, dysgeusia, pain, constipation, and diarrhea are symptoms commonly reported by patients undergoing cancer treatment (Tong, Isenring, & Yates, 2009). A subset of those patients may experience the symptoms to such an extent that their ability to achieve adequate dietary intake is limited, compromising nutritional status and leading to negative outcomes for patients and treating facilities. Malnourished patients experience poorer quality of life, decreased treatment tolerance, increased complications (Ravasco, Monteiro Grillo, & Camilo, 2007), and longer hospital admissions (Gout, Barker, & Crowe, 2009), which jeopardizes treatment adherence and tumor control (Ihbe-Heffinger et al., 2004), increasing mortality (Dewys et al., 1980; Ovesen, Allingstrup, Hannibal, Mortensen, & Hansen, 1993) and burdening healthcare resources (Moore, Tumeh, Wojtanowski, & Flowers, 2007).

Despite advances in antiemetic pharmaceuticals, poorly controlled chemotherapy-related nausea is experienced by as many as 84% of patients (Colaguri et al., 2008; Dibble, Isreal, Nussey, Casey, & Luce, 2003; Hesketh, 2008; Hickok, Roscoe, Morrow, & Ryan, 2007), with about 40% reporting at least one episode of vomiting during treatment (Isenring, Capra, & Bauer, 2004b; Isenring, Cross, Kellett, Koczwara, & Daniels, 2010; Tong et al., 2009). Functional capacity is impaired by CINV, increasing the risk of malnutrition (Hesketh, 2008; Ravasco et al., 2007; Tipton et al., 2007); a risk that is amplified if CINV limits dietary intake. The literature describes malnutrition in an inpatient or mixed inpatient and outpatient setting, and few studies have used validated tools to evaluate the prevalence of malnutrition in the chemotherapy ambulatory care unit alone.

Purpose/Objectives: To determine the prevalence of malnutrition and chemotherapy-induced nausea and vomiting (CINV) limiting patients' dietary intake in a chemotherapy unit.

Design: Cross-sectional descriptive audit.

Setting: Chemotherapy ambulatory care unit in a teaching hospital in Australia.

Sample: 121 patients receiving chemotherapy for malignancies, aged 18 years and older, and able to provide verbal consent.

Methods: An accredited practicing dietitian collected all data. Chi-square tests were used to determine the relationship of malnutrition with variables and demographic data.

Main Research Variables: Nutritional status, weight change, body mass index, prior dietetic input, CINV, and CINV that limited dietary intake.

Findings: Thirty-one participants (26%) were malnourished, 12 (10%) had intake-limiting CINV, 22 (20%) reported significant weight loss, and 20 (18%) required improved nutrition symptom management. High nutrition risk diagnoses, CINV, body mass index, and weight loss were significantly associated with malnutrition. Thirteen participants (35%) with malnutrition, significant weight loss, intake-limiting CINV, and/or who critically required improved symptom management reported no prior dietetic contact; the majority of those participants were overweight or obese.

Conclusions: Of patients receiving chemotherapy in this ambulatory setting, 26% were malnourished, as were the majority of patients reporting intake-limiting CINV.

Implications for Nursing: Patients with malnutrition and/or intake-limiting CINV and in need of improved nutrition symptom management may be overlooked, particularly patients who are overweight or obese—an increasing proportion of the Australian population. Evidence-based practice guidelines recommend implementing validated nutrition screening tools, such as the Malnutrition Screening Tool, in patients undergoing chemotherapy to identify those at risk of malnutrition who require dietitian referral.

Identifying patients at risk for malnutrition and optimizing symptom management to reverse or prevent malnutrition is an essential part of patient care (Watterson et al., 2009). Ambulatory care oncology nurses have frequent patient contact that enables them to monitor patient nutritional risk more closely than other health professionals and facilitate referrals to the dietitian for full nutrition assessment and symptom management. However, in the absence of formal malnutrition screening with validated tools, patients at risk of malnutrition may not be identified. In such cases, issues related to malnutrition and symptoms that limit dietary intake are likely to be addressed reactively rather than proactively. As such, nutrition interventions may be offered only to the severely malnourished (Ottery, 2000).

The current study aimed to determine the prevalence of malnutrition, CINV, and CINV that limited dietary intake in an Australian chemotherapy ambulatory care unit. In this study, patients with malnutrition and patients requiring nutrition symptom management for CINV that limited dietary intake who had not been seen by a dietitian also were identified.

Methods

Design

The cross-sectional descriptive audit was approved by the Princess Alexandra Hospital Ethics Committee as a quality improvement project. Informed verbal consent was obtained from all participants. Patient medical notes were screened for eligibility criteria, and patients who received chemotherapy at any stage of treatment for solid or hematologic malignancy in the chemotherapy ambulatory care unit were included. Patients were excluded if they were younger than 18 years old or pregnant.

Data were collected for five weeks from Monday through Friday (July to August 2009). Demographic data including age, gender, and diagnosis were collected from the medical notes. Data pertaining to prior dietetic involvement were obtained from the medical notes and clarified with the patient. Oncologic diagnoses were categorized as breast, colorectal, head and neck, hepatobiliary, lung, lymphoma, myeloma, esophagus, prostate, upper gastrointestinal (GI), unknown primary, and other.

Nutrition Assessment

An accredited practicing dietitian trained in the scored Patient-Generated Subjective Global Assessment (PG-SGA) instrument (Ottery, 2000) performed all data collection and nutrition assessments. The PG-SGA, which assesses the nutritional status of patients with cancer, is validated in the ambulatory oncology

setting to identify nutrition-related symptoms and their impact on intake (Bauer, Capra, & Ferguson, 2002; Isenring, Bauer, & Capra, 2003; Read et al., 2005). Patient-subjective and clinician-objective assessments including diagnosis, weight change, metabolic demands, dietary intake, functional capacity, symptoms that impair dietary intake and body fat, fluid status, and muscle stores are cross-referenced to provide a global rating, the Subjective Global Assessment (SGA). The tool produces the following ratings: SGA A, well nourished; SGA B, moderately or suspected of being malnourished; and SGA C, severely malnourished. This tool triages patients using a score that is calculated by allocating 0–4 points per section to indicate impact on nutritional status and the level or intensity of intervention required to address nutrition-related issues. A score of 9 or greater predicts worsening nutritional status, indicating a need for improved nutrition-related symptom management with or without nutritional supplementation (Ottery, 2000). Typical scores range from 0–35, with a higher score indicating greater need for dietetic involvement in symptom management (Isenring, Capra, & Bauer, 2004a).

The presence of CINV and CINV that limited dietary intake in the two weeks prior to assessment was recorded within the PG-SGA. Body mass index (BMI) was calculated from measured height and weight where possible, and otherwise was based on self-reported heights and weights. Patient BMI was categorized by age as underweight, normal range, and overweight or obese (Bannerman et al., 2002; National Health and Medical Research Council, 2003).

Statistical Analyses

The data were analyzed using STATA/IC, version 11.0, for Windows®. Statistical significance was reported at the conventional $p < 0.05$ level (two-tailed). Descriptive data are presented as frequencies (categorical data) and mean and standard deviation (continuous data). Associations among demographics and nutritional status were examined using chi-square analyses. For the purpose of statistical analyses, nutritional status was merged to form two groups, well nourished (PG-SGA A) and malnourished (PG-SGA B or C). Oncologic diagnoses of head and neck, esophageal, hepatobiliary, and upper GI formed the high nutrition risk group. Unknown primary and other were merged into other. Significant weight loss was defined as 5% or greater in one month or 10% or greater in six months.

Results

Of 123 patients audited, 121 agreed to participate in the study. Reasons for nonparticipation were “too unwell” and “declined to participate.” Table 1 describes

Table 1. Patient Characteristics

Characteristic	\bar{X}	SD	Range
Age (years)	58.9	14.8	18–89
Weight (kg)	77.4	15.5	41–118
Body mass index (kg/m ²)	26.7	5.5	15–45
Characteristic	n	%	
Gender (N = 121)			
Male	71	59	
Female	50	41	
Diagnoses (N = 121)			
High nutrition risk ^a	21	17	
Colorectal	19	16	
Breast	16	13	
Lung	14	12	
Myeloma	6	5	
Prostate	3	3	
Lymphoma	27	22	
Other ^b	15	12	
Weight^c (N = 116)			
Underweight	9	8	
Normal range	47	40	
Overweight or obese	60	52	
Nutritional status (N = 118)			
SGA A (well nourished)	87	74	
SGA B (moderate or suspected malnutrition)	28	24	
SGA C (severe malnutrition)	3	2	
CINV (N = 118)			
Nausea	42	36	
Vomiting	14	12	
CINV limiting dietary intake (N = 118)			
Nausea	12	10	
Vomiting	3	3	

^a The high nutrition risk group consists of head and neck, esophageal, hepatobiliary, or upper gastrointestinal cancer.

^b Unknown primary and all who do not fit other categories.

^c Body mass index categories less than 65 years old (National Health and Medical Research Council, 2003): 18.5 or less kg/m² (underweight), 18.5–24.9 kg/m² (normal range), 25 or greater kg/m² (overweight or obese); aged 65 years old or greater (Bannerman et al., 2002): less than 22 kg/m² (underweight), 22–29 kg/m² (normal range), 30 or greater kg/m² (overweight or obese).

CINV—chemotherapy-induced nausea and vomiting; SGA—Subjective Global Assessment

the demographic characteristics of participants. The majority of participants were male and overweight or obese. Lymphoma was the most common oncologic diagnosis, followed by high nutrition risk diagnoses and colorectal cancer.

Nutritional Status

Thirty-one participants (26%) were moderately (n = 28, 23%) or severely (n = 3, 2%) malnourished. High nutrition risk diagnoses ($\chi^2 = 12.6$, $p < 0.001$) and BMI ($\chi^2 = 10.8$, $p < 0.05$) were significantly associated with malnutrition. Of those identified as malnourished, 23 patients (79%) were within the normal or overweight

or obese BMI ranges. Six of the seven malnourished participants who reported no prior dietetic contact were within the normal or overweight or obese BMI ranges. The median PG-SGA score was 4 (1, 17). Using a score of 9 or greater, 20 participants (17%) required improved nutrition-related symptom management, five of whom reported no prior dietetic involvement.

Weight Change

Mean weight change was -0.8 kg in one month (SD = 4.4) and -1.5 kg in six months (SD = 7.9). Twenty-two (18%) patients reported significant weight loss, 18 of whom were within the normal range or overweight or obese BMI categories. Of those who experienced significant weight loss, nine patients (41%) reported no prior dietetic input despite four of them being malnourished. Significant weight loss was associated with malnutrition ($\chi^2 = 31.5$, $p < 0.001$).

Chemotherapy-Induced Nausea and Vomiting

Fourteen patients (12%) reported vomiting and 42 (35%) reported nausea in two weeks. Of those reporting CINV, 12 patients reported CINV to the extent that it limited their dietary intake. One participant with intake-limiting CINV was underweight, all but two were malnourished, and eight patients had a PG-SGA score of 9 or greater. CINV was significantly associated with malnutrition ($\chi^2 = 22.5$, $p < 0.001$). Four patients with CINV that limited their dietary intake reported no prior dietetic involvement; all were in the normal or overweight or obese BMI ranges.

Prior Dietetic Involvement

Fifty-one participants (42%) reported prior dietetic input. Thirteen patients (35%) who were identified as having malnutrition, significant weight loss, critical need for improved symptom management, and intake-limiting CINV reported no prior dietetic input. Of those who were missed, eight (62%) were overweight or obese, and four (31%) were within the normal BMI range.

Discussion

Chemotherapy ambulatory care units have rarely been evaluated in isolation for the prevalence of malnutrition and CINV that limits dietary intake because many studies have surveyed mixed inpatient and outpatient populations. The reported prevalence of cancer-related malnutrition has ranged from 11%–80% in the literature (Bauer et al., 2002; Creaser, 2010; Lavianno, Meguid, & Rossi-Fanelli, 2003; Read, Choy, Beale, & Clarke, 2006b; Segura et al., 2005); the wide variation is attributed to tumor site and likely influenced by tumor type and stage, chemotherapy agent, the setting where

patients were surveyed, and the definition of malnutrition used (Vandebroek & Schrijvers, 2008). The current study found that 26% of patients in the chemotherapy ambulatory care unit were malnourished, a figure consistent with that reported by Isenring, Cross, Daniels, Kellett, and Koczwara (2006) in their validation of the Malnutrition Screening Tool (MST) in the ambulatory chemotherapy setting. In a study of patients with cancer undertaken in a medical outpatient facility, Read et al. (2006a) reported a higher prevalence, with about 66% of the sample identified as malnourished. However, this could be because of a higher proportion of high nutritional risk diagnoses and minimal exposure to dietetic services as the patient group surveyed were new to the clinic and had no prior chemotherapy or radiotherapy treatment. This highlights a high prevalence of pretreatment malnutrition, which may not be identified on presentation to ambulatory care units in the absence of formal nutrition screening.

The current analysis demonstrates that malnutrition is associated with CINV that limits dietary intake, with nausea being one of the most common and distressing symptoms experienced by patients undergoing chemotherapy (Hesketh, 2008; Tipton et al., 2007; Tong et al., 2009). Nausea has been found to adversely affect the dietary intake of 21%–35% of patients receiving chemotherapy from one month to one year of treatment (Tong et al., 2009). In the current study, intake-limiting CINV likely was minimized by the effect of the high dietetic involvement in patient care and cross-sectional nature of the data collection, which captured patients at all times throughout treatment. Although patients experiencing vomiting that limited dietary intake reported prior dietetic input, 33% of those experiencing intake-limiting nausea in the absence of vomiting reported no prior dietetic input despite its association with malnutrition. Forty percent of those in critical need of improved symptom management experienced nausea that impaired dietary intake. Vomiting is an overt symptom that is identified easily; however, poorly-controlled chemotherapy-related nausea impairs functional capacity, increasing the risk of malnutrition (Hesketh, 2008; Ravasco et al., 2007; Tipton et al., 2007) and poorer treatment outcomes. Despite the increasing availability of pharmacologic agents for managing CINV, the effective management of those symptoms remains a challenge for clinicians. Evidence-based practice recommends that, in addition to pharmaceuticals, dietary interventions are likely to minimize the symptoms (Tipton et al., 2007).

Bozzetti (2009) found that 40% of patients undergoing chemotherapy experienced weight loss. In the current study, significant weight loss is defined as 5% or greater in one month or 10% or greater in six months, resulting in a prevalence of 18%; however, Bozzetti

(2009) determined weight loss to be significant at a 10% or greater loss from usual weight, irrespective of time frame. Weight loss is associated with malnutrition and is a component of many screening tools used to assess nutritional risk. In the ambulatory setting, weight loss can be monitored easily by patients and nurses as patients are advised to monitor their weight in addition to regular weighing at the ambulatory clinic.

Malnutrition is a major cause of morbidity and mortality in cancer (Dewys et al., 1980). It reduces the response to treatment, has a negative impact on quality of life (Ravasco et al., 2007), and burdens healthcare facilities by increasing costs through lengthened therapies, longer hospital stays, and increased clinician consultation times for therapeutic interventions and treatment-related toxicities (Alexandre et al., 2003). It may have been difficult for staff to identify malnutrition in this group because 52% were overweight or obese and only 8% were underweight. Although low BMI and malnutrition are associated, 23 patients in the normal or overweight or obese ranges were malnourished. The high proportion of patients in nonunderweight BMI categories highlights the increasing difficulty in identifying those in need of dietetic interventions. The authors found that six patients with malnutrition, seven with significant weight loss, and four critically in need of improved nutrition symptom management in the higher BMI categories reported no prior dietetic input. Overweight and obese patients may be pleased with inadvertent weight loss during treatment and, therefore, may be less inclined to report it as a concern. Clinicians and patients need to be aware of the effects malnutrition may have on patient outcomes (Watterson et al., 2009), particularly in those receiving chemotherapy, as changes in nutritional status have been associated with changes in the absorption, metabolism, and elimination of chemotherapy drugs (Vandebroek & Schrijvers, 2008).

During the audit, a dietetic presence was in the ambulatory care unit, which may have influenced the number of referrals to the dietitian. Therefore, it is of clinical concern that 35% of the patients who had signs or symptoms indicating a need for dietetic referral reported no prior dietetic involvement. With no formal nutrition screening processes in place, patients were referred ad hoc, and many who were malnourished or required improved nutrition-related symptom management were missed. Relying on BMI and patient self-reporting symptoms is inadequate for identifying all patients at risk for malnutrition or with poor nutritional status. The multidisciplinary team must correctly identify, refer, and support patients with poor nutritional status or who are at risk of malnutrition; a process made more difficult in the absence of formal screening.

Limitations

Patients undergoing chemotherapy experience many symptoms that negatively affect their dietary intake. In this audit, only intake-limiting CINV was evaluated for prior dietetic involvement, supporting the implementation of formal nutrition screening tools. As such, the findings of patients with symptoms who needed dietetic involvement but were missed are likely an underestimate. In addition to intake-limiting CINV and BMI, other variables such as taste may be associated with malnutrition. However, those variables were not evaluated because of the small sample size.

Implications for Nursing

A primary goal of nursing is to provide an evidence-based, holistic approach to health care. Malnutrition increases risk of infections, pressure ulcers, and falls (Watterson et al., 2009). For patients undergoing chemotherapy, nutritional status also may play a role in toxicity (Alexandre et al., 2003) and has implications for adherence to treatment protocols and clinical outcomes. In patients undergoing anticancer treatments in the ambulatory setting, nausea that impairs dietary intake or results in significant weight loss is associated with malnutrition. The symptoms of malnutrition may be missed, particularly in patients who are overweight or obese; therefore, healthcare professionals should not only evaluate patient weight, but also weight history as captured in most malnutrition screening tools.

A valid screening tool, such as the MST, can be implemented to identify patients at risk for malnutrition. The MST is comprised of two questions related to recent appetite and weight history, is highly sensitive, and is specific in terms of identifying patients at risk for malnutrition (Ferguson, Capra, Bauer, & Banks, 1999). It has high inter-rater reliability and may be completed by medical, nursing, and administrative staff or even by the patients (Ferguson et al., 1999; Isenring et al., 2006; Watterson et al., 2009). A score of 2 or greater indicates need for referral to the dietitian for triaging and, if appropriate, full nutritional assessment. The MST provides a fast and efficient means to formally identify patients at risk of malnutrition, allowing for referral to a dietitian (Watterson et al., 2009).

The frequent patient contact of ambulatory oncology nursing staff places them in an excellent position to routinely screen patients for nutritional risk and advocate for their nutritional care. Patients at risk can receive

a thorough nutritional assessment, which usually is conducted by a dietitian, but can be done by a nurse who is experienced and trained in the use of nutrition assessment tools such as the PG-SGA (Ottery, 2000). Dietitians are trained in nutrition assessment and work in an evidence-based framework to personalize dietary advice, providing nutrition counseling and support. A dietitian or nutrition support team following a thorough nutrition assessment will determine the appropriate form of nutrition support (e.g., high energy, high-protein meals, snacks, supplements, tube feeding) as appropriate.

In the radiotherapy setting, strong evidence supports nutrition intervention and management of the symptoms that adversely affect dietary intake to improve nutritional status and quality of life (Isenring et al., 2008). However, additional research is needed in the ambulatory chemotherapy setting to clarify any potentially beneficial effects of similar interventions (Colagiuri et al., 2008; Tong et al., 2009). The introduction of formal, valid screening tools, such as the MST, would aid in identifying patients at risk for malnutrition on commencement, as well as routinely throughout chemotherapy. The process would facilitate a formal referral pathway to dietetic services capturing patients with pretreatment malnutrition and those at risk for chemotherapy-related malnutrition. Once referred, dietitians can assess nutritional status using the PG-SGA rating. Therefore, the effectiveness of any interventions to manage poor nutritional intake as a result of CINV could be monitored using the PG-SGA score. The score is not only sensitive to nutrition intervention but also to deterioration, ensuring provision of a strong evidence base to guide clinical practice and ensure appropriate nutrition care.

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References

- Alexandre, J., Gross-Goupil, M., Falissard, B., Nguyen, M.L., Gornet, J.M., Misset, J.L., & Goldwasser, F. (2003). Evaluation of the nutritional and inflammatory status in cancer patients for the risk assessment of severe haematological toxicity following chemotherapy. *Annals of Oncology*, 14, 36–41. doi:10.1093/annonc/mdg013
- Bannerman, E., Miller, M.D., Daniels, L.A., Cobiaci, L., Giles, L.C., Whitehead, C., . . . Crotty, M. (2002). Anthropometric indices

- predict physical function and mobility in older Australians: The Australian Longitudinal Study of Aging. *Public Health Nutrition*, 5, 655–662.
- Bauer, J., Capra, S., & Ferguson, M. (2002). Use of the scored Patient-Generated Subjective Global Assessment (PG-SGA) as a nutrition assessment tool in patients with cancer. *European Journal of Clinical Nutrition*, 56, 779–785.
- Bozzetti, F. (2009). Screening the nutritional status in oncology: A preliminary report on 1,000 outpatients. *Supportive Care in Cancer*, 17, 279–284.
- Colagiuri, B., Roscoe, J.A., Morrow, G.R., Atkins, J., Giguere, J.K., & Colman, L.K. (2008). How do patient expectancies, quality of life, and post-chemotherapy nausea interrelate? *Cancer*, 113, 654–661.
- Creaser, N. (2010). Nutritional status of oncology patients admitted to a rural day chemotherapy unit as measured by the Patient Generated-Subjective Global Assessment. *Nutrition and Dietetics*, 67, 231–236.
- Dewys, W.D., Begg, C., Lavin, P.T., Band, P.R., Bennett, J.M., Bertino, J.R., . . . Tormey, D.C. (1980). Prognostic effect of weight loss prior to chemotherapy in cancer patients. Eastern Cooperative Oncology Group. *American Journal of Medicine*, 69, 491–497.
- Dibble, S.L., Isreal, J., Nussey, B., Casey, K., & Luce, J. (2003). Delayed chemotherapy-induced nausea in women treated for breast cancer [Online exclusive]. *Oncology Nursing Forum*, 30, E40–E47. doi:10.1188/03.ONFE40-E47
- Ferguson, M., Capra, S., Bauer, J., & Banks, M. (1999). Development of a valid and reliable malnutrition screening tool for adult acute hospital patients. *Nutrition*, 15, 458–464.
- Gout, B.S., Barker, L.A., & Crowe, T.C. (2009). Malnutrition identification, diagnosis and dietetic referrals: Are we doing a good enough job? *Nutrition and Dietetics*, 66, 206–211. doi:10.1111/j.1747-0080.2009.01372.x
- Hesketh, P.J. (2008). Chemotherapy-induced nausea and vomiting. *New England Journal of Medicine*, 358, 2482–2494.
- Hickok, J.T., Roscoe, J.A., Morrow, G.R., & Ryan, J.L. (2007). A phase II/III randomized, placebo-controlled, double-blind clinical trial of ginger (*Zingiber officinale*) for nausea caused by chemotherapy for cancer: A currently occurring URCC CCOP cancer control study. *Supportive Cancer Therapy*, 4, 247–250. doi:10.3816/SCT.2007.n.022
- Ihbe-Heffinger, A., Ehlken, B., Bernard, R., Berger, K., Peschel, C., Eichler, H.G., . . . Lordick, F. (2004). The impact of delayed chemotherapy-induced nausea and vomiting on patients, health resource utilization and costs in German cancer centers. *Annals of Oncology*, 15, 526–536. doi:10.1093/annonc/mdh110
- Isenring, E., Bauer, J., & Capra, S. (2003). The scored Patient-Generated Subjective Global Assessment (PG-SGA) and its association with quality of life in ambulatory patients receiving radiotherapy. *European Journal of Clinical Nutrition*, 57, 305–309. doi:10.1038/sj.ejcn.1601552
- Isenring, E., Capra, S., & Bauer, J. (2004a). Nutrition intervention is beneficial in oncology outpatients receiving radiotherapy to the gastrointestinal or head and neck area. *British Journal of Cancer*, 91, 447–452.
- Isenring, E., Capra, S., & Bauer, J. (2004b). Patient satisfaction is rated higher by radiation oncology outpatients receiving nutrition intervention compared with usual care. *Journal of Human Nutrition and Dietetics*, 17, 145–152. doi:10.1111/j.1365-277X.2004.00502.x
- Isenring, E., Cross, G., Daniels, L., Kellett, E., & Koczwara, B. (2006). Validity of the malnutrition screening tool as an effective predictor of nutritional risk in oncology outpatients receiving chemotherapy. *Supportive Care in Cancer*, 14, 1152–1156.
- Isenring, E., Cross, G., Kellett, E., Koczwara, B., & Daniels, L. (2010). Nutritional status and information needs of medical oncology patients receiving treatment at an Australian public hospital. *Nutrition and Cancer*, 62, 220–228. doi:10.1080/01635580903305276
- Isenring, E., Hill, J., Davidson, W., Brown, T., Baungartner, L., Kalig, K., . . . Bauer, J. (2008). Evidence based practice guidelines for the nutritional management of patients receiving radiation therapy. *Nutrition and Dietetics*, 65(Suppl. 1), S1–S20.
- Laviano, A., Meguid, M.M., & Rossi-Fanelli, F. (2003). Cancer anorexia: Clinical implications, pathogenesis, and therapeutic strategies. *Lancet Oncology*, 4, 686–694.
- Moore, S., Tume, J., Wojtanowski, S., & Flowers, C. (2007). Cost-effectiveness of aprepitant for the prevention of chemotherapy-induced nausea and vomiting associated with highly emetogenic chemotherapy. *Value in Health*, 10, 23–31. doi:10.1111/j.1524-4733.2006.00141.x
- National Health and Medical Research Council. (2003). *Clinical practice guidelines for the management of overweight and obesity in adults*. Canberra, Australia: Commonwealth of Australia.
- Ottery, F.D. (2000). The clinical guide to oncology nutrition. In P. McCallum & C. Polisea (Eds.), *Patient generated subjective global assessment* (pp. 11–23). Chicago, IL: American Dietetic Association.
- Ovesen, L., Allingstrup, L., Hannibal, J., Mortensen, E.L., & Hansen, O.P. (1993). Effect of dietary counseling on food intake, body weight, response rate, survival, and quality of life in cancer patients undergoing chemotherapy: A prospective, randomized study. *Journal of Clinical Oncology*, 11, 2043–2049.
- Ravasco, P., Monteiro Grillo, I., & Camilo, M. (2007). Cancer wasting and quality of life react to early individualized nutritional counseling! *Clinical Nutrition*, 26, 7–15. doi:10.1016/j.clnu.2006.10.005
- Read, J.A., Choy, S.T., Beale, P., & Clarke, S.J. (2006a). An evaluation of the prevalence of malnutrition in cancer patients attending the outpatient oncology clinic. *Asia-Pacific Journal of Clinical Oncology*, 2, 80–86.
- Read, J.A., Choy, S.T., Beale, P.J., & Clarke, S.J. (2006b). Evaluation of nutritional and inflammatory status of advanced colorectal cancer patients and its correlation with survival. *Nutrition and Cancer*, 55, 78–85.
- Read, J.A., Crockett, N., Volker, D.H., MacLennan, P., Choy, S.T., Beale, P., & Clarke, S.J. (2005). Nutritional assessment in cancer: Comparing the Mini-Nutritional Assessment (MNA) with the scored Patient-Generated Subjective Global Assessment (PGSGA). *Nutrition and Cancer*, 53, 51–56. doi:10.1207/s15327914nc5301_6
- Segura, A., Pardo, J., Jara, C., Zugazabeitia, L., Carulla, J., de Las Penas, R., . . . Gomez-Candela, C. (2005). An epidemiological evaluation of the prevalence of malnutrition in Spanish patients with locally advanced or metastatic cancer. *Clinical Nutrition*, 24, 801–814.
- Tipton, J.M., McDaniel, R.W., Barbour, L., Johnston, M.P., Kayne, M., LeRoy, P., & Ripple, M.L. (2007). Putting Evidence Into Practice: Evidence-based interventions to prevent, manage, and treat chemotherapy-induced nausea and vomiting. *Clinical Journal of Oncology Nursing*, 11, 69–78. doi:10.1188/07.CJON.69-78
- Tong, H., Isenring, E., & Yates, P. (2009). The prevalence of nutrition impact symptoms and their relationship to quality of life and clinical outcomes in medical oncology patients. *Supportive Care in Cancer*, 17, 83–90. doi:10.1007/s00520-008-0472-7
- Vandebroek, A.J., & Schrijvers, D. (2008). Nutritional issues in anti-cancer treatment. *Annals of Oncology*, 19(Suppl. 5), v52–v55.
- Watterson, C., Fraser, A., Banks, M., Isenring, E., Miller, M., Silvester, C., . . . Ferguson, M. (2009). Evidence based practice guidelines for the nutritional management of malnutrition in adult patients across the continuum of care. *Nutrition and Dietetics*, 66, S1–S34. doi:10.1111/j.1747-0080.2009.01383.x