# University of Dundee

## Lifestyle in patients at increased risk of colorectal cancer

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**Lifestyle in patients at increased risk of colorectal cancer**

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**Specific role / authorship of all the authors**

ASA is Principal Investigator. ASA & RJS contributed to the conception and design of the study SC was responsible for data collection. ASA & SC contributed to data analyses. All authors contributed to the interpretation of data, drafting of the paper and a critical review of its content and the final version submitted for publication.

**Conflict of Interest**

The authors declare that they have no conflicts of interest.

## Abstract

### Aim

To assess modifiable risk factors in patients at high risk for colorectal cancer (CRC) and their experience of lifestyle advice.

### Method

A questionnaire study in high risk CRC patients attending for surveillance colonoscopy. Current lifestyle behaviours (smoking, alcohol, diet [fruit and vegetables, wholegrains, red meat, processed meat], physical activity and bodyweight) related to CRC were ascertained and experience on receiving, seeking and desire for advice were queried.

### Results

In total, 385 study invitations were sent and 208 (54%) questionnaires were returned. The majority of participants (72%) were estimated to have a BMI outwith the healthy range, 89% achieved a fibre score indicative of a low plant based diet and 91% reported eating processed meat. Overall, 36% were achieving at least 4 recommendations and 2% adhering to all recommendations examined. The main area which participants reported receiving advice on was body weight (33%) and 31% reported they had personally sought information on this topic although the data suggest that 72% of people may benefit from such guidance. Fewer participants reported receiving (18 to 26%) and seeking (15 to 17%) dietary advice on fruits, vegetables and wholegrains. Many participants said they would find lifestyle information useful, notably in relation to body fatness (43%) and physical activity (38%).

### Conclusion

The development of a process for supporting lifestyle change in this patient group, who are already engaging in positive health practices (regular colonoscopy surveillance) could usefully be identified and tested.

**Introduction**

Colorectal cancer is the third most common cancer worldwide. Risk for the disease includes non-modifiable factors (principally age, presence of inflammatory bowel disease and a strong family history) [1]. The influence of these factors on disease development may be modified by lifestyle factors [1, 2]. Current estimates for the role of lifestyle factors in the development of colorectal cancer (CRC) in the general population suggest that around half of the disease can be accounted for by high intakes of red and processed meat and alcohol, raised body weight and low levels of dietary fibre intake and physical activity [3].

People considered at increased risk of CRC (a previous diagnosis of adenomatous polyps, previous CRC, a strong family history of CRC and long-standing inflammatory bowel disease) are probably equally (or more) susceptible to lifestyle related risk than the general population. In a pooled analysis, Cho et al [4] reported that the relative risks of CRC with alcohol intakes of ≥30 g/d were 1.23 (95%CI 0.96 - 1.57) among those with no family history and 2.02 (95%CI 1.30 - 3.13) among those with a family history of the disease. There is some evidence of an increased risk by family history and body mass index (BMI) most recently highlighted by Movahedi et al [1], who reported that in patients with Lynch syndrome in the CAPP 2 study [5], obesity was associated with a 2.41 (95%CI 1.22 - 4.85) relative risk of developing CRC compared to participants with a BMI <25 kg/m2 (reference group), and CRC risk increased by 7% for each 1kg/m2 increase in BMI. The relative risk of all lifestyle-related cancers in obese people was 1.77 (95% CI 1.06 - 2.96; p=0.03). In addition, it is important to acknowledge that for people who are diagnosed with CRC, obesity is associated with poorer prognosis, increases in disease recurrence and overall mortality [6]. Red and processed meat also appear to be associated with greater risk in people with a family history although results vary by type of meat, cooking methods and processing [7]. There is less evidence of protective effects of physical activity and dietary fibre in high risk groups although in part this may be due to the small number of studies reported [31]

There is little evidence that current information about the relationship between lifestyle and CRC has been widely disseminated to the general population or to those at increased risk of colorectal cancer. Participants in the BeWEL study [8] (n=329) who had a colorectal adenoma and BMI >

25kg/m2 reported very low knowledge about lifestyle risk [9]. Formative work for the study reported that patients with colorectal adenomas need to be aware of the relevant risk factors and need to be able to relate these to current personal behaviours before the 'teachable moment' opportunity for promoting change can be perceived as relevant [10]. The authors noted that, whilst there is a shared and accepted understanding of the relationship between smoking and lung cancer, there is much less awareness of the relationship between colorectal cancer and lifestyle and considerable confusion exists over definitions of desirable levels of relevant behaviours (e.g. meat consumption, activity levels). These findings have been echoed by Dowswell et al [11] who found that patients with high risk colorectal adenomas believed that their current behaviour was appropriate or that they perceived no risk between health behaviour and disease outcome. Thus even where knowledge of current recommendations for disease reduction is high, translation to appropriate action is often hindered by pre-existing beliefs about the perceived healthiness of current diet and lifestyle.

However, in the BeWEL intervention trial it was demonstrated that around half (49%) of all patients with colorectal adenomas (and therefore at increased risk of CRC) were interested in participating in lifestyle interventions. When offered a comprehensive intervention programme, participants responded well and achieved significant lifestyle changes (in diet, alcohol, and physical activity and body weight), maintained over a 12 month period with a high degree of study retention (91%) [12].

It is clearly important to communicate relevant lifestyle messages to this high risk group but little is known about current diet and lifestyle (notably in those with BMI <25kg/m2 who may perceive themselves to be healthy due to weight status). Data related to lifestyle behaviours in people at increased risk of colorectal cancer is sparse. Caswell et al [13] reported in a group of 37 patients with adenomas that 37% failed to meet minimum recommended levels of physical activity, 8% of total energy was supplied by alcohol (12% in men), mean fibre was low and red and processed meat higher than recommended.

 In Scotland, only one study [14] has examined diet and lifestyle factors in people diagnosed with CRC but this was a case-control study of CRC patients, and it is unclear if behaviours may have changed due to disease status (notably physical activity and sugary drink consumption).

The aim of this investigation was to assess current modifiable risk factors in patients at high risk for colorectal adenomas and their experience of lifestyle advice in order to explore the need for evidence based communications for disease risk reduction.

**Methods**

The lifestyle assessment study was undertaken as part of an investigation on the utility of a Faecal Immunochemical Test for haemoglobin (FIT) in patients with a greater risk of CRC (compared to general population) who were enrolled in a colonoscopy surveillance programme [15]. This cohort included patients with a past history of adenomatous polyps, previous bowel cancer and a strong family history of bowel cancer. All patients were invited to complete a FIT test before attending their routine surveillance colonoscopy. On receipt of stool samples to the laboratory, a patient information sheet (as required by ethics procedures), a questionnaire about current lifestyle and stamped address envelope was then sent to the participant by the research centre. None of the research staff had access to any NHS patient data (including contact details). The completed questionnaires were anonymous which meant that participants/non participants could not be re-contacted.

Sample Size

Study size was pragmatically based on the FIT study recruitment plan that estimated 840 patients would participate. Based on response rates for previous questionnaire studies we aimed to achieve a 50% response rate (i.e. 420 participants).

Lifestyle Questionnaire Measures

As this questionnaire study was an additional request to an existing study, the researchers wished to reduce participant burden to a minimum and aimed to keep the data collection tool short and in a form that could be administered as a self-completion tool. The questionnaire aimed to gather key lifestyle data from previously validated questionnaires but recognised that the use of a full food frequency questionnaire for the purpose of estimating nutrient intake was unpractical.

The self-completion questionnaire elicited data on:

1.      Demographics - gender, age, ethnicity, marital status and education.

Socio economic position was based on the variable Scottish Index of Multiple Deprivation (SIMD) [16] determined by postal code. This measure is a categorical system of identifying social position based on area of residence which takes account of housing, crime, access to services, education, health, income and employment.

2.      Self-reported height and body weight (which enabled BMI to be estimated).

3.      Lifestyle behaviours pertinent to cancer prevention were assessed as markers of adherence to cancer prevention guidelines:

•       Smoking - Participants were asked to report smoking status (and number of cigarettes smoked if current smokers).

•       Alcohol - Intake was estimated using a 7 day recall to indicate how many drinks containing alcohol had been consumed over the previous seven days. This total was then recoded to provide an approximate number of units of alcohol as described by Emslie et al [17].

•       Physical Activity - Was estimated using the short form International Physical Activity Questionnaire (IPAQ) [18]. The IPAQ assesses walking, activities of moderate and vigorous intensity as estimates of frequency (days per week), and duration (time per day). These are combined to provide a summation of duration (in minutes) and frequency (days). Participants were then categorized as active if they achieved either 3 days of 20 min vigorous activity/week, 5 days of 30 min moderate activity/week (walking), or 5 or more days of any combination of walking, moderate or vigorous activity, achieving a minimum of at least 600 MET minutes/week, i.e. equivalent of 150 minutes of moderate activity per week as recommended by World Cancer Research Fund (WCRF)/ American Institute for Cancer Research (AICR) expert report [19]. If none of the above were achieved they were categorised as inactive.

•       Red and Processed Meat – consumption were estimated by frequency of consumption scales using the relevant questions in the validated EPIC food frequency questionnaire [20] and average portion measures for Scots adults obtained from work undertaken by Wrieden and

Barton [21]. Processed meat was defined as beef burgers, sausage, liver products, savoury pies, corned beef, ham, luncheon meat and bacon.

• Plant Foods –In the WCRF/AICR 2007[2] report definition of plant foods, three food categories are highlighted: non-starchy vegetables and fruit, unprocessed cereals and/or pulses and limited refined starchy foods. No short questionnaire was available which captured all this information. However, the validated DINE questionnaire [22], which encompassed vegetables, fruit, cereals and legumes, was considered the most efficient measure to estimate a dietary fibre score which could then be used as a proxy for plant foods. It also allows a greater emphasis on total plant foods rather than the commonly used proxy of fruits and vegetables which can provide misleading results on total plant foods consumption. The DINE questionnaire estimates dietary fibre based on the fibre content of standard portion sizes of fibre rich foods, weighted by frequency of consumption (e.g. less than once per week, 1-2 times per week). Full details of analytical procedures are presented by Roe et al [22]. A fibre score of less than 30 ('low') is equivalent to a fibre intake of 20g/day or less, score of > 30 to <40 is moderate, whilst over 40 ('high') is equivalent to an intake of more than 30g/day. The upper value of 40 was selected as greatest likelihood of complying with recommendations because this is consistent with UK guidance on dietary fibre.

4.     Lifestyle advice

Experience on receiving advice on the following topics were sought: Smoking, alcohol, diet (fruit and vegetables, wholegrains, red meat, processed meat), physical activity (and inactivity) and bodyweight. The items queried if they

• Had ever personally been advised on any of these topics?

• Had ever searched for or sought information on these topics?

• Would find it useful to have information on any of these topics?

Finally, for the same list of topics, participants were asked to rate each of these lifestyle variables in influencing their risk of colorectal cancer. Responses were rated from 1 (Not at all important) through to 5 (Very important) with a 'Don't know' option added.

A health behaviour score was then calculated where +1 was scored for each health measure which was in accordance with behavioural recommendations (or a proxy in the case of plant foods) for cancer prevention by the 2007 World Cancer Research Fund (WCRF) [19], and consistent with those of the 2018 WCRF report [2]. The domains scored were smoking, body fatness, alcohol intake, physical activity, red and processed meat consumption and plant food proxy (dietary fibre). No weighting was applied to domains. The possible score ranged from 0 to 7 points (higher score = engaging in greater number of healthy behaviours).

Questionnaire data underwent double entry and checking procedures (double entry checking with 1:5 questionnaires).

Questionnaire responses were analysed for descriptive summaries using SPSS 22 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp).

Ethical approval was granted by the East of Scotland Research Ethics Committee (REF no 14/ES/1091).

**Results**

Over 15 consecutive months (during 2014 and 2015), 1103 patients were appointed for surveillance colonoscopy and of these, 643 returned a FIT sample and were therefore eligible to be sent a questionnaire. However, permissions for the current questionnaire study were not attained until later in the main study period which resulted in 385 study invitations being sent out over a 20 month recruitment period (2015 to 2016) and 208 (54%) questionnaires were returned. Similar numbers of men and women responded (51% male) and they ranged in age from 33 to 88 (mean 63 ± SD 11.3) years. Most respondents were Caucasian (99%), married or cohabiting (70%), had post school educational qualifications (62%), and were retired from employment (52%). One fifth were resident in areas of high social deprivation (Table 1).

With respect to reported behaviours, most (91%) participants reported being non-smokers (with 51% having never smoked). Eighty percent were consuming meat within the red meat limits and 74% reported meeting minimum physical activity recommendations. The majority (62%) also reported drinking alcohol within the limits set by national guidelines. Sixty seven (32%) reported

no alcohol consumption in line with current WCRF recommendations. The majority of participants (72%) were estimated to have a BMI out-with the healthy range, 89% achieved a fibre score indicative of a low plant diet and 91% reported eating processed meat (Table 2). Overall, the composite score for lifestyle risk was 3.5 ±1.1 with 36% achieving at least 4 recommendations and 2% adhering to all recommendations examined.

The scores for the perceived importance of the lifestyle topics as a risk factor for CRC were high (> 4.3/possible 5) and suggest a population familiar with current recommendations. However the proportion of respondents receiving and seeking advice on these topics was low (less than one third). Overall, many participants said they would find guidance useful, notably in relation to body fatness (43%) and physical activity (38%) (Table 3).

Some participants reported behaviours parallel to the experience of reported advice. For example, 26% reported low physical activity levels and 30% had been advised on this topic. For red meat, 20% were consuming high intakes and 15% had received advice. For smoking, 9% of participants reported smoking and 17% had received advice on this topic (which includes ex-smokers). These are, however, in contrast to alcohol where 38% reported alcohol intakes higher than desirable and only 14% having received advice.

Turning to the areas where lifestyle guideline adherence was low (BMI and diet), the area in which most participants reported receiving advice on was body weight (33%) and 31% reported they had personally sought information on this topic, although the data suggest that 72% of people may have benefited from guidance. Fewer participants reported receiving (18 to 26%) and seeking (15 to 17%) dietary advice on fruits, vegetables and wholegrains. In addition, around one third of participants said they would find advice on this topic useful. A low proportion of participants reported receiving (14%) and seeking (12%) advice on processed meat, although 90% reported consuming such foods and a quarter of participants said they would find this information useful.

**Discussion**

Despite evidence for the importance of lifestyle in the aetiology of colorectal cancer, current behaviours in high risk patients are sub-optimal with respect to body weight and dietary factors which are often less well known as increasing risk of cancer [9]. In part, these findings are similar to the general Scottish adult population where 66% are overweight or obese [23] and underline the need for public health approaches to support healthy lifestyles. Whilst it is clear that patients under colonoscopy surveillance have greater opportunities to engage with NHS staff (and the health promoting health service) [24], the findings suggest that this "teachable moment" opportunity is often missed. The results suggest that there is considerable interest in receiving advice about lifestyle topics related to CRC and indeed many have searched by themselves for such information. Generally, the findings indicate that patients regard all of the lifestyle topics as influential which may make any lifestyle counselling more acceptable. In addition, there is a growing body of evidence [25, 26] that people respond positively to health professional advice on weight management.

The main strength of the study is that (to the best of our knowledge) the current work is the first to report current lifestyles and experience of lifestyle advice in this group of high risk patients. In addition, many men participated (reflecting the higher incidence of the disease in men) which is less common for lifestyle questionnaire studies. The main weakness of the study is the socio-demographic profile of participants recruited who were predominantly Caucasian and with small numbers from the two lowest deprivation quintiles (e.g. higher socio-economic status). Although this distribution reflects the general demographic for high risk attendees in this region (where there is little ethnic diversity), it highlights the difficulties in offering both surveillance and lifestyle interventions to affected people from more deprived areas. It is important to note that these findings are illustrative rather than representative. We are unable to report a comparison between socio-demographic characteristics of responders and non-responders because we were not granted access to NHS data for this purpose. The sample size was less than planned due to the numbers of people participating in the FIT study being less than expected, but the response rate was adequate and better than anticipated. The current data collection method did not allow detailed nutrient data to be assessed but has enabled key lifestyle variables relevant to cancer to

be described. Estimating intakes of plant based food is particularly challenging and a proxy value is an indicator only. Estimating a risk score is not a novel approach [27,28] (though never previously reported in high risk patients) and there has been considerable discussion on how much weight to give each variable in the total score (e.g. if obesity is the most important item should it be allocated 2 points instead of 1 point).

It is likely that there was a bias towards survey completion by people with a more favourable lifestyle which has further implications for overall habits in this population group. The data is all self-reported and we have no validation of actual habits or measures - an approach which often leads to under-reporting and socially biased results [29]. However, if these results reflect best practice then there is clearly significant room for improvement.

Our previous work on lifestyle in people attending genetics clinics in Tayside [30] also highlighted that current behaviours were sub-optimal. In addition, qualitative data suggested that there were considerable doubts about the link between lifestyle and cancer and that fatalistic views were associated with poorer health behaviours. The current findings show that amongst people at higher risk of developing CRC there are a number of health behaviours that are associated with CRC that could be targeted for risk reduction. Current evidence suggests [31] that the combined effect of lifestyle factors (examined by dietary risk score) and family history appear to be strongly related to increase CRC risk (risk estimates of between 2.7 and 14), suggesting that one or more risk factors act synergistically. These findings also highlight the importance of lifestyle advice versus discussion of single variables. Our recent pilot trial of a lifestyle intervention in patients referred to family history clinics [32] suggesting that a lifestyle programme for people with a family history of cancer is feasible to conduct, acceptable to participants, and indicative results suggest favourable outcomes. However, post intervention interviews with participants highlighted the importance of providing a credible rationale for lifestyle change which underlines the need for health professionals working in this area to introduce and endorse the importance of a range of risk factors in multicomponent interventions.

The generalisability of the current findings from one geographical area to others are unclear, although a number of studies have now reported that people with a family history from different countries do not have lifestyles consistent with current recommendations [33, 34]. A recent review of nutritional and lifestyle factors in familial colorectal cancer makes a very strong case for providing effective lifestyle counselling for high risk individuals [31]. In addition, such changes in lifestyle can help to decrease common co-morbidities including type 2 diabetes mellitus and cardiovascular disease [35]. The relatively uneven spread of lifestyle advice and interest suggests that opportunities and teachable moments could be developed for these patients. Such approaches might include brief verbal interventions by relevant staff, supported by written material and signposting to web based resources, community facilities and effective weight management programmes.

Being able to offer advice and guidance may also make it easier to alleviate concern by NHS staff that lifestyle topics are sensitive and difficult to raise and have the potential danger of impacting on professional relationships [36]. The development of a process for supporting lifestyle change in this patient group, who are already engaging in positive practice (regular colonoscopy screening), seems timely.

## Transparency Declaration

The lead author affirms that this manuscript is an honest, accurate and transparent account of the study being reported. The lead author affirms that no important aspects of the study have been omitted and that any discrepancies from the study as planned have been explained.

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***Table 1*** *Sociodemographic characteristics of respondents (n=208)*

| Variable | Category | n(%) |
|---|---|---|
| **Age (years)** | Range | 33-88 |
| | Mean (±SD)[2] | 63.0 (±11.3) |
| **Gender** | Male | 107 (51) |
| | Female | 95 (46) |
| | Missing | 6 (3) |
| **SIMD[1] Quintiles** | 1 (highest deprivation) | 18 (9) |
| | 2 | 22 (11) |
| | 3 | 53 (25) |
| | 4 | 60 (20) |
| | 5 (lowest deprivation) | 41 (20) |
| | Missing | 14 (6) |
| **Marital status** | Single | 16 (18) |
| | Married/ co-habiting | 152 (73) |
| | Divorced/Widowed/Separated | 35 (17) |
| | Missing | 5 (2) |
| **Ethnicity** | White | 205 (99) |
| | Asian/Asian British | 1 |
| | Missing | 2 |
| **Qualifications** | Secondary school | 79 (38) |
| | Other professional / technical qualification after school | 91 (44) |
| | University degree | 28 (14) |
| | Post-graduate degree (e.g. Masters or PhD) | 7 (3) |
| **Employment** | Retired | 102 (52) |
| | Unemployed | 7 (3) |
| | Employed full-time | 53 (26) |
| | Employed part-time | 25 (12) |
| | Student full-time | 2 (1) |
| | Other | 10 (5) |
| | Missing | 2 (1) |

[1] Social Index of multiple deprivation (SIMD) [(15)]

[2] Standard deviation (SD)

**Table 2 WCRF cancer prevention recommendations and participant achievement of these recommendations**

| Recommendation | Criteria for meeting recommendation: | Meeting recommendations n (%) |
|---|---|---|
| Alcohol[1] | <14 units/week | 127/205 (62%) |
| Body Fatness: Be as lean as possible within the normal range of body weight | BMI 18.5 – 24.9kg/m$^2$ | 55/197 (28%) |
| Fibre: Eat mostly foods of plant based origin | High fibre diet (DINE score >40) | 22/208 (11%) |
| Physical Activity: Be physical active | IPAQ ≥30mins moderate five days per week | 153/208 (74%) |
| Processed meat: Avoid | Avoid all processed meats | 18/205 (9%) |
| Red Meat: Limit intake | ≤500g red meat per week | 166/208 (80%) |
| Smoking: Avoid | Non/ex smoker | 189/208 (91%) |

[1]The WCRF guide for drinking recommendation was within 14 units/week as recommended by Chief Medical Officers.

**Table 3 Experience of Lifestyle Advice [2]**

| | Smoking (n=208) | Alcohol (n=205) | Physical Activity (n=208) | Body Fatness (n=197) | Red Meat (n=208) | Processed Meat (n=205) | Fruit &Vegetables (n=195) | Wholegrains (n=208) |
|---|---|---|---|---|---|---|---|---|
| **Personally advised (%)** | 36 (17.3) | 28 (13.5) | 62 (29.8) | 69 (33.2) | 31 (14.9) | 29 (13.9) | 55 (26.4) | 37 (17.8) |
| **Searched for information (%)** | 26 (12.5) | 29 (13.9) | 52 (25.0) | 65 (31.3) | 25 (12.0) | 24 (11.5) | 36 (17.3) | 31 (14.9) |
| **Would find it useful (%)** | 28 (13.5) | 44 (21.2) | 79 (38.0) | 90 (43.3) | 57 (27.4) | 59 (28.4) | 68 (32.7) | 63 (30.3) |
| **Rating for influence on CRC (1-5) Mean±SD** | 4.5±1.5 | 4.5±1.5 | 4.4±1.3 | 4.5±1.1 | 4.3±1.3 | 4.5±1.3 | 4.4±1.2 | 4.4±1.3 |

2      [2] Numbers for each response vary because some people omitted to respond to some items

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