

This is an Open Access document downloaded from ORCA, Cardiff University's institutional repository:<https://orca.cardiff.ac.uk/id/eprint/145434/>

This is the author's version of a work that was submitted to / accepted for publication.

Citation for final published version:

Maunsell, Rose, Sodergren, Samantha, Hopkinson, Jane , Shaw, Clare, Foster, Claire and Wheelwright, Sally 2021. Nutritional care in colorectal cancer-what is the state of play? Colorectal Disease 10.1111/codi.15933

Publishers page: <http://dx.doi.org/10.1111/codi.15933>

Please note:

Changes made as a result of publishing processes such as copy-editing, formatting and page numbers may not be reflected in this version. For the definitive version of this publication, please refer to the published source. You are advised to consult the publisher's version if you wish to cite this paper.

This version is being made available in accordance with publisher policies. See <http://orca.cf.ac.uk/policies.html> for usage policies. Copyright and moral rights for publications made available in ORCA are retained by the copyright holders.



Nutritional care in colorectal cancer – what is the state of play?

Rose Maunsell RD, Research Fellow, Health Sciences, University of Southampton, UK

Samantha Sodergren PhD, Research Fellow, Health Sciences, University of Southampton, UK

Jane Hopkinson PhD, Velindre Professor of Nursing and Interdisciplinary Cancer Care, School of Healthcare Sciences, Cardiff University, UK

Clare Shaw PhD RD, Consultant Dietitian, Royal Marsden Hospital, UK

Claire Foster PhD, Professor of Psychosocial Oncology and Director of Macmillan Survivorship Research Group, Health Sciences, University of Southampton, UK

Sally Wheelwright PhD, Senior Research Fellow, Health Sciences, University of Southampton, UK

Corresponding author

Rose Maunsell, r.maunsell@soton.ac.uk, ORCID ID: 0000-0003-4106-6519

Ethics approval and consent to participate

N/A

Competing interests

Dr Clare Shaw has received payments for consultancy work from Boehringer Ingelheim, and for teaching from Eli Lilly.

Funding information

The authors received no specific funding for this work.

Word count (excluding abstract, references, tables, figures and legends)

Revised

Abstract

Background

Nutrition is associated with aetiology and impacts outcomes in colorectal cancer (CRC). This study aimed to explore nutritional symptoms and concerns of patients with CRC and CRC dietetic resource across the UK.

Methods

Study 1: Descriptive analysis of nutrition-related measures in the ColoRectal Wellbeing (CREW) study, a prospective 5 year longitudinal cohort study of a representative sample of 872 adults with non-metastatic CRC.

Study 2: Descriptive analysis of data collected using a freedom of information request to all UK trusts/boards on dietetic resource for CRC.

Results

Study 1: 31% of CREW participants wanted more diet and lifestyle advice. At three months post-surgery, 10% reported poor appetite. A fifth experienced weight loss and 16% had concerns regarding weight loss 9 months post-surgery.

Study 2: Just 3% of hospitals providing CRC services had a dedicated CRC dietitian (hepato-pancreato-biliary (11.1%), head and neck cancer (14.3%)). There was no dietetic outpatient follow-up of CRC patients in 72% of hospitals.

Conclusions

Dietetic resource for patients with CRC is scarce even though weight loss, poor appetite, and unmet needs are common and persist over time. Work is needed to embed nutritional care into the management of patients with CRC.

What does this paper add to the literature?

Nutrition is associated with CRC risk and outcomes. Research shows patients with CRC have nutrition-related unmet needs. This study explores the nutrition-related symptoms (e.g. weight loss and poor appetite) experienced by patients with CRC and the dietetic resource available. The work is an important first step in understanding how to improve nutritional care in CRC.

Background

Colorectal cancer (CRC) is the third most common cancer globally, with nearly 1.8 million new cases in 2018.¹ The incidence of CRC is expected to continue to rise, with the number of cases annually set to reach 3 million by 2040.² The reason for this growth is thought to be multi-factorial, but lifestyle risk factors, such as diet and obesity, play a pivotal role.³

In addition to an association with aetiology, diet and nutritional status also have an effect on treatment outcomes, complications and mortality in CRC.^{4,5} Obesity increases the risk of cancer recurrence,⁶ impairs response to targeted therapies, and reduces survival rates.⁷ At the other end of the spectrum, undernutrition and weight loss are frequently seen in CRC, with up to 25% of patients undernourished at the point of entry to secondary care,⁸ and over 50% with preoperative weight loss.⁹ Undernutrition has significant negative consequences for patients with CRC, including increased adverse effects during chemotherapy,¹⁰ shorter survival times,¹⁰ longer hospital stays,¹¹ and reduced quality of life.¹² In some cases, involuntary weight loss, low skeletal muscle mass and function, and/or nutrient deficiencies, can be masked by an overweight or obese presentation.^{8,13} This paradox may result in the under-detection of malnutrition in this patient group, leaving patients vulnerable to its harmful consequences.¹⁴

Irrespective of nutritional status, individuals with CRC are likely to need to alter their diet throughout their treatment and recovery; examples include following a low fibre or 'low residue' diet to minimise the size and frequency of stools, and to prevent irritation of the bowel after surgery¹⁵, dietary modifications to manage mucositis in patients undergoing chemotherapy, or alterations to diet and fluid intake to manage stoma output.

Up to 70% of patients with CRC are undernourished or at risk of undernutrition¹⁶ and require nutritional support to optimise their energy, protein, and micronutrient intake. This approach contradicts traditional healthy eating messages by promoting intake of high energy foods with less focus on diet quality, thus education is important to ensure patients understand why this approach is needed and when to transition to a diet to reduce the risk of recurrence post treatment.¹⁷ For those unable to meet their nutritional needs orally, complete or supplementary enteral nutrition or 'tube feeding' may be initiated. In cases where the gut is inaccessible or not functioning, parenteral nutrition or 'intravenous feeding' may be used.

For patients who are post-treatment and not malnourished, the advice is to adopt a diet that observes the same cancer prevention guidelines as the general population,¹⁷ whilst managing any on-going issues with bowel function, and achieving a healthy weight. Patients who have had a

significant length of bowel resected and/or a permanent stoma may have the added complexity of chronic malabsorption of micronutrients and fluids.

This complex interplay of nutrition-related symptoms and dietary alterations may be burdensome for patients with CRC. Previous research has shown that patients with CRC have unmet needs related to diet and nutrition-related symptoms. A survey of 3,300 CRC survivors found that over 20% would like more advice on diet and lifestyle¹⁸ whilst a qualitative cancer survivorship study of multiple cancer types, including CRC, found that dietary advice was not provided by health professionals, even when requested¹⁹. Screening for malnutrition in cancer patients can be infrequent and is often not acted upon, suggesting that there is a widespread lack of appreciation of nutrition as an essential component of supportive care.¹⁴

The existing evidence suggests nutrition is an area of CRC care that requires more attention. The aim of this study was to expand on existing work by identifying the nutritional symptoms and concerns of patients with CRC enrolled in a cohort study collecting information using patient-reported outcomes (Study 1), and to explore the provision of dietetic resource in CRC care across the UK (Study 2).

Study 1: Secondary Analysis of ColoRectal Wellbeing (CREW) study

Method

The ColoRectal Wellbeing (CREW) study is a multi-centre, prospective cohort study of adults who were diagnosed with non-metastatic CRC and awaiting curative intent surgery. The focus of CREW was the recovery of health and wellbeing in the 5 years after surgery and the primary outcome was quality of life. Eligible patients attending 29 UK cancer centres during the recruitment period (November 2010 –March 2012) were invited to participate. Full details of eligibility criteria, recruitment strategy, sample size, and retention are provided elsewhere.^{20,21} At each time point (baseline, 3, 9, 15, 24, 36, 48- and 60-months post-surgery), participants were sent a series of measures relating to health and wellbeing, including specific questions relating to appetite, weight change, diet and dietitian support, as detailed below.

Clinical details were extracted from medical records at baseline and verified at 24 months post-surgery. Self-reported co-morbidities were recorded at 3 months post-surgery.

Measures

For a full description of the questionnaires included in the CREW study, see Wheelwright et al. 2020.²⁰ Table 1 lists the appetite, diet and weight items included at each time point.

Table 1: Appetite, diet, and weight items

Item	Time point						
	3 months	9 months	15 months	24 months	36 months	48 months	60 months
Have you lacked appetite? (from EORTC QLQ-C30)	X	X	X	X	X	X	X
Have you worried about your weight? (from EORTC QLQ-CR29)	X	X	X	X	X	X	X
Have you experienced weight loss since you started treatment? If yes, is this a symptom of cancer or treatment side effect? (from IPQ-R ²⁵)			X				
Has your weight changed since your diagnosis? Response options: Increased, decreased, stayed the same, don't know (ad hoc item)				X	X	X	X
Have you altered your diet since diagnosis? Response options: yes (add free text details), no (ad hoc item)		X		X	X	X	X
Would you have found advice on diet/lifestyle helpful over the past 2 years? Response options: yes, no (ad hoc item)				X			
Have you received diet information/advice since diagnosis? Response options: yes, no (ad hoc item)					X	X	X

EORTC QLQ-C30 and EORTC QLQ-CR29

The core EORTC quality of life questionnaire (QLQ-C30)²² and CRC-specific module (QLQ-CR29)²³ questions are rated on a 4-point response scale from “not at all” to “very much”. For the QLQ-C30 appetite question, a linear transformation was applied to produce scores ranging from 0 to 100, with a score of >50 indicating clinically significant appetite loss (defined as ‘deserving attention and discussion during the clinical encounter’).²⁴ For the QLQ-CR29 worry about weight question, the proportion of patients responding either “quite a bit” or “very much” was calculated.

Ethics

The CREW study was approved by the UK National Health Service National Research Ethics Service (REC reference number: 10/H0605/31).

Data Analysis

Descriptive statistics and descriptions of dietary changes and experience of dietary advice will be presented. Statistical analyses were carried out using IBM Statistics SPSS version 24.

Results

Participants

A representative cohort of 872 people with non-metastatic CRC agreed to complete CREW questionnaires. At baseline, 756 (88%) of those who received a questionnaire responded. Response rates remained high throughout the study (>70%), and those who continued to return questionnaires were broadly representative of the whole cohort.²⁰

The majority of respondents were white and retired with a mean age of 68 years, 60% male, and 65% with cancer of the colon. Eighteen percent received neoadjuvant treatment and 35% adjuvant chemotherapy or radiotherapy.²⁰ Following CRC surgery, 13.1% of people with colon cancer and 77.6% with rectal cancer had a stoma, mostly temporary.

Comorbidities

At 3 months, 72% of patients reported at least one comorbidity, 34% of which were conditions that are known to impact upon nutritional status or nutrition-related symptoms, or require alterations to the diet (e.g. diabetes, inflammatory bowel disease, stomach ulcer, stroke, liver disease or depression).

Appetite

The percentage of patients with a clinically important appetite loss²⁴ was highest at 3 months following surgery (10%, n=66), with the symptom persisting at 60 months in 5% (n=18) of the cohort.

Weight

At the end of treatment (15 month follow-up questionnaire), 125 participants (21%) reported weight loss since treatment had started and of these, 52% believed this was a symptom of cancer, while 62% attributed this to their treatment. Table 2 presents patient-reported weight changes since diagnosis according to BMI classification. Of those in the overweight/obese category, at least 30% gained weight at each time point. Weight loss was common (17-29% of the sample) in both overweight and healthy weight participants, across all time points.

Table 2. Reported weight change since diagnosis according to BMI status at diagnosis

BMI category at diagnosis*	Weight change	Months post-surgery			
		24 months % (n)	36 months % (n)	48 months % (n)	60 months % (n)
Healthy weight 18.5-24.9kg/m ²	Increase	26% (32)	24% (24)	26% (24)	16% (12)
	Decrease	29% (35)	26% (26)	22% (20)	21% (16)
	Stable	45% (55)	47% (47)	53% (49)	63% (47)
Overweight/obese ≥25kg/m ²	Increase	31% (67)	30% (49)	31% (49)	30% (44)
	Decrease	22% (47)	22% (36)	19% (31)	17% (25)
	Stable	46% (99)	47% (76)	50% (79)	53% (78)

*Underweight participants have not been included as numbers were too small to be meaningful (n=10 at baseline, n=2 at 60 months).

At 3 months post-surgery, 16% of patients reported that they had worried about their weight “quite a bit” or “very much”. This remained consistent, with 12-15% reporting worry about their weight at later time points.

Diet

At 9 months post-diagnosis, a quarter of patients reported that they had altered their diet since being diagnosed, this was similar at subsequent time points. Descriptions of dietary changes, which were categorised independently by two researchers (RM and SW), indicated that most of these changes were either an attempt to adopt what patients perceived to be a healthier diet or to manage symptoms. Examples of healthier diet changes included reduction of red or processed meat intake, increasing fruit and vegetable intake, increasing fibre intake, and adopting weight reducing measures such as reduced portion sizes. Patients who were trying to manage stoma output or bowel habits following surgery, or subsequent stoma reversal, reported measures such as reduced fibre, increased salt intake or the avoidance of ‘problem’ or ‘trigger’ foods.

Diet support and advice

At 24 months post-surgery, almost a third (31%) of patients indicated that advice on diet and lifestyle would have been helpful. Chi-square tests did not find an association between preference for advice and either sex, age (when comparing those above and below 70 years) or quintiles of deprivation. By 36 months, 35% of the people who wanted advice had received it. A quarter of people (25%) who had not indicated a desire for diet and lifestyle advice had received some by 36 months. At 48 and 60 months, 26% and 27% respectively of all participants indicated they had received diet and lifestyle advice. Of those people who had experienced weight loss since starting treatment, less than half (43%) received diet and lifestyle advice. Only a third (34%) of those people who indicated they had ever experienced clinically important appetite loss or worry about their weight reported receiving diet and lifestyle advice.

Discussion

Over 20% of patients with CRC in the CREW cohort experienced weight loss after commencing treatment. Weight loss in patients with cancer is independently associated with an unfavourable prognosis, increased toxicity of anticancer treatments resulting in reductions or interruptions of scheduled treatment, and reduced quality of life.^{25,26} It is therefore essential that those experiencing weight loss are identified and receive appropriate advice. Patients reported longstanding concerns regarding their weight and poor appetite. A quarter of patients reported altering their diet since diagnosis, and it is not clear whether they received support or guidance from an appropriately trained professional in doing so. To add to the complexity, around a quarter of the patients reported co-morbidities that may have impacted upon nutritional status or dietary intake. Just a quarter of the sample reported that they had received diet and lifestyle advice, highlighting a shortfall in the implementation of NICE guidance²⁷. NICE guideline 151 states that patients should be given advice on:

- diet, including advice on foods that can cause or contribute to bowel problems such as diarrhoea, flatulence, incontinence and difficulty in emptying the bowels
- weight management, physical activity and healthy lifestyle choices (for example stopping smoking and reducing alcohol use).

Moreover, almost a third of the sample would have found advice on diet helpful, highlighting an unmet need, in line with other research in patients with CRC.^{18,19} There was no association between sex, age or level of deprivation and want for dietary advice, suggesting that this should be explored with all patient groups.

Limitations

Nutrition and diet related data were not collected at every time point. It would have been valuable to have had this data immediately following completion of treatment to understand the key issues and their prevalence at this critical point. Changes in body weight were self-reported without verification from hospital records and were therefore dependent on recollection. The data set was not sufficient to provide meaningful insight into the needs of subgroups of patients with CRC e.g. colon vs rectal cancer, stoma vs no stoma. Investigation of the needs of patients following stoma reversal would also have been of interest.

Study 2: Freedom of Information (FOI) Request

Method

All NHS Trusts providing cancer services within England (n=133) and Wales (n=1), Health Boards within Wales (n=7) and Scotland (n=13), and Health and Social Care Trusts within Northern Ireland (n=5) were contacted in September and October 2019 to complete a survey about the dietetic services commissioned for CRC care via a Freedom of Information (FOI) Request (see supplementary information). All Trusts/Boards were asked to complete a separate survey for each acute hospital offering cancer care within their remit, however response rates were calculated for the Trust/Board. The survey included nine questions (see supplementary information), asking about the hospital and dietetic services for CRC.

According to the Freedom of Information Act 2000 (Scotland 2002), information held by public authorities (such as hospitals) is accessible to members of the public, with a statutory response time of 20 working days. FOI requests do not provide access to personal data and therefore ethical approval is not required. In the event of a non-response, a reminder email was sent to the Trust/Board within a week of the lapsed target response date. The Trust/Board was counted as a 'no-reply' if no response was received within 2 weeks of the reminder.

Data analysis

Descriptive summaries of Trust/Board responses to the FOI request were produced to give an overview of dietetic support for CRC in hospitals across the UK.

Results

Of the 159 Trusts/Boards who were contacted, 149 (94%) responded. All Trusts/Boards in Scotland (n=13), Northern Ireland (n=5) and Wales (n=8) who were approached provided data. In England, 123/134 (92% of those contacted) provided data, 1/134 (1%) declined and there was no response from 9/134 (7%).

There were 256 hospitals in the cohort, over half (60%) of which were district general hospitals (DGH), with the remaining described as teaching hospitals (TH). Hospital demographics are shown in Table 3 along with DGH and TH definitions. The majority of both DGH and TH provided CRC services (85.2%, 82.2% respectively), with 16.1% of DGH and 54.5% of TH being specialist CRC centres.

Table 3: Hospital demographics

Hospital type	Number of hospitals	Mean number (range) of inpatient beds	Providing CRC services	Specialist CRC centre
District general*	154	404 (27-1032)	127 (85.2%)	24 (16.1%)

Teaching hospital**	102	550 (24-1721)	83 (82.2%)	55 (54.5%)
---------------------	-----	---------------	------------	------------

*defined as a major provider of secondary care in the local area

**defined as a centre of secondary or tertiary care in a major city that is affiliated with a medical school and/or has a large academic department

Dietetic Services

Of those hospitals providing CRC services (84%), 3% (n=8, 2 DGH and 6 TH) had a dedicated CRC dietitian, with a mean WTE of 0.8 (0.5-1.0 WTE). One further hospital described 0.3 WTE for dietetic input into an enhanced recovery pathway for colorectal patients undergoing surgery. When compared to other cancer types, the percentage of hospitals with a dietitian dedicated to CRC (3.2%) was less than that for hepato-pancreatico-biliary (11.1%) and head and neck cancer (H&N) (14.3%), higher than that for breast (1.2%), and comparable to that for lung cancer (2.8%).

Cancer specialist dietitians covering multiple cancer types, including CRC, were in place at 28% of hospitals providing CRC services. Around a third (31%) of hospitals reported to have non-specialist (band 5) dietetic time for CRC care (65% not available, 5% missing data). In all cases, non-specialist dietetic time was available as part of the general caseload, rotation, or ward cover, rather than time being specifically funded or commissioned for CRC.

Outpatient follow-up

The majority of hospitals (72%) reported that no dietetic outpatient follow-up was available for CRC patients. Where available, outpatient follow-up was offered via either the CRC dedicated dietitian, the general cancer specialist dietitian, the community dietetic team, a non-specialist (band 5) dietitian or a combination of these. In the 8 hospitals with a dedicated CRC specialist dietitian, 75% (n=6) offered outpatient follow-up to CRC patients (n=4 by the CRC dedicated dietitian, n=2 by the community dietetic team).

Discussion

Data from the FOI request revealed that dietetic resource in CRC care in the UK is scant and inconsistent: just 3% of hospitals providing CRC services had a dedicated CRC dietitian. This lack of dedicated dietetic resource raises the question of whether the complex nutritional symptoms of patients with CRC are being managed effectively, by an individual with the necessary knowledge and expertise. Whilst it is recognised that nutritional advice may be provided by other members of the multi-disciplinary team, research by the National Institute for Health Research (NIHR) Cancer and Nutrition Collaboration has shown that healthcare professionals often lack confidence in providing this advice and are not aware of the relevant nutritional guidelines.²⁸ The benefits of a dedicated

dietitian and proactive nutritional intervention in the care of patients with CRC, has been shown to improve patient reported outcomes such as symptom control, energy levels and stoma output.²⁹ Further to this, dedicated dietetic resource for CRC patients ensures ring-fenced time for this patient group, as opposed to general cancer care dietetic time (available at 28% of hospitals in the sample), where resource is split across tumour types.

A higher proportion of hospitals reported dedicated dietetic resource for hepato-pancreatico-biliary and head and neck cancers (11% and 14% respectively), which may in part be due to recognition of the greater risk of malnutrition and need for disease specific dietary advice in these cancer types. This highlights the need for further work to emphasise the importance of nutrition in the management of CRC, including addressing the associated digestive issues such as altered bowel habit or high stoma output, which are likely to impact upon QoL.¹⁸

There was a distinct lack of dietetic outpatient follow-up, with just 28% of hospitals providing outpatient follow-up to CRC patients. Post treatment is a critical period,³⁰ and CREW illustrates that patients may experience a lack of appetite and weight changes for several years following a diagnosis of CRC. It may be assumed that outpatient follow-up is picked up by primary care, although this is unknown. Further work is needed to understand the primary care nutrition and dietetic services available to individuals who have completed treatment for CRC.

Limitations

While the FOI request method for data collection ensured a high response rate, the amount of detail collected was limited in order to avoid incurring a fee for which there was no funding. Although we do not know who completed the FOI requests, each organisation has a legal duty to ensure the information is accurate.

General discussion and conclusions

This paper reports findings from a secondary data analysis of a representative cohort of CRC patients treated with curative intent, to explore nutrition-related symptoms and concerns (Study 1), and used a FOI request to ascertain the dietetic support available to people diagnosed with any stage of CRC in the UK (Study 2). The findings show that the CRC patient population have significant nutrition-related symptoms, concerns and unmet needs for up to 5 years after diagnosis, with inconsistent dietetic resource in this area. The lack of dedicated dietetic resource suggests that the importance of diet and nutrition in CRC care is under-recognised. Previous research has shown that for nurses, surgeons and physicians, a lack of guidelines, a belief that diet has no impact upon cancer outcomes, and passing on the responsibility to provide dietary advice, are all barriers to addressing diet in

cancer care.³¹ In addition, patients are often unaware of their own nutritional risk and unsupported self-management of diet and weight leads to nutritional deficits.³²

It is imperative that CRC patients are provided with gold standard nutritional care, including access to dedicated dietetic resource, in order to enhance cancer-related outcomes, reduce other long term health problems, maximise quality of life, and minimise the burden on the healthcare system. To achieve this in the absence of dedicated dietetic care, it is essential that patients and healthcare professionals understand and recognise the importance of nutrition as an integrated part of CRC care. Key to this is raising awareness of the role of nutrition in CRC, patient and healthcare professional education, and the development of digital resources to support the identification and management of individuals in need of nutrition intervention.

References

1. International Agency for Research on Cancer (Globocan). Colorectal cancer. 2018 [Available from: http://gco.iarc.fr/today/data/factsheets/cancers/10_8_9-Colorectum-fact-sheet.pdf].
2. International Agency for Research on Cancer, World Health Organisation. Cancer Tomorrow. 2018 [Available from: http://gco.iarc.fr/tomorrow/graphic-isotype?type=0&population=900&mode=population&sex=0&cancer=39&age_group=value&apc_male=0&apc_female=0].
3. Arnold M, Sierra M, Laversanne M, Soerjomataram I, Jemal A, Bray F. Global patterns and trends in colorectal cancer incidence and mortality. *Gut*. 2017;66:683-91.
4. Brown SC, Abraham J, Walsh S, Sykes PA. Risk factors and operative mortality in surgery for colorectal cancer. *Ann R Coll Surg Engl*. 1991;73(5):269-72.
5. Schwegler I, von Holzen A, Gutzwiller J, Schlumpf R, Mühlebach S, Stanga Z. Nutritional risk is a clinical predictor of postoperative mortality and morbidity in surgery for colorectal cancer. *British Journal of Surgery*. 2010;97(1):92-7.
6. Scarpa M, Ruffolo C, Erroi F, Fiorot A, Basato S, Pozza A, et al. Obesity is a Risk Factor for Multifocal Disease and Recurrence after Colorectal Cancer Surgery: A Case-Control Study. *Anticancer Research*. 2014;34(10):5735-41.
7. Bardou M, Barkun A, Martel M. Obesity and colorectal cancer. *Gut*. 2013;62:933-47.
8. Burden S, Hill J, Shaffer J, Todd C. Nutritional status of preoperative colorectal cancer patients. *Journal of Human Nutrition and Dietetics*. 2010;23:402-7.
9. Lidder P, Thomas S, Fleming S, Hosie KB, Lewis SJ. Nutritional intervention in patients undergoing colorectal surgery: support for the routine prescription of oral nutritional supplements pre- and post-operatively. *Gut*. 2010;59:A35.

10. Barret M, Malka D, Aparicio T, Dalban C, Locher C, Sabate J-M, et al. Nutritional Status Affects Treatment Tolerability and Survival in Metastatic Colorectal Cancer Patients: Results of an AGEO Prospective Multicenter Study. *Oncology*. 2011;81:395-402.
11. Garth A, Newsome C, Simmance N, Crowe TC. Nutritional status, nutrition practices and post-operative complications in patients with gastrointestinal cancer. *Journal of Human Nutrition And Dietetics*. 2010;23(4):393-401.
12. Gupta D, Lis C, Granick J, Grutsch JF, Vashi PG, Lammersfeld CA. Malnutrition was associated with poor quality of life in colorectal cancer: a retrospective analysis. *Journal of Clinical Epidemiology*. 2006;59(7):704-9.
13. Prado C, Lieffer J, McCargar L, Reiman T, Sawyer MB, Martin L, et al. Prevalence and clinical implications of sarcopenic obesity in patients with solid tumours of the respiratory and gastrointestinal tracts: a population-based study. *Lancet Oncology*. 2008;9:629-35.
14. Lorton C, Griffin O, Higgins K, Roulston F, Stewart G, Gough N, et al. Late referral of cancer patients with malnutrition to dietitians: a prospective study of clinical practice. *Support Care in Cancer*. 2020;28(5):2351-60.
15. Bowel Cancer UK. Diet after treatment 2019 [Available from: <https://www.bowelcanceruk.org.uk/about-bowel-cancer/living-with-and-beyond-bowel-cancer/diet-after-treatment/>].
16. Daniele A, Divella R, Abbate I, Casamassima A, Garrisi VM, Savino E, et al. Assessment of Nutritional and Inflammatory Status to Determine the Prevalence of Malnutrition in Patients Undergoing Surgery for Colorectal Carcinoma. *Anticancer Research*. 2017;37(3):1281-1287.
17. World Cancer Research Fund. Diet, Nutrition, physical activity and colorectal cancer. 2017 (revised 2018).
18. Department of Health. Quality of life of cancer survivors in England: Report on a pilot survey using Patient Reported Outcome Measures (PROMS). London; 2012.
19. Beeken R, Williams K, Wardle J, Croker H. "What about diet?" A qualitative study of cancer survivors' views on diet and cancer and their sources of information. *European Journal of Cancer Care*. 2016;25:774-83.
20. Wheelwright S, Permyakova N, Calman L, Din A, Fenlon D, Richardson A, et al. Does quality of life return to pre-treatment levels five years after curative intent surgery for colorectal cancer? Evidence from the ColoRECTal Wellbeing (CREW) study. *PLoS ONE*. 2020;15(4):e0231332.
21. Fenlon D, Addington-Hall J, Richardson A, Smith P, Corner J, Winter J, et al. A cohort study of the recovery of health and wellbeing following colorectal cancer (CREW study): protocol paper. *BMC Health Serv Res*. 2012;12:90.

22. Aaronson N, Ahmedzai S, Bergman B, Bullinger M, Cull A, Duez NJ, et al for the European Organization for Research and Treatment of Cancer Study Group on Quality of Life. The European Organization for Research and Treatment of Cancer QLQ-C30: a quality-of-life instrument for use in international clinical trials in oncology. *J Natl Cancer Inst.* 1993;85(5):365-76.
23. Whistance R, Conroy T, Chie W, Costantini A, Sezer O, Koller M, et al on behalf of the European Organisation for the Research and Treatment of Cancer (EORTC) Quality of Life Group. Clinical and psychometric validation of the EORTC QLQ-CR29 questionnaire module to assess health-related quality of life in patients with colorectal cancer. *Eur J Cancer.* 2009;45(17):3017-26.
24. Giesinger J, Loth F, Aaronson N, Arraras JI, Caocci G, Efficace F, et al. Thresholds for clinical importance were established to improve interpretation of the EORTC QLQ-C30 in clinical practice and research. *Journal of Clinical Epidemiology.* 2020;118:1-8.
25. Arends J, Bachmann P, Baracos V, Barthelemy N, Bertz H, Bozzetti F, et al. ESPEN guidelines on nutrition in cancer patients. *Clinical Nutrition.* 2016.
26. Shaw C, Starling N, Reich A, Wilkes E, White R, Shepelev J, et al. Modification of systemic anti-cancer therapies and weight loss, a population level real-world evidence study. *Therapeutic Advances in Medical Oncology.* 2020;12:1–64.
27. National Institute for Health and Care Excellence (2020) Colorectal Cancer (NICE guideline 151). Available at: <https://www.nice.org.uk/guidance/ng151> [Accessed 9 August 2021].
28. Murphy J, Munir F, Davey F, Miller L, Cutress R, White R, et al. The provision of nutritional advice and care for cancer patients: a UK national survey of healthcare professionals. *Support Care Cancer.* 2021;29:2435–2442.
29. Scott E, Stokes N, Burgess G. The role of the colorectal cancer dietetic and nutrition service at University Hospitals of Leicester NHS Trust. *Clinical Nutrition ESPEN.* 2019;29:278.
30. Balhareth A, Aldossary M, McNamara, D. Impact of physical activity and diet on colorectal cancer survivors' quality of life: a systematic review. *World Journal of Surgical Oncology.* 2019;17(1):153.
31. Williams K, Beeken R, Fisher A, Wardle J. Health professionals' provision of lifestyle advice in the oncology context in the United Kingdom. *European Journal of Cancer Care.* 2015;24:522-30.
32. Hopkinson J, Kazmi C, Elias J, Wheelwright S, Williams R, Russell A, et al. Diet and weight management by people with non-metastatic colorectal cancer during chemotherapy: mixed methods research. *Colorectal Cancer.* 2020;9(2).