The Bowel Cancer Screening Programme: examining its successes and challenges

Abstract

Bowel cancer is a major cause of premature mortality in the UK. While there are suitable, cost-effective screening procedures that identify early-stage disease and reduce cancer-related deaths, there are obstacles to uptake by the at-risk population, including embarrassment and distaste of sample collection, low sensitivity of the tests to identify cancer and precancerous conditions, and the suitability of the preparative processes prior to screening. This article describes the faecal occult blood tests used in the bowel cancer screening programme, the barriers to successful screening, the importance of bowel preparation and experiences from an NHS bowel cancer screening unit, in addition to new biomarker screening methods.

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- Colorectal cancer
- Colonoscopy
- Occult blood
- Patient participation rates
- Health literacy

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Bowel cancer

Bowel cancer is the fourth most common form of cancer in the UK. There are approximately 42 000 new cases each year, resulting in over 16000 deaths annually, making bowel cancer the second highest cause of cancer-related mortality (Cancer Research UK, 2014). Although improvements in treatment have led to a gradual reduction in mortality over the past 30 years, 5-year survival is still only around 50% in the UK, and appears to be significantly lower than in other comparable countries. This is mainly due to the relatively late presentation to health services at an advanced stage of disease, which reduces the chance of successful treatment (Coleman et al, 2011).

Early-stage detection can be improved with screening procedures, which identify symptoms that are normally ignored or overlooked by patients, and can lead to earlier diagnosis and improved clinical outcome (Hewitson et al, 2008). Screening also enables the detection and excision of precancerous adenomas, thereby reducing colon cancer risk.

Guaiac faecal occult blood test

A symptom of bowel cancer is blood combined with faecal material, with the amount of intraluminal bleeding from vascularised colorectal cancers and adenomas being related to the size, stage and site of the neoplasia (Geraghty et al, 2014). Screening using a guaiac faecal occult blood test (gFOBt) has been shown to be effective in identifying cancer and precancerous conditions, reducing mortality by 16% in people offered screening and by 25% in those accepting the invitation for the procedure (Hewitson et al, 2008). Economic analyses also suggest that screening is cost-effective, with a cost per quality-adjusted life-year gained of less than £3000 (Tappenden et al, 2007).

As a consequence, the NHS Bowel Cancer Screening Programme (BCSP) was introduced in England in April 2006 with the proposal for biennial gFOBt screening of 60 to 69-year-olds, which was later extended to include those up to 74 years of age. By October 2008, the programme was being coordinated from four regional hubs and almost 2.1 million people had been invited to participate (Logan et al, 2011).

The protocol involves sending out letters of intent to identified individuals, quickly followed by a self-completed testing card. This is an immunoassay (hema screen™, Immunostics, USA) (*Figure 1*), which uses a natural resin from

a tree that grows in the Caribbean and the northern coast of South America. This resin is impregnated into filter paper and interacts with haemoglobin through an enzymatic reaction to produce a stable by-product (lasts up to 21 days at room temperature), which later, in a designated laboratory, can be detected with the addition of a solution of hydrogen peroxide to produce a blue-coloured derivative (Immunostics, inc., 2013).

The card contains three windows, each containing two sample areas. Two small specimens from different areas of a faecal sample are smeared onto the sample areas and the window cover is closed. Samples from two other, but not necessarily consecutive, days should be added and sealed, and sent back to the accredited testing laboratory by post. A kit with that tests positive for five or six occult haemoglobin spots is classified as abnormal, and further investigation is recommended. Between one and four positive spots is considered unclear, and a second kit is sent out for re-testing. If the second kit result is normal, a third kit is sent out. If either the second or third kits contain one or more positive spots, then the outcome is described as a weak positive, and colonoscopy is recommended. Following an unclear result in kit one, or if both kits are normal, patients are returned to the screening programme for repeat testing in 2 years' time. Subjects diagnosed with colorectal cancer are referred to their local multidisciplinary team for surveillance (Cairns et al, 2010).

An early assessment of the programme involving the first 1 million screening tests sent out showed that the return rate of completed tests was modest, with approximately 50% of men and 55% of women participating, which included 2.5% of men and 1.5% of women having an abnormal test result (Logan et al, 2011). These patients were invited for a hospital-based interview and offered a further exploratory investigation, usually colonoscopy, and over 17 000 people underwent that procedure. Cancer and higher-risk adenomas were found in 12% and 43% of men and 8% and 29% of women respectively (Logan et al, 2011).

A further assessment at the end of May 2014 showed that the BCSP programme had

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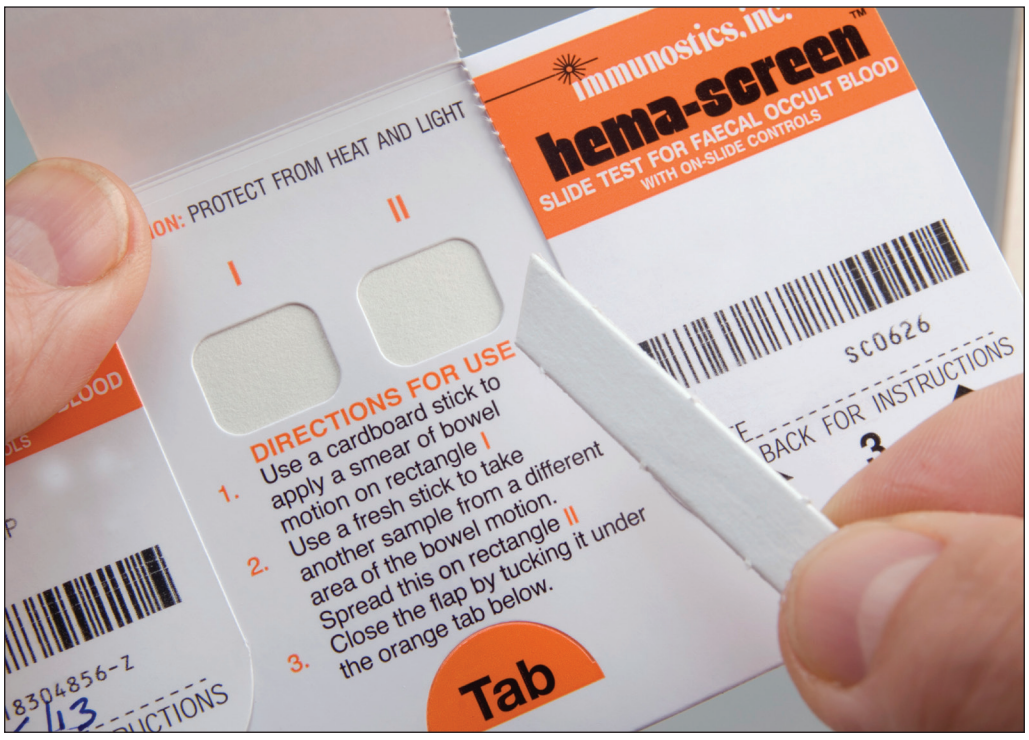

Figure 1. The guaiac faecal occult test card contains three windows, each with two sample areas. Faecal samples are smeared onto the sample areas, the card is sealed, and sent to the laboratory by post.

diagnosed over 19 000 neoplasms, with a higher proportion of advanced (Dukes' A) cancers (Geraghty et al, 2014), and that 3% of patients with bowel cancer are diagnosed through the NHS BCSP (Morris et al, 2012).

Barriers to successful screening

Although the immunoassay test cards are relatively inexpensive and the process of analysis is well established, there are still significant problems with the screening process. Because the assay cannot differentiate between fresh blood (from haemorrhoids, constipation or menstruation) and occult blood from a neoplasm, there are a significant number of false positives. Furthermore, due to the dispersal of sometimes minute amounts of occult blood and the small number of samples, the presence of haemoglobin may be missed, resulting in a number of false negatives.

Participation rates

To make an informed decision about whether to complete the screening test, individuals are advised that the screening test is not a diagnostic but rather a screening test, and that the sensitivity of the test is low, meaning that some individuals may return a positive test but will not have cancer, or alternatively some individuals with early-stage bowel cancer will not return a positive test. Despite the occasional false-positive or false-negative result, clinical trials have shown that the faecal occult blood test is the safest and most cost-effective screening test available (Flight et al, 2008).

For the BCSP to succeed in reducing the incidence and prevalence of bowel cancer, individuals need to be persuaded to complete the test. Participation rates have been disappointingly low (Szczepura et al, 2008). In an effort to explain this, various social and environmental factors have been identified that can influence a person's decision whether or not to participate in the screening programme. These include a person's sex, age, ethnicity, socioeconomic status, level of education and health literacy (Thompson et al, 2011). Other factors identified include the widespread concern about collecting and storing faecal matter (O'Sullivan and Orbell, 2004), and sending such samples through the post for analysis (Chapple et al, 2008).

Other investigators have explored the role of GPs in the decision-making process, and suggest that uptake would be higher if GPs were more actively involved in promoting the benefits of the BCSP programme (Beeker et al, 2000), and showed a greater willingness to follow-up the patient should they not initially accept the invitation to participate (West et al, 2007).

Additional factors that have been shown to significantly contribute to a low uptake are: negative experiences with the health-care system; an individual's perceptions of risk and benefit of identifying a cancer; and the support and encouragement from a spouse or carer (Eckberg et al, 2014).

Bowel preparation

Once the invitation to participate has been confirmed and a positive result returned, the patient is invited to the hospital-based screening centre to discuss the next stage, which is usually investigative colonoscopy. This is where the next challenge is met: the quality of the bowel preparation prior to the examination. This is a major determinant of the endoscopist's ability to visualise the colonic mucosa, to detect adenomas and carry out a high-quality examination necessary for biopsies or adenoma excision, which in some cases may be less then 5 mm in diameter (Adler et al, 2013). Moderate or high-quality preparations may allow identification and treatment to proceed, but low-quality preparations, which occur in about 30% of cases, will require time and resource-consuming repeat colonoscopy (Clark et al, 2014). More importantly, it will mean that the colonoscopy will miss existing colorectal cancers and decrease adenoma detection (Menees et al, 2013).

The main product frequently used for bowel preparation is Klean-Prep® powder for oral solution, a mixture of laxative polyethylene glycol (magrogol) and sodium and potassium salts, with the addition of macrogols for patients with constipation or diverticular disease. The use of split-dose bowel preparation, in which patients take a portion of the laxative the evening before colonoscopy and the other half on the day of colonoscopy, has been shown to improve bowel preparation quality (Park et al, 2010). Patients who have a mid-morning or later appointment

also are more likely to have a better-quality bowel preparation (Menees et al, 2014).

There also appears to be reluctance or an inability among patients to adhere to the preparation instructions, particularly among ethnic minorities and those of low socioeconomic and educational status, with about 16% of patients not complying with written and verbal instructions. A major challenge, therefore, is to ensure compliance with the protocol, as this necessary to reduce the risk of a suboptimal bowel preparation (Menees et al, 2014).

Experiences of an NHS screening unit

A West Midlands-based bowel cancer screening centre combines three screening sites with a varied socioeconomic demographic distribution. Between January and December 2014, a total of 73 000 gFOBts were sent to patients, including repeat test kits, with 36 070 (49%) being completed and returned for analysis. Of these, 848 (2.4%) were offered an appointment with a screening nurse following a positive test result. Following this, 646 (76%) endoscopic procedures were undertaken, which included colonoscopy, limited colonoscopy and flexible sigmoidoscopy, with an additional 44 radiological investigations being performed (Clair Millard, personal communication, 26 March 2015).

Out of the 646 endoscopic procedures carried out, 53 (8%) cancers were found, with episode outcomes of 7%, 11% and 72% for high, intermediate and low-risk surveillances respectively. Low-risk surveillance is now part of the BCSP recall system, with patients getting a home gFOBt kit for the monitoring of small adenomatous polyps, or normal investigation based on the original British Society of Gastroenterology surveillance guidelines for all colonoscopy patients (Atkins and Saunders, 2002).

BCSP specialist screening practitioners are responsible for collating results and histological reports, and counselling patients before and after the procedure, to ensure adherence to the preparation protocols, and their role includes the breaking of bad news following positive results. They form the nursing staff that aim to provide a professional service and to improve the quality of care for cancer patients (NHS choices, 2011).

Other biomarkers

While gFOBt is still widely used in the BCSP, other biomarkers are available and others are emerging that provide a superior analytical test, with improved sensitivity and specificity for detecting early-stage cancers or adenomas. Faecal immunochemical testing (FIT) has been shown to be more specific and sensitive to detecting human blood than its guaiac-based predecessor, and works by using monoclonal or polyclonal antibodies raised against the globin component of blood (Burch et al, 2007). Participation rates have been shown to be significantly higher for individuals offered FIT compared with those offered a gFOBt, mainly because the sampling method is less awkward and gives a greater sense of accuracy (Vart et al, 2012).

Although a comparative analysis showed that a screening programme based on biennial screening with FIT would be preferable to the use of gFOBt in terms of accuracy and quality-adjusted life-years gained, it would be more expensive as a testing method, and would require more colonoscopy resources and result in more individuals suffering adverse effects, such as major abdominal bleeding, bowel perforation, and possible death from peritonitis (Sharp et al, 2012).

An alternative approach is the detection of volatile organic compounds in urine, the profile of which varies between different types of cancer. This technique requires sophisticated, expensive, analytical methods, which are not immediately available. Although this approach has a high degree of sensitivity and specificity and may be more acceptable to patients, access to it is severely limited due to its high cost (Arasaradnam et al, 2014).

Conclusion

In conclusion, the NHS BCSP is well established throughout England, with a well-run system of test distribution, analysis and counselling. However, it suffers from a low rate of acceptance by many members of population at risk of developing bowel cancer, mainly due to the sampling protocol and low confidence in the accuracy of the test. When patients with potential colonic abnormalities are identified, there are still barriers to successful screening, including non-adherence to the prolonged and

unpleasant bowel preparation method, which incurs the need for repeat testing and greater costs. The use of other testing approaches like FIT may be more acceptable, but only if the increased financial cost can be overcome. **GN**

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