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ORIGINAL ARTICLE

A dietitian-led clinic for patients receiving (chemo)radiotherapy for head and neck cancer

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Abstract
Purpose Malnutrition is prevalent in head and neck cancer patients and is associated with poorer outcomes and increased health care costs. This study aimed to evaluate the acceptability, organisational efficiency and clinical outcomes of a dietitian-led head and neck cancer clinic.
Methods Two consecutive, independent, patient cohorts were studied with a pre–post-test design of 98 patients prior to the introduction of a dietitian-led clinic (DLC) and the subsequent 100 patients who attended the newly formulated DLC. The two groups were compared for frequency of dietitian intervention, weight loss, enteral feeding, hospital admissions and post-treatment medical follow-up requirements.
Results Nutritional management in a DLC was associated with reduced nutrition-related admissions from 12% to 4.5% (p=0.0029), unplanned nasogastric tube insertions from 75% to 39% (p=0.02), improved transition to oral diet post-radiotherapy from 68.3% to 76.7% (p=0.10) and reduced radiation oncologist review at 2 weeks post-radiotherapy from 32% to 15% patients (p=0.009) compared to the cohort prior to the DLC.
Conclusions A dietitian-led head and neck cancer clinic is associated with improved efficiency and nutritional management of head and neck cancer patients and offers a feasible model of care.

Keywords Head and neck cancer · Radiotherapy · Dietitian led clinic · Nutrition · Care pathway

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Introduction

The global incidence of head and neck tumours is approximately 500,000 new cases per year and continues to rise [1]. Treatment regimens for these patients depend on tumour site and stage, but include both surgery and adjuvant radiotherapy or chemotherapy or primary concurrent chemoradiotherapy. Malnutrition is a significant issue in head and neck cancer patients, both before, during and following treatment. It is frequently present prior to treatment (25–50% of patients) and has been shown to have a significant impact on the severity and time to recovery of treatment-related toxicities [2–4]. Enteral feeding tube insertion, nasogastric tube (NGT) or percutaneous endoscopic gastrostomy (PEG) is required in up to 57% of patients [5]. Malnutrition has also been shown to be associated with shorter survival time, decreased quality of life, treatment interruptions, reduced response to treatment and increased health care costs through unplanned admissions to correct dehydration and malnutrition [2, 3, 6]. Late

recognition of malnutrition can have serious implications for patient outcomes and organisational efficiency.

Background and rationale for study

Nutritional care of head and neck cancer patients undergoing chemoradiation at our centre has traditionally been managed in a general dietitian outpatient clinic in a separate location to the radiation oncology clinic limiting opportunity for multidisciplinary collaboration. Patient access to the clinic was limited and had a high non-attendance rate (27%). This contributed to less frequent patient review than evidence indicates and thus potentially, suboptimal nutritional care. Co-locating dietetic reviews with radiation oncologist and nursing clinics has been demonstrated to improve team communication, leading to efficient identification and resolution of symptoms associated with nutritional complications and reduction in unplanned admissions [2, 7]. The concept of non-medically led services, in particular nurse-led services, is an increasingly common feature of health care services internationally, and evidence indicates their clinical service efficiency and their safety and acceptability to patients [8].

In the setting of increased demand on health care services, innovative and cost-effective new service delivery models are being sought. Evidence indicates that some models of traditional follow-up may be better suited to nursing or allied-health-led models [8, 9].

This study set out to test a new model of care delivery within the head and neck service at a major metropolitan cancer centre to assess the feasibility and acceptability of dietitian-led review for patients undergoing radiotherapy treatment for a range of head and neck cancer diagnoses and evaluate the potential for enhanced patient outcomes and organisational cost savings. The primary aims of the study were to determine the impact of a dietitian-led clinic (DLC), guided by evidence-based nutrition care pathways, on the frequency of dietitian review, patient weight loss, enteral feeding (timing of nasogastric tube insertion, planned versus unplanned insertions and post-treatment transition to oral diet), the number of nutrition related inpatient admissions, requirement for a medical review at 2 weeks following radiotherapy (RT). Secondary aims were dietitian adherence to care pathways and patient satisfaction with the DLC.

Materials and methods

Study design

This is a two, consecutive, independent cohort study, with a pre–post-test design.

Patients in cohort 1 were identified ahead of the introduction of the DLC (usual care) to retrospectively establish baseline data.

Patients in cohort 2 were recruited in the DLC.

Approval from our institution's ethics committee was obtained to undertake the study.

Participants

Patients were identified from weekly new patient start lists. Consent was sought from cohort 2 participants ahead of data collection.

Eligibility

Patients in both cohorts were required to meet the following inclusion criteria: primary diagnosis of head and neck cancer, ≥18 years of age, chemoradiotherapy naive and receiving treatment with at least 15 fractions of RT or chemoradiotherapy.

Patients were excluded from participating in the study if they were receiving palliative treatment or induction chemotherapy.

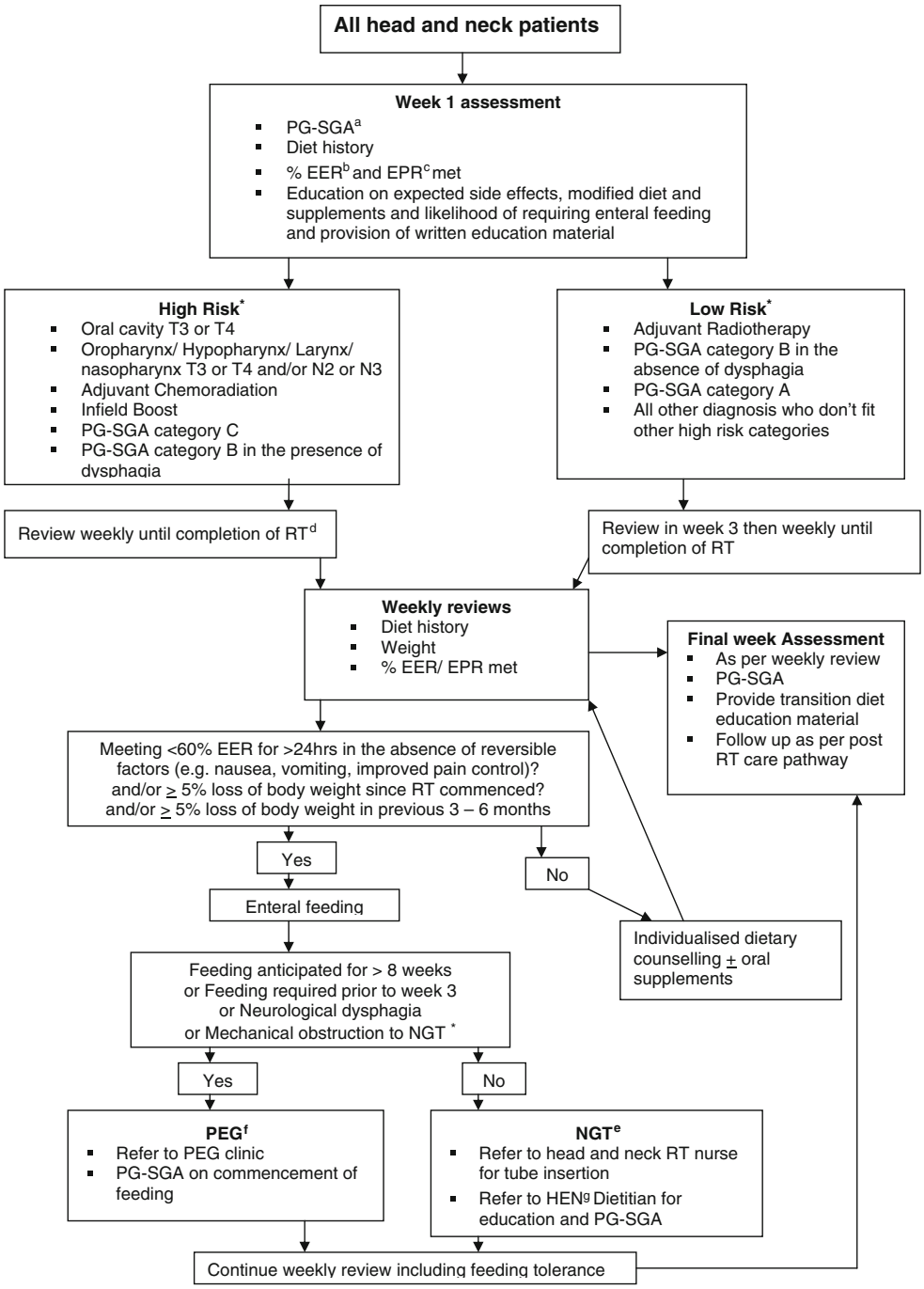
Patients recruited to the study were classified as high or low nutritional risk according to the following criteria: high nutritional risk, oral cavity T3 or T4, oropharynx/hypopharynx/larynx T3 or T4 and/or N2 or N3, adjuvant chemoradiation, accelerated hyper fractionated radiotherapy (infield boost); low nutritional risk, adjuvant RT, all other diagnosis that do not fit into high-risk categories.

In both cohorts, dietitian consultations involved measuring patient weight and weight history, completing a checklist of current nutrition impact symptoms, taking a diet history, estimating energy and protein requirements, educating patients on the expected side effects of treatment and individualised dietary counselling. Enteral feeding, in both cohorts, was commenced via NGT in patients expected to require <8 weeks enteral nutrition or via PEG in patients expected to require >8 weeks enteral nutrition. PEG insertion was made either prior to RT or within the first 1–2 weeks of RT. NGT insertion occurred during RT, usually in an ambulatory setting.

The dietitian-led clinic process

The DLC was set up to operate alongside the twice weekly radiation oncologist (RO) on-treatment review clinics to enable multidisciplinary collaboration. In the DLC, nutritional intervention was managed according to two evidence-based care pathways for patients during RT (Fig. 1) and post-RT (Fig. 2).

The DLC pathways were based on critical appraisal of relevant articles identified from a literature review as well as recommendations from Australian evidence-based guidelines for the nutritional management of patients receiving radiotherapy [10]. The care pathways were developed in collaboration with the multidisciplinary team.



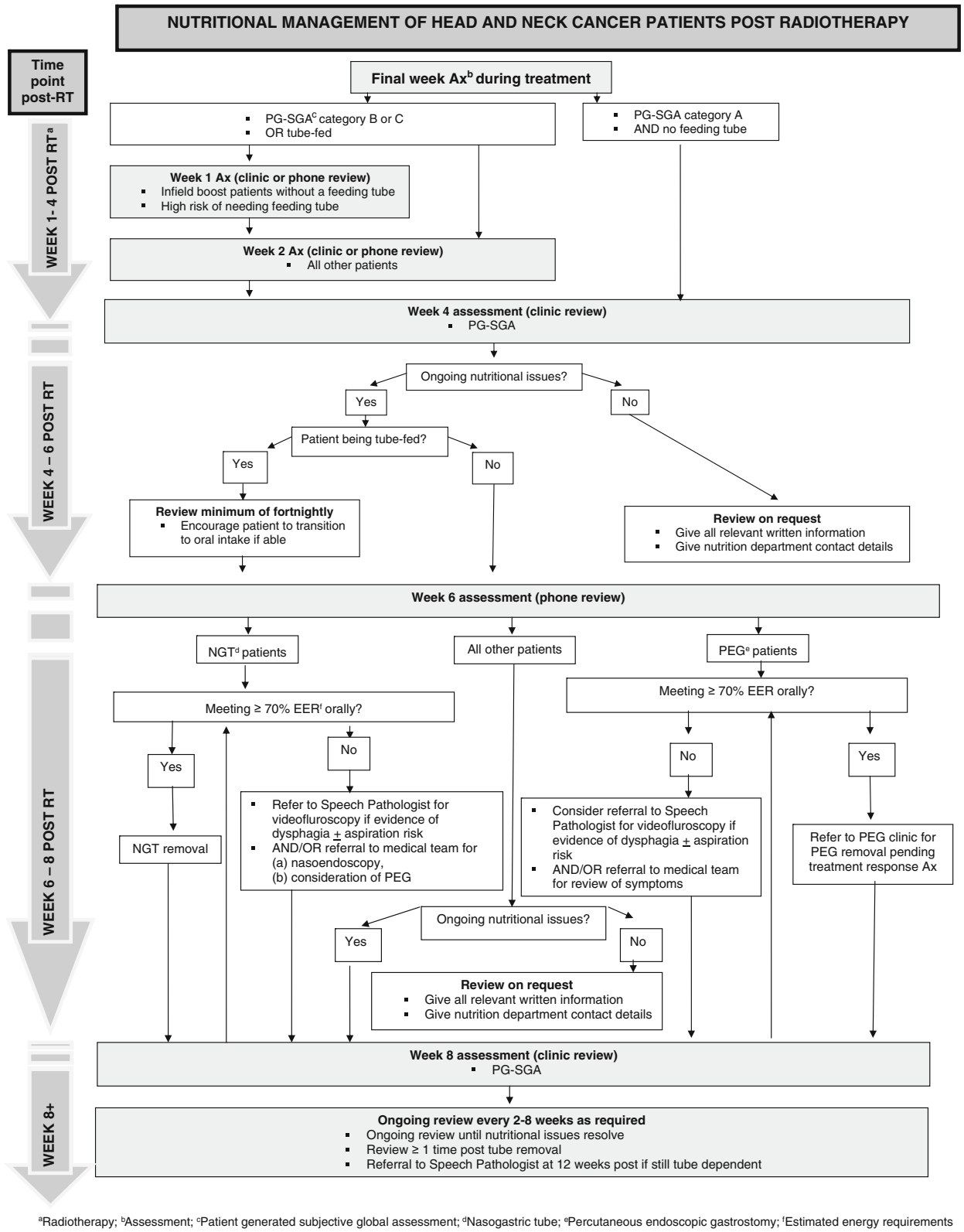
[a]Patient generated subjective global assessment; [b]Estimated energy requirement; [c]Estimated protein requirement; [d]Radiotherapy; [e]Nasogastric tube; [f]Percutaneous endoscopic gastrostomy; [g]Home enteral nutrition.
*These criteria are guidelines. Some variation for individual patients may be necessary

Fig. 1 Nutritional management during radiotherapy

Patients attending for review during RT in usual care (cohort 1) were scheduled for an initial assessment in week 1 of RT and then reviewed as frequently as deemed necessary by the attending dietitian and radiation oncologist.

Patients recruited in the DLC (cohort 2) attended weekly consults with a dietitian during RT, with the exception of week 2 of radiotherapy for low-risk patients. Cohort 2 patients attended two to four dietitian-led consults in the 8 weeks post-RT either in person or were reviewed by a dietitian by phone call.

Commencement of enteral feeding in cohort 1 was at the instigation of the RO or the dietitian and usually related to weight loss of more than 5 kg or significantly reduced oral intake (<50% of estimated nutrition requirements). An integral part of the DLC was the shift from usual care to



[a]Radiotherapy; [b]Assessment; [c]Patient generated subjective global assessment; [d]Nasogastric tube; [e]Percutaneous endoscopic gastrostomy; [f]Estimated energy requirements

Fig. 2 Nutritional management post-radiotherapy

enable dietitians to prescribe and initiate enteral feeding tube (NGT and PEG) insertions. Criteria for commencement of enteral feeding and feeding tube removal are described in Figs. 1 and 2, respectively.

RO reviews at 2 weeks post-RT were replaced by dietitian reviews, as the high risk of compromised nutrition was usually the greatest clinical issue in this immediate post-treatment period. Suitability of patients for no RO review during this period was established at the completion of RT through discussion of each individual patients needs at a multidisciplinary team meeting.

The dietitian-led clinic team

Nutritional care was led by three dietitians who held Masters of Nutrition and Dietetics and who had specialist experience in head and neck cancer (range from 2 to 5 years). Dietitians were trained in the use of the Ottery's Patient Generated Subjective Global Assessment (PG-SGA) [11] and the requirements of the nutrition care pathways to ensure standardised implementation of the DLC interventions.

Resource requirement

An initial DLC assessment was allocated between 20 and 30 min, and each review appointment was allocated 10–20 min of direct patient contact. Two dietitians were present in each clinic.

Data collection and study measures

Participant's demographic data (age, gender, diagnosis, and treatment plan) was collected through the hospital's patient record system.

Data were collected on the following variables.

The frequency of dietitian review

The timing of patient's first contact with a dietitian and frequency of review during and post-RT were recorded for cohorts 1 and 2 through recording clinic attendance.

Patient weight loss

Patient weight was recorded (to one decimal place on digital scales—Seca robusta 813, Hamburg, Germany) in week 1 of RT, at time of NGT insertion (where applicable), in final week of RT and week 4 post-RT. Body mass index (BMI) (kg/m^2) was collected at week 1 only.

Percentage weight loss was recorded for the time between week 1 and the final week of RT, week 1 and NGT insertion (where applicable), week 1 RT and week 4 following RT, the final week RT and week 4 following RT.

Enteral feeding

The average timing during RT to NGT insertion, the number of unplanned NGT insertions, the number of patients expected to require a NGT (those classified as high nutrition risk) and the number of planned NGT insertions in these patients were recorded for both cohorts for a 6-month period prior to the implementation of the DLC (cohort 1) and for 6 months after the implementation of the DLC (cohort 2). An unplanned NGT insertion was defined as <24 h notice of a tube insertion.

The number of patients who required enteral feeding (NGT or PEG) and the presence of a feeding tube (NGT or PEG) was recorded at week 8 following treatment completion, when management of patients in the DLC ceased, for the 16-month duration of the study.

The number of nutrition-related inpatient admissions The number of hospital admissions for nutrition-related complications was recorded for both cohorts. A nutrition-related admission included for NGT insertion (if unable to be inserted in the ambulatory setting), loss of weight, poor nutritional intake, dehydration or intolerance of enteral feeds.

Data were collected for 6 months prior to the implementation of the DLC (cohort 1) and for 6 months after the implementation of the DLC (cohort 2).

Requirement for a medical review at 2 weeks following radiotherapy

To assess the feasibility and safety of replacing RO reviews with dietitian reviews at 2 weeks post-RT, the number of patients requiring review by a RO during the 2 week post-treatment period was recorded for both cohorts.

The following data were collected for cohort 2 only.

Dietitian adherence to care pathways

Adherence to the DLC care pathways was recorded by dietitians in the DLC through completion of a checklist of care pathway requirements immediately following patient review.

Patient satisfaction with the dietitian-led clinic

The intent was not to compare satisfaction between cohort 1 and 2, but to identify aspects of the DLC potentially in need of revision. Patient satisfaction with the DLC was measured with a self-administered questionnaire adapted with permission from a validated tool developed by the Rheumatism Research Unit, University of Leeds [12]. Patients were given the questionnaire following their week 4 post-treatment

review at the clinic. Satisfaction was measured for the following aspects of care: general satisfaction, giving of information, empathy with the patient, technical quality and competence, attitude towards the patient and access and continuity. Overall satisfaction was measured by combining the scores of each of the satisfaction domains to give a total score out of 5. A score >3 indicates satisfaction.

Sample size calculation

A minimum sample size of 200 patients was calculated to be required in order to detect a difference of 2% body weight loss with a significance level of 0.05 between cohort 1(usual care) and cohort 2 (DLC) groups, with a power of 80%.

Statistical analysis

Descriptive statistics (mean, standard deviation) were performed to compare cohorts 1 and 2 with respect to demographics, weight loss and dietitian adherence to care pathways data. Student's *t* test was used to compare the means, with the associated *p* value.

To compare difference in proportions, we used a *Z* test, which is based on the normal approximation to the binomial distribution.

Results

One hundred eligible patients were identified by the research assistant for cohort 1; however, two patients were later found not to meet the inclusion criteria and were subsequently excluded from the analysis. Of the 183 patients attending the DLC during the recruitment period, 132 were eligible, 24 were not approached by the research assistant due to the timing of appointments and 100 consented to the study. This gave a total of 198 study patients.

Participant characteristics are described in Table 1. There were more males in cohort 2 than in cohort 1, but there were no other significant differences between the groups. Table 1 details the general intensity of treatment in each patient cohort, radiotherapy alone, concurrent chemoradiation using platinum-based chemotherapy or altered fractionation (in-field boost regimen). Conformal radiotherapy techniques were used in all patients. There were no significant differences in the median radiotherapy dose (60 Gy versus 66 Gy) or treatment intensity of either cohort (p=0.084). The percentage of patients who required enteral feeding was similar in each cohort, with 42% (n=41) in cohort 1 and 43% (n=43) in cohort 2 (p=0.89). Twenty-three (56%) patients in cohort 1 had an NG tube compared with 33 (77%) in cohort 2. Eighteen patients (44%) in cohort 1 had a PEG tube, compared with ten (23%) in cohort 2.

The frequency of dietitian review

The DLC operated twice per week with an average of 21 (range, 7–36) patients seen in each DLC. The frequency of patients' first contact with the dietitian improved significantly in cohort 2 with 81% (n=81) of patients seen by a dietitian in the first 5 days of RT compared to 39.8% (n=39) in cohort 1 (p=<0.0001). High nutritional risk patients were analysed separately with 82% (n=56) of patients seen by a dietitian within the first 5 days of RT in cohort 2 compared to 50% (n=29) in cohort 1 (p=<0.0001). The proportion of patients who were reviewed as frequently as recommended in care pathways are shown in Fig. 3.

Patient weight loss

There was no significant difference in weight loss between the two cohorts between any of the specified time points (Table 2).

Enteral feeding

Changes in the timing of and planning of NGT insertions are shown in Table 2. There was no significant difference in the number of high nutritional risk patients expected to require an NGT between the cohorts (p=0.68).

Post-treatment transition to oral diet In the post-treatment period, 76.7% (n=33) of the patients in cohort 2 requiring enteral feeding during RT had transitioned to oral diet by week 8 post-treatment completion, compared to 68.3% (n=28) in cohort 1 (p=0.10). Of the patients who had not yet transitioned to oral diet by this time, 7.3% (n=3) had an NGT and 24.4% (n=10) had a PEG in situ in cohort 1. In cohort 2, 13.9% (n=6) had an NGT and 9.3% (n=4) had a PEG.

The number of nutrition-related hospital admissions Nutritional management in the DLC was associated with a significant reduction in the percentage of patients admitted for nutrition-related reasons from 12% (n=26) in cohort 1 to 4.5% (n=10) in cohort 2 (p=0.003). The total number of nutrition-related admission days reduced from 199 in cohort 1 to 62 in cohort 2. This a difference of 137 nutrition-related admission days, which based on a cost per day (excluding radiotherapy costs) of $693 (AU) equates to a saving of $95,000 (AU) per annum.

Requirement for a medical review at 2 weeks following radiotherapy The percentage of patients reviewed by a

Table 1 Patient characteristics

Parameter	Mean (range) or no. (%)		*p* value
	Cohort 1, *n*=98	Cohort 2 *n*=100	
Age (years)	60.2 (18–91)	63.12 (21–90)	0.14
Weight (kg)	75.5 (40–106), *n*=72	80.9 (47–180)	0.05
BMI (kg/m^2)[a]	25.8 (16–38), *n*=68	27.2 (16–49)	0.072
Gender			
Male	66 (67.3)	84 (84)	0.006
Female	32 (32.7)	16 (16)	
Primary site			
Oropharynx	20 (20.4)	33 (33.0)	0.26
Oral cavity	18 (18.4)	11 (11.0)	
Larynx/hypopharynx	23 (23.5)	22 (22.0)	
Nasopharynx/paranasal sinuses	8 (8.2)	9 (9.0)	
Other	29 (29.6)	25 (25.0)	
TNM stage			
I	15 (15.3)	18 (18.0)	0.43
II	19 (19.3)	18 (18.0)	
III	20 (20.4)	25 (25.0)	
IV	38 (38.8)	38 (38.0)	
N/A	3 (3.1)	1 (1.0)	
X	3 (3.1)	0	
Treatment			
ChemoRT	46 (46.9)	55 (55.0)	0.084
Infield boost/ b.d.[c] RT	6 (6.1)	9 (9.0)	
RT alone	45 (45.9)	36 (36.0)	
Median RT dose (Gy)	60 (50–70)	66 (50–70)	
Nutritional risk			
High[d]	57	68	0.151
Low[e]	41	42	

[a]Body mass index

[b]Radiotherapy

[c]Bi-daily

[d]High nutritional risk defined as oral cavity T3 or T4, oropharynx, hypopharynx, larynxT3 or T4 and/or N2 or N3, adjuvant chemoradiation, accelerated hyperfractionated radiotherapy (infield boost)

[e]Low nutritional risk defined as adjuvant radiotherapy, all other diagnosis that do not fit into high risk category

radiation oncologist in the first 2 weeks post-RT reduced by 53% from 32% (*n*=32) of patients in cohort 1 to 15% (*n*=15) of patients in cohort 2 (*p*=0.009).

Dietitian adherence to care pathways Dietitian adherence to the care pathways ranged from 92.3 to 99.7% across all time points. Reasons for non-adherence were weight not

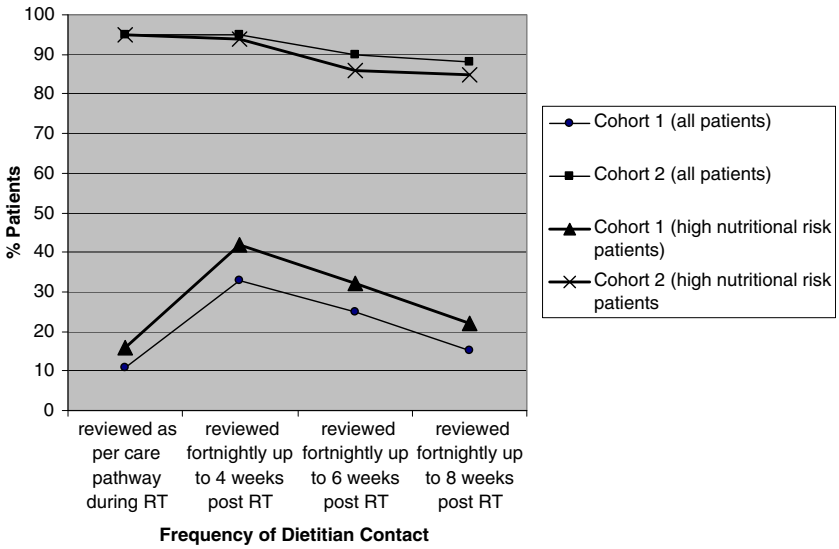


Fig. 3 Frequency of dietitian contact

Table 2 Weight loss and enteral feeding in each cohort

Variable	Cohort 1 Mean (SD[a])	Cohort 2 Mean (SD)	*p* value
Percent weight loss between			
Week 1 and final week RT[b,c]	−4.4 (4.0)	−4.0 (4.4)	NS[d]
Week 1 and 4 post-RT	−6.2 (5.9)	−5.4 (5.3)	NS
Week 1 and NGT[e] insertion	−6.2 (5.4)	−5.7 (4.6)	NS
Final week and week 4 post-RT	1.1 (3.8)	1.6 (3.6)	NS
NGT insertions			
Unplanned	15 (75)	11 (39)	0.02
Planned (high nutrition risk patients)	4 (23)	14 (56)	0.04
Timing during RT (week of RT)	5.35	4.75	0.18

[a]Standard deviation
[b]Radiotherapy
[c]The percentage weight loss is calculated by the following formula [(final week − week 1)/ week 1]×100
[d]Not-significant
[e]Nasogastric tube

measured or PG-SGA not completed due to patient illness or the review being conducted via a phone call.

Patient satisfaction Of the 100 patients recruited into cohort 2, 96 (96%) completed the patient satisfaction questionnaire (Table 3). Overall satisfaction was 4.0, indicating a high level of patient satisfaction with the DLC and no requirement to refine any aspect of the new DLC model.

Discussion

With the high incidence of malnutrition and requirement for enteral nutrition support in the head and neck population, a role was identified for dietitians to lead nutritional aspects of patient care during and post-radiotherapy treatment. This is an innovative and previously untested model of supportive care delivery. Its strength lies in encompassing collaboration across the multidisciplinary team with a clearly defined intent to improve patient management through the delivery of evidence based nutritional care by specialist head and neck cancer dietitians.

Previous studies have established the benefits of dietary counselling and nutrition support in head and neck cancer patients undergoing RT [13–15]. The current study was designed to test a new model for providing intensive nutrition intervention to head and neck cancer patients undergoing RT. Frequency of nutrition intervention during and post-RT substantially improved in cohort 2 and is consistent with recommendations in the literature [10, 13]. A high level of clinician compliance with the evidence-based care pathways demonstrates the feasibility of a DLC and the ability to successfully translate best-practice guidelines into patient care.

Despite the improved frequency of interventions, we found no significant difference in patient weight loss between the two groups. This is at odds with the results of previous studies [13] and may be explained by the multidisciplinary team's high baseline awareness and referral for enteral nutrition support prior to significant weight loss in cohort 1.

The DLC enabled dietitians to prescribe and initiate referrals for enteral feeding tube insertions. The medical staff were informed when these referrals had been made. The percentage of patients who required enteral feeding was similar in each cohort (n=41/41% cohort 1, n=43/43% cohort 2) and is consistent with the range of 32–57% cited in the literature [5, 16]. However, we found improved efficiencies in the process of NGT insertions with an earlier, although not statistically significant improvement in the timing of NGT insertion during RT (week 5.35, cohort 1; week 4.75, cohort 2). The number of unplanned NGT insertions in all patients and the number of planned NGT insertions in high nutritional risk patients both improved significantly (p=0.02, p=0.037 respectively). Both cohorts had a low level of feeding tube dependency by week 8 post-RT; however, more patients in cohort 2 had transitioned back to oral diet by week 8 post-treatment. This is most likely due to the intensity of nutrition intervention during the post-RT period.

Table 3 Patient satisfaction with the DLC model of care

Number of patients	Individual aspect of care satisfaction (score out of 5)						Overall score (out of 5)
	General satisfaction	Giving of information	Empathy with the patient	Technical quality and competence	Attitude toward the patient	Access and continuity	
96	4.1	3.9	3.9	4.3	4.0	3.8	4.0

The DLC model was associated with a significant decrease in nutrition-related hospital admissions. This is the first study to demonstrate an association between evidence-based, intensive nutrition interventions and decreased hospital admissions in the head and neck cancer population. The total number of nutrition-related admission days reduced from 199 in cohort 1 to 62 in cohort 2, a cost saving of $95,000 (AU) per annum based on a cost per day of $693 (AU) excluding radiotherapy costs. This impact of a DLC is an important outcome to health services.

In the immediate post-RT phase, up to 4 weeks post-treatment, patients continue to experience acute toxicities from treatment [17, 18]. During this period, patients are at risk of further nutritional decline but may not require the frequent medical treatment reviews required during RT. In the DLC, radiation oncologist reviews at 2 weeks post-RT were replaced with dietitian review for ongoing intensive nutrition intervention. Referral to the radiation oncologist was initiated if non-nutritional issues were identified by the dietitian. Only 15% of patients in cohort 2 required a radiation oncologist review at this time point, demonstrating the feasibility and safety of replacing radiation oncologist reviews at this time with a well-defined cohort of patients. To our knowledge, this is the first study to demonstrate this. This is another area of potential cost saving enabled by a DLC.

Patient satisfaction with care is an important aspect of any health care service and an important outcome to consider when developing a new model of care. In this study, patients indicated satisfaction with all domains of the DLC.

One of the limitations of our study was that the DLC commenced after patients had started their RT treatment and not all patients were consistently seen by a dietitian prior to commencing RT. The opportunity for dietitians to identify patients requiring prophylactic PEG placement was therefore missed. Debate still surrounds the decision to use a PEG or NGT to provide nutrition to head and neck cancer patients with acute toxicities from RT treatment [19–21]. There remains no high level evidence to guide decisions regarding which specific patients would benefit from prophylactic PEG placement, particularly focusing on valid nutritional outcomes and swallowing rehabilitation, and this remains an area requiring further high level research [22, 23]. In addition, co-location of nutritional management with the RO on treatment review clinics was not tested separately to the DLC model. Therefore, the impact of co-location alone remains unknown.

Conclusion

This pre–post-test study of a dietitian-led clinic demonstrated efficient nutritional management and potential for cost savings in the treatment of head and neck cancer patients during and post-RT. The DLC was associated with a reduction in nutrition-related hospital admissions, a reduction in unplanned NGT insertions and reduced requirements for medical follow-up in the immediate post-treatment phase as well as improved transition to oral diet in the post-treatment period. This study has shown a DLC to be a feasible model of care and an effective way of integrating best-practice guidelines into clinical care.

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