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Abstract

*Aim:*

Non-surgical treatment for head and neck cancer (HNC) often results in severe toxicities, which are detrimental to a patient's health and quality of life. There is limited published UK data on unplanned hospital admissions and reasons associated with admission. We aim to identify frequencies and reasons for unplanned hospital admissions, highlighting those patient groups who are most vulnerable.

*Methods:*

A retrospective study of unplanned hospital admissions of HNC patients receiving non-surgical treatment was completed. An inpatient admission was defined as  $\geq 1$  night spent in the hospital. To test potential demographic and treatment predictors of inpatient admission, a multiple regression model was constructed using the endpoint measure (unplanned admission), as the dependent variable.

*Results:*

A cohort of 216 patients was identified over a 7-month period, and 38 of these patients (17%) required an unplanned admission. Treatment type was the only statistically significant predictor of in-patient admission. The majority of admissions were patients receiving chemoradiotherapy (CRT) (58%) with predominant reasons for admission being nausea and vomiting (25.5%) and decreased oral intake/dehydration (30%). Of the patients admitted, 12 had a prophylactic PEG placed pre-treatment, and 18 of 26 admitted without prophylactic PEG required nasogastric tube feeding during their admission.

*Discussion:*

Almost one-fifth of HNC patients over this time period required hospital admission; the majority of which can be attributed to treatment toxicities when receiving CRT. This is concurrent with other studies which review the impact of radiotherapy versus CRT. Increased support and monitoring, particularly focused on nutrition, are required for patients with HNC who receive CRT.

*Key message:*

This article describes a retrospective review of a patient undergoing non-surgical treatment for head and neck cancer. These patients frequently require unplanned hospital admission. The results indicate that patients undergoing (chemo)radiotherapy are most vulnerable to deterioration and additional support focused on nutrition for these patients is indicated.

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Keywords (separated by '-') Unplanned admission - Head and neck cancer - Oncology - Chemoradiotherapy

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Footnote Information

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2 **A review of unplanned admissions in head and neck cancer patients**  
3 **undergoing oncological treatment**

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7 **Abstract**

**AQ1** **Aim** Non-surgical treatment for head and neck cancer (HNC) often results in severe toxicities, which are detrimental to a patient's health and quality of life. There is limited published UK data on unplanned hospital admissions and reasons associated with admission. We aim to identify frequencies and reasons for unplanned hospital admissions, highlighting those patient groups who are most vulnerable.

**Methods** A retrospective study of unplanned hospital admissions of HNC patients receiving non-surgical treatment was completed. An inpatient admission was defined as  $\geq 1$  night spent in the hospital. To test potential demographic and treatment predictors of inpatient admission, a multiple regression model was constructed using the endpoint measure (unplanned admission), as the dependent variable.

**Results** A cohort of 216 patients was identified over a 7-month period, and 38 of these patients (17%) required an unplanned admission. Treatment type was the only statistically significant predictor of in-patient admission. The majority of admissions were patients receiving chemoradiotherapy (CRT) (58%) with predominant reasons for admission being nausea and vomiting (25.5%) and decreased oral intake/dehydration (30%). Of the patients admitted, 12 had a prophylactic PEG placed pre-treatment, and 18 of 26 admitted without prophylactic PEG required nasogastric tube feeding during their admission.

**Discussion** Almost one-fifth of HNC patients over this time period required hospital admission; the majority of which can be attributed to treatment toxicities when receiving CRT. This is concurrent with other studies which review the impact of radiotherapy versus CRT. Increased support and monitoring, particularly focused on nutrition, are required for patients with HNC who receive CRT.

**Key message** This article describes a retrospective review of a patient undergoing non-surgical treatment for head and neck cancer. These patients frequently require unplanned hospital admission. The results indicate that patients undergoing (chemo) radiotherapy are most vulnerable to deterioration and additional support focused on nutrition for these patients is indicated. **AQ2**

29 **Keywords** Unplanned admission · Head and neck cancer · Oncology · Chemoradiotherapy

**Introduction**

Chemoradiotherapy is an important and effective treatment for head and neck cancer (HNC) but can often induce acute and chronic toxicities such as significant swallowing difficulties [1] that can be detrimental to patients' health and quality of life. Although treatment schedules and regimes have sought to reduce toxicity and improve overall disease control [2], side effects such as mucositis, dysphagia and nausea and vomiting remain common [3]. As well as the incurred distress to patients and their families, these symptoms can lead to treatment breaks with high healthcare resource utilisation, such as unplanned hospital admission during treatment [4].

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42 Current evidence affirms that treatment breaks are  
 43 associated with poorer overall survival rates, patients  
 44 with short (4–8 days) or long breaks (> 8 days) had lower  
 45 absolute 4-year overall survival by 4 and 12% [5], with  
 46 preliminary data suggesting that hospitalisation during  
 47 radiotherapy for HNC may be an early marker for worse  
 48 survival in this patient cohort [6]. A small number of  
 49 studies in the USA suggest that hospitalisation during  
 50 treatment is a relatively common occurrence, affecting up  
 51 to a third of patients [7–9].

52 Identified risk factors associated with unplanned  
 53 hospitalisation include treatment type, premorbid status  
 54 and social circumstances. Systemic chemotherapy is an  
 55 independent risk factor for treatment toxicity leading to  
 56 unplanned admission as well as comorbidities (notably  
 57 poorly controlled diabetes and chronic pulmonary disease)  
 58 [7–9]. An individual’s social circumstances have also been  
 59 shown to influence the likelihood of unplanned admission  
 60 [6] with unmarried status purporting a greater admission  
 61 risk. There is currently limited corroborative evidence  
 62 from UK-based treatment cohorts in the literature, and  
 63 both nutritional and oral intake status are risk factors of  
 64 particular interest that warrant further impact assessment  
 65 for admission.

66 Research in this area is vital to establish pre-emptive  
 67 management pathways to minimise admission risk, reduce  
 68 treatment interruptions and ultimately, improve patient  
 69 outcomes. The aim of this study was to investigate the  
 70 frequency, reasons and predictors of unplanned hospital  
 71 admissions in HNC patients during non-surgical treatment  
 72 modalities, with a specific focus on enteral feeding status  
 73 and associated issues.

74 **Methods**

75 The study was registered and approved following institu-  
 76 tional review (Clatterbridge Cancer Centre NHS Foundation  
 77 Trust’s Audit Committee).

78 This was a single-centre cohort study of unplanned hos-  
 79 pital admissions of HNC patients receiving non-surgical  
 80 treatment modalities as part of their treatment package at a  
 81 large tertiary oncology unit in North West England over a  
 82 7-month period. These admissions all occurred at varying  
 83 time points during their treatment schedule.

84 All HNC referrals from 1.4.20 to 31.10.20 were screened,  
 85 and those patients who underwent chemoradiotherapy in  
 86 either primary, adjuvant or palliative settings were included  
 87 in the analysis and entered into an anonymised electronic  
 88 medical record system. This time period coincided with the  
 89 first wave of the COVID-19 pandemic.

90 Data on patient demographics—age, gender and disease  
 91 characteristics including tumour site and staging, TNM7

stage [10] treatment intent (curative or palliative) and the  
 treatment modality (chemotherapy, radiotherapy, chemoradi-  
 otherapy)—was captured. Feeding tube status was recorded,  
 including the timepoint of placement, pre or during treat-  
 ment, and route of insertion—nasogastric or long-term  
 enteral feeding tube (ie. percutaneous endoscopic gastro-  
 stomy (PEG), radiologically inserted percutaneous gastro-  
 stomy (RIG) or jejunostomy (JEJ)).

Unplanned admissions were categorised according  
 to attendance at the “Clinical Decisions Unit” in the  
 Clatterbridge Cancer Centre—where urgent medical  
 care is provided during normal working hours. Reasons  
 for unplanned admission are recorded by the medical  
 professional who completes the initial assessment, and  
 these reasons were categorised and coded using the terms:  
 nausea and vomiting, nasogastric tube insertion, reduced  
 oral intake/dehydration, infection, dysphagia/aspiration,  
 deranged types of blood, etc. Data on admissions to other  
 acute centres was not available.

Data was anonymised and screened for accuracy and con-  
 sistency by a second internal reviewer.

**Analysis**

Analyses were carried out using SPSS for Windows version  
 24 (Chicago, Illinois, USA) [11]. Univariable analysis was  
 initially performed to test each potential explanatory vari-  
 able association with hospital admission, using Pearson’s  
 Chi-square test for categorical explanatory variables. A con-  
 servative *p* value (0.1) for univariate analysis was used to  
 take variables forward to binary logistic regression. A back-  
 wards selection procedure was used to determine the final  
 model (criteria for entry *p* < 0.05 and for removal *p* > 0.1).  
 The overall fit of the model was ascertained using the Hos-  
 mer and Lemeshow goodness of fit test.

**Results**

**Patient characteristics**

There were 216 patients identified as fitting the inclusion  
 criteria during the six-month data collection period. Patient  
 characteristics are summarised in Table 1.

Of this cohort, 38 patients (17%) required an unplanned  
 admission during their treatment, and 9 of these patients  
 had more than one admission with a total admission  
 number of 47. The majority of admissions were patients  
 receiving primary curative-intent chemoradiotherapy  
 (CRT) (58%). For the majority of patients, the treatment  
 intent was curative.

**AQ4** **Table 1** Patient characteristics: age, sex, tumour location and stage and treatment modality

Characteristics	Number (%)	Unplanned admission (n)	<i>p</i> value
<b>Age</b>			
< 50	19 (0.9%)	6	<b>0.009</b>
50–59	64 (29.6%)	12	
60–69	70 (32.4%)	17	
> 70	63 (29%)	3	
<b>Sex</b>			
Male	171 (79%)	26	0.41
Female	44 (21%)	12	
<b>Tumour site</b>			
Oral	41 (19%)	9	0.19
Oropharyngeal	86 (40%)	18	
Larynx	39 (18%)	2	
Hypopharynx	13 (6%)	4	
Nasopharynx	12 (5.6%)	3	
Unknown primary	6 (2.7%)	1	
Other	19 (8.8%)	1	
<b>Tumour stage</b>			
1	39 (18%)	5	<b>0.06</b>
2	67 (31%)	9	
3	28 (13%)	4	
4	63 (29%)	16	
Unknown/not documented	19 (9%)	4	
<b>N stage</b>			
0	55 (25.5%)	5	<b>0.08</b>
1	31 (14.4%)	8	
2	109 (50.5%)	18	
3	6 (2.8%)	3	
Unknown	15 (6.9%)	4	
<b>Treatment</b>			
Radiotherapy	142 (65.7%)	14	<b>0.003</b>
Chemoradiotherapy	72 (33.3%)	22	
Chemotherapy only	2 (0.9%)	2	
Pre-treatment gastrostomy	45 (21%)	12	<b>0.07</b>

*P* values for each potential explanatory variable for unplanned admission. Those in bold were taken forward to the binary logistic model

137 In total, 45 (21%) patients had a prophylactic gastrostomy  
 138 tube (PEG/RIG/ JEJ) placed pre-treatment. Eighteen patients  
 139 had a reactive nasogastric tube placed during an admission.  
 140 Oropharynx was the most common tumour site for both PEG  
 141 ( $n=26$ ) and NG placement ( $n=7$ ) followed by oral cavity  
 142 (PEG ( $n=7$ ) and NGT ( $n=5$ )).

143 Of the patients admitted ( $n=38$ ), 12 had a prophylac-  
 144 tic gastrostomy placed pre-treatment, and 18 of 26 admit-  
 145 ted without prophylactic enteral feeding required reactive  
 146 nasogastric tube feeding during their admission.

## Predictors of unplanned hospital admission

147

148 A binary logistic regression model was tested to see if inde-  
 149 pendent variables ( $p > 0.1$ ) from the univariate analysis (see  
 150 Table 1) predicted an unplanned admission. The model was  
 151 statistically significant  $\chi^2 = 18.47$ ,  $p < 0.0001$  (see Table 2).  
 152 Patients treated with chemoradiation were more likely to be  
 153 admitted than those receiving radiotherapy. Patients with  
 154 T3-4 tumours were more likely to be admitted than those  
 155 with T1-2 (25% vs. 15%). Age was also a significant vari-  
 156 able. Just under one-third of patients aged < 50 years were  
 157 admitted to hospital, compared with five per cent of those  
 158 aged > 70 years.

159 The predominant reasons for admission being nausea and  
 160 vomiting (34%) and decreased oral intake/dehydration (34%)  
 161 are shown in Table 3.

## Discussion

162

163 This study is the first UK-based cohort to our knowledge  
 164 to report on unplanned hospital admissions for HNC  
 165 patients receiving non-surgical treatment in a tertiary  
 166 oncology centre. The frequency of admissions was lower  
 167 than reported in other studies; 21% compared with 36 [7,  
 168 8] despite similar demographics. During the data collection  
 169 period, the COVID-19 pandemic placed unprecedented  
 170 pressure upon surgical services [12] with a subsequent  
 171 increase in non-surgical management of HNC. Services  
 172 aimed to reduce unplanned hospital admissions and the risk  
 173 of COVID-19 exposure in this vulnerable group meaning  
 174 that criteria for admission were likely temporarily elevated.  
 175 There was advice published suggesting increased caution

**Table 2** Treatment intent

Treatment intent	Number (%)	Number admitted
Curative (primary)	116 (53.7%)	27
Curative (adjuvant)	72 (33.3%)	10
Palliative	28 (13%)	1

**Table 3** Hospital admission during non-surgical treatment**AQ6**

Variable	Std error	Odds ratio	95% CI	<i>p</i> value
Treatment category	0.71 0.29	2.0	1.2–3.6	0.01
Tumour stage	0.35 0.15	1.4	1.1–1.9	0.02
Age	0.44 0.21	0.64	0.43–0.97	0.03

Standardised beta coefficients, 95% CI and *p* value for binary logistic regression model

**Table 4** Unplanned hospital admissions (*n* = 38) and reasons for admission

Unplanned admission	Number (%)
More than one admission	
Yes	9 (4%)
No	207 (96%)
Total number of admissions	47
Admission reason	
Reduced PO intake	14 (30%)
Nausea and vomiting	12 (25.5%)
Deranged bloods	6 (13%)
NGT insertion	4 (8.5%)
Dysphagia/aspiration	3 (6%)
Infection	2 (4%)
Pain	0
Other	6 (13%)

176 with the use of chemoradiotherapy with the majority of  
 177 those patients over 60 years of age receiving radiotherapy  
 178 alone or palliative RT (with reduced volumes) [13]. This  
 179 may explain the reduction in unplanned admissions in our  
 180 study compared to published cohorts. Despite this, almost  
 181 one-fifth of HNC patients required hospital admission,  
 182 and one-fifth of these had multiple admissions, similar to  
 183 findings elsewhere. [7]

184 In keeping with previous work, patients receiving  
 185 primary chemoradiotherapy were at greater risk of  
 186 admission, many of whom had substantial deterioration  
 187 in their diet and fluid intake [8, 9]. Reasons for  
 188 chemoradiotherapy-related admissions include nausea  
 189 and vomiting, dehydration/malnutrition, mucositis-  
 190 related eating and drinking problems and pneumonia  
 191 [14]. Although not coded for within our data, it is likely  
 192 that reduced intake (one of the predominant reasons for  
 193 admission in our study) was due to mucositis. Prevention  
 194 and treatment strategies for mucositis should be a core  
 195 part of clinical care and patient education [15]. A quarter  
 196 of patients admitted also had nausea and vomiting with  
 197 decreased oral intake/dehydration. Although implicated as

**Table 5** Enteral feeding status

	Number
Pre-treatment enteral feeding tube?	
Yes	45
No	170
Nasogastric tube placed on admission?	
Yes	18
No	20

a reason for admission in other cancer groups [16], nausea  
 and vomiting appear more common in HNC patients (25%  
 vs. 13%) (Tables 4 and 5).

Importantly, placing a prophylactic gastrostomy did  
 not seem to prevent hospital admission, as 27% of those  
 with a prophylactic gastrostomy required admission com-  
 pared with 15% of patients without a tube. Conversely,  
 other centres have reported prophylactic gastrostomy does  
 reduce unplanned admissions [17]. In our cohort, the deci-  
 sion to place a prophylactic gastrostomy was on a per-  
 sonalized case-by-case basis rather than a protocol-driven  
 approach. The placement of prophylactic versus reactive  
 feeding tubes has long been debated within the literature,  
 and there are no nationally agreed selection criteria, with  
 demonstrable variation in clinical practice [18]. Recent  
 work to identify a clinical algorithm suggests performance  
 status, tumour subsite, stage and nodal involvement, and  
 platinum-based chemotherapy are predictors of the need  
 for prophylactic gastrostomy [19, 20].

The tumour stage was also a predictor of an admission.  
 Patients with higher staged tumours are more likely to have  
 multi-modality treatment but may also present at diagnosis  
 with significant weight loss, dysphagia and multiple co-  
 morbidities rendering them more vulnerable to hospital  
 admission [21, 22]. The analysis showed that age was an  
 important variable, with those < 50 years having a higher  
 percentage of admissions, although patient numbers in this  
 category were low. Whether other previously identified  
 predictors such as social circumstances influenced these  
 findings is unknown [7].

There are a number of limitations in this study. We did  
 not include co-morbidities, frailty score or social circum-  
 stances in our data collection as these were details not  
 uniformly entered into medical records. These may be sig-  
 nificant influencing factors [9, 23] and may help to identify  
 vulnerable groups at an earlier stage. For future research,  
 it would also be beneficial to review whether t-stage data  
 and time point of treatment influenced admission in this group.

A better understanding of unplanned hospital  
 admissions is important as such events can lead to a  
 change in treatment plan e.g. reduced chemotherapy  
 cycles, to manage severe side effects, thus negatively  
 impacting overall survival [24]. In summary, whilst our  
 admission rates appear favourable, findings suggest that  
 concurrent chemoradiotherapy results in more severe  
 toxicities and increased unplanned admission rates.  
 Pre-emptive management of treatment side effects,  
 such as mucositis, nausea and dysphagia, should be  
 prioritised, particularly in vulnerable groups. Nutritional  
 prehabilitation delivered before and during treatment may  
 help to prevent deterioration, although evidence to support  
 its effectiveness in HNC is lacking (Cantwell et al., 2022).  
 Regional data is also important in order to appropriately

251 consent patients when discussing treatment plans. Patient's  
252 nutrition and hydration status should be closely monitored  
253 throughout treatment. An increased focus on nutritional  
254 support may help to reduce the frequency of hospital  
A38 utilisation in this patient group in the future.

256

257 **Author contribution** All authors contributed to the study's conception  
258 and design. Material preparation, data collection and analysis were  
259 performed by Emer Fahy. The first draft of the manuscript was written  
260 by Emer Fahy, and all authors commented on previous versions of the  
261 manuscript. All authors read and approved the final manuscript.

## 262 Declarations

263 **Ethical approval** Not applicable.

264 **Competing interests** The authors declare no competing interests.

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