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Diet and Behavior Modifications by Long-Term Rectal Cancer Survivors to Manage Bowel Dysfunction-Associated Symptoms

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Abstract

Background: Rectal cancer (RC) survivors experience significant bowel function issues after treatment. We aimed to describe self-reported dietary and behavioral modifications among long-term (≥ 5 years) RC survivors to manage bowel dysfunction.

Methods: RC survivors from Kaiser Permanente Northern California and Northwest regions completed surveys either via postage-paid return mail or telephone. Summary statistics on diet/behavioral modifications data were tabulated by proportion of responses. Modifications and frequency of bowel symptoms cited and were compared by ostomy status.

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Results: A total of 575 respondents were included (overall response rate = 60.5%). Fruits and vegetables were troublesome for symptoms, but was also helpful in mitigating constipation, obstruction, and frequency, as well as improving predictability. Many respondents attributed red meat (17.7%), fried foods (13.9%), spicy foods (13.1%), carbonated beverages (8.0%), and sweets (7.6%) to increased diarrhea, gas, and urgency. Common behavioral modifications included controlling meal portions (50.6%), timing regularity (25.3%), and refraining from late night eating (13.8%). Permanent ostomy survivors were more likely to report symptoms of obstruction, while anastomosis survivors were more likely to report urgency.

Conclusions: Multiple modifications were attempted by RC survivors to manage bowel symptoms. Identifying diet changes among RC survivors can improve symptom management and survivorship care.

INTRODUCTION

In 2017, approximately 40,000 Americans will be diagnosed with rectal cancer (RC); 68% of these individuals are estimated to be long-term survivors (>5 years).^{1,2} The treatment of RC is multimodal, and current standard of care involves the sequenced combination of surgery, radiotherapy, and chemotherapy. The determination of an optimal treatment regimen for RC is complex. The decision-making process often involves careful consideration of the functional sequelae of treatments, which includes the creation of a permanent stoma or the possibility of maintaining or restoring normal bowel function/continence.

Bowel dysfunction is one of the most common long-term effects of RC treatment, regardless of ostomy status (permanent ostomy or anastomosis). The term “low anterior resection syndrome” is often used to describe the constellation of bowel dysfunction-related symptoms, such as fecal incontinence, frequency, urgency, sense of incomplete fecal evacuation, and lack of flatulence control,^{3–6} associated with sphincter-sparing resection of part or all of the rectum. The impact of bowel dysfunction on health-related quality of life (HRQOL) is well-known; fecal incontinence and urgency significantly affect social and psychological functioning in survivors.^{7–9} Our previous research suggests that survivors who take longer after surgery to become comfortable with their diet or regain their appetite are more likely to report worse HRQOL.¹⁰ In addition, permanent ostomies are associated with substantial HRQOL challenges including leakage, skin complications, dissatisfaction with appearance, and interference with work and activities.^{11–16} Bowel control may vary more for survivors with anastomoses, and persistent problems with fecal incontinence and gas are common.^{8,17}

RC survivors face psychological and behavioral adjustments to manage bowel dysfunction. Importantly, bowel symptoms may be modifiable; efforts to identify and evaluate lifestyle approaches that contribute to symptom relief are needed. However, empirically-based interventions to manage bowel dysfunction are lacking. The American Cancer Society Colorectal Cancer Survivorship guidelines categorized the level of evidence for bowel function interventions at level III, with evidence from case studies or reports only.¹⁸ Strategies include functional self-care, social activity alterations, and complementary/alternative approaches.¹⁹ Antidiarrheal medications and bulking agents, protective pads/

diapers, and dietary modifications are common functional self-care strategies. Social activity alterations are used to prevent bowel accidents in public.²⁰ Complementary therapies are less frequently reported.²⁰ Dietary and behavioral adjustments are common functional self-care strategies for managing bowel dysfunction.^{17,21,22} More than half of RC survivors report dietary adjustments and intentional social isolation to prevent bowel accidents in public.²³ Our previous research suggests that survivors pursue substantial, permanent dietary and behavioral modifications after surgery, regardless of ostomy status.¹⁰ Other potential interventions include low-fat or elemental diets, probiotic supplementation, biofeedback therapy, and pelvic or abdominal musculature exercise.¹⁸ RC survivors often report that they were unable to obtain adequate information on long-term treatment effects, and that adequate knowledge of the impact of long-term effects such as bowel dysfunction may have altered their initial choice of treatment.²⁴

The prevalence of dietary modifications and alteration of daily activities in RC survivors has been described for only a small number of studies,^{17,21,22} and evidence describing the specific types of dietary and daily activity changes is lacking. We previously described the dietary and behavioral adjustments undertaken by 856 long-term CRC survivors to achieve bowel control, which included the identification of helpful and troublesome foods, meal and non-meal related behavioral adjustments, and the use of exercise and medications.¹⁰ With the current analysis, we aimed to describe the specific dietary and behavioral modifications used by long-term (≥ 5 years) RC survivors to manage bowel dysfunction-associated symptoms. We sought to answer the following questions: (1) what dietary and behavioral modifications are attributed to specific bowel-dysfunction symptoms? and (2) what are the proportions of symptom citations and modifications by ostomy status?

MATERIALS AND METHODS

Sample and Setting

This analysis was performed using data from a population-based survey study conducted between 2010 and 2011 that enrolled RC survivors from Kaiser Permanente (KP), a large integrated healthcare delivery system. The methods of this study have been published elsewhere.^{25,26} In brief, we recruited long-term (≥ 5 years post-diagnosis) RC survivors from two KP regions (Northern California and Northwest). Eligible survivors were identified through the tumor registry at each site based on the following criteria: 1) diagnosed with RC at least 5 years prior to the survey; 2) history of a major intra-abdominal operation that resulted in either a permanent ostomy or anastomosis; 3) were members of the two KP regions at the time of survey; and 4) age 18 years or older. Survivors who were undergoing cancer treatment at the time of survey and those who requested no contact were excluded.

Procedures and Outcome Measures

All studies were approved by the University of Arizona Institutional Review Board (coordinating site) and collaborating KP sites. Eligible participants received a mailed survey packet that was sent by their respective KP site. The packet included the following: 1) a cover letter; 2) the validated City of Hope Quality of Life Colorectal Cancer (COH-QOL-CRC) survey; and 4) a postage-paid, pre-addressed return envelope. Informed consent was

obtained from each patient through mailed surveys. Survivors were given the option of completing the written survey or answering questions via telephone. Participants who did not return completed packets within two weeks following the mailings were contacted by telephone. Survivors who refused participation were no longer contacted.

The COH-QOL-CRC was developed by Grant and colleagues, and the tool assesses HRQOL in the four domains of physical, psychological, social, and spiritual well-being.^{27–31} The first component consists of 47 closed-choice and open-ended items, and the second component contains 43 HRQOL items evaluated using 11-point Likert scales. Two versions of the COH-QOL-CRC are available based on ostomy status (permanent ostomy versus anastomosis). Subjects were classified into three surgery groups: permanent ostomy (PO), anastomosis with no history of temporary ostomy (AN), and anastomosis with history of temporary ostomy (TO). Within the survey, several items are included to elicit diet and behavioral modifications. Two items addressed self-reported helpful and troublesome foods (“since your surgery, are there any foods or drinks that has helped [caused problems] with your bowel function?”). Supplement/medication use was solicited using one item (“since your surgery, are there any supplements, medicines, or any other products that has helped with your bowel function?”). Behavior modifications (“since your surgery, are there any other changes that have helped with your bowel function?”) was also solicited with one item. For each of the four questions, participants selected the associated bowel symptoms (obstruction, predictability, constipation, gas, nausea, diarrhea, vomiting, bloating, urgency, skin irritation around ostomy [or around the anus for anastomosis patients]) that were helped or exacerbated by each specific modification. Medical history items were extracted from the KP electronic medical record, including length of time since surgery, radiation treatment, chemotherapy, and the Charlson-Deyo comorbidity index.³²

Statistical Analysis

Responses from all four questions on diet and behavioral modifications were initially pooled and tallied to facilitate analysis. Several co-authors reviewed the responses and created codes for each of the four questions. For helpful and troublesome foods, each response for specific food items were grouped into higher-level food categories. For supplements and medications, a similar approach was used, whereby each specific supplement/medication was grouped into higher-level class categories. For behavior modification, where responses were primarily provided in free-text, written comments, the responses were coded and categorized using content analysis. All questions, responses and/or categories that were mentioned less than 9 times were re-coded into broader categories. All responses were double-coded by co-authors, and data that were discordantly coded were discussed with all investigators for refinement and consensus.

Subject characteristics that were continuous measures were compared across three ostomy status groups (PO, AN, TO) with one-way ANOVA, including Bonferroni-corrected, post-hoc contrasts performed if the overall ANOVA F-test was significant ($p < .05$). Categorical subject characteristics and the frequency of symptoms cited at least once were compared across the three ostomy status groups with chi-square or Fisher’s exact test; when difference in symptoms cited across three groups was significant, we performed two pairwise

Bonferroni-corrected contrasts. Summary statistics (frequencies and percentages) were tabulated for all modification item coded responses and percent of subjects responding within the four modification questions. We summarized diet/behavior modifications by ostomy status without statistical testing. A p-value <.05 was considered statistically significant. Analysis was performed with Stata 14.0 (StataCorp, College Station, TX).

RESULTS

Demographic Characteristics

The overall response rate to the survey was 60.5% (575 complete/951 eligible). Of the 575 RC survivors who completed the survey, 382 (66.4%) responded to at least one of the four questions on diet and behavior modifications. Affirmative response rates to each of the four questions were as follows: 200 (35%) identified helpful foods, 237 (41.2%) identified troublesome foods, 205 (43%) identified helpful supplements/medications, and 87 survivors (20.4%) endorsed various forms of behavior modification. As shown in Table 1, the majority of survivors were in the Anastomosis group (AN, 56.2%), followed by Permanent Ostomy (PO, 30.3%), and Temporary Ostomy (TO, 13.3%). Mean age at survey ranged from 68.4 to 72.9 years. Years since diagnosis and surgery were significantly longer in the PO group ($p < .001$).

Helpful and Troublesome Foods for Bowel Symptoms

As shown in Table 2, the majority of respondents endorsed fruits and vegetables as helpful for bowel symptoms (58% and 42.5%, respectively). “Helpful” fruits included various fruit juices, prunes, bananas, apples, and dried fruits. Helpful vegetables included leafy greens and brassica (cabbage or mustard family greens). Fruits and vegetables were attributed to mitigating constipation, obstruction, frequency, and improved predictability. Beyond fruits and vegetables, survivors also endorsed beverages, such as water (28.5%). Other unique “helpful” foods included fiber-rich foods (23.5%), cereal (14.0%), bread (8.0%), and starches (7.5%).

Troublesome foods are reported in Table 2. Survivors reported a wide range of troublesome food categories for bowel symptoms; these included vegetables (75.5%), dairy (36.3%), fruits (31.2%), protein (31.2%), fats/fried foods (19.4%), spices/spicy food (18.6%), starches (15.2%), nuts (14.8%), and sugar (10.1%). Specific troublesome vegetables included cabbage, beans, celery, corn, lettuce, onions, and spinach. Other troublesome foods included red meat (17.7%), carbonated beverages (8.0%), sweets (7.6%), sugar substitutes (2.5%), and alcohol (5.1%); these foods reportedly increased diarrhea, gas, and urgency. Interestingly, several foods and food groups were reported as both helpful and troublesome: vegetables (specifically cabbage), fruits, and beverages such as coffee.

Supplements and Medications for Managing Bowel Symptoms

Table 3 summarizes supplements/medications used by survivors to manage bowel symptoms. These included anti-diarrheals (34.6%), dietary fiber supplements (24.4%), stool softeners (22.0%), laxatives (18.5%), antacid (8.3%), and probiotics (7.3%). Prescription medications, including opioids, were also cited as helpful for bowel symptoms.

Behavioral Modifications for Bowel Control

As shown in Table 3, behavior changes were primarily meal-related, and focused on timing and quantity of food consumption. Content analysis of free text comments revealed four themes: meal portions (50.6%), regular time for meals (25.3%), no late eating (13.8%), and grazing (11.5%). Overall, the majority of survivors endorsed smaller meal portions (35.6%) and eating less (14.9%) as an effective behavioral strategy for bowel control. These strategies reportedly mitigated constipation, obstruction, bloating, frequency, urgency, and improved bowel predictability. Other behavioral adjustments included not eating before or after activities (8.0%), not eating at all (6.9%), snacking at regular times (3.4%), eating less when traveling (2.3%), and chewing food thoroughly (1.1%).

Proportion of Symptoms Cited and Modifications by Ostomy Status

Symptoms and associated diet/behavioral modification reported by RC survivors were compared by ostomy status. As shown in Table 4, PO survivors were more likely to report obstruction (PO 28.5% vs TO 9.8%, $p=.02$; PO 28.5% vs AN 12.1%, $p=.002$). Urgency was significantly more likely in subjects with anastomosis, for both AN vs PO (23.7% vs 6.0%, $p=.002$) and TO vs PO (23.5% vs 6.0%, $p=.002$). AN survivors were more likely to report constipation compared to PO (AN 54.4% vs PO 37.9%, $p=.008$). TO survivors were more likely to report diarrhea compared to PO (TO 62.8% vs PO 42.2%, $p=.04$). Pain, cramping, and discomfort were more likely to be reported by TO compared to AN survivors (TO 3.9% vs AN 0%, $p=.04$).

As shown in Figure 1, a greater proportion of AN survivors reported vegetables being helpful for bowel control (AN 40.2% vs PO 22.6% vs TO 19%), whereas more PO and TO survivors reported vegetables being troublesome (AN 37.6% vs PO 51.3% vs TO 53%). A greater proportion of PO survivors reported nuts as being troublesome for bowel symptoms (PO 21.3% vs AN 6.4% vs TO 12%). AN and TO survivors reported more frequent use of dietary fiber for bowel symptoms (AN 23.7%, TO 28.6% vs PO 11.1%). For behavioral adjustments, more PO survivors endorsed regular timing of meals as “helpful” with bowel symptoms (PO 36.6% versus AN 19.1%).

DISCUSSION AND CONCLUSION

Bowel dysfunction and associated symptoms are among the most common and feared long-term effect of RC treatment, and adversely affect survivors' HRQOL.^{33,34} Several self-management strategies for bowel control have been reported by our research team and others; these include physical activity, dietary modification, supplements, medications, and behavioral change.^{10,35} Importantly, bowel symptoms are modifiable, underscoring the need to identify and test approaches that contribute to symptom relief. A better understanding of the specific diet patterns and behavior changes that survivors undertake to achieve bowel control could lead to interventions to mitigate the negative impact of bowel dysfunction.³⁶ However, in the United States, there are inconsistencies in the implementation of state-level and national dietary guidelines for cancer survivorship.

Our findings confirm that in long-term RC survivors, diet and behavior modifications are common self-management strategies used to achieve bowel control. We had previously reported that dietary adjustments occurred regardless of ostomy status (40.5% ostomy, 42.7% anastomosis).¹⁰ We also found that it took survivors up to 12 months to be comfortable with their diet, and that a subset of survivors never felt comfortable with their diet (18.9% ostomy, 11.3% anastomosis). Survivors who took longer to adjust to their diet or never felt comfortable with their diet were significantly more likely to report poor HRQOL.¹⁰ These findings suggest that interventions to support diet adjustments and quality could result in improved HRQOL for RC survivors.

Our analysis revealed several interesting findings. First, we observed tremendous variation in diet modifications applied by RC survivors to achieve bowel control. This may be due to several potential factors, including use of trial-and-error approaches for choice of modifications, a lack of structured guidance and coaching, lack of access to evidence-based information on the relationship of diet and bowel symptoms, and inconsistent efficacy that results in variations in diet choice. Factors such as age, gender, level of education, time from surgery, ostomy status, level of physical activity, and variability of baseline diet could also potentially explain the variations observed in our findings. Importantly, survivors reported foods such as vegetables and fruits to be both helpful and troublesome for symptoms. For survivors who have trouble tolerating vegetables and fruits, the association with bowel problems could influence survivors' ability to adhere to survivorship diet recommendations that may affect recurrence and survival.^{37,38} In addition, studies have shown that RC survivors receive inadequate and inconsistent information on bowel dysfunction from healthcare professionals, including physicians, nurses, as well as registered dietitian nutritionists (RDNs).²⁴ This limited their ability to manage bowel symptoms and participate in shared treatment decision-making. Beyond symptom management, a healthy diet has been associated with decreased recurrence and improved survival after RC.^{39–41} Yet, current dietary guidelines for cancer survivorship do not address the unique needs of RC survivors suffering from bowel symptoms, and may not be congruent with self-prescribed diet modifications for symptom management. Behavioral approaches in the context of cancer survivorship require personalization to balance the risk-benefit ratio in relation to not only the modification of food selections that impact bowel symptoms, but also in consideration of their role in promotion of survival after a cancer diagnosis.

While this is one of the first reports on this subject matter, limitations of this study should be noted. First, our data maybe subject to recall bias. Second, the analysis may not fully explain the effect of time since surgery on modifications and differences observed by ostomy status. For example, time since diagnosis and surgery were longer for the permanent ostomy survivors and may have confounded our findings. Many survivors who participated in the study were approximately 14 years after surgery at the time of the survey. In addition, the mean age of our sample was about 70 years. These factors could have influenced our findings because bowel symptoms may be different by age and over time. Strengths of the study include a large population-based sample of RC survivors that is well-characterized.

In summary, long-term RC survivors used multiple diet and behavior modifications to manage their persistent bowel dysfunction symptoms. Food choices and diet modification

appeared to be very individualized, although some specific foods can be suggested to improve bowel function. Nutrient-rich foods, such as fruits and vegetables, can be helpful for some survivors, but difficult to tolerate for others. Clearly, more research is needed to identify factors that distinguish these two diametrically-opposed responses. Despite these discrepancies, findings from our current analysis will assist with the design of dietary behavior change interventions for symptom management in RC survivors. The intervention should be personalized to the survivor's tolerance, preference, culture, and context. It should coach survivors in making appropriate dietary and behavior modification based on specific triggers that affect bowel function. Coaching on dietary changes should help patients make connections between what they consume and their bowel function, and to develop plans for designing and testing food and medication strategies to optimize bowel function. Most importantly, diet modifications in the context of symptom management can serve as “teachable moments” to promote healthy diet choices for long-term survival.

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*PO = permanent ostomy; AN=anastomosis; TO=temporary ostomy

Figure 1 Parts A-D.
Diet and Behavioral Modifications by Ostomy Status

Table 1.

Subject characteristics by ostomy status

Characteristics	Permanent Ostomy (N=116)	Anastomosis (N=215)	Temporary Ostomy (N=51)	p-value
Age (yr), mean $\pm$ SD	72.9 $\pm$ 11.6	71.7 $\pm$ 10.9	68.4 $\pm$ 10.4	.06
Age at diagnosis (yr), mean $\pm$ SD	57.4 $\pm$ 12.5	58.5 $\pm$ 10.7	56.9 $\pm$ 10.9	.53
Male, n (%)	74 (63.8)	109 (50.7)	33 (64.7)	.03
Race/Ethnicity, n (%)	91 (78.5)	171 (79.5)	45 (88.2)	.33
Non-Hispanic White	10 (8.6)	8 (3.7)	0 (0)	
Hispanic	4 (3.5)	8 (3.7)	1 (2.0)	
African American	7 (6.0)	19 (8.8)	2 (3.9)	
Asian	4 (3.5)	9 (4.2)	3 (5.9)	
Other/unknown/mixed				
Education: college degree, n (%)	32 (27.6)	93 (43.3)	14 (27.5)	.001
Yes	80 (69.0)	97 (45.1)	31 (60.8)	
No	4 (3.5)	25 (11.6)	60 (11.8)	
Missing				
Income over \$50,000/yr, n (%)	48 (41.4)	96 (44.7)	23 (45.1)	.60
Yes	63 (54.3)	99 (46.1)	25 (49.0)	
No	5 (4.3)	20 (9.3)	3 (5.9)	
Missing				
Married/Partnered, n (%)	80 (70.2)	130 (60.5)	42 (82.4)	.007
Years since diagnosis, mean $\pm$ SD	14.7 $\pm$ 7.3	12.7 $\pm$ 5.2 ^I	11.1 $\pm$ 4.6 ^I	<.001
Years since surgery, mean $\pm$ SD	14.6 $\pm$ 7.5	12.6 $\pm$ 5.2 ^I	10.8 $\pm$ 4.9 ^I	<.001

^I significantly different from permanent ostomy, p<.05 Bonferroni adjusted

Table 2.

Helpful and Troublesome Foods and Associated Bowel Symptoms

HELPFUL FOODS (N=200)											
Foods	Mentions	Percent of responses (n= 587)	Percent of Subjects (n=200)	Constipation/Obstruction/Bloating/Pain	Predict/ Frequency	Gas	Diarrhea	Urgency	Nausea/Vomiting	Skin Irritation	General Wellbeing
Fruits											
Total	232	39.5	58.0	134	37	25	16	6	0	0	0
Juice	59	10.1	29.5	36	14	9	4	2	0	0	0
Prunes	47	8.0	23.5	39	6	6	0	1	0	0	0
Bananas	14	2.4	7.0	3	1	0	6	1	0	0	0
Apples	13	2.2	6.5	6	1	4	3	2	0	0	0
Dry Fruit	11	1.9	5.5	8	1	1	0	0	0	0	0
Stone Fruit	10	1.7	5.0	7	0	0	0	0	0	0	0
Other Fruits [‡]	78	13.3	39.0	35	14	5	3	0	0	0	0
Vegetables											
Total	85	14.5	42.5	50	18	18	5	3	2	3	0
Green Leafy Vegetables	17	2.9	8.5	12	5	2	2	1	1	1	0
Brassica (cabbage/mustard family)	9	1.5	4.5	2	2	3	0	1	0	0	0
Other Vegetables [‡]	59	10.1	29.5	36	11	13	3	1	1	2	0
Beverages											
Total	84	14.3	42.0	41	18	7	9	7	2	6	5
Water	57	9.7	28.5	29	11	5	5	3	1	4	2
Tea	14	2.4	7.0	7	2	2	3	3	1	1	2
Coffee	13	2.2	6.5	5	5	0	1	1	0	1	1
Starches											
Total	80	13.6	40.0	26	12	10	15	7	3	1	1
Cereal	28	4.8	14.0	12	7	4	1	2	0	0	1
Bread	16	2.7	8.0	3	2	2	6	2	2	1	0

Foods	Mentions	Percent of responses (n= 587)	Percent of Subjects (n=200)	Constipation/Obstruction/Bloating/Pain	Predict/ Frequency	Gas	Diarrhea	Urgency	Nausea/ Vomiting	Skin Irritation	General Wellbeing
Starches (general)	15	2.6	7.5	1	0	0	2	0	0	0	0
Beans	11	1.9	5.5	7	2	3	0	0	0	0	0
Rice	10	1.7	5.0	3	1	1	6	3	1	0	0
Fiber (general)											
Total	47	8.0	23.5	23	12	4	3	2	0	1	0
Proteins											
Total	34	5.8	17.0	5	10	6	6	4	0	1	1
Protein (general)	15	2.6	7.5	1	1	1	0	0	0	0	1
Poultry	10	1.7	5.0	3	4	3	3	3	0	0	0
Red meat	9	1.5	4.5	1	5	2	3	1	0	1	0
Dairy											
Total	25	4.3	12.5	7	4	3	7	2	0	2	0
Cheese	13	2.2	6.5	1	3	1	4	2	0	1	0
Yogurt	12	2.0	6.0	6	1	2	3	0	0	1	0
TROUBLESOME FOODS (N=237)											
Vegetables											
Total	179	26.4	75.5	77	6	112	57	26	11	8	0
Brassica (cabbage/ mustard family)	43	6.4	18.1	23	0	34	10	2	2	1	0
Beans	40	5.9	16.9	15	2	34	13	7	1	0	0
Bulky, fibrous (celery, corn)	17	2.5	7.2	14	1	2	2	0	4	0	0
Green Leafy Vegetables	16	2.4	6.8	3	1	7	8	5	0	3	0
Onions	10	1.5	4.2	1	1	9	4	4	0	0	0
Spinach	9	1.3	3.8	1	0	3	6	1	0	0	0
Other Vegetables [†]	44	6.5	18.6	20	1	23	14	7	4	4	0
Dairy											
Total	86	12.7	36.3	41	10	43	47	25	6	2	0

Foods	Mentions	Percent of responses (n= 587)	Percent of Subjects (n=200)	Constipation/Obstruction/Bloating/Pain	Predict/ Frequency	Gas	Diarrhea	Urgency	Nausea/Vomiting	Skin Irritation	General Wellbeing
Fruits											
Total	74	10.9	31.2	27	5	15	27	6	4	8	0
Tomatoes	14	2.1	5.9	7	2	6	3	1	1	3	0
Other Fruits [†]	60	8.9	25.3	20	3	9	24	5	3	5	0
Proteins											
Total	74	10.9	31.2	30	5	20	25	0	6	2	0
Red meat	42	6.2	17.7	22	2	6	12	6	4	1	0
Processed Meats	11	1.6	4.6	2	0	4	4	0	1	0	0
Protein (general) [†]	21	3.1	8.9	6	3	10	9	3	1	1	0
Added Fats											
Total	46	6.8	19.4	16	1	12	31	19	1	3	0
Fried	33	4.9	13.9	10	1	10	25	14	1	3	0
Added fats (general) [†]	13	1.9	5.5	6	0	2	6	5	0	0	0
Spices											
Total	44	6.5	18.6	13	5	20	25	9	2	15	0
Spicy foods	31	4.6	13.1	10	4	16	17	7	2	14	0
Spice (general) [†]	13	1.9	5.5	3	1	4	8	2	0	1	0
Beverages											
Total	39	5.8	16.5	14	5	19	14	7	0	3	0
Carbonated drinks	19	2.8	8.0	7	3	11	3	4	0	0	0
Coffee	14	2.1	5.9	4	2	7	8	3	0	2	0
Other Beverages [†]	6	0.9	2.5	3	0	1	3	0	0	1	0

Foods	Mentions	Percent of responses (n= 587)	Percent of Subjects (n=200)	Constipation/Obstruction/Bloating/Pain	Predict/ Frequency	Gas	Diarrhea	Urgency	Nausea/ Vomiting	Skin Irritation	General Wellbeing
Starches											
Total	36	5.3	15.2	33	3	8	5	5	0	2	0
Bread	23	3.4	9.7	18	1	1	2	3	0	0	0
Starches (general) [‡]	13	1.9	5.5	15	2	7	3	2	0	2	0
Nuts											
Total	35	5.2	14.8	31	2	2	6	2	3	3	0
Peanuts	10	1.5	4.2	9	1	1	0	0	1	0	0
Nuts (general) [‡]	25	3.7	10.5	22	1	1	6	2	2	3	0
Fiber (general)											
Total	28	4.1	11.8	21	1	9	8	2	2	1	0
Sugar											
Total	24	3.5	10.1	8	1	8	15	2	1	3	0
Sweets	18	2.7	7.6	8	1	7	11	1	1	3	0
Sugar substitutes	6	0.9	2.5	0	0	1	4	1	0	0	0
Alcohol (general)											
Total	12	1.8	5.1	3	2	5	6	1	0	3	0

^{*} Mentioned at least 9 times to be listed separately

[‡] Combined all fruits mentioned less than 9 times

[‡] Combined all vegetables mentioned less than 9 times

Table 3.

Supplements/Medications and Behavioral Changes that Improved Bowel Symptoms

Variable	Mentions	Percent of responses (n= 300)	Percent of Subjects (n=205)	Constipation/Obstruction/Bloating/Pain	Predict/ Frequency	Gas	Diarrhea	Urgency	Nausea/Vomiting	Skin Irritation	Other
SUPPLEMENTS/MEDICATIONS (N=205)											
Anti-Diarrheals											
Total	71	23.6	34.6	8	13	5	60	14	0	1	0
Imodium	46	15.3	22.4	7	8	3	36	9	0	1	0
Lomotil	17	5.6	8.3	0	5	0	16	3	0	0	0
Other Anti-Diarrheals [†]	8	2.6	3.9	1	0	2	8	2	0	0	0
Dietary Fiber Supplements											
Total	50	16.6	24.4	26	23	4	8	4	0	3	10
Metamucil	28	9.3	13.7	18	12	1	5	3	0	2	3
Other Dietary Fiber Suppl. [‡]	22	7.3	10.7	8	11	3	3	1	0	1	7
Stool Softeners											
Total	45	15.0	22.0	52	10	7	0	2	1	0	2
Laxatives											
Total	38	12.6	18.5	40	11	4	3	0	2	1	2
Milk of Magnesia	11	3.6	5.4	13	3	2	1	0	1	1	1
Other Laxatives [†]	27	9.0	13.2	27	8	2	2	0	1	0	1
Antacids											
Total	17	5.6	8.3	10	1	12	2	0	2	0	1
Probiotics											
Total	15	5.0	7.3	9	7	6	5	2	1	1	2
Prescription Medications											
Total	12	4.0	5.9	4	3	2	2	2	0	2	2
Anti-Gas											

Variable	Mentions	Percent of responses (n= 300)	Percent of Subjects (n=205)	Constipation/Obstruction/Bloating/Pain	Predict/ Frequency	Gas	Diarrhea	Urgency	Nausea/ Vomiting	Skin Irritation	Other
Total	11	3.6	5.4	2	0	11	0	1	0	0	0
Opioids											
Total	9	3.0	4.4	1	2	0	6	2	0	2	1
Other Supplements/Medications/Products [†]											
Total	32	10.6	15.6	12	5	4	2	4	0	5	7
BEHAVIORAL CHANGES (N=87)											
Meal Portions											
Total	44	41.1	50.6	30	16	15	11	7	5	0	0
Smaller Meals	31	29.0	35.6	24	10	9	6	5	4	0	0
Eat Less	13	12.1	14.9	6	6	6	5	2	1	0	0
Regular Time for Meals											
Total	22	20.6	25.3	5	14	5	5	2	0	0	6
No Late Eating											
Total	12	11.2	13.8	7	4	5	3	2	2	0	2
Graze											
Total	10	9.3	11.5	6	5	1	2	3	1	0	2
Other Behavior Changes [†]											
No eating before or after activity	7	6.5	8.0	0	1	2	2	1	0	0	1
Not Eating	6	5.6	6.9	3	3	2	0	1	0	0	0
Regular time of Snacks	3	2.8	3.4	1	1	1	2	1	0	0	0
Eat Less When Traveling	2	1.9	2.3	0	2	0	0	0	0	0	0
Chew Thoroughly	1	0.9	1.1	1	0	0	0	0	0	0	0

* Mentioned at least 9 times to be listed separately

[†] Combined all items mentioned less than 9 times

Table 4.

Symptoms reported associated with modifications by ostomy status

Symptom	Permanent Ostomy (n=116)	Anastomosis (n=215)	Temporary Ostomy (n=51)	p-value
Constipation	44 (37.9)	117 (54.4) ²	23 (45.1)	.02
Obstruction	33 (28.5) ³	26 (12.1)	5 (9.8)	<.001
Bloating	27 (23.3)	57 (26.5)	14 (27.5)	.77
Pain, cramps, discomfort	2 (1.7)	0 (0)	2 (3.9) ⁴	.02
Predictability	68 (58.6)	107 (49.8)	29 (56.9)	.27
Gas	34 (29.3)	65 (30.2)	16 (31.4)	.96
Diarrhea	9 (42.2)	102 (47.4)	32 (62.8) ⁵	.05
Urgency	7 (6.0) ⁶	51 (23.7)	12 (23.5)	<.001
Nausea	8 (6.9)	15 (6.5)	3 (5.9)	.99
Vomiting	5 (4.3)	10 (4.7)	2 (3.9)	.99
Skin irritation ¹	23 (19.8)	40 (18.6)	4 (7.8)	.12
General wellbeing	2 (1.7)	3 (1.4)	0 (0)	.99

¹ Skin around stoma for ostomy, around anus for anastomosis² p<.01 AN vs PO³ p<.05 PO vs AN, PO vs TO⁴ p<.05 TO vs AN⁵ p<.05 TO vs PO⁶ p<.01 PO vs AN, PO vs TO