

Colonoscopy screening for colorectal cancer: the outcomes of two recruitment methods

Mike Corbett, Sharon L Chambers, Bruce Shadbolt, Lybus C Hillman and Doug Taupin

One in 20 Australians will develop colorectal cancer (CRC),¹ and almost half of these people will die from the disease.² Survival from CRC is highly stage-dependent. Localised disease has a 94% 5-year survival rate;³ however, using current approaches, only 35% of CRC is diagnosed at this stage.⁴ Screening to detect presymptomatic individuals in the at-risk age group reduces CRC mortality.⁵ In addition, nearly all CRCs arise from adenomatous polyps; these typically grow slowly, with a median time to development of cancer of 10 years. As a result, removal of polyps through endoscopic polypectomy may reduce CRC risk by up to 90% in those screened.⁶

Although CRC screening is desirable and advocated by expert groups,⁵ it is not widespread. The most appropriate initial screening test — faecal occult blood testing (FOBT), flexible sigmoidoscopy, or colonoscopy — remains a subject of debate.⁵

Because the success of screening programs hinges on participation rates and compliance, methods for recruitment of participants need to be established. Participation in CRC screening using FOBT has been reported to improve when subjects are invited by their own general practitioners.^{7,8} However, less is known about participation in colonoscopic screening programs. Therefore, we explored participation in colonoscopic screening by comparing two recruitment strategies: selection of subjects drawn from a sample of general practice databases, followed by invitation by the subject's own GP, versus invitations by the investigators to subjects drawn at random from the electoral roll.

METHODS

Recruitment

Recruitment for the study commenced in May 2002 and closed in December 2003,

ABSTRACT

Objectives: To determine the response to colorectal cancer (CRC) screening by colonoscopy, through direct invitation or through invitation by general practitioners.

Design and setting: Two-way comparison of randomised population sampling versus cluster sampling of a representative general practice population in the Australian Capital Territory, May 2002 to January 2004.

Intervention: Invitation to screen, assessment for eligibility, interview, and colonoscopy.

Subjects: 881 subjects aged 55–74 years were invited to screen: 520 from the electoral roll (ER) sample and 361 from the general practice (GP) cluster sample.

Main outcome measures: Response rate, participation rate, and rate of adenomatous polyps in the screened group.

Results: Participation was similar in the ER arm (35.1%; 95% CI, 30.2%–40.3%) and the GP arm (40.1%; 95% CI, 29.2%–51.0%) after correcting for ineligibility, which was higher in the ER arm. Superior eligibility in the GP arm was offset by the labour of manual record review. Response rates after two invitations were similar for the two groups (ER arm: 78.8%; 95% CI, 75.1%–82.1%; GP arm: 81.7%; 95% CI, 73.8%–89.6%). Overall, 53.4% ineligibility arose from having a colonoscopy in the past 10 years (ER arm, 98/178; GP arm, 42/84). Of 231 colonoscopies performed, 229 were complete, with 32% of subjects screened having adenomatous polyps.

Conclusions: Colonoscopy-based CRC screening yields similar response and participation rates with either random population sampling or general practice cluster sampling, with population sampling through the electoral roll providing greater ease of recruitment.

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and the final colonoscopy was performed in January 2004.

Electoral roll arm: From the Australian Electoral Commission, we obtained a random sample of residents of the Australian Capital Territory aged 55–74 years. This sample was cross-referenced against the ACT Cancer Registry, and people with a known diagnosis of cancer were excluded. Invitation letters containing simple information about CRC and colonoscopy and signed by the study investigators were mailed to the selected subjects.

General practice arm: Six general practices, geographically spread to best represent the ACT, were recruited to the study. Participat-

ing GPs then selected from their practice databases ACT residents aged 55–74 years whom they believed met eligibility criteria (identical to eligibility criteria to be used at Visit 1; see Box 1). An invitation letter identical to that used in the electoral roll arm, but also signed by the invitee's GP, was mailed.

Reminders: For both arms, a reminder letter was mailed if an invitee did not reply after 4 weeks. We telephoned those invitees who did not respond to the second letter after a further 4 weeks, or who declined without reason. We invited all who declined to complete a non-participant questionnaire.

Visit 1

We contacted respondents by phone or mail, according to their preference, and arranged Visit 1 at the Gastroenterology Unit, Canberra Hospital. At this visit, an information sheet was provided and written consent for the study was obtained. We asked participants about their medical history, including medications, family history

The Canberra Hospital, Woden, ACT.

Mike Corbett, FRACP, Gastroenterologist, Gastroenterology Unit;

Sharon L Chambers, RN, GradDipNurs, Clinical Nurse Consultant, Gastroenterology Unit;

Bruce Shadbolt, PhD, FRACP, Centre for Advances in Epidemiology and Information Technology;

Doug Taupin, PhD, Director, Gastroenterologist, Gastroenterology Unit.

Brindabella Specialist Centre, Garran, ACT.

Lybus C Hillman, MD, FRACP, Gastroenterologist.

Reprints will not be available from the authors. Correspondence: Dr D Taupin,

The Canberra Hospital, PO Box 11, Woden, ACT 2606. doug.taupin@act.gov.au

1 Exclusion criteria

- Prior diagnosis of cancer, not including non-melanomatous skin cancer.
- Colonoscopy, faecal occult blood test, sigmoidoscopy, barium enema or virtual colonoscopy within 10 years.
- Recent onset of lower gastrointestinal tract symptoms (bleeding, change in bowel habit, abdominal pain, weight loss, bloating, anaemia) causing GP attendance in the previous 12 months.
- Significant comorbidity (American Society of Anesthesiologists class III or greater).⁹
- Previous colonic surgery.
- Therapeutic anticoagulation.
- Participation in a clinical trial in the previous 3 months.
- A person unlikely to be compliant or unable to give informed consent.

of cancer, and previous screening behaviour. Eligibility criteria were assessed (Box 1).

Visit 2

Participants were allocated according to preference to one of three endoscopy centres: Canberra Hospital, Calvary Hospital, or Mugga Wara Endoscopy Centre. All endoscopists were accredited by the Conjoint Committee of the Gastroenterological Society of Australia, the Royal Australasian College of Physicians and the Royal Australasian College of Surgeons for Recognition of Endoscopy Training.

All colonoscopy participants underwent a physical examination to record their fitness for sedation.

GP sedationists or nurse sedationists administered sedation with a combination of fentanyl, midazolam and propofol. Colonoscopy was performed with attention to quality recommendations.¹⁰

Visit 3

Participants attended a third time to receive results of the colonoscopy and results of histopathology where relevant. Recommendations for post-polypectomy surveillance were made according to National Health and Medical Research guidelines.¹¹ We sent a letter to the participant's GP summarising the results and a recommendation for surveillance.

Statistical analysis

Using a quota approach, the number of subjects aged 55–74 years residing in the Australian Capital Territory needed to achieve 100 to 125 colonoscopies determined the sample size for each method of recruitment. We calculated that this number of colonoscopies would provide 95% confidence in an estimated adenomatous polyp detection rate band of 24% to 36%.

Based on the research hypothesis that the general practice sample would achieve better participation than the electoral roll sample, and assuming a ratio of invitees to participants of 3 : 1 for the general practice sample, 850 (350 and 500) invitees would be sufficient to detect a 10% difference in rate comparisons with a power of 0.8.

We analysed recruitment by comparing proportions at each stage of the recruitment process leading to colonoscopy. Percentages

and 95% confidence intervals are presented. The general practice cluster design was considered in the estimation of confidence intervals.

Ethics approval

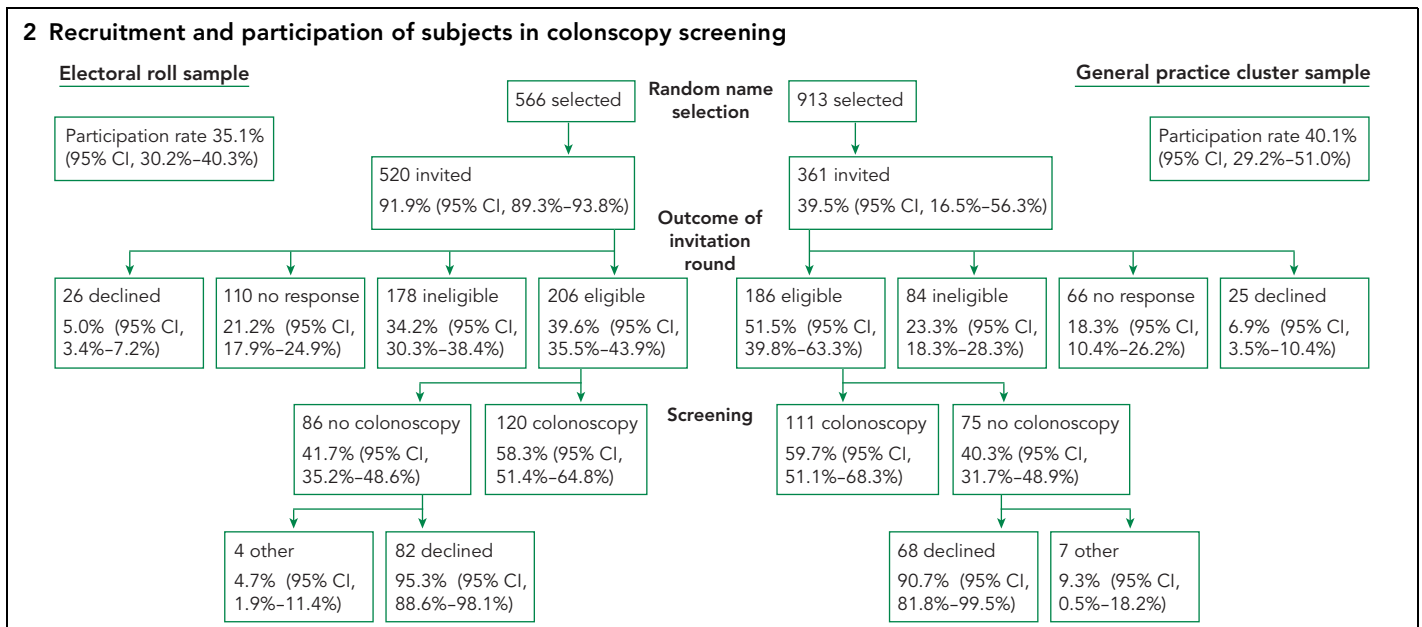
The study was approved by the ACT Human Research Ethics Committee and the Calvary Hospital Medico-Moral Human Research and Ethics Committee.

RESULTS

In the electoral roll arm, 566 people were selected. Forty-six were excluded for being on the ACT Cancer Registry, so 520 invitations were sent, resulting in 120 colonoscopies being performed (Box 2). Thus, for every four subjects invited, one screening colonoscopy was performed. In the general practice arm, 913 names were selected from the GPs' databases, leading to 361 invitations after review of patients' details, and resulting in 111 colonoscopies (Box 2). Thus, for every three invitations, one screening colonoscopy was performed. This difference in proportions was significant ($P = 0.025$).

After name selection in the general practice sample, 60% (552/913) were not invited; 309 (56%) of those not invited were classified as "archived", as their files had been archived after 3 years of inactivity. These selections could not be electronically filtered at the time of name selection, but were not retrievable; consequently, it was not known whether these patients had changed GPs. GPs had various archiving

2 Recruitment and participation of subjects in colonoscopy screening



practices, with two practices contributing 271 (88%) of these 309 files. Three of the six general practices required extensive manual reviewing of records to select people for invitation.

Non-response and refusal

Non-response rates were similar between the two arms, with 21.2% of the electoral roll sample and 18.3% of the general practice sample not responding to either invitation letter or telephone call (Box 2). The proportions responding but declining participation were also similar (electoral roll arm, 5.0%; general practice arm, 6.9%).

Ineligibility

The sample in the general practice arm was pre-screened for eligibility, whereas the electoral roll arm had limited pre-screening via cancer registry matching. As a result, a higher proportion of the electoral roll invitees were ineligible for participation (electoral roll arm, 34.2%; general practice arm, 23.3%; $P < 0.001$). The major reason for ineligibility in both arms was previous colonoscopy, accounting for more than 50% (Box 3). Taken across the electoral roll sample of invitees, a conservative estimate is that 19% (95% CI, 15%–22%) of people aged between 55 and 74 years in the ACT had a colonoscopy before the study.

In the general practice arm, 15.6% (84/270) of GPs' medical records did not contain patients' recent histories of colorectal screening tests, as determined by the history obtained at Visit 1.

Participation rates

We defined participation as (number of colonoscopies) / (number invited – number ineligible). Participation rates were similar in the two samples ($P = 0.2$; Box 2).

Among those eligible, 58.3% of the electoral roll sample underwent a colonoscopy, compared with 59.7% of the general practice sample. More than 90% of eligible subjects who did not have a screening colonoscopy declined the procedure at Visit 1; the remainder failed to attend. Both samples had similar responses to the first and second invitations, with 73.6% (170/231) of the colonoscopies performed requiring one invitation.

3 Reasons for ineligibility among people classified as ineligible within the study's samples

Reason for ineligibility	Electoral roll	General practice
Previous colonoscopy	98 (55%)	42 (50%)
Significant comorbidity	12 (7%)	1 (1%)
Away from residence	6 (3%)	13 (16%)
Diagnosed with cancer	19 (11%)	8 (10%)
Barium enema	7 (4%)	9 (11%)
Faecal occult blood test	3 (2%)	5 (6%)
English language proficiency	12 (7%)	4 (5%)
Other*	21 (12%)	2 (2%)
Total	178 (100%)	84 (100%)

*Other includes taking warfarin, recent surgery, anaemia, iron deficiency, GP already organised colonoscopy, and died.

4 Findings of adenomatous and hyperplastic polyps in 231 colonoscopies

Subjects in whom polyps were identified	104	(45%)
Subjects with advanced polyps	8	(3.5%)
Subjects with adenomatous polyps	74	(32.0%)
Subjects with hyperplastic polyps	53	(22.9%)

Variation in participation

There were no significant sex differences between the two recruitment arms in those who were invited (electoral roll women, 51.3%, 259/505; general practice women, 50.4%, 179/355), or those who had colonoscopy (electoral roll women, 49%, 59/120; general practice women, 46%, 51/111).

We then compared the two arms according to place of residence. The electoral roll sample was similar to the 2001 matched ACT Census population estimates ($P = 0.5$, data not shown), whereas the general practice sample was significantly different ($P < 0.001$). Among subjects who had a screening colonoscopy, electoral roll participants were geographically representative ($P = 0.3$), whereas general practice participants had a geographic distribution different to that of the matching ACT population ($P < 0.001$).

These results indicate that, despite our attempts to recruit people from general practices across the ACT, population representativeness could not be assured.

Colonoscopy outcomes

In total, 231 screening colonoscopies were performed. Of these, 229 were complete bowel examinations, resulting in a completion rate of 99%. Overall, 45% of participants had polyps identified and removed.

Thirty-two per cent of participants had adenomatous polyps and 22.9% had hyperplastic polyps (Box 4). Advanced adenomas (10 mm or greater in size, or displaying high-grade dysplasia or prominent villous histology) were present in eight subjects (3.5%).

Participant satisfaction with colonoscopy screening was excellent, with 99% of the 219 subjects attending Visit 3 saying they were willing to have a colonoscopy in the future.

DISCUSSION

Expert groups uniformly recommend screening for colorectal cancer in people with average risk. Randomised clinical trials have demonstrated a reduction in CRC mortality of 15%–33% after screening by FOBT followed by colonoscopy in subjects testing positive.^{12–14} The evidence that screening by

colonoscopy alone reduces CRC incidence is weaker, coming from cohort studies^{6,15} and a small randomised trial,¹⁶ although the level of prevention is 80%–90%. Colonoscopic screening is the preferred strategy of the American Cancer Society and the American College of Gastroenterology.⁵ The National Health and Medical Research Council recommends either biennial FOBT or 5-yearly flexible sigmoidoscopy for people at average risk.¹¹

The efficacy of screening by either FOBT or colonoscopy is influenced by participation rates. To our knowledge, there are no results available from general population sample screening trials using colonoscopy; although large-scale studies have been published, subjects were referred or recruited from specialised populations.^{17–19} One study reported 45% participation among 7005 veterans, with 54% of those invited declining involvement.¹⁷ Initial participation in FOBT (performance of the first round of tests) ranges from 50% to 67%,^{14,20} participation rates decline thereafter, with 20%–50% of initial participants completing further examinations.^{21,22} Ongoing participation in FOBT screening outside clinical trials is typically less than 30%.²³

In this study, we compared two population samples — from the ACT electoral roll and from GPs' patient databases. The two recruitment approaches yielded similar par-

ticipation rates, with 35% of the electoral roll sample participating and 40% participating from the general practice sample (note: these estimates include non-responders, who could not be assessed for eligibility, in the denominator). These rates are lower than initial participation in FOBT, but compare favourably with the 10-year compliance.²⁰

We caution that the ACT has a relatively well-educated, high-income population that may respond more favourably to screening requests than the rest of Australia.²⁴ However, evidence from the Australian population suggests that socioeconomic status does not affect participation in cancer screening.^{25,26}

We encountered several limitations to GP-based recruitment. General practice databases were diverse, with half of the practices requiring manual review of records to select people for invitation. In addition, GPs had various archiving practices. Many potential subjects may have been excluded from the invitation round because their files had been archived. We could not determine if these patients had left the practice or were merely "inactive". The labour of manual record sorting could be traded off against better eligibility. However, about 15% of records of general practice invitees did not contain histories of recent colorectal screening tests — a major source of ineligibility. Furthermore, recruitment through general practice databases does not ensure that the population will be proportionally represented, as our comparison to the 2001 matched ACT Census population estimates showed. Equity is a key principle of population screening,²⁷ and these findings suggest that GP-based recruitment could reduce equity compared with a broader population approach.

The GPs we recruited to the study were enthusiastic. Others have reported that engaging GP participation can be an obstacle to screening studies.^{28,29}

A weakness of the electoral roll approach was that more than a third of those invited were ineligible for colonoscopy screening (Box 2). On the other hand, a centralised invitation process allows control of the flow of people attending screening centres. During the study, this control was used to ensure resources were well managed.

The electoral roll sample showed that 19% of the population aged 55–74 years had a colonoscopy in the 10 years before recruitment. This provides a practical estimate to be used with modelled estimates in

determining the costs of population CRC screening.

Our study was designed to test the observation from FOBT studies^{7,8} that an invitation for screening from a subject's usual GP rather than a central organisation is more likely to lead to screening participation. Supporting this hypothesis, an Australian study also reported superiority of GP recruitment to an aspirin prevention study, with participation of 1 in 6 invitees (general practice) versus 1 in 17 (electoral roll).³⁰ In contrast, we found that subjects invited by GPs were only slightly more likely to reply or attend the first visit for colonoscopic screening. Not surprisingly, those attending from GP invitations were more likely to meet eligibility criteria, but eligible invitees were no more likely to actually attend for colonoscopy. Therefore, the source of invitation played little role in the likelihood of a subject responding or attending. For consideration of design of large-scale population screening, the benefit of recruitment from general practices (superior eligibility) must be offset against the increase in recruitment work required, and in the likely uneven recruitment by region, and consequent effect on equity.

Colon cancer screening is highly cost-effective compared with other accepted healthcare interventions.³¹ The overall cost and personnel requirements of colonoscopic screening are sensitive to compliance rates and the prevalence of adenomatous polyps in the screened population.³² We have not presented an assessment of costs or personnel requirements, but our data may be useful for baseline assumptions.

This study provides useful data in relation to recruitment for large-scale CRC screening, particularly in the Australian setting. Electoral roll recruitment is simple, effective and yields better population coverage than general practice recruitment alone. General practice recruitment by itself has several limitations, and would need to be supported by other programs. Nevertheless, regardless of recruitment process, we found that it is possible to formally engage the community, GPs, gastroenterologists and healthcare organisations in population-based colorectal screening.

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COMPETING INTERESTS

None identified.

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