

Initial impact of Australia's National Bowel Cancer Screening Program

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Colorectal cancer (CRC) is the second most commonly diagnosed cancer in Australia, with an annual incidence of more than 13 000 cases and 4100 deaths from this disease.¹ Screening is an attractive option for bowel cancer, because there is an identifiable precursor lesion in the form of an adenomatous polyp, the bowel is readily accessible for screening, and detecting cancers at an earlier stage has a proven impact on mortality.

Faecal occult blood testing is the most widely studied form of bowel cancer screening. CRC can be identified in 5%–10% of those with a positive faecal occult blood test (FOBT) result, and an adenoma will be identified in another 20%–35%.² The likelihood of finding bowel cancer is 12–40 times greater in a person with a positive FOBT result compared with a negative test result.^{3–5} Four randomised studies of faecal occult blood testing have demonstrated a reduction in CRC incidence and mortality.^{4,6–8} A systematic review and meta-analysis of these studies⁸ found that mortality was reduced by 16% for those allocated to screening and by 23% for those who were actually screened.

Despite the proven impact of FOBT screening on bowel cancer mortality, which is similar to the impact of mammographic screening on breast cancer mortality,⁹ progress in rolling out a national screening program in Australia has been slow. Concerns have included uncertainties about the impact of faecal occult blood testing offered as routine screening rather than in clinical trials, the ability to provide the large number of follow-up colonoscopies that would be required, and the costs of screening. However, a pilot study conducted between November 2002 and June 2004 concluded that a nationally coordinated bowel cancer screening program would be feasible, acceptable and cost-effective.¹⁰

In August 2006, a limited National Bowel Cancer Screening Program (NBCSP) was initiated, with invitations to undertake FOBT screening sent to all Australians who turned 55 or 65 years of age between 1 May 2006 and 30 June 2008. Invitations were also sent to people who had been invited to participate in the pilot study. A register was

ABSTRACT

Objective: To examine the initial impact of the National Bowel Cancer Screening Program (NBCSP), which was launched in May 2006 and offers faecal occult blood testing to Australians aged 55 or 65 years.

Design and setting: Review of data on colorectal cancer (CRC) cases diagnosed between May 2006 and June 2008 from a prospective database used at 19 Australian hospitals, linked and analysed by BioGrid Australia.

Main outcome measures: Number of CRC cases detected through the NBCSP or symptomatic presentation, and differences by sex, stage at diagnosis, tumour location and level of socioeconomic disadvantage.

Results: 1628 cases of CRC were identified; 1268 had information on the patients' test status as part of the NBCSP, and 40 of these (3.2%) were recorded as being detected by the NBCSP. Of 75 CRC cases in patients aged 55 or 65 at diagnosis, 22 were NBCSP-detected. Overall, there was no difference in NBCSP-detected cases by sex. The distribution of tumour locations was similar between NBCSP-detected cases and symptomatic cases, but NBCSP-detected cancers were diagnosed at an earlier stage than symptomatic cancers (stage I, 40% v 14%; stage IV, 3% v 15%, respectively). Of patients diagnosed through the NBCSP, 63% were from areas of least socioeconomic disadvantage (deciles 8–10) and 18% were from the most disadvantaged areas (deciles 1–4) ($P = 0.0375$).

Conclusion: Initiation of the Australian NBCSP has had a measurable impact on CRC stage at diagnosis, and an improvement in survival would be anticipated. The lower uptake among people from disadvantaged areas is of concern.

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set up by Medicare Australia to handle invitations, monitoring of data and follow-up notifications. However, limited data are being collected on colonoscopy findings in those with a positive FOBT result, and no resources have been allocated to determine the program's ultimate impact on bowel cancer incidence or mortality.

We aimed to examine the initial impact of the NBCSP by analysing data collected by colorectal surgeons on patients presenting with bowel cancer.

METHODS

BioGrid Australia is a novel concept in biomedical research that has successfully implemented prospective and standardised data capture (<http://biogrid.org.au>). It provides a platform to link data from multiple disease and research databases within and between participating hospitals in a uniform, de-identified manner. The Colorectal Surgical Society of Australia and New Zealand and BioGrid Australia are working

together to create a standard dataset on patients with CRC, using data collected by colorectal surgeons at participating sites.

A search of this prospective database was undertaken, with data available from 19 participating sites on CRC cases diagnosed between May 2006 and June 2008. Data analysed included patient demographics, method of diagnosis (FOBT screening as part of the NBCSP, or symptomatic presentation), stage at diagnosis and tumour location. The influence of socioeconomic status was determined using the national decile for each patient's residential postcode on the Australian Bureau of Statistics (ABS) 2006 Index of Relative Socio-economic Disadvantage (IRSD). We compared the highest (8–10) with the lowest (1–4) deciles.

The study received ethics approval from all participating sites, and information was de-identified before linkage and analysis.

Data were analysed using SAS Enterprise Guide 4.1 (SAS Institute Inc, Cary, NC, USA).

1 Number of patients diagnosed with colorectal cancer, by method of diagnosis, age and sex

	No.	Median age (years)	Women	Men
No. of colorectal cancer cases*	1268	69.3	570	698
Symptomatic presentation	1186	69.6	525	661
Total detected by FOBT	82	66.3	45	37
Detected by FOBT as part of the NBCSP	40	65.3	20	20

FOBT = faecal occult blood test. NBCSP = National Bowel Cancer Screening Program.

*In patients with information available on FOBT status as part of the NBCSP.

RESULTS

We identified 1628 cases of CRC diagnosed between May 2006 and June 2008. Of these, information on the patients' FOBT status as part of the NBCSP was available for 1268. The median age of these patients was 69 years (range, 17–99 years), and 55% were male (Box 1). Of the 1268 patients, 82 (6.5%) had CRC detected by FOBT, and 1186 (93.5%) had symptomatic presentations. Of the 82 FOBT-detected cancers, 40 were recorded as being screened through the NBCSP, 28 had FOBTs not conducted through the program, and details of the FOBT were unknown for 14 (eight men, six women). Overall, 3.2% of cases with FOBT information (40/1254) were diagnosed through the NBCSP (Box 1).

All further analyses are comparisons of patients diagnosed by an FOBT as part of the NBCSP versus all those presenting with symptomatic tumours.

In patients aged 55 or 65 years at diagnosis, there were 97 cases of CRC, with information on method of diagnosis available for 75 of these patients. Twenty-two cases were NBCSP-detected, compared with 53 patients who presented with symptoms (Box 2). The other 18 cases recorded as NBCSP-detected in patients who were *not* 55 or 65 years of age are likely explained by significant delays in rolling out the program in some areas, and invitations also being sent to the pilot program participants.

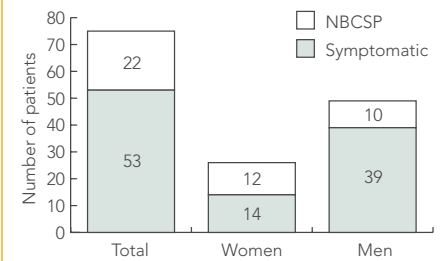
Twenty of the 690 men (2.9%) and 20 of the 564 women (3.5%) with FOBT information had NBCSP-detected cancers, a difference that was not statistically significant (Box 1). In the patients aged 55 or 65 years, a similar difference was seen, with a non-significant trend for more women than men (46% v 20%) to be diagnosed through the NBCSP ($P = 0.15$) (Box 2).

We found that cancers diagnosed through the NBCSP were detected at a much earlier stage, with 16 of these 40 patients (40%) presenting with stage I CRC and only one patient (3%) presenting with metastatic dis-

ease. In contrast, among the 1588 patients with symptomatic presentations, 14% (229) had stage I disease and 15% (242) were found to have stage IV disease ($P = 0.0004$) (Box 3). Analysis of data for the subset of 75 patients aged 55 or 65 years at diagnosis revealed a similar stage distribution in those with symptomatic cancers, with the difference remaining statistically significant ($P < 0.005$).

Of the 40 NBCSP-detected cases, 40% were right colon tumours and a further 40% were left colon tumours (Box 3). In the 1588 patients with symptomatic presentations, the tumour location distribution was similar, with 33% having right colon tumours, 34% left colon tumours and 30% rectal tumours.

2 Number of patients aged 55 or 65 years diagnosed with colorectal cancer, by method of diagnosis and sex



NBCSP = National Bowel Cancer Screening Program.

Analysis of the impact of socioeconomic status revealed that a majority (25; 63%) of the 40 patients whose tumours were diagnosed by NBCSP screening were from the highest three IRSD national deciles, whereas only seven patients (18%) were from the lowest four deciles ($P = 0.0375$) (Box 3). Of patients diagnosed symptomatically, 37% were in the highest three deciles and 27% were in the lowest four deciles, suggesting an impact of socioeconomic status on participation in screening, but the difference was not statistically significant.

3 Stage at diagnosis, tumour location, and national decile of socioeconomic disadvantage, by method of diagnosis

	NBCSP-detected (n = 40)	Symptomatic presentation (n = 1588)
Stage at diagnosis*		
I	16 (40%)	229 (14%)
II	10 (25%)	488 (31%)
III	10 (25%)	376 (24%)
IV	1 (3%)	242 (15%)
Unknown†	3 (8%)	253 (16%)
Tumour location		
Right colon	16 (40%)	525 (33%)
Left colon	16 (40%)	535 (34%)
Rectum	8 (20%)	472 (30%)
Unknown	0	56 (3%)
National decile‡§		
1–4 (most disadvantaged)	7 (18%)	436 (27%)
5–7	6 (15%)	449 (28%)
8–10 (least disadvantaged)	25 (63%)	580 (37%)
Unknown	2 (5%)	123 (8%)

Figures are number (%) of patients. NBCSP = National Bowel Cancer Screening Program.

* $P = 0.0004$. † Unknown stages are predominantly due to patients with rectal cancers who had neoadjuvant treatment before surgery. ‡ On the Australian Bureau of Statistics 2006 Index of Relative Socio-economic Disadvantage based on patients' postcodes. § $P = 0.0375$.

DISCUSSION

This study is the first to demonstrate the impact of the Australian NBCSP, with 3.2% of CRC cases being diagnosed through this program, despite screening invitations only being offered to people aged 55 or 65 years. The most significant finding is the earlier stage at diagnosis in NBCSP-detected cases compared with symptomatic cancer, indicating a likely significant impact on survival for patients undergoing NBCSP screening. Of concern is the apparent lack of uptake of screening among the more disadvantaged sections of the population. An alternative explanation is that these individuals are undergoing initial FOBT screening, but then either do not pursue colonoscopic follow-up or have difficulty accessing colonoscopy.

As expected, we observed a shift in stage distribution for NBCSP-detected cancers, with a higher proportion of stage I disease compared with symptomatic cancers, and a higher proportion of patients with symptomatic cancers presenting with stage IV disease than in the NBCSP-screened group. This stage shift is consistent with that seen in randomised studies. For example, a randomised controlled trial in the United Kingdom reported that 51% of cancers were Dukes' stage A and 5% were stage D in the screened population, compared with 11% stage A and 29% stage D in the non-screened population.⁶

The impact of uptake of FOBT screening in routine practice may be less than that seen in clinical trials, where compliance rates have varied from 60% to 75%. In the Australian pilot study, the participation rate was 45.4%,¹⁰ and preliminary data from the NBCSP suggest a similar uptake. A significant concern from the pilot study evaluation was that only 55% of people with a positive FOBT result were recorded as subsequently undergoing a colonoscopy (although there were uncertainties due to missing data for people with a positive FOBT result¹⁰). These figures are consistent with the proportion of NBCSP-detected cases of only 29% in the target age group (55 and 65 years) in our study, compared with the 45%–50% of screen-detected cases in randomised clinical trials,^{5–7} where initial participation and colonoscopic follow-up were higher.

A national survey in the United States found that only 23.5% of people over 50 years took up an offer of FOBT screening,¹¹ and in Germany, the national uptake of FOBT screening is 20% for men and 30% for women.¹² These findings reinforce the challenge of getting people to participate in

FOBT-based bowel cancer screening programs. Some previously postulated reasons for poor uptake are socioeconomic status, lower education level and lack of health insurance.^{13–17} The latter clearly has an impact in the US, where a recent National Health Interview Survey found that among people aged 50–64 years with private insurance, nearly half (48.3%) had had a recommended CRC screening test in the previous 10 years, compared with fewer than one in five (18.8%) of those who were uninsured.¹⁸

ABS IRSD data from 2006 indicate that 23.6% of all Australians were living in deciles 1–4, 32.1% in deciles 5–7 and 44.3% in deciles 8–10. This distribution is similar to that seen in our study population, suggesting that our results are representative of the overall population in Australia in regards to socioeconomic status. Our findings are consistent with previous studies that have demonstrated that socioeconomic play a significant role in health care and deprivation in Australia.¹⁵ Studies have also shown that those people most needing care are least likely to receive it, and that the quality of care received by people with lower socioeconomic status is different from those with higher status.^{16,17,19} A UK analysis of clinical data from a large randomised controlled trial found that, although socioeconomic deprivation had no significant effect on the prevalence of CRC, it did have a significant effect on participation in screening.²⁰ People from more economically deprived areas had less interest in and uptake of the test than their counterparts in less deprived areas.

Our data provide some evidence for an impact of sex on participation in the NBCSP, with the program detecting a higher proportion of CRC cases in women than men (Box 2). This is consistent with Medicare data showing that significantly more women than men participate in screening.²¹ More data will be required to see if this trend becomes a significant difference. Similarly, while our data suggest that fewer rectal cancers were diagnosed in the NBCSP group, larger numbers are required to see if the impact of screening is dependent on tumour location.

A recent issue that may have an ongoing impact on the success of the NBCSP is the distribution of faulty FOBT kits to 475 000 people between 1 December 2008 and 8 May 2009. There is uncertainty about the accuracy of negative results from these kits. Although not affecting the results of our study, which examined patients diagnosed up until June 2008, this setback could have

a negative impact on the public's confidence in the program. All participants with a negative test result from a faulty kit are being offered rescreening, but any future assessments of the program will have to take this issue into account.

Our study has multiple limitations. Data were missing for a significant number of patients and, where data were available, there is currently no mechanism to validate their accuracy. The small number of NBCSP-detected cancer patients in the study limits the analysis and interpretation of data relating to these patients. With the further roll-out of the program and the increasing number of sites participating in data collection nationally, we hope to update these results with a larger sample size in the future.

Future plans include linking data from each participating site with the Medicare database, to ensure we have accurate information about whether patients participated in the NBCSP and the result of their FOBT, and obtaining data from colonoscopies performed in response to a positive FOBT result, to gain information on the number of adenomas found and removed. This would also allow analysis of the time from a positive FOBT result to colonoscopy and ultimately to surgery, to determine the potential impact of socioeconomic status on this pathway. We are continuing to analyse data over time to observe any trends and to further explore the impact of sex and socioeconomic status.

In conclusion, the NBCSP has so far had a measurable impact. The small overall impact of the program will persist unless and until the program expands to additional age groups. Increasing participation among those offered testing is also an essential and, we believe, attainable goal.

COMPETING INTERESTS

None identified.

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