Impact of UK Colorectal Cancer Screening Pilot on hospital diagnostic services

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Abstract

Objective To determine the impact of the UK Colorectal Cancer Screening Pilot on hospital services involved in the diagnosis of colorectal cancer (predominantly colonoscopy, double contrast barium enema and pathology).

Methods Routine data from seven hospitals at two sites within Scotland and England participating in the Pilot were collected on activity levels and waiting times for key hospital services (GI medicine, surgery and radiology), plus questionnaire survey data from hospital consultants.

Results Hospital colonoscopy activity increased by 31 per cent in Scotland and 21 per cent in England due to the investigation of faecal occult blood testing (FOBt) positive subjects. The demand for symptomatic (non-screening) colonoscopy also increased. Pilot-generated activity was less than predicted for barium enema services (maximum 3 per cent increase in service volume) but greater than expected for pathology, with approximately 200 specimens/month generated. Out-patient review of Pilot colonoscopy patients and associated administrative duties added substantially to overall GI service workload, but quantification was limited by the quality of routinely available data. There was a wide discrepancy in colonoscopy waiting times between screened and symptomatic patients, with predominantly longer waits for symptomatic patients: otherwise the quality of colonoscopy services appeared to improve. In any future national screening programme, follow-up of patients with adenomas will result in a further increase of 28 per cent in the number of colonoscopies generated (over and above colonoscopy for FOBt-positive subjects), adding substantially to overall workload.

Conclusions During the planning of any successful national colorectal cancer screening programme, careful consideration must be given to the wider aspects of workload associated with screening, as well as to the implementation of appropriate hospital data collection systems.

Keywords: colorectal cancer, screening, hospital impact

Introduction

The UK Colorectal Cancer (CRC) Screening Pilot was established on the recommendation of the National Screening Committee (NSC), to determine the effectiveness, feasibility and acceptability of screening for colorectal cancer using faecal occult blood testing (FOBt). This followed their review of trials, which concluded that there was sufficient evidence that FOBt screening could reduce mortality from the disease to consider introducing a UK colorectal screening programme. The Pilot was subsequently established at two sites, one in central England and the other in Scotland.

Screening of the total population of 50–69-year-olds using FOB kits began at the Scottish site on 31 March 2000 and at the English site on 6 September 2000. Invitations were sent on a weekly basis by dedicated staff at one Scottish and one English Pilot centre. Patients who agreed to participate and who were subsequently found to have a positive FOBt were referred for colonoscopy at local hospitals participating in the Pilot. Sessions distinct from those for symptomatic patients were established for the assessment of screen-positive individuals and additional funding was provided for these, including the provision of a CRC screening nurse at each hospital to review FOB-positive subjects and arrange colonoscopy. In the event of the colonoscopy being incomplete or the patient being unable to undergo colonoscopy, the patient was referred for a double contrast barium enema. Patients found to have positive investigations were referred for appropriate treatment.

This study was undertaken as part of an independent, multidisciplinary evaluation of the Pilot commissioned by the Department of Health. Its aim was to determine the impact of the Pilot on hospital services involved in the diagnosis of colorectal cancer and to provide information that would be helpful...
in shaping these services to support a national screening programme. We initially identified three key domains of workload impact that would be crucial in the establishment of such a programme. They were impact on (1) colonoscopy services, (2) other gastrointestinal (GI) services (including both medical and surgical outpatients) and (3) radiology. During the course of the study, pathology services emerged as a fourth key domain affected by screening. Although it is possible that symptomatic in-patient cases might be adversely affected by the additional burden of screened cases, the impact of screening on surgical in-patient services was not investigated in detail in the current study, as this focused on diagnostic services. It will, however, be considered more fully during evaluation of the second round of screening in England (D. Weller, personal communication).

Methods

Routine data were collected from the Scottish and English Pilot centres and from each of the hospitals participating in the Pilot (Table 1) for the 2-year period prior to, and during, the Pilot. Data on activity levels and waiting times were requested for colonoscopy, double contrast barium enema (DCBE) and, in Scotland, GI out-patient services. In Scotland, consultants were asked to comment on the face validity of these data, which were collected throughout the course of the Pilot, and to explain any pertinent findings or artefacts. A small proportion of the initial data proved to be incorrect, and steps were taken to retrieve the correct data set. It was not possible to conduct this validity check in England, where routine data were collected at the end of the Pilot evaluation period.

To supplement the routinely available data, we surveyed hospital consultants closely involved with the Pilot to obtain more detailed information on the amount and nature of additional workload, quality and resource issues and views on a national screening programme. This was based on a series of semi-structured interviews with consultants in the lead NHS Trust in Scotland and a self-completion questionnaire sent to one gastroenterologist, one surgeon and one radiologist from each of the participating hospitals.

Quantitative data were analysed using Excel and free text comments in the questionnaire were analysed using a comparative approach. Because of concerns over data quality, reporting was limited to issues where routine data was consistent with findings from the consultant survey.

Results

Some routine data were provided by all the Pilot hospitals, but completeness was highly variable and often poor. The response rate of consultants to the questionnaire survey was 90 per cent in Scotland and 78 cent in England.

Colonoscopy

Table 2 shows that the (pre-Pilot) predicted rate for Pilot colonoscopies per hospital was not achieved. This was due to existing pressures including the availability of colonoscopists. Waiting times for Pilot colonoscopy rose above the requisite 2–4 weeks, initial invitations for screening were suspended for varying periods (Table 2) and in several areas, screening had to be extended beyond the initially planned 24-month period. Overall, colonoscopy

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Table 1 Sources of routine hospital data used in evaluation

<table>
<thead>
<tr>
<th>Pilot Site</th>
<th>NHS Trust</th>
<th>Hospital</th>
<th>Data provided</th>
</tr>
</thead>
</table>
| Scotland  | Grampian  | Aberdeen Royal Infirmary | Colonoscopy activity (monthly)  
Surgery activity (monthly)  
DCBE activity (monthly)  
DCBE waiting times (monthly)  
Colonoscopy activity (monthly)  
DCBE waiting times (monthly)  
Colonoscopy activity (monthly)  
DCBE waiting times (monthly) |
|           | Dr Gray's | Ninewells         | Colonoscopy activity (monthly)  
DCBE activity (monthly)  
DCBE waiting times (monthly)  
Colonoscopy activity (monthly)  
DCBE waiting times (monthly)  
Colonoscopy activity (monthly)  
DCBE waiting times (monthly)  
Colonoscopy activity (monthly)  
DCBE waiting times (monthly) |
| England   | George Eliot | Victoria  | Colonoscopy activity (monthly)  
DCBE activity (monthly)  
DCBE waiting times (monthly)  
Colonoscopy activity (monthly)  
DCBE waiting times (monthly)  
Colonoscopy activity (monthly)  
DCBE waiting times (monthly)  
Colonoscopy activity (monthly)  
DCBE waiting times (monthly) |
activity was increased by 31 per cent in Scotland and 21 per cent in England as a direct result of performing screening colonoscopy and this increase varied widely between hospitals (Table 2).

The number of colonoscopies performed for ‘symptomatic’ (non-Pilot) patients was also higher during the Pilot than previously. In the Scottish Pilot site, annual colonoscopy activity rose from 1157 procedures in the year prior to the Pilot to 1245 (excluding Pilot patients) during the first year of the Pilot, an increase of 7.6 per cent. This increase in symptomatic colonoscopy varied between hospitals and was most marked during the first year of the Pilot (Figs 1 and 2). In the consultant survey, possible reasons given for the increase in symptomatic cases included increased awareness about bowel cancer in the general population, a lowering of the threshold for investigation of symptoms, and/or increased use of colonoscopy over barium enema.

Waiting times for symptomatic patients increased with the start of the Pilot and, at most hospitals, were higher for symptomatic patients than for Pilot patients throughout the screening period (Fig. 3). However, there was evidence from the consultant survey of a positive impact of the Pilot on other aspects of the quality of colonoscopy services, including an increased use of protocols and guidelines and an improvement in individual colonoscopist skills. The latter was supported by a colonoscopy completion rate of 89.9 per cent (higher than the UK average), probably reflecting the provision of additional skills-training to Pilot colonoscopists, as well as the selection of Pilot areas (at least in part) due to their ability to provide high quality colonoscopy.

Although consultants were generally supportive of CRC screening, all felt that the resources provided had been insufficient to fully support Pilot colonoscopy activity. In any future national screening programme, they felt that additional support would be required for staff (endoscopy, administrative and specialist nursing) and physical expansion of patient facilities (preparation, procedure, recovery and consulting room space) as many units were already stretched to over-capacity. It was frequently noted that there are currently not enough trained endoscopy staff in the NHS to undertake the additional screening colonoscopies that would be generated by a national screening programme.

**Other GI services**

It was not possible to use routinely available data to quantify the effect of the Pilot on overall out-patient activity due to the wide range of influences on these (external to the Pilot), and changes in coding procedures over the period of introduction of the Pilot, leading to artefacts. However, eight of 11 consultants surveyed (84 per cent in Scotland and 40 per cent in England) reported seeing Pilot patients as out-patients post-colonoscopy, thereby increasing the workload. Regional differences in Pilot-generated out-patient work may have reflected differences in Pilot protocols (post-colonoscopy appointments with the CRC screening nurse were offered routinely in England but not in

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**Table 2** Screening colonoscopy at Pilot hospitals

<table>
<thead>
<tr>
<th>Target population (50–69 years)</th>
<th>No. screening invites sent (per week)</th>
<th>Estimated rate of colonoscopy (per week)</th>
<th>Usual no. Pilot colonoscopy sessions (per week)</th>
<th>Usual no. patients per Pilot colonoscopy session</th>
<th>Average rate of Pilot colonoscopy (per month)*</th>
<th>Increase in colonoscopy activity due to Pilot colonoscopies (%)*</th>
<th>Periods of suspension of screening invites (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>112 046†</td>
<td>12 + 3</td>
<td>1000</td>
<td>1000</td>
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<td>1000</td>
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<td>5</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>112 046</strong></td>
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<td><strong>112 046</strong></td>
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</table>

*During first 18 months of Pilot and once steady rate of Pilot colonoscopy reached in Scotland and during first 24 months of Pilot in England.
Figure 1 Average monthly colonoscopy activity (per quarter) at Scottish Pilot hospitals, prior to and during the Pilot.
Figure 2  Average monthly colonoscopy activity (per year) at English Pilot hospitals, prior to and during the Pilot.
Consultants reported seeing approximately 25 per cent of Pilot colonoscopy patients as out-patients (two/week), including those with cancer and large polyps. The degree to which patients with non-malignant pathologies were reviewed as out-patients varied between hospitals (but, if not seen by hospital consultants, these patients created extra referrals for GPs). Three consultants specifically mentioned that FOB-positive patients with no pathology at colonoscopy were often re-referred to the GI services where they could present a management problem. Four of nine consultants also felt that there had been an increase in out-patient referrals for non-Pilot patients since the start of the Pilot.

Overall, 552 cancers detected by screening were diagnosed. In the consultant survey, only one consultant noted any increase in medical in-patient activity related to cancer detection, but all surgeons reported an impact on in-patient surgical services, due to the need for major bowel resections and treatment of polyp recurrences. In each of the Scottish NHS Trusts, an average of five Pilot patients/month were found to have colorectal cancer. The majority of these required surgery, resulting in an estimated 20 per cent increase in overall surgical activity for colorectal cancer. Given that the average consultant colorectal surgeon currently treats 50 new cases of colorectal cancer per year in the UK, this figure is likely to rise to 60 per year, at least in the initial stages of a national screening programme. In the Pilot, surgeons felt that ‘Cancers were being dealt with at the expense of other debilitating illnesses’ and that there was a ‘Lack of operating time, facilities and surgeons’. It was not possible to establish the impact of the Pilot on waiting times for colorectal surgery, due to co-existent initiatives to reduce waiting times for cancer patients in general during the time course of the Pilot.

All consultant staff who performed colonoscopies reported a substantial increase in their administrative duties and requirement for clerical support due to the Pilot (including that related to out-patient review). This included correspondence with general practitioners and patients, review of case notes and dealing with telephone enquiries.

**Radiology**

Routine data on DCBE activity showed that a maximum of five extra DCBEs/month were performed on screen-positive patients at each Pilot hospital (scoping on average eight Pilot patients/week) and that Pilot-generated DCBE activity constituted less than 3 per cent of overall activity. In general, activity levels tended to be slightly lower and waiting times shorter during the Pilot compared with the previous year (data not shown), primarily due to waiting list initiatives (high pre-Pilot levels of activity aimed at reducing waiting times).

Radiologists surveyed considered that workload related to the Pilot (including administration and clerical duties) was

![Figure 3](http://jpubhealth.oxfordjournals.org/)

**Figure 3** Waiting times for colonoscopy at Pilot hospital (by quarter). Note: Data from single Pilot hospital. Other hospital data incomplete, but where available, demonstrated similar trends in both Scotland and England, as did responses from consultant survey.
minimal in relation to the overall workload of the service and related principally to increases in requirement for cancer staging examinations, such as abdominal ultrasound or abdominal/pelvic CT. However, since DCBE procedures were done almost exclusively for incomplete colonoscopy (rather than patients unable to undergo colonoscopy), it was noted that requirements for DCBE might increase given less experienced colonoscopists.

Five of six radiologists surveyed felt that the resources provided by the Pilot had been adequate to cope with any small additional workload (one noted the need for additional consultant cover for radiographer sessions). In terms of service quality, the introduction of double reading of DCBE was the only change in procedure noted at more than one hospital.

Pathology
During the course of this study, it emerged that the Pilot was having a greater than expected impact on workload for hospital pathology departments. Histopathology specimens received from colonoscopy-screened patients included polyp and other biopsies plus specimens following resection. The total number of patients with at least one biopsy per polyp was higher in Scotland ($n=1668$) than in England ($n=939$). In general, several biopsies per patient were taken and this was often higher than the two to three biopsies per patient predicted prior to the start of the Pilot (range 1–12 in England, 1–18 in Scotland), thereby increasing both the length of time required for pathological diagnosis, and the amount of administrative support needed. The average number of biopsies generated per month was also higher in Scotland (approximately 118/month) compared with England (approximately 75/month). In Scotland, the number of pathology tests created as a result of the Pilot varied considerably between the three Trusts (from an average of 25 to 97/month per Trust during the second year of the Pilot), at least partly due to variations in the number of biopsies taken per patient. In the Trust with the highest Pilot-generated activity (average of 97 tests/month compared with predicted 50/month), one pathologist estimated that his workload had increased by 25–30 per cent over the duration of the Pilot, and described the personal impact as ‘profound’. In England, a similar increase in workload for pathologists was noted and, while generally supportive of the screening programme and satisfied with the Pilot’s quality assurance provisions, pathologists noted that the resources provided for pathology had been considerably underestimated.

Discussion
The UK Pilot of Colorectal Cancer Screening occurred during a time of considerable change and uncertainty within the NHS, including protracted negotiations over new consultant and GP contracts. There was a strong focus on waiting times for cancer-related appointments, investigations and treatments, and this brought into sharp focus the additional potential burden imposed by a new screening programme. There was also a perception from within primary care that secondary care services were failing to meet demand. Against this background, it was critical to provide an understanding of the workload impact issues raised by the UK Pilot.

An increase in colonoscopy workload during the Pilot was inevitable and proved substantial, with increases in monthly colonoscopy activity for individual hospitals of up to 65 per cent. There was also an increase in demand for colonoscopy for symptomatic patients, although the extent to which the Pilot contributed to this increase remained uncertain. Up to 25 per cent of colonoscopy-screened subjects were reviewed as out-patients because of positive pathology and screen-positive subjects without pathology could be re-referred by GPs. There was also a substantial increase in consultant administrative duties and a need for clerical support. Requirement for surgical (but not medical) in-patient services increased initially, reflecting the earlier detection of prevalent cancers due to screening. Theoretically, requirements for surgery in the longer term should be no greater than pre-screening (and may even fall as adenomas are removed) but experience from the breast screening programme would suggest that these may never return to pre-screening levels.

Follow-up of subjects found to have adenomas at screening colonoscopy will have a further, profound impact on workload for colonoscopy services in a national screening programme. Thirty-nine per cent of Pilot subjects at colonoscopy had polyp cancer (2.5 per cent) or adenoma (36.7 per cent), for which repeat colonoscopy every 3–5 years has been recommended. Using simplifying assumptions (and no sensitivity analyses), we estimated that adenoma follow-up would account for approximately 22 per cent of colonoscopies undertaken due to screening during the first 8 years of a national screening programme. This represents an increase of approximately 28 per cent in the number of colonoscopies generated, over and above colonoscopy for FOBT-positive subjects. In the medium term, increased detection rate and survival from cancer as a result of screening (but before any reduction in cancer incidence), may also increase requirements for colonoscopic review of cancer patients.

Overall, the Pilot resulted in considerable strain for colonoscopy and other GI services, which were already hard-pressed, and was sustained in many instances only due to the goodwill of consultants and other staff. Consultants expressed concern that the service will be facing huge problems if national screening is introduced without adequate resourcing. We estimate that for every screening colonoscopy session resourced, the equivalent of one additional consultant session would be required to deal with the related additional workload, including adenoma surveillance, colonoscopy for symptomatic patients, out-patient workload and administration. It was also felt that one CRC screening nurse per hospital was inadequate, and that 1.5 to 2.0 whole time equivalents (WTEs) would be required in each hospital, together with 0.5 WTE secretarial support (in at least one

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hospital, such secretarial support was obtained, with successful results. Various strategies have been suggested to deal with the additional workload of CRC screening, including accelerated training of endoscopists, the training and employment of endoscopy nurses and the introduction of dedicated ‘screening doctors’ to provide screening colonoscopy services.

In contrast with colonoscopy, the Pilot-generated demand for DCBE proved much smaller than predicted, creating less than 3 per cent increase in service volume. This was primarily due to lower colonoscopy failure rates than expected, emphasizing the importance of maintaining high levels of skill among colonoscopists. If CT colonography replaces DCBE as the investigation of choice for failed colonoscopy, the demand for DCBE will be reduced further. Conversely, the Pilot resulted in a considerable increase in workload for pathology services and substantial additional resources would be required for a national screening programme. It has been estimated that for each District General Hospital, an additional 0.1 WTE pathologist would be required, and this should be accompanied by an equivalent increase in secretarial and laboratory support.

This study suggested that overall the Pilot had a positive influence on the organization of colonoscopy services. However, waiting times for symptomatic patients increased with the start of the Pilot and there was a marked discrepancy in waiting times between screened and symptomatic patients. In any national CRC screening programme, waiting times for all colonoscopy should ideally be reduced to less than 4 weeks before the start of screening. A number of capacity-building and quality-improvement initiatives for colonoscopy are already underway nationally, including standard setting by the British Society of Gastroenterology stemming from a major audit of endoscopy services (M. Hellier, personal communication) and the establishment of six endoscopy training units through the Royal College of Surgeons. Long-term quality monitoring will be an important part of any national screening programme and should include central flagging of medical records to determine cancer rates among patients with a negative colonoscopy.

The considerable difficulty experienced in collecting routine hospital data for this study reflected the lack of systematic and/or easily accessible methods of data collection within hospitals, as well as time pressures on staff from whom data was requested. Prior to the start of a national screening programme, robust systems for the collection of relevant evaluation data, including a common dataset for all hospital colonoscopy activity, must be set in place for workload monitoring and quality assurance. In Scotland, the national Steering Group for CRC screening is developing a suitable common dataset and within at least some NHS Boards, IT systems are being developed to collect the relevant data in a systematic manner, for all day-case and in-patient colonoscopies. It is envisaged that data will be aggregated and analysed by the Information and Statistics Division (ISD). Central statistical support will also be required for the production of quality assurance reports (for all stages of the screening process), and for the evaluation of the effectiveness of the programme (currently provided by ISD for the Breast Screening Programme in Scotland).

In conclusion, the UK CRC Screening Pilot had a considerable direct impact on workload in secondary care, particularly for colonoscopy and pathology services. There also appears to have been an indirect impact on the demand for non-screening colonoscopy services. The impact on secondary care will be a key determinant in the success of a future national CRC screening programme. It will be important to ensure that all aspects of increased workload are considered and that waiting times for colonoscopy for symptomatic patients are brought in line with those for screened patients.

Acknowledgements

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References