

ORIGINAL ARTICLE

Failure of Screening or Failure to Screen?

The Screening Behavior of Patients With Colorectal Cancer in the Leipzig Area

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SUMMARY

Background: Colorectal cancer (CRC) is the second most common cancer-related cause of death in Germany. Screening for colorectal cancer is effective and is covered by statutory health insurance in Germany.

Methods: The authors studied the screening behavior of patients with CRC in the Leipzig area in the 10 years before their diagnosis. The patients were asked to fill out a standardized questionnaire, and their primary care physicians were questioned, in order to determine what screening measures had been performed and why none had been performed in some cases.

Results: 212 patients with CRC were studied. In 175 (83%), cancer had been diagnosed after the appearance of symptoms ("symptomatic group"); in 37 (17%), it had been detected by screening ("screening group"). 51% of the overall patient group had undergone CRC screening in the 10 years before their diagnosis. A test of the stool for occult blood was the most common screening method but was generally not performed in conformity with guidelines. 25 patients (12%) had undergone a screening colonoscopy in the 10 years before their diagnosis; of these 25, 20 had undergone a screening colonoscopy in the 5 years before their diagnosis. The main reason why screening was not performed was ignorance of its availability.

Conclusions: This retrospective study revealed that, of 212 patients with CRC, most had not previously undergone CRC screening in conformity with guidelines. Better patient education by physicians may improve the effectiveness of screening. Appropriate screening measures include fecal occult blood testing and colonoscopy in conformity with guidelines.

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Key words: colorectal cancer, screening test, health services research, colonoscopy, stool test

Colorectal cancer (CRC) is the second most common type of cancer in Germany, with an estimated incidence of 73 000 new cases in 2007 (1) (figure 1). The mortality associated with the disease correlates with the stage of disease at the time of diagnosis (2). Patients in whom the CRC is detected at a curative, operable stage have a 5 year survival rate of 65% to 95%. By contrast, hardly any chance of cure exists in metastasized stage IV cancers, in spite of advances in chemotherapy and interdisciplinary therapy (2).

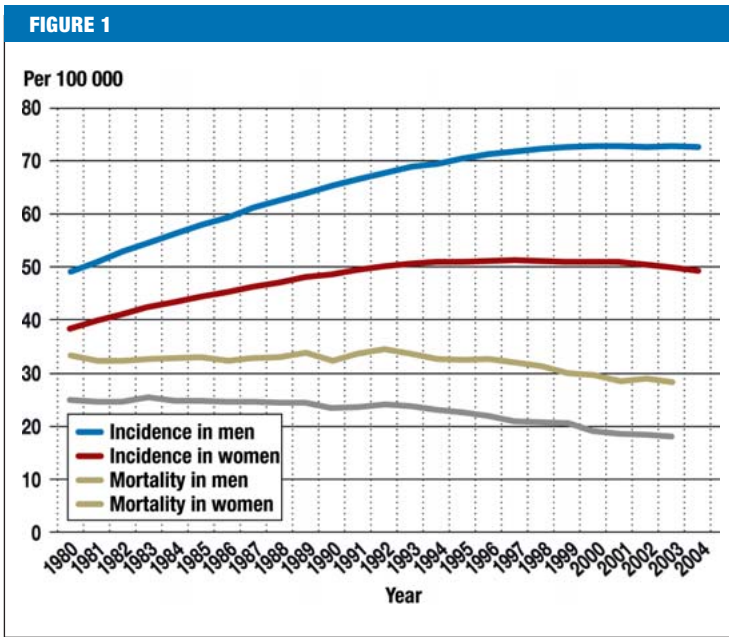
Screening examinations enable detection of CRC in the pre-stages or early stages as adenomatous polyps. The oldest method for early detection is digital rectal examination. This has been included in German cancer screening/early detection programs introduced by the statutory health insurers in 1971, for men and women aged 45 years or older. In 1982, the test for fecal occult blood (FOB) was added as a screening measure for CRC. Since 2002, colonoscopy has been integrated in the early detection program for those older than 55.

The effectiveness of early detection measures can be measured by means of several parameters. The most persuasive one is certainly the reduction in mortality due to CRC. The effectiveness of FOB tests (FOBT) in CRC screening has been widely documented. Annual application reduces mortality due to CRC by 25% (3). Once-only FOB testing after digital rectal examination is not suitable (4).

Endoscopy has the highest specificity and sensitivity in detecting CRC or its preliminary stages. It also has the advantage that a therapeutic intervention can be undertaken during the same session. Endoscopic ablation of adenomas (polypectomy) can prevent the development of a cancer at the still benign stage of the adenoma-carcinoma sequence. The rate of complications is low for endoscopy (5, 6).

For sigmoidoscopy, case-control studies have shown a reduction in the incidence of and mortality due to CRC in the rectosigmoid area (7, 8). More neoplasias in the distal colon are detected by using this procedure than by using FOBT alone (9). The protective effect of sigmoidoscopy lasts for 6 to 10 years.

Only complete colonoscopy enables the detection of neoplasias in the right colon; the procedure has a high sensitivity and specificity for cancers and adenomas of the entire colon. The incidence of CRC after colonoscopic



Age standardized incidence and mortality of colorectal cancer in Germany per 100 000 population (European population), all age groups (1)

polypectomy falls by 66% to 90% (10, 11). When complete colonoscopy is used under controlled (study) conditions, neoplasias rarely remain undetected (12). After screening colonoscopy without polypectomy, the protective effect lasts for a minimum of 10 years (13).

On the basis of existing data, the S3 guideline for CRC was published in 2004 (2). According to this guideline, colonoscopy is recommended for early detection screening in people at average risk for CRC—i.e., no first degree relatives with CRC, polyps, or adenomas—after the age of 50. The investigation should be repeated after 10 years. In people who refuse a colonoscopy, sigmoidoscopy should be performed every 5 years, with annual FOB testing. If a patient refuses all types of screening endoscopy the annual FOBT should be done in isolation. A positive FOBT should not be repeated, but colonoscopy should be undertaken in each and every case.

In order to further improve CRC screening, it is important to analyze the current situation with regard to services. Our study investigated patients with CRC in the Leipzig region where service deficits exist. We aimed to find answers to the following questions:

- Was the offer of screening taken up?
- Did the conducted screening measure conform to the guideline?
- Which reasons, if any, existed for a cancellation, refusal, or insufficient extent of the screening investigation?

Methods

Between November 2004 and December 2005, all patients were recruited from four academic teaching hospitals and one university hospital in the Leipzig region who had been admitted as inpatients for the purpose of having surgery for histologically confirmed colorectal cancer. The exclusion criterion for participation in the study was tumor recurrence. Before participation, patients had to give written informed consent. Ethics approval was obtained from the ethics committee.

Demographic data, a family history with regard to CRC, and data relating to the diagnosed CRC (detection method, histology, location) were captured from the patients' files. The patients were questioned retrospectively for their medical history and screening method they had attended by means of a standardized questionnaire. The questionnaire covered the following topics:

- Patient data
- Name of the hospital
- The reason why the CRC was detected (symptoms or screening)
- The type of complaints
- Screening investigations in the preceding 10 years (bearing in mind that screening colonoscopy was not covered by the statutory health insurance companies in Germany before 2002)
- Concomitant colonic diseases, especially chronic inflammatory bowel diseases
- Family history

TABLE 1

Patients' demographic and tumor location data, classified by screening group and total group

	Total	Screening	Symptom
Median age	68 years	67 years	68 years
Sex m/f	117/95	20/17	97/78
Location of tumor			
Rectum	87 (41%)	13 (35%)	74 (42%)
Sigmoid colon	51 (24%)	12 (32%)	39 (22%)
Descendent colon	9 (4%)	0	9 (5%)
Transverse colon	16 (8%)	3 (8%)	13 (7%)
Ascendent colon	35 (17%)	5 (14%)	30 (17%)
Cecum	14 (7%)	4 (11%)	10 (6%)

- Familiarity with the prevention program for CRC.

The patients were then asked to give their reasons for not attending screening measures in an open interview.

The patients' primary care physicians (family doctors) were contacted via standardized interviews and, where required, visits, in order to evaluate and validate which screening investigations had been undertaken and what their chronology was, as well as to answer open questions.

The statistical evaluation of the data and the graphical illustration of measured values and frequencies were done by using computer software. The patient interviews were analyzed with the help of the clinic for psychosomatic medicine at Leipzig university hospital.

Results

Patients

Altogether 212 patients with CRC were included in the 14 months study period. The diagnosed cancers were located in the rectosigmoid area in 138 patients (65%) and in the proximal part of the colon in the remaining 74 patients (35%) (table 1). For 19 patients (9%), first degree relatives were known to have CRC. None of the patients' medical histories yielded a prior diagnosis of CRC or chronic inflammatory bowel disease. No genetically related disorders were found in any of the patients.

Screening behavior

The CRC had been diagnosed in the context of a screening investigation in 37 patients (17%) (screening group); in 10 patients, screening colonoscopy had been performed, and in 27, colonoscopy was undertaken after a positive FOBT result.

In the remaining 175 patients (83%), an investigation was initiated because they had symptoms (symptom group). These included:

- Fecal blood (41%)
- Changed bowel habits (42%)
- Weight loss (17%)
- Performance weakness (16%)
- Anemia (9%)
- Pain (19%) (table 2).

Eight of the 175 patients in the symptom group were younger than 50 and therefore below the age limit for the screening program. They were not included in the analysis of the screening services.

More patients in the screening group had sought out screening examinations than those in the symptom group. During the preceding 10 years, 33 of the 37 patients in the screening group (89%) participated in CRC screening. By contrast, only 74 of 167 of the patients in the symptom group (44%) had participated in screening measures. The proportion of all patients that had attended screening investigations in the 10 years before their diagnosis was 53%. The FOBT as an exclusive screening measure was used by 40% of patients, making it the most common screening measure (figure 2).

TABLE 2

CRC detected by screening or symptoms, with the symptoms that resulted in investigation

	Number (%)
Detected by screening	37 (17)
Detected by symptoms	175 (83)
Fecal blood	87 (41)
Changed bowel habits	89 (42)
Weight loss	35 (17)
Performance weakness	33 (16)
Anemia	19 (9)
Pain	41 (19)

Multiple mentions of complaints were permitted
CRC, colorectal cancer

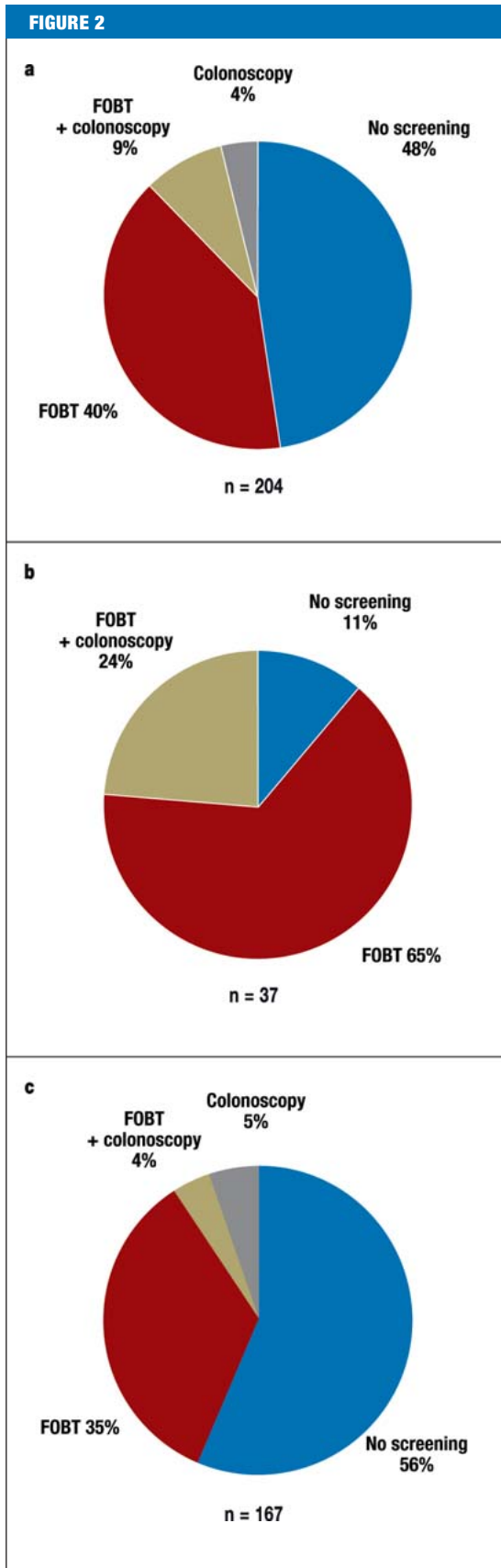
Testing for fecal occult blood

In the 10 years before their diagnosis, 100 patients had received one or more FOBT kits. In 51 patients, the test had been conducted annually; in 17 patients, every other year; and in the remaining patients, merely sporadically (figure 3). In 93 patients, all tests had yielded negative results; a positive result was noted in 7 cases. In those 7 patients, the positive test result was followed up by colonoscopy in 4 cases, which resulted in polypectomy in 2 patients. In the other 2 patients, no neoplasia was found. Three patients with positive FOBT results underwent another FOB test, whose result was negative. No further investigations were undertaken.

If the diagnostic investigations are included (the FOBT immediately preceding the diagnosis of CRC), findings were positive in 35 of 105 patients who underwent fecal testing. In 30 patients, the positive result led to the detection of a CRC (86%). The median time to diagnosis in patients with a positive FOBT was 1 month. However, in 4 patients (11%), the time from positive FOBT to diagnosis was longer than 12 months. In 70 of 105 patients, the last FOBT before diagnosis was negative. In 22 patients, the CRC was diagnosed within a year after a negative FOBT, and in 41 patients after more than a year (figure 4a). In the remaining 7 patients it was not possible to precisely determine the date of the last FOBT.

Colonoscopy

In the 10 years preceding the diagnosis of CRC, 25 patients underwent screening colonoscopy. In 4 patients this followed a positive finding on FOBT; in 7 it was done without prior FOB testing; and in 14 it was done in addition to a negative FOBT result. The mean time lag between the most recent colonoscopy and the CRC diagnosis was 2 years, and 5 years or less in 20 out of 25 patients (80%) (figure 4b).



Screening examinations in the 10 years preceding diagnosis in (a) all patients (n = 204), (b) patients in the screening group (n = 37), and (c) patients in the symptom group (n = 167)

In 4 cases, the colonoscopy had not reached as far as the cecum. Three patients therefore received a written invitation to attend further diagnostic tests; however, this did not happen in 2 cases and yielded no pathological findings in the third.

In 13 patients a polyp was resected colonoscopically. In 7 of these patients, CRC was diagnosed within 3 years after their most recent colonoscopy, and in another 4 patients, this happened within 5 years.

In 3 patients who underwent polypectomy, no recommendations were made regarding further investigations/treatment, and in 5 further patients, the recommendations were ignored.

After screening colonoscopy in the preceding 10 years the location of the cancers was comparable to that in the entire group: 68% of the 25 patients who had attended screening had a CRC in the rectosigmoid area and 32% in the proximal colon.

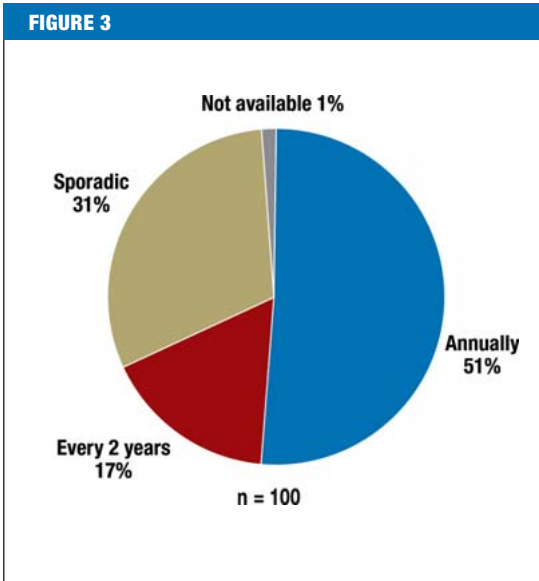
Reasons for omitted screening measures

Altogether 105 patients had not participated in any screening investigations in the 10 years preceding their diagnosis. The main reason was a lack of awareness of the option of (12%) or the indication for screening (47%). Lacking advice from the doctor (7%) or a patient's own negligence (9%) are also reported. A further 11% were scared of the screening test. 14% of patients reported being too young for the investigation (table 3). In the entire group, 43% were unaware of the option of screening colonoscopy, financed by the statutory health insurers, after the age of 55. The sex and age distribution in the unscreened group was not fundamentally different from that in the whole group.

Conclusions

The value of CRC screening is well documented. Screening lowers the mortality due to CRC. Adenomas as benign precursors of CRC are detected in approximately 1 in 5 screening participants and can be removed during the screening colonoscopy without any complications. In about 1% of participants, CRC is diagnosed, with 90% of these at an inoperable stage (6). If an early stage CRC is detected during screening, the chances of cure are much better than in cancers that were detected on the basis of symptoms (14). It is desirable for as many people as possible in the respective age groups to attend screening measures. Up to 2005, 8.8% of men and 10.2% of women who were entitled to participate in screening programs in Germany had used this option (6).

The present study from the Leipzig region shows that 83% of patients with CRC were not diagnosed by means of screening programs. More than half the patients had not attended any screening investigations at all. In two thirds of cases the reason was a lack of awareness that such programs were available. Providing relevant information is therefore still of crucial importance, and primary care physicians should initiate this. The Lebensblicke (15) and Felix Burda (16) foundations



Use of FOBT in patients who underwent FOB testing as a screening measure within the 10 years preceding a diagnosis of CRC

are support organizations that provide (German-language) information material free of charge.

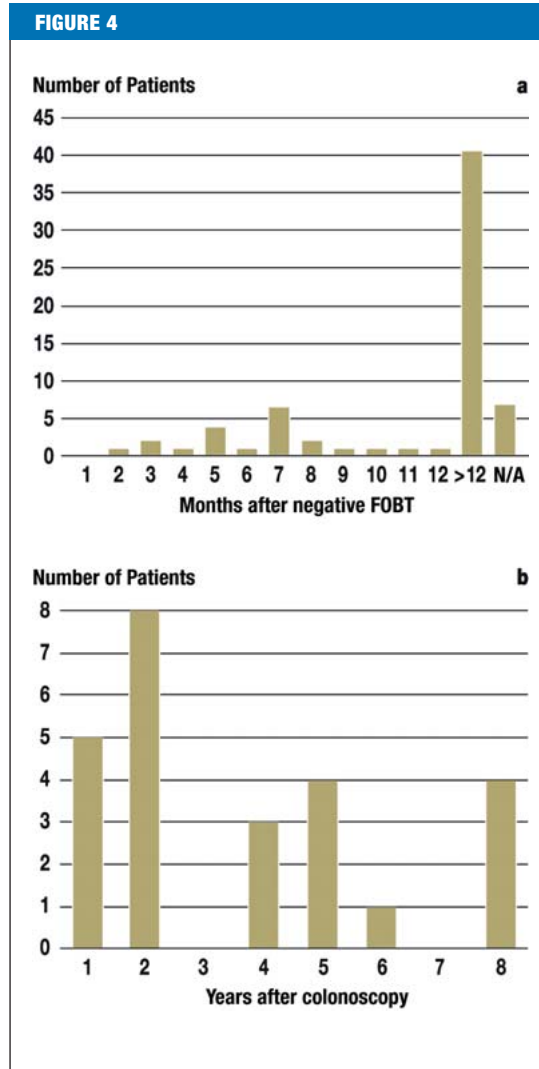
The simplest procedure is the FOBT. To be reliably effective, the test should be used in 3 subsequent bowel movements and should be repeated annually. Some cancers and many adenomas do, however, not bleed or do so only intermittently and may therefore be undetectable on the FOB test. After the first positive FOBT, endoscopy should be performed to ensure that no colorectal neoplasias are being overlooked.

Endoscopy is the gold standard investigation to detect neoplasias and initiate simultaneous treatment if adenomas or low risk cancers are found. If the findings are unremarkable, colonoscopy substantially reduces the risk of CRC in the long term and needs to be repeated only after 10 years (13). In the present study, screening colonoscopies had been conducted in 25 patients within 10 years before their diagnosis. The rate of new or colonoscopically undetected CRC was thus rather high in this cohort (17, 18).

Potential risk factors for undetected colorectal cancers or pre-stages include:

- Older age
- Disease factors such as polyps located in the right colon, number of polyps, defective DNA repair mechanisms, concomitant diverticulosis
- Investigation related factors such as cleanliness of the colon during the examination, skill and experience of the endoscopist (17, 18, 19).

The patients' age and location of the CRC in the 25 patients who had undergone screening colonoscopy did not substantially differ from the remaining cohort and from comparable groups in other publications. In one fifth of cases, recommendations after polypectomy



Time span between most recent screening test without findings and diagnosis of CRC. (a) FOBT (n = 70), (b) colonoscopy (n = 25). N/A: not available

or incomplete colonoscopy were inadequate; in one third, the recommended method to proceed after colonoscopy screening was ignored. Examination related parameters are another potential factor that influences improved screening results and should be considered while developing screening programs.

A further obstacle to colonoscopy as a mass screening method are reservations within the population. Especially the laborious preparation in the form of bowel lavage plays a part (20). Preparations containing polyethylene glycol (PEG) ascorbic acid have found better acceptance among patients because of the reduced volume of only 2 liters than the solutions previously used for bowel lavage (21). However, no absolutely effective, tolerable, and safe method for bowel lavage has been found to date. To reduce the incidence of CRC further, current screening methods should be improved and alternative reliable screening methods

TABLE 3

Reasons why 105 patients did not attend screening tests

Reasons	Number (%)
Lack of awareness of screening option	69 (66)
Too young	15 (14)
Fear	12 (11)
Own negligence	9 (9)

should be identified that find better acceptance in the population.

Radiological methods such as computed tomography (CT) colonography or magnetic resonance (MR) colonography require the same disagreeable preparation on the part of the patient as endoscopy. Further, these are expensive and, in the case of CT colonography, associated with radiation exposure. Studies of the effectiveness of CT colonography have shown that its diagnostic accuracy is not quite on a par with that of colonoscopy (22). Radiological approaches can thus not be recommended as the baseline method for CRC screening. A new method currently under investigation is colon capsule endoscopy (23). FOBT has been the most widely accepted of current screening methods. Improved fecal tests with high negative predictive values would constitute a substantial advantage. Serological tests, such as measuring the complement anaphylatoxin C3a (C3a-desArg) might have the potential to improve early detection measures (24).

Advances in interdisciplinary oncological treatment have, in many cases, resulted in converting stage IV colorectal cancers from a death sentence into a chronic disease. Joint efforts in the areas of information provision, as well as in primary, specialist, and secondary care provision should make it possible to transform colorectal cancer from an epidemic into a sporadically occurring, curable neoplasia. The approaches to improved care provision identified here have partly already been put into practice and should be considered during every consultation with and treatment of any patient older than 50.

Conflict of interest statement

The authors declare that no conflict of interest exists according to the guidelines of the International Committee of Medical Journal Editors.

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