

## Original Article

# Dietary advice provided to those undergoing pelvic radiotherapy

Nickola Pallin, Jane Richardson

*Institute of Health and Society, University of Worcester, Henwick Grove, Worcester, UK*

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## Abstract

**Background:** In those receiving radiotherapy for pelvic cancers, up to 80% develop gastrointestinal symptoms, with dietary interventions recommended to reduce these symptoms. However, research outlining the current dietary support provided to patients undergoing radiotherapy for pelvic cancer is lacking.

**Aim:** To identify the gastrointestinal symptoms experienced by those undergoing pelvic radiotherapy and to identify the dietary support provided to these patients.

**Methods and materials:** A service evaluation was undertaken in one NHS Trust hospital whereby patients undergoing radical pelvic radiotherapy during a 15-week recruitment period were invited to complete an anonymous questionnaire. Participants were recruited using purposive sampling and the data were analysed descriptively using SPSS.

**Results:** In total, 31 patients responded achieving a response rate of 48%. The most frequent reported gastrointestinal symptoms were gas and flatulence followed by diarrhoea, nausea and abdominal pain. The main dietary changes implemented by the respondents and recommended by health care professionals included reducing fibre intake, reducing certain vegetables, reducing caffeine and increasing water.

**Findings:** The results illustrate the impact of gastrointestinal side effects on patients' dietary intake. The results highlight that nutritional guidance need to be standardised, especially for the management of diarrhoea and gas and flatulence as these were the most common occurring side effects. With radiographers most frequently giving nutritional advice they must be provided with guidance to support those undergoing pelvic radiotherapy.

**Keywords:** diet; gastrointestinal symptoms; pelvic radiotherapy; radiation-induced bowel damage

## INTRODUCTION

Radiotherapy is the use of ionising radiation to treat illness and is an important treatment for

Correspondence to: Nickola Pallin, Institute of Health and Society, University of Worcester, Henwick Grove, Worcester, UK. Tel: 020 7935 8544. E-mail: pallinn@tcd.ie

cancer.<sup>1</sup> Within the United Kingdom, ~30,000 patients undergo pelvic radiotherapy each year.<sup>1</sup> The most common physical side effects occurring among those undergoing pelvic radiotherapy are gastrointestinal symptoms.<sup>2,3</sup> These include diarrhoea or constipation, abdominal pain, nausea, steatorrhoea, bloating and weight loss,

negatively affecting patients' quality of life (QOL).<sup>4-7</sup>

The challenge of radiotherapy is to ensure an adequate dose of radiation is delivered to the treatment area, while sparing normal non-cancerous tissue to avoid side effects.<sup>8</sup> Radiation damage occurs in cells undergoing mitosis resulting in apoptosis, autophagy, senescence and necrosis, all activated to different extents in different tissues and genetically controlled leading to an inflammatory process resulting in side effects.<sup>9</sup> Cells with a quicker turnover are more vulnerable to the effects of radiation. With the intestinal mucosa repopulating its cells every 5 days, it is vulnerable to radiation damage with gastrointestinal symptoms usually beginning during the second week of treatment.<sup>10</sup> Chemotherapy also damages the rapidly turning over gastrointestinal tract epithelium, further predisposing patients to gastrointestinal side effects.<sup>11</sup> The inflammatory response of the gastrointestinal tract to irradiation flattens the intestinal microvilli decreasing enzymatic activity, absorptive surface area and total gut transit time leading to pelvic symptoms and malabsorption of nutrients.<sup>12-14</sup>

Dietary support is one approach in managing some of these patients' symptoms and is non-invasive and low cost.<sup>15</sup> However, despite this, the current nutritional advice for managing bowel side effects following pelvic radiotherapy is inconsistent and lacks standardised guidelines.<sup>6,16</sup> Nutritional interventions suggested in the literature include reducing fibre, fat and lactose, and administering probiotics for managing symptoms on the premise that malabsorption of fat, lactose, carbohydrate and small bowel bacterial overgrowth occurs following radiotherapy.<sup>4,6,17,18</sup>

Following an electronic search of databases, no studies were identified that investigated the current dietary advice provided clinically to patients who suffer from gastrointestinal symptoms following radiotherapy. Therefore, it is unknown if the needs of these patients are being met. In the absence of nutrition advice, patients may implement their own coping strategies including decreasing dietary intake or self-imposing restricted diets potentially leading to a nutritionally inadequate diet.<sup>14</sup> Minimising food

restriction is important because malnutrition is an adverse prognostic factor in most cancers and as up to 33% of patients are malnourished at the start of pelvic radiotherapy minimising the progression of this is important.<sup>6</sup>

In order to develop practical guidance on the use of nutrition support it is important to know what nutritional support is being provided to those who have undergone pelvic radiotherapy. Therefore, the overall aim of this study was to investigate patients' experience regarding the management of gastrointestinal symptoms during pelvic radiotherapy with a particular focus on nutritional management. The objectives were to

- establish which patients experienced gastrointestinal side effects;
- evaluate the service provided by health care providers regarding nutritional advice to patients who have undergone pelvic radiotherapy;
- evaluate if patients' dietary intake has been affected by radiotherapy.

### Ethical approval

Ethical approval was obtained from the University of Worcester. As this study was deemed a service evaluation it did not require NHS ethical approval.<sup>19</sup> However, permission was granted by the NHS Trust Research and Development department. This research study was undertaken in line with the Data Protection Act 1998<sup>20,21</sup> and anonymity was assured through the use of an anonymous questionnaire.

### METHODS

A cross-sectional study was undertaken with participants undergoing pelvic radiotherapy in a single NHS Trust, with the use of purposive sampling. A cross-sectional survey was used to investigate a sample that is representative of a population.<sup>22</sup> In this instance, patients undergoing pelvic radiotherapy in the same Trust.

A self-completion postal questionnaire was designed to meet the study's overall aim (Appendix A). The questionnaire was developed based on the questionnaires used by Henson et al.,<sup>16,23</sup> the Picker Patient Experience Questionnaire-15<sup>24</sup>

and the patient experience questionnaire,<sup>25</sup> which are reliable and validated measures of patient experience.<sup>24,25</sup>

The questionnaire was not piloted among those representing the study population due to the likely small sample size and time constraints, however, it was developed and piloted among those with a background in radiotherapy and nutrition to identify any potential problems.

Potential participants were selected according to meeting the inclusion and exclusion criteria.

#### Inclusion criteria:

- All patients over 18 years undergoing radical pelvic radiotherapy.
- Patients willing to participate.
- Ability to read and write in English.

#### Exclusion criteria:

- Those undergoing palliative treatment.
- Those unwilling to participate.
- Those considered inappropriate for inclusion by clinical oncology consultant.
- Age <18 years.
- Patients unable to complete patient-reported questionnaires.

The principal investigator approached all participants meeting the inclusion criteria towards the end of their treatment outlining the research and why they have been asked to participate. This was carried out from the October 2015 to January 2016. Participants were provided with a pack including the questionnaire, participant information leaflet and stamped addressed envelope. Consent was implied by the return of the questionnaire. During the time of data collection, 65 patients were provided with a questionnaire, 31 were returned giving a response rate of 48%.

The responses were coded, entered and analysed using the statistical package SPSS version 16. Descriptive analysis was undertaken to represent data numerically and provide frequencies, percentages, means and standard deviations. To investigate relationships between variables a Fisher's exact test was used. A *p* value  $\leq 0.05$  was

used. Qualitative data obtained from open-ended questions in each questionnaire were summarised in groups and put into tables. The main points are illustrated below using selected coded extracts and quotations.

## RESULTS

Table 1 summarises the characteristics of the 31 participants. The majority of respondents were male, having undergone treatment for prostate cancer, with the other respondents having undergone treatment for endometrial, cervical or bowel cancer. Four of the participants had undergone chemotherapy, three of which had bowel cancer and one cervical cancer. Table 2 outlines the reported incidence of gastrointestinal side effects among each cancer group. Only one respondent stated that he did not suffer from any gastrointestinal side effects. No significant relationships were found between age, gender, diagnosis and chemotherapy and the occurrence of gastrointestinal side effects. Although all female patients (*n* = 5) experienced diarrhoea, this was not statistically significant (*p* = 0.07). Three of the four patients who had chemotherapy-experienced diarrhoea, but this was not statistically significant (*p* = 0.639).

In total, 18 respondents (58%) made changes to their diet to alleviate bowel symptoms, which involved omitting certain foods, increasing water intake, eating less food and drinking herbal teas.

**Table 1.** Participant characteristics

	Male	Female	Total
No. of participants	26 (84%)	5 (16%)	31
Median age (years)	70	64	
Age range	53–90	34–73	
Cancer site			
Prostate	23 (74%)	0	23
Endometrial	0	3 (10%)	3
Bowel (three rectal and one anal)	3 (10%)	1 (3%)	4
Cervical	0	1 (3%)	1
Time since finished Radiotherapy (weeks)			
0–2 weeks after treatment	24 (77%)	4 (13%)	28
3–4 weeks after treatment	0	1 (3%)	1
5–6 weeks after treatment	0	0	0
More than 6 weeks after treatment	2 (6%)	0	2
Received chemotherapy	2 (6%)	2 (6%)	4

**Table 2.** Incidence of side effects among respondents

	Cancer diagnosis				
	Prostate (n = 23)	Endometrial (n = 3)	Bowel (n = 4)	Cervical (n = 3)	Total
<b>Side effect</b>					
Diarrhoea	13 (56%) <sup>a</sup>	3 (100%)	3 (75%)	1 (100%)	20 (65%) <sup>b</sup>
Nausea	2 (9%)	1 (33%)	0	1 (100%)	4 (13%)
Gas and flatulence	18 (78%)	2 (67%)	3 (75%)	1 (100%)	24 (77%)
Abdominal pain	5 (22%)	1 (33%)	1 (25%)	0	7 (22%)
<b>Side effect ongoing</b>					
Diarrhoea	6 (26%)	1 (33%)	1 (25%)	1 (100%)	9 (29%)
Nausea	1 (4%)	1 (33%)	0	1 (100%)	3 (10%)
Gas and flatulence	9 (39%)	0	2 (50%)	0	11 (35%)
Abdominal pain	2 (9%)	1 (33%)	1 (25%)	0	4 (13%)

Notes: <sup>a</sup>Percentage refers to percentage of those with that cancer.

<sup>b</sup>Percentage refers to percentage of all patients (n = 31).

This was a result of experiencing reduced appetite and restricting certain foods which aggravated their symptoms. The following comments are illustrative of this finding.

'Sometimes not wanting food or just a little' (66-year-old male with bowel cancer).

'From week four needed to almost completely remove dietary fibre' (65-year-old male with prostate cancer).

For the management of diarrhoea, eight (40%) made dietary changes including reducing fibre intake, reducing certain vegetables and caffeine. Of the 24 that suffered with gas 12 (50%) implemented dietary changes with seven stating this helped ease the gas, one stated 'no' and four stated 'a little'. The changes made by patients to alleviate gas and flatulence included drinking herbal teas, reducing fibre, reducing fizzy drinks and omitting pulses from their diet.

'Reduced fibre, cut out fizzy drinks' (34-year-old female with cervical cancer), which she stated helped.

'White bread instead of brown, green veg avoided, tea and coffee avoided, raw fruit avoided, cereals avoided' (73-year-old female with endometrial cancer), which she stated helped.

One of the objectives of this service evaluation was to evaluate if and what nutritional advice is provided to patients by health care professionals

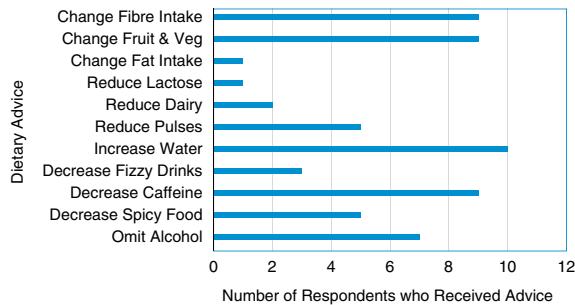


Figure 1. Dietary advice provided by health care professional to alleviate diarrhoea.

(HCPs). Radiographers were the most frequently cited HCPs from whom patients received dietary information with some respondents stating they got advice regarding management of bowel side effects from a doctor and a nurse.

The dietary advice provided to 13 patients to help alleviate diarrhoea is outlined in Figure 1. Out of the nine respondents who were advised to change their dietary fibre intake six wrote what this advice was, which included both increasing fibre and reducing fibre. The advice provided by HCPs to help alleviate nausea are outlined in Figure 2.

In total, 17 patients received dietary advice to help alleviate gas. This was a multiple choice question and the dietary advice provided and the frequency of such advice is illustrated in Figure 3. Two received 'other' information which was to 'eat regularly and avoid large meals' and use

'peppermint capsules'. Of the six patients who suffered with abdominal pain, four received dietary advice from a HCP who was a radiographer in all cases. The advice provided is shown in Figure 4.

## DISCUSSION

### Incidence of side effects

In this study, 97% of the participants suffered from gastrointestinal side effects, likewise Andreyev<sup>26</sup> reports that up to 80% develop early gastrointestinal symptoms. Similar to other studies, gas and flatulence was the most common

reported gastrointestinal symptom followed by diarrhoea, abdominal pain and nausea.<sup>4,6</sup>

Although a small sample ( $n = 4$ ) all of those with gynaecological cancer and 75% ( $n = 3$ ) of those with bowel cancer experienced diarrhoea. As this is a small sample it cannot be assumed that all patients undergoing pelvic radiotherapy for gynaecological and bowel cancer experience diarrhoea. However, with a larger area of the gastrointestinal irradiated in those with gynaecological and bowel cancer this further causes gastrointestinal symptoms.<sup>27</sup> In addition, those with gynaecological and bowel often receive chemotherapy, as was the case in the current study, and therefore consideration should be made to ensure these patients are closely monitored for side effects and early intervention implemented as appropriate as these side effects can negatively impact patients' QOL.<sup>5</sup>

### Dietary interventions implemented by patients

In total, 18 (58%) of the patients in the present study made dietary changes to alleviate bowel symptoms. These findings as listed above are similar to other research.<sup>5,9,28,29</sup> Although in the present study the majority of patients stated the dietary changes helped alleviate symptoms one limitation was that respondents could select a number of dietary changes implemented and therefore it was not possible to identify which dietary change improved symptoms.

### Dietary advice provided by HCPs

Oncology practice advises a low-fibre diet during the course of radiotherapy to manage gastrointestinal symptoms,<sup>6</sup> as the findings in the present study show. Although there was some contrast, with some patients advised to increase fibre and others advised to decrease it the majority were advised to reduce fibre intake. Those with cancer receive a wide range of advice from many sources about foods they should eat and avoid, and often this advice is conflicting.<sup>30</sup> This highlights the need for the development of definitive guidance on the nutritional management of gastrointestinal side arising from radiotherapy.

Although reducing fibre intake is commonly advised to patients, omitting all fibre may worsen

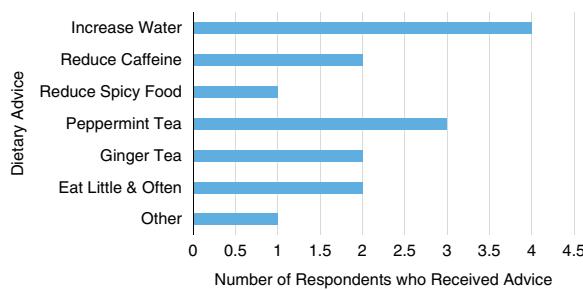


Figure 2. Dietary advice provided by health care professional to alleviate nausea.

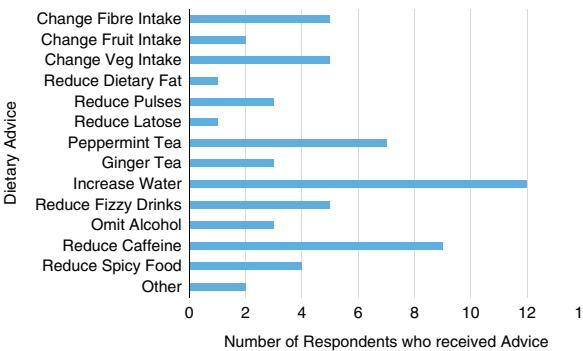


Figure 3. Dietary advice provided by health care professional to alleviate gas.

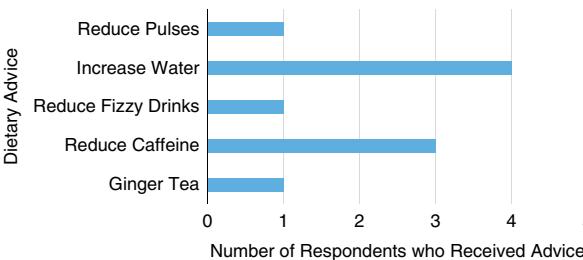


Figure 4. Dietary advice provided by health care professional to alleviate abdominal pain.

patients' diarrhoea because the intake of dietary fibre can help alleviate diarrhoea by increasing faecal mass and modulating gastrointestinal motility.<sup>31</sup> It has also been shown that increasing soluble fibre intake reduces the incidence and severity of diarrhoea during radiotherapy.<sup>32</sup> However, this fibre used was psyllium seed husk, a supplementary soluble fibre and not food soluble fibre. Although psyllium is not routinely provided in the department where this study was undertaken fibre supplements are recommended in the information booklet by Macmillan Cancer Support<sup>33</sup> to manage bowel problems after pelvic radiotherapy and therefore patients may take supplemental soluble fibre as it is readily available over the counter.

During radiotherapy, a pilot study undertaken among 60 patients showed a statistically significant reduction in the incidence of diarrhoea in those who took one to two tsp of psyllium daily.<sup>34</sup>

Low-residue diets can be nutritionally inadequate and are not recommended for long periods of time.<sup>35</sup> Soluble fibre is an essential nutrient for gastrointestinal health because it is fermented by colonic microbiota to produce short-chain fatty acids, one of which is butyrate.<sup>36</sup> Butyrate has immunemodulatory and anti-inflammatory actions which may negate some of the effects of radiotherapy, suggesting that fibre should not be completely eliminated.<sup>36,37</sup> This is illustrated whereby the American Cancer Society<sup>38</sup> does not recommend excluding all fibre but recommends an increase in soluble fibre foods.

Among the respondents, decreasing fibre intake was achieved by decreasing certain vegetables, pulses, fruits and wholegrains. The vegetables most commonly reduced included fibrous and raw vegetables. McGough et al.<sup>6</sup> from their review concluded that reduced intake of raw vegetables is beneficial in preventing acute gastrointestinal symptoms. This is because these foods can aggravate the lining of the bowel, which has become inflamed following radiotherapy.<sup>39</sup>

Reducing caffeine, omitting alcohol, increasing water intake and avoiding spicy foods is in agreement with other dietary advice provided to alleviate diarrhoea as they stimulate the bowel.<sup>35,38</sup>

Ensuring adequate fluid intake is important for those who experience diarrhoea to avoid dehydration and maintain electrolyte balance.<sup>40</sup>

As illustrated above reducing dairy and lactose was recommended to participants in this study. Avoiding dairy and lactose for the management of diarrhoea is suggested by many authors.<sup>6,7,35,38</sup> Although a small sample, three of those who underwent chemotherapy (75%) suffered from diarrhoea. One study illustrated that 5-fluorouracil-based chemotherapy, which is a standard chemotherapy regime for colorectal cancer exacerbated the incidence of diarrhoea and bloating on the premise that these patients may have developed lactose intolerance.<sup>41</sup> Therefore, in clinical practice recommending the avoidance of dairy and or lactose may help alleviate diarrhoea in some individuals undergoing pelvic radiotherapy and/or chemotherapy.

To help alleviate gas and flatulence the advice followed by patients in this study is in line with a typical anti-flatulent diet suggested by other sources.<sup>42,43</sup> Including reducing caffeine, avoiding excessive dairy intake, reducing hot and spicy foods, reducing gas-forming vegetables (onions and brassica vegetables) and eating cooked vegetables warm.<sup>43</sup> Oates et al.,<sup>43</sup> although a small study with 30 participants showed that an anti-flatulent diet during radiotherapy reduces rectal volume variability. However, this study also used psyllium husk, which can minimise abdominal distension, gas, and bloating because it delays gastric emptying and reduces the acceleration of colon transit.<sup>34</sup> This finding further highlights the benefit of including soluble fibre in these patients' diet. However, caution should be taken with patients who have decreased gut motility and/or taking opioid pain medications to prevent intestinal blockage.<sup>44</sup>

Although this study focusses on an important area for concern, it has some limitations. First, the majority of patients who were included in this service evaluation had prostate cancer, however, with prostate cancer being the most common cancer among men in the United Kingdom,<sup>45</sup> in a study involving all patients undergoing pelvic radiotherapy it is likely there will be an over representation. In addition, the presentation of

gastrointestinal side effects depends on the type of radiotherapy given, the dose given and treatment time,<sup>46</sup> therefore it would be beneficial if these treatment details were known.

## CONCLUSION

Overall, pelvic radiotherapy affected patients' dietary intake. The most common dietary advice offered by HCPs and implemented by participants in this study included restricting fibre intake, altering fruit and vegetable intake, increasing water and decreasing caffeine. It is clear that more dietary interventions aimed at decreasing symptoms are needed, especially for the management of diarrhoea and gas and flatulence as these were the most common occurring side effects. Due to the suggested benefits of psyllium seed husk in the management of gastrointestinal side effects further research in this area is needed.

With the findings showing some conflicting dietary advice being provided to patients it is recommended that clear guidelines regarding dietary advice for these patients are developed. With radiographers most frequently giving nutritional advice to these patients they must be supported and provided with guidance regarding clinical and dietary management to support those undergoing pelvic radiotherapy.

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## Conflicts of Interest

None.

## References

- National Health Service. NHS standard contract for radiotherapy (all ages). London: NHS Commissioning Board, 2013. <http://www.england.nhs.uk/wp-content/uploads/2013/06/b01-radiotherapy.pdf>. Accessed on 21st August 2016.
- Birgisson H, Pahlman L, Gunnarsson U, Glimelius B. Late adverse effects of radiation therapy for rectal cancer-a systematic overview. *Acta Oncol* 2007; 46 (4): 504–516.
- Henson C C, Burden S, Davidson S E, Lal S. Nutritional interventions for reducing gastrointestinal toxicity in adults undergoing radical pelvic radiotherapy. *Cochrane Database Syst Rev* 2013: 1–47.
- Andreyev J. Gastrointestinal complications of pelvic radiotherapy: are they of any importance? *Gut* 2005; 54 (8): 1051–1054.
- Gami B, Harrington K, Blake P et al. How patients manage gastrointestinal symptoms after pelvic radiotherapy. *Aliment Pharmacol Ther* 2003; 18 (10): 987–994.
- McGough C, Baldwin C, Frost G, Andreyev H J N. Role of nutritional intervention in patients treated with radiotherapy for pelvic malignancy. *Br J Cancer* 2004; 90 (12): 2278–2287.
- National Cancer Institute. Cancer Therapy Evaluation Program. USA: National Cancer Institute, 2009. [http://ctep.cancer.gov/protocolDevelopment/electronic\\_applications/ctc.htm](http://ctep.cancer.gov/protocolDevelopment/electronic_applications/ctc.htm). Accessed on 2nd February 2016.
- Bentzen S M, Baumann M. Clinical manifestations of normal-tissue damage. In: Steel, G G (ed.) *Basic Clinical Radiobiology*. London: Hodder Arnold, 2002: 56–67.
- Wouters B G. Irradiation-induced damage and the DNA damage response. In: Steel, G G (ed.) *Basic Clinical Radiobiology*. London: Hodder Arnold, 2002: 27–40.
- Del Fabbro E, Demark-wahnefried W, Baracos V. Nutrition and the Cancer Patient. New York: Oxford University Press, 2010.
- Beck P L, Wong J F, Li Y et al. Chemotherapy and radiotherapy-induced intestinal damage is regulated by intestinal trefoil factor. *Gastroenterology* 2004; 126 (3): 796–808.
- Yeoh E, Horowitz M, Russo A et al. Effect of pelvic irradiation on gastrointestinal function: a prospective longitudinal study. *Am J Med* 1993; 95 (4): 397–406.
- Packey C D, Ciorba M A. Microbial influences on the small intestinal response to radiation injury. *Curr Opin Gastroenterol* 2010; 26: 88–94.
- DeWitt T, Hegazi R. Nutrition in pelvic radiation disease and inflammatory bowel disease: similarities and differences. *Biomed Res Int* 2014: 1–6.
- Macmillan Cancer Support. Cured but at what cost? Long-term consequences of cancer and its treatment. UK: Macmillan Cancer Support, 2013. [http://www.macmillan.org.uk/Documents/AboutUs/Newsroom/Consequences\\_of\\_Treatment\\_June2013.pdf](http://www.macmillan.org.uk/Documents/AboutUs/Newsroom/Consequences_of_Treatment_June2013.pdf). Accessed on 22<sup>nd</sup> July 2016.
- Henson C C, Andreyev H J N, Symonds R P, Peel D, Swindell R, Davidson S E. Late-onset bowel dysfunction after pelvic radiotherapy: a national survey of current practice and opinions of clinical oncologists. *Clin Oncol* 2011; 23 (8): 552–557.
- Webb G J, Brooke R, De Silva A N. Chronic radiation enteritis and malnutrition. *J Dig Dis* 2013; 14 (7): 350–357.

18. Wedlake L J, Shaw C, Whelan K, Andreyev H J N. Systematic review: the efficacy of nutritional interventions to counteract acute gastrointestinal toxicity during therapeutic pelvic radiotherapy. *Aliment Pharmacol Ther* 2013; 37 (11): 1046–1056.
19. Department of Health. Governance arrangements for research ethics committees: a harmonised edition. Leeds: Department of Health, 2012. [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/213753/dh\\_133993.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/213753/dh_133993.pdf). Accessed on 9<sup>th</sup> May 2015.
20. Great Britain. Data Protection Act. London: Stationery Office, 1998.
21. General Medical Council. Good medical practice. Manchester: General Medical Council, 2013.
22. Denscombe M. The Good Research Guide for Small Scale Social Research Projects, 4<sup>th</sup> edition. Berkshire: Idea, 2010.
23. Henson C. Optimising the management of gastrointestinal symptoms following pelvic radiotherapy. PhD, the University of Manchester, Manchester, 2014.
24. Jenkinson C, Coulter A, Bruster S. The Picker Patient Experience Questionnaire: development and validation using data from in-patient surveys in five countries. *Int J Qual Health Care* 2002; 14 (5): 353–358.
25. Steine S, Finset A, Laerum E. A new, brief questionnaire (PEQ) developed in primary health care for measuring patients' experience of interaction, emotion and consultation outcome. *Fam Pract* 2001; 18 (4): 410–418.
26. Andreyev H J N. Gastrointestinal symptoms after pelvic radiotherapy: a new understanding to improve management of symptomatic patients. *Lancet Oncol* 2007; 8 (11): 1007–1017.
27. Mitchell E P. Gastrointestinal toxicity of chemotherapeutic agents. *Semin Oncol* 2006; 33 (1): 106–120.
28. Dunberger G, Lind H, Steineck G, Waldenström A C, Onelöv E, Avall-Lundqvist E. Loose stools lead to fecal incontinence among gynecological cancer survivors. *Acta Oncol* 2011; 50 (2): 233–242.
29. Jakobsson S, Ekman T, Ahlberg K. Living through pelvic radiotherapy: a mixed method study of self-care activities and distressful symptoms. *Eur J Oncol Nurs* 2014; 19 (3): 301–309.
30. Doyle C, Kushi L H, Byers T et al. Nutrition and physical activity during and after cancer treatment: an American Cancer Society guide for informed choices. *CA Cancer J Clin* 2006; 56 (6): 323–353.
31. Roberfroid M. Dietary fiber, inulin, and oligofructose: a review comparing their physiological effects. *Crit Rev Food Sci Nutr* 1993; 33 (2): 103–148.
32. Murphy J, Stacey D, Crook J, Thompson B, Panetta D. Testing control of radiation-induced diarrhea with a psyllium bulking agent: a pilot study. *Can Oncol Nurs J* 2000; 10 (3): 96–100.
33. Macmillan Cancer Support. Bowel problems after pelvic radiotherapy. UK: Macmillan Cancer Support, 2010. [http://www.nhs.uk/ipgmedia/national/Macmillan%20Cancer%20Support/Assets/Pelvicradiotherapyinmen-bowelproblems\(CB\).pdf](http://www.nhs.uk/ipgmedia/national/Macmillan%20Cancer%20Support/Assets/Pelvicradiotherapyinmen-bowelproblems(CB).pdf). Accessed on 20th January 2016.
34. Singh B. Psyllium as therapeutic and drug delivery agent. *Int J Pharm* 2007; 334 (1): 1–14.
35. National Cancer Institute. Managing chemotherapy side effects. National Cancer Institute, 2012. <http://www.cancer.gov/publications/patient-education/diarrhea.pdf>. Accessed on 19th January 2016.
36. Hamer H M, Jonkers D M A E, Venema K, Vanhoutvin S A L W, Troost F J, Brummer R J. Review article: the role of butyrate on colonic function. *Aliment Pharmacol Ther* 2008; 27 (2): 104–119.
37. Cook S I, Selin J H. Review article: short chain fatty acids in health and disease. *Aliment Pharmacol Ther* 1998; 12: 449–507.
38. American Cancer Society. Side effects from radiation therapy to the stomach and abdomen. ACS, 2015. <http://www.cancer.org/treatment/treatmentsandsideeffects/treatmenttypes/radiation/understandingradiationtherapyaguideforpatientsandfamilies/understanding-radiation-therapy-radiation-to-stomach-and-abdomen>. Accessed on 10th August 2016.
39. Wedlake L, Thomas K, McGough C, Andreyev H J N. Small bowel bacterial overgrowth and lactose intolerance during radical pelvic radiotherapy: an observational study. *Eur J Cancer* 2008; 44 (15): 2212–2217.
40. Shaw C, Taylor L. Treatment-related diarrhea in patients with cancer. *Clin J Oncol Nurs* 2012; 16 (4): 413–417.
41. Österlund P, Ruotsalainen T, Peuhkuri K et al. Lactose intolerance associated with adjuvant 5-fluorouracil-based chemotherapy for colorectal cancer. *Clin Gastroenterol Hepatol* 2004; 2 (8): 696–703.
42. Macmillan Cancer Support. Pelvic radiotherapy in women – side effects during treatment. Macmillan Cancer Support, 2013. <http://www.nhs.uk/ipgmedia/National/Macmillan%20Cancer%20Support/assets/Pelvicradiotherapyin-women-possiblesideeffects%28CB%29.pdf>. Accessed on 22nd July 2016.
43. Oates R W, Schneider M E, Lim Joon M et al. A randomised study of a diet intervention to maintain consistent rectal volume for patients receiving radical radiotherapy to the prostate. *Acta Oncol* 2014; 53 (4): 569–571.
44. Stubbe C E, Valero M. Complementary strategies for the management of radiation therapy side effects. *J Adv Pract Oncol* 2013; 4 (4): 219–231.
45. National Institute for Health and Care Excellence. Prostate cancer: diagnosis and management. NICE, 2014. <http://www.nice.org.uk/guidance/cg175>. Accessed on 2nd February 2016.
46. Andreyev H J N. Gastrointestinal problems after pelvic radiotherapy: the past, the present and the future. *Clin Oncol* 2007; 19 (10): 790–799.

## APPENDIX A

### Survey

#### A - Background Data

1. Are you male or female?  
 Male       Female
2. What age are you? (please state).....
3. What is your diagnosis?  
 Prostate Cancer       Bowel Cancer  
 Bladder cancer       Cervical Cancer  
 Endometrial Cancer  
 Other (please specify).....
4. When did you finish your radiotherapy?  
 0-2 weeks ago       3-4 weeks ago       5-6 weeks ago       More than 6 weeks ago
5. Have you had chemotherapy?  
 Yes       No
6. If you had chemotherapy was it  
 Before Radiotherapy       During Radiotherapy       After Radiotherapy

#### B - Management of Side Effects - Diarrhoea

1. During your radiotherapy treatment did you suffer from diarrhoea (passing three or more loose or liquid stools per day)?  
 Yes       No (If NO, go to Section C)
2. If yes is this still ongoing?  
 Yes       No
3. Please rate the severity of your diarrhoea (Please circle)  
1 = No impact      10 = Extremely distressing  
1      2      3      4      5      6      7      8      9      10
4. Did you need to take medicine to help ease your diarrhoea (e.g loperamide/immodium)?  
 Yes       No
5. Did you make any changes to your diet to help ease your diarrhoea?  
 Yes       No
6. If yes what were these changes?  
.....  
.....
7. Did this help ease your diarrhoea?  
 Yes       No       A little
8. Were you provided with any dietary advice by a healthcare professional during your radiotherapy to help ease your diarrhoea?  
 Yes       No
9. If yes which healthcare professional provided you with advice? Please tick more than one option if applicable.  
 Radiographer       Registered Hospital Dietician       Doctor       Nurse  
 Other (Please specify).....

**10 If yes what advice were you provided with to help ease your diarrhoea?  
Please tick more than one option if applicable.**

- Change your intake of fibre in your diet (Please specify.....)
  - Change your vegetable and fruit intake (Please specify.....)
  - Change your dietary fat intake (Please specify.....)
  - Reduce pulses
  - Reduce intake of lactose
  - Reduce intake of dairy
  - Increase water
  - Reduce fizzy drinks
  - Reduce caffeine
  - Reduce Spicy food
  - Eliminate alcohol
  - Other (please specify).....

## C - Management of Side Effects - Constipation

- Change your dietary fat intake (Please specify).....
  - Reduce pulses
  - Reduce intake of lactose
  - Reduce intake of dairy
  - Increase water
  - Reduce fizzy drinks
  - Reduce caffeine
  - Reduce Spicy food
  - Other (Please specify).....

#### **D - Management of Side Effects - Nausea**

- Increase water
  - Eat little and often
  - Other (Please specify.....)

E - Management of Side Effects – Gas and Flatulence

1. During your radiotherapy treatment did you suffer from gas and flatulence?  
   Yes       No (If NO, go to Section F)

2. If yes is this still ongoing?  
L Yes      L No

3. Please rate the severity of your gas and flatulence(Please circle)

4. Did you make any changes to your diet to help ease your gas and flatulence?  
□ Yes □ No

5. If yes, what were these changes?.....  
.....

6. Did this help ease your gas and flatulence?

Yes       No       A little

7. Were you provided with any dietary advice by a healthcare professional during your radiotherapy to help with your gas and flatulence whilst undergoing radiotherapy?  
1 Yes    2 No

8. Which healthcare professional provided you with advice? Please tick more than one option if applicable.

9. If yes what advice were you provided with to help ease your gas and flatulence?  
*Please tick more than one option if applicable.*

- Change your intake of fibre in your diet (Please specify.....)

Change your fruit intake (Please specify.....)

Change your vegetable intake (Please specify.....)

Reduce dietary fat

Reduce pulses

Reduce intake of lactose

Reduce intake of dairy

Drink peppermint tea

Drink ginger tea

Increase water

Reduce fizzy drinks

Omit Alcohol

Reduce caffeine

Reduce Spicy food

Other.....



Please give details.....  
.....

1. Were you provided with any written information or information booklets that provided dietary advice to help manage possible side effects from radiotherapy?  
 Yes       No

2. If yes who provided you with written information? Please tick more than one option if applicable.  
 Radiographer       Registered Hospital Dietician       Doctor       Nurse  
 Other (Please specify).....

3. If yes what written information were you given? Please tick more than one option if applicable.

NHS Hospital Written Information  
 Macmillan Cancer support Booklets  
 Other (please specify).....

4. Did you find the written information helpful?  
 Yes       No       Sometimes

Please give details.....  
.....

5. Overall was your dietary intake affected whilst receiving your radiotherapy treatment?  
 Yes       No       A little

Please Specify  
.....  
.....

6. Did you seek advice about managing side effects from elsewhere outside of the hospital or radiotherapy department?  
 Yes       No

If yes where did you get advice from?.....  
.....

7. If you obtained advice from elsewhere was this helpful?  
 Not Applicable       Yes       No

8. Do you have any additional suggestions about what helped in managing your side effects whilst undergoing radiotherapy treatment?  
.....  
.....

9. Do you have any suggestions that could have improved the care provided to you regarding the management of your side effects?  
.....  
.....

Thank you for taking the time to complete this survey