

# Demographic and Psychosocial Factors Associated with Perceived Risk for Colorectal Cancer

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## Abstract

**Objective:** The objective of this study was to investigate demographic and psychosocial predictors of perceptions of risk for colorectal cancer (CRC) in a population-based sample. **Method:** The study was a cross-sectional survey of 18,447 men and women aged 55–64 years. A mailed questionnaire assessed perceived comparative risk for CRC along with demographic characteristics (age, gender, ethnicity, marital status, and socioeconomic status), health-related factors (family history, subjective health and bowel symptoms, and health behaviors), and emotional state (anxiety).

**Results:** Being male and older were associated with lower perceived risk. Having a family history of CRC, poorer subjective health, more symptoms, and higher levels of anxiety were all associated with increased perceived risk of CRC. Smokers and nonexercisers perceived their risk as higher. **Conclusion:** Misperceptions surrounding the effects of age and gender on CRC risk, as well as the genetic link and pathogenesis of CRC, need to be addressed in risk communications. (Cancer Epidemiol Biomarkers Prev 2004;13(3):366–372)

## Introduction

There is a growing body of evidence that screening for early-stage colorectal cancers (CRC) or precancerous adenomas could reduce CRC mortality (1–3). With screening strategies that have been proven to reduce risk, attention turns to understanding how to maximize screening utilization, because screening programs can only be effective public health tools if people use them in sufficient numbers.

Almost all models of preventive health [health belief model (4), protection motivation theory (5), and precaution adoption process model (6)] view perceptions of risk, in combination with belief in the efficacy of screening, as the motivational engine behind many precautionary behaviors. At a minimum, people must recognize that there could be a possibility of contracting the disease before personal action to protect health or prevent disease is likely to follow, but many studies go further in showing a level of “dose-response” in the relationship between perceived susceptibility and utilization of protective behaviors such as cancer screening (7–10). Data from the United Kingdom Flexible Sigmoidoscopy (FS) Trial pilot centers found that 98% of those who perceived their risk of developing bowel cancer as higher than others were interested in FS screening compared with 84% who viewed their risk as “the same” and 74% who perceived their risk to be lower than average (10). Understanding the determi-

nants of perceived susceptibility for cancer is therefore a crucial element of understanding cancer preventive health behaviors.

Biases operate when individuals estimate the likelihood of a future event. One such bias is the tendency to show what has been termed “unrealistic optimism.” Weinstein (11) developed the concept of unrealistic optimism in response to the observation that most people report that their risk of a range of adverse events, including illnesses and accidents, is lower than average. While some individuals are very likely correct, as a group, this is logically not possible. Judging whether any one individual’s risk perception is realistic or unrealistic is problematic, particularly in the absence of objective risk indicators, so some authors prefer to use the term “comparative optimism” (12). In this article, we use the term “comparative optimist” to refer to those people who perceive their risk of developing a disease or illness as lower than average.

Comparative optimism has been demonstrated for a range of serious illnesses including heart attack, stroke, and cancer (13). In a sample of 547 predominantly low-income African Americans, 36% estimated their CRC risk to be below average, while only 4% believed they were at above average risk (14). Similar results have been reported for breast cancer (15–17) and oral cancer (18).

Identifying population subgroups who are most optimistic, or studying the psychological characteristics of comparative optimists *versus* pessimists, have been underresearched areas (19). Interventions designed to enhance health behaviors might benefit from a clearer understanding of the correlates of risk perception in order that risk communications could be made more effective.

Age is one demographic factor that has been investigated more than others. Perceived risk of breast cancer

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has been shown to decrease with age (20) and similarly perceptions of CRC risk (21, 22). Other studies have found no relationship between age and perceived risk for developing cancer (14, 23, 24), but no study has reported that older adults—the group most objectively at risk—feel less optimistic.

The relationship between gender and perceived risk is equivocal; some studies find women to be more comparatively optimistic (21), some find men to be more optimistic (13), and others report no relationship (14). The association between ethnicity and perceived risk is similarly unclear and has not been fully explored in a population sample of both men and women. Many studies in the risk perception literature have included indicators of socioeconomic status (SES), such as education and income, but associations between perceived risk and SES have been inconsistent.

A family history of the disease is one of the few factors that is consistently linked with higher perceived risk (15, 16, 20, 23, 25). Having a family history was the single most important factor identified by older adults as determining their perceived risk for CRC in a qualitative study in the United States (26). Male automotive employees with a family history of CRC or polyps perceived their risk of CRC to be significantly higher than those without a family history (22). One explanation is that personal experience with the illness provides the opportunity to feel vulnerable through a process of vicarious learning (27–29). Another is that people may believe they are genetically predisposed if a close relative has had the illness. Data tend to support the genetic explanation with heredity being mentioned as a risk-increasing factor for CRC in those with a family history of CRC (25) and in a sample of lower-income African Americans (14). There is also evidence for public perception of family history as a risk-increasing factor for cancer in general (30).

Poorer subjective health has been related to higher risk perceptions (30), although this could be due to confounding, because poorer health is related to lower SES, more likelihood of visits to doctors, and higher levels of anxiety and depression. More specific health factors have also been linked with perceptions of risk in the area of breast cancer, with self-reported breast problems being associated with increased perceived risk for breast cancer (16).

Health behaviors are associated with perceived risk for cancer, whether or not there is a specific epidemiological link. In general, individuals who engage in fewer detrimental health behaviors perceive their risk to be lower than their peers; for example, nonsmokers (correctly) perceive their overall risk of developing cancer as lower than smokers (14, 20, 22, 24, 30). Lipkus *et al.* (16) also found that participants in their telephone survey of older women viewed exercise, diet, and not smoking as risk-decreasing factors for breast cancer.

Emotional factors have been shown to be associated with risk perceptions in many studies. People with high levels of state anxiety generally display less comparative optimism than nonanxious people (31, 32). A study of African American women's risk perceptions for breast cancer showed that those who overestimated their risk of developing breast cancer had higher scores on depression and anxiety (33).

In reviewing the literature on the correlates of perceived risk for cancer, we identified only four studies investigating the correlates of perceived risk for CRC (14, 21, 22, 25). None used a population-based sample focusing instead on specific population subgroups: siblings of CRC patients (25), African Americans (14), low-income men and women (21), and white, male, automotive industry workers (22). Further, no previous study has included a broad range of demographic, health, and psychological factors in a multivariate model. The present study used baseline data from the United Kingdom FS Trial, which is a population-based trial of once-only FS screening for older adults. We predicted that older British adults would show comparative optimism for CRC and investigated how a range of demographic, health, and psychological factors were associated with perceptions of risk in this large, community-based sample.

## Materials and Methods

**Design and Procedure.** The design of this study was cross-sectional. None of the participants had been screened for CRC in the past, because screening is not otherwise available in the United Kingdom. Therefore, risk judgments should not be confounded by prior screening behavior.

Data come from the baseline assessment of a subset of 354,262 participants in the United Kingdom FS Trial who had been randomized to receive a prescreening questionnaire through the post (see Ref. 34 for further details). Participants ( $N = 18,447$ ) were men and women aged 55–64 years registered with general practitioners in five trial centers (Leicester, Welwyn Garden City, Leeds, Harrow, and Birmingham).

### Materials

**Perceived Risk.** The perceived risk/comparative optimism item asked: "Compared with other men and women of your age, do you think your chances of getting bowel cancer are: lower; about the same; higher" as used by Weinstein (28). Responses were scored by allocating  $-1$  for "lower,"  $0$  for "about the same," and  $+1$  for "higher." Thus, a negative score implies an optimistic bias while a positive number implies a pessimistic bias. In two centers (Leeds and Harrow), response options were on a five-point scale ranging from "much lower" ( $-2$ ) to "much higher" ( $+2$ ). For the main analyses, the responses were recoded into a three-point scale (*i.e.*, "much lower" and "lower" were recoded as "lower" and "higher" and "much higher" were recoded as "higher"). Analyses were also rerun for the two centers with the five-point response options to determine if a different pattern of results emerged.

**Demographic Characteristics.** Age and gender were known from the health authority records. Additional simple questions were used to assess ethnicity (white, black, Asian, other, or do not wish to answer) and marital status (married/living as married, divorced, separated, widowed, or single).

Postcode data were used to link participants' area of residence to information from census enumeration districts to index neighborhood-level deprivation [the

Townsend Material Deprivation Index (35)] using data from the 1991 census (36). A Townsend score of zero represents the national average, negative values represent below-average levels of deprivation, and positive values represent higher than average deprivation. The Townsend index also allowed comparisons to be made between responders and nonresponders. For the purposes of analyses, the Townsend score was divided into quartiles.

**Family History.** Family history of CRC was assessed with the question, "Have any members of your family (BLOOD relatives, not relatives by marriage) had bowel cancer?" Options were mother, father, son(s), daughter(s), sister(s), and brother(s); participants were asked to indicate "yes; no; do not know" for each relative. These responses were coded into categories of none, one, and two or more.

**Health Behaviors.** Health behaviors were assessed with two single items, which asked if participants smoked or took regular exercise. Response options were "yes" or "no."

**Bowel Symptoms and Subjective Health.** Bowel symptoms over the past 3 months were assessed with a list of seven symptoms (constipation, hemorrhoids, diarrhea, wind, pains in abdomen, incontinence, and blood in stools). Symptom frequency was rated as "no; occasionally; frequently." A total symptoms score was calculated by totaling the number of symptoms that were experienced occasionally or frequently. Subjective health was assessed with the item, "Would you say that for someone of your age your own health in general is: excellent; good; fair; poor" (37).

**Anxiety.** State anxiety was recorded with the shortened, six-item version of the Spielberger State Trait Anxiety Inventory (38, 39). Internal reliability of the State Trait Anxiety Inventory was high with Cronbach's  $\alpha = 0.83$ .

**Analysis of Results.** Results were analyzed using SPSS (version 10.1). One-sample  $t$  tests were employed to detect a significant deviation from average risk, which would indicate an optimistic bias.  $\chi^2$  tests and simple and multiple ordinal regression were used to determine the association between perceived risk and demographic, health, and psychological factors. It is recognized that in a sample as large as this it is not appropriate to put too much emphasis on statistical significance; however, significance levels will still be reported and results showing practical significance are highlighted.

## Results

**Respondents.** The response rate for the baseline questionnaire was 61% ( $n = 11,254$ ). Townsend Material Deprivation scores were available for 18,343 participants. Respondents ( $n = 11,254$ ) came from neighborhoods with significantly lower Townsend scores ( $M = -0.009$ ,  $SD = 3.08$ ) than nonrespondents [ $M = 0.89$ ,  $SD = 3.17$ ;  $n = 7193$ ,  $t(18,341) = 19.01$ ,  $P < 0.001$ ], indicating that they lived in less socioeconomically deprived areas.

However, in terms of population levels of deprivation, respondents were representative of England where the national average Townsend score is zero, which is not significantly lower than the mean of the present sample. More women (54%) than men (46%) returned the baseline questionnaire. Respondents were predominantly white (96%) and married (76%), with a mean age of 60 years.

**Comparative Optimism.** Overall, respondents showed the predicted tendency to be comparatively optimistic about their chances of developing bowel cancer [ $M = -0.08$ ,  $SD = 0.50$ ;  $t(10,758) = -16.57$ ,  $P < 0.001$ ]. Seventeen percent thought their chance of getting bowel cancer was lower than other men or women of their age, 74% thought it was about the same, and 9% thought their risk was higher (see Table 1). In the two centers where five response options were given to the comparative risk question, the results were broadly similar with 7% rating their risk as "much lower," 11% as "a little lower," 71% as "about the same," 8% as "a little higher," and 2% as "much higher."

**Associations between Demographic Factors and Perceived Risk.** Nineteen percent of males saw their risk of developing CRC as lower than their peers compared with 15% of women (see Table 1). Age differences were also significant but very small; in the older age group (60–64 years), 18% of respondents saw their bowel cancer risk as lower compared with 16% in the younger age group (55–59 years). Marital status was not significantly related to perceived risk. Twice as many non-white (32%) as white (16%) respondents saw their risk of CRC as lower than their peers. The pattern of results in each of the three non-white groups (black, Asian, and other) were very similar, so they were combined in the non-white group to give more robust estimates for the analyses. There was no significant difference in risk perception across socioeconomic groups.

### Associations between Psychosocial Factors and Perceived Risk

**Family History.** Having a family history of bowel cancer was associated with less comparative optimism (see Table 1). Eighteen percent of respondents with no first-degree relative (FDR) with bowel cancer perceived their risk to be lower than their peers compared with 11% of those with one FDR and 3% of those with two or more.

**Health Behaviors.** Both measured health behaviors were associated with risk perceptions. Thirteen percent of smokers perceived their risk to be lower than their peers compared with 18% of nonsmokers. Twelve percent of nonexercisers saw their risk as lower compared with 19% of respondents who exercised regularly.

**Bowel Symptoms and Subjective Health.** Fewer bowel symptoms and perceiving health as better were significantly associated with greater comparative optimism. Twenty-three percent of those reporting zero or one bowel symptom perceived their risk as lower than average compared with only 8% of those who had four or more bowel symptoms. Thirty-two percent of individuals rating their subjective health as excellent were

**Table 1. Demographic and psychosocial influences on perceived risk of CRC (%)**

|                                      | Perceived risk |          |        | Statistical significance                       |
|--------------------------------------|----------------|----------|--------|--|
|                                      | Lower          | The same | Higher |  |
| All respondents ( <i>n</i> = 11,254) | 16.9           | 74.3     | 8.9    |  |
| Gender                               |                |          |        |  |
| Female ( <i>n</i> = 5863)            | 15.3           | 74.9     | 9.7    |  |
| Male ( <i>n</i> = 4896)              | 18.7           | 73.5     | 7.8    | $\chi^2$ (2, 10,759) = 28.8, <i>P</i> < 0.001  |
| Age                                  |                |          |        |  |
| 55–60 years ( <i>n</i> = 5188)       | 15.7           | 74.9     | 9.5    |  |
| 60–64 years ( <i>n</i> = 5297)       | 17.7           | 74.2     | 8.1    | $\chi^2$ (1, 10,485) = 12.1, <i>P</i> = 0.001  |
| Ethnicity                            |                |          |        |  |
| White ( <i>n</i> = 10,066)           | 16.2           | 75.0     | 8.8    |  |
| Non-white ( <i>n</i> = 381)          | 32.5           | 57.5     | 10.0   | $\chi^2$ (1, 10,447) = 33.8, <i>P</i> < 0.001  |
| Marital status                       |                |          |        |  |
| Married ( <i>n</i> = 8013)           | 16.5           | 75.4     | 8.1    |  |
| Not married ( <i>n</i> = 2582)       | 18.2           | 70.8     | 11.0   | $\chi^2$ (1, 10,595) = 1.09, <i>P</i> = 0.297  |
| Townsend score                       |                |          |        |  |
| 1 (affluent; <i>n</i> = 2678)        | 16.7           | 75.5     | 7.8    |  |
| 2 ( <i>n</i> = 2864)                 | 16.3           | 75.4     | 8.3    |  |
| 3 ( <i>n</i> = 2697)                 | 17.2           | 74.4     | 8.3    |  |
| 4 (deprived; <i>n</i> = 2497)        | 17.3           | 71.4     | 11.3   | $\chi^2$ (1, 10,706) = 3.0, <i>P</i> = 0.085   |
| Family history (FDRs only)           |                |          |        |  |
| 0 ( <i>n</i> = 8345)                 | 17.8           | 75.5     | 6.4    |  |
| 1 ( <i>n</i> = 665)                  | 10.7           | 64.8     | 24.5   |  |
| 2+ ( <i>n</i> = 58)                  | 3.4            | 63.8     | 32.8   | $\chi^2$ (1, 9068) = 195.9, <i>P</i> < 0.001   |
| Smoking                              |                |          |        |  |
| Smoker ( <i>n</i> = 2439)            | 12.8           | 76.5     | 10.7   |  |
| Nonsmoker ( <i>n</i> = 8139)         | 18.1           | 73.7     | 8.2    | $\chi^2$ (1, 10,578) = 45.7, <i>P</i> < 0.001  |
| Exercise regularly                   |                |          |        |  |
| Yes ( <i>n</i> = 6828)               | 19.2           | 72.7     | 8.1    |  |
| No ( <i>n</i> = 3369)                | 12.4           | 77.5     | 10.1   | $\chi^2$ (1, 10,197) = 68.2, <i>P</i> < 0.001  |
| Bowel symptoms                       |                |          |        |  |
| 0, 1 ( <i>n</i> = 4412)              | 22.9           | 73.2     | 3.9    |  |
| 2, 3 ( <i>n</i> = 4244)              | 15.1           | 76.7     | 8.2    |  |
| 4+ ( <i>n</i> = 2103)                | 7.8            | 71.6     | 20.6   | $\chi^2$ (1, 10,759) = 565.4, <i>P</i> < 0.001 |
| Subjective health                    |                |          |        |  |
| Excellent ( <i>n</i> = 1251)         | 32.2           | 63.1     | 4.6    |  |
| Good ( <i>n</i> = 6257)              | 17.5           | 75.4     | 7.0    |  |
| Fair ( <i>n</i> = 2680)              | 9.6            | 77.5     | 12.9   |  |
| Poor ( <i>n</i> = 402)               | 8.5            | 69.4     | 22.1   | $\chi^2$ (1, 10,590) = 414.6, <i>P</i> < 0.001 |
| Anxiety                              |                |          |        |  |
| Low ( <i>n</i> = 3295)               | 21.5           | 73.1     | 5.4    |  |
| Medium ( <i>n</i> = 3478)            | 15.9           | 76.3     | 7.8    |  |
| High ( <i>n</i> = 3797)              | 13.8           | 73.3     | 12.9   | $\chi^2$ (1, 10,570) = 161.4, <i>P</i> < 0.001 |

comparatively optimistic compared with 8% of those reporting their subjective health to be poor.

**Anxiety.** Less anxious respondents were more comparatively optimistic about their chance of developing bowel cancer relative to their peers. Twenty-two percent of respondents in the lowest anxiety tertile perceived their risk as lower than their peers compared with 14% in the highest.

**Ordinal Regressions.** Simple ordinal regressions were carried out to provide direct comparisons with subsequent multiple analyses (see Table 2, columns 1 and 2). In line with the results from the  $\chi^2$  analyses, the simple ordinal regressions showed that being male, in the older age group (55–59 years), and non-white were each associated with being more comparatively optimistic. Marital status was not significantly related to perceived risk. Smokers, nonexercisers, and those with a family history of CRC, more symptoms and poorer subjective health, and higher levels of anxiety all perceived their risk as higher. Those in the lowest socioeconomic deprivation quartile were more comparatively pessimistic

compared with the most affluent group, although this result was only just significant.

Multiple ordinal regression was then used to identify the independent predictive effects of each of the variables while controlling for the other factors (see Table 2, columns 3 and 4). The odds ratios in the multiple analyses were very much the same as in the simple analyses, indicating that each of the factors had effects that were largely independent of one another. One difference was that the effect of socioeconomic deprivation reversed, with respondents in the more deprived quartiles being more comparatively optimistic; but again, the result was only just significant.

## Discussion

The aim of this study was to examine the predictors of perceived risk for CRC in a large, population-based survey of older men and women. Simple analyses showed that respondents who were male, older, and non-white viewed their risk of bowel cancer as lower

than their peers. In line with other work, having a family history of CRC, poorer health behaviors, more related (bowel) symptoms, poorer subjective health, and higher levels of anxiety were all also associated with higher perceived risk. Effects, which were measured at more than two levels (*e.g.*, family history), showed a “dose-response” relationship.

The results from the multiple analysis were broadly similar to the simple analyses for gender, age, ethnicity, family history, bowel symptoms, subjective health, health behaviors, and anxiety, indicating that these factors contributed independently to perceived risk.

It was interesting to find that being male and older were both associated with lower perceived risk, because these two factors have consistently been linked to higher risk of CRC, at least in the United Kingdom (40), so the comparative optimism bias was opposite to the true risk. These findings highlight the need for future risk communications to address any misperceptions surrounding age and gender. Non-white respondents were also more comparatively optimistic in their CRC risk judgments, but there is evidence to

suggest that they may be relatively accurate in their view, because African, Caribbean, and South Asian migrants to England and Wales have been shown to have significantly lower CRC risk than white Britons (41–43).

Of the health correlates, family history, bowel symptoms, and subjective health were the three factors showing the strongest associations with perceived risk, confirming other work that shows these to be frequently cited influences on risk judgments (16, 26, 30). These findings are of some concern. The problem with individuals “using” family history of CRC to judge their own risk is that the genetic link for most colorectal malignancies is limited (44), so while a very strong family history might be a cause for greater vigilance, CRC in a single FDR, diagnosed after the age of 60 years, does not substantially increase risk (45). The converse of this is that the absence of a family history is no basis for complacency. The finding that bowel symptoms and subjective health strongly influence risk perception is also worrying given that the pathogenesis of CRC is often asymptomatic until an advanced stage (26), so lack

**Table 2. Simple and multiple ordinal regressions of the predictors of perceived risk of CRC (lower/the same/higher)**

|                            | Simple odds of perceived risk | Simple significance | Multiple odds of perceived risk | Multiple significance |
|----------------------------|-------------------------------|---------------------|---------------------------------|-----------------------|
| Gender                     |                               |                     |                                 |                       |
| Female                     | 1.00                          |                     | 1.00                            |                       |
| Male                       | 0.79 [0.72, 0.86]             | <0.001              | 0.84 [0.76, 0.94]               | 0.001                 |
| Age                        |                               |                     |                                 |                       |
| 55–59 years                | 1.00                          |                     | 1.00                            |                       |
| 60–64 years                | 0.86 [0.78, 0.94]             | <0.001              | 0.89 [0.80, 0.98]               | 0.021                 |
| Ethnicity                  |                               |                     |                                 |                       |
| White                      | 1.00                          |                     | 1.00                            |                       |
| Non-white                  | 0.49 [0.39, 0.61]             | <0.001              | 0.50 [0.38, 0.64]               | <0.001                |
| Marital status             |                               |                     |                                 |                       |
| Married                    | 1.00                          |                     | 1.00                            |                       |
| Not married                | 1.04 [0.94, 1.16]             | 0.390               | 0.92 [0.81, 1.04]               | 0.189                 |
| Townsend deprivation       |                               |                     |                                 |                       |
| 0 (affluent)               | 1.00                          |                     | 1.00                            |                       |
| 1                          | 1.04 [0.93, 1.18]             | 0.471               | 0.98 [0.86, 1.13]               | 0.828                 |
| 2                          | 1.00 [0.88, 1.13]             | 0.982               | 0.83 [0.68, 0.96]               | 0.011                 |
| 3 (deprived)               | 1.13 [1.00, 1.28]             | 0.050               | 0.86 [0.74, 1.00]               | 0.051                 |
| Family history (FDRs only) |                               |                     |                                 |                       |
| 0                          | 1.00                          |                     | 1.00                            |                       |
| 1                          | 3.53 [2.94, 4.24]             | <0.001              | 3.37 [2.76, 4.10]               | <0.001                |
| 2+                         | 6.63 [3.87, 11.36]            | <0.001              | 5.58 [3.02, 10.33]              | <0.001                |
| Smoking                    |                               |                     |                                 |                       |
| No                         | 1.00                          |                     | 1.00                            |                       |
| Yes                        | 1.43 [1.29, 1.58]             | <0.001              | 1.32 [1.16, 1.49]               | <0.001                |
| Exercise                   |                               |                     |                                 |                       |
| Yes                        | 1.00                          |                     | 1.00                            |                       |
| No                         | 1.50 [1.36, 1.65]             | <0.001              | 1.27 [1.14, 1.42]               | <0.001                |
| Bowel symptoms             |                               |                     |                                 |                       |
| 0, 1                       | 1.00                          |                     | 1.00                            |                       |
| 2, 3                       | 1.75 [1.59, 1.93]             | <0.001              | 1.59 [1.42, 1.78]               | <0.001                |
| 4+                         | 4.72 [4.16, 5.37]             | <0.001              | 3.69 [3.16, 4.32]               | <0.001                |
| Subjective health          |                               |                     |                                 |                       |
| Excellent                  | 1.00                          |                     | 1.00                            |                       |
| Good                       | 2.13 [5.37, 8.94]             | <0.001              | 1.81 [1.56, 1.37]               | <0.001                |
| Fair                       | 4.17 [3.59, 4.85]             | <0.001              | 2.99 [2.47, 3.60]               | <0.001                |
| Poor                       | 6.92 [5.37, 8.94]             | <0.001              | 4.43 [3.20, 6.13]               | <0.001                |
| Anxiety                    |                               |                     |                                 |                       |
| Low                        | 1.00                          |                     | 1.00                            |                       |
| Medium                     | 1.42 [1.79, 2.21]             | <0.001              | 1.13 [1.00, 1.28]               | 0.057                 |
| High                       | 1.99 [1.79, 2.21]             | <0.001              | 1.20 [1.05, 1.37]               | 0.006                 |

of symptoms and feeling well should not lead individuals to believe themselves to be at low risk. Risk communications about CRC therefore need to tackle misunderstandings of both the genetic link and the pathogenesis of CRC.

One reassuring finding is that smokers and nonexercisers appear to recognize their increased risk of developing CRC, with both groups perceiving their risk to be higher than nonsmokers and exercisers, in line with previous work (14, 16, 20, 22, 24, 30). This reflects a relative accuracy in their judgments because smoking and inactivity have been associated with increased risk of CRC (46), although whether most people are aware of this specific link is somewhat unlikely.

Overall, this large sample of older British adults showed modest levels of optimism about their chances of developing CRC, but the proportion of individuals making optimistic judgments was lower than in some other studies. Seventeen percent of respondents were optimistic about their risk of developing CRC, which is considerably lower than the 36% reported by Lipkus *et al.* (14) for CRC in a telephone survey of American adults older than 50 years and the almost 50% reported by Aiken *et al.* (15) for breast cancer in a questionnaire survey of women aged 37–77 years. Similarly, fewer than 11% of respondents with a family history in our study showed an optimistic bias, substantially lower than among Blalock *et al.*'s (25) respondents, of whom 29% of 40–75-year-olds with a FDR with CRC saw their risk as lower than their peers.

Why should our respondents show less of an optimistic bias than previous research? One explanation may be the cultural differences in risk perception between the United Kingdom and the United States, where most work in this area has been carried out. In the words of Kahneman (47), "Americans are the most optimistic people in the world." When American and Danish college students were asked about comparative risk for unplanned pregnancy, sexually transmitted disease, and HIV, Americans were much more optimistically biased than Danes (48). Other studies comparing levels of optimism between West and East, represented by North America and Japan, have also found North Americans to display more optimism (49, 50). Another possibility is that the context of the present study, in which participants were taking part in a new screening program, might have effectively selected out individuals who felt themselves to be at lower risk. Both U.S. studies cited above used samples from community settings: Aiken *et al.* (15) used the context of a community women's group and Lipkus *et al.* (14) assessed adult users of a community health center. However, against this interpretation is the fact that a survey of a similar sample, which did not mention screening, showed similar (low) levels of optimism for CRC (51), suggesting that British pessimism rather than the selective recruitment into the trial of British pessimists is more likely to explain the findings.

There are limitations to this study that need to be considered in interpreting the results. It is part of a larger-scale project on CRC screening, which might limit or bias participation. Participation rates at the survey stage were moderate (61% response rate; similar to other primary care surveys), but comparative opti-

mism levels were similar to those found in a parallel survey not raising the issue of screening, so this does not seem likely to significantly bias the results. The measures of smoking and exercise were based on simple one-item questions to reduce participant burden, but such brief measures may not fully capture these behaviors. The study also addressed only a limited array of possible influences on perceived risk. In terms of personal health behaviors, factors known to be related to CRC such as intake of folate, fruits, vegetables, fiber, and saturated fat were not assessed in this study. Finally, the study was cross-sectional in design, so cause and effect cannot be determined. However, we know from a separate sample of British adults, not included in the FS Trial, that many of the participants had never really thought about bowel cancer before, so it is unlikely that their perceptions of cancer affected the other variables (52). It is possible that the inclusion of questions on family history and symptoms may have alerted participants to their possible effect on bowel cancer risk, but this is minimized by the fact that in the questionnaire the comparative risk question came before any questions on family history and bowels symptoms.

The present study is the first of its kind to explore the correlates of perceived risk for CRC in a large population sample of both men and women and to take a multivariate approach to investigate a broad range of demographic and psychosocial factors. The results indicate that there are several different factors that tend to promote lower levels of perceived risk. Being male and older were each associated with lower perceived risk. Misperceptions such as these should be addressed in public health education. Lack of a family history of disease and fewer physical symptoms are factors that might logically decrease perceived risk but, in the context of population-based presymptomatic screening, may serve as barriers to preventive health behaviors. Being less anxious and having a healthier life-style are, as expected, associated with lower perceived risk but are also likely to be related to (other) beneficial health behaviors such as screening.

In practical terms, if a CRC screening program is to be effective, then as many of the population as possible need to be sufficiently motivated to participate. Perceived risk is the key motivating factor in almost all models of preventive behavior. The present study has examined associates of perceived risk and in so doing has highlighted factors that we may be able to address in public health education to increase screening participation.

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