




BMJ Open Engaging lower screening groups: a field experiment to evaluate the impact of a multiwave national campaign on participation in the National Bowel Cancer Screening Program

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ABSTRACT

Objectives This field study evaluated a multiwave media campaign that aired in 2019 to promote participation in the Australian National Bowel Cancer Screening Program (NBCSP), which provides free biennial mailed-out immunochemical faecal occult blood test (iFOBT) kits to Australians aged 50–74 years.

Design Adjusted negative binomial regression models determined rate ratios of iFOBT kits returned during and following three campaign waves compared with 2018 (baseline). Interaction terms determined whether effects differed by gender×age group, socioeconomic status (SES) and previous participation.

Setting Australia.

Participants All Australians eligible for the NBCSP (men and women aged 50–74 years) who returned an iFOBT kit between 1 January 2018 and 30 October 2019.

Interventions A multiwave national integrated media campaign to promote participation in the NBCSP.

Main outcome measures iFOBT kit return rate and number of iFOBT kits returned during and immediately following campaign activity overall and within historically lower screening groups (men, 50–59 years old; lower SES; never participants).

Results The rate of iFOBT kits returned increased significantly during all three campaign waves, with evidence of carry-over effects of the second wave coinciding with a general practitioner mail-out strategy (all $p < 0.001$). At each wave, effects were observed among men and women in the younger (50–59 years old) age group, but were less consistent for the older age group. Each SES group and both never and previous participants had increased return rates at each wave, but increases were stronger among mid-higher SES and those who had never participated. An estimated 93 075 extra iFOBT kits were returned due to the campaign.

Conclusions The campaign increased participation, especially among those who were younger and never previously screened—key groups to recruit given reparticipation rates of over 80%. Ongoing investment in national integrated media campaigns of sufficient duration and intensity can increase bowel cancer screening and ultimately save lives.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ The study findings are strengthened by the use of an objective measure of programme participation, as well as statistical adjustment for seasonality, other state-based campaigns and various other factors.
- ⇒ This study was unique in that the data permitted analyses of multiple waves of national campaign activity within sociodemographic subgroups as part of a national sample, expanding upon previous comparable one-off state-specific evaluations.
- ⇒ The overall campaign effect on bowel screening participation may be slightly underestimated as the current study did not capture bowel screening completed outside the National Bowel Cancer Screening Program, yet exposure to the campaign may have prompted individuals to pursue bowel screening through alternative avenues.
- ⇒ This study was unable to assess campaign effects among other potentially lower screening groups, many of which experience higher rates of bowel cancer than the general population, and therefore should be prioritised for further investigation.

INTRODUCTION

Bowel cancer is the second leading cause of cancer-related mortality in Australia, yet the vast majority (>90%) of cases can be successfully treated if diagnosed early.¹ The National Bowel Cancer Screening Program (NBCSP), which provides free biennial mail-out home screening immunochemical faecal occult blood test (iFOBT) kits for Australians aged 50–74 years, plays a vital role in the early detection of bowel cancer and is predicted to save 59 000 lives between 2015 and 2040 at current participation levels.^{2–4} However, only 43.5% of eligible participants are up to date with screening through the NBCSP, which is well below the national target of 56.6%.^{5 6} This proportion is even lower among certain

subgroups, including those residing in lower socioeconomic areas (40.5%), those in the lowest eligible age bracket (50–54 years; 33.5%), particularly younger men (31.4%), and those who have received an invitation but never previously participated (17.4%).⁵ Hence, there is considerable scope to promote programme engagement and ultimately lessen the burden of bowel cancer.

Integrated multimedia campaigns are an effective tool to promote health-related behaviour change on a population level, including in the context of cancer screening.^{7 8} Generally, effective health campaigns are backed by significant financial investment, disseminated across large audiences, repeated multiple times, endorsed by general practitioners (GPs) and employ a focused message and simple call to action.^{7 9 10} Studies of mass media campaigns promoting bowel screening internationally show favourable effects, including in the USA,¹¹ the UK¹² and Malaysia,¹³ yet are limited by inadequate reach within lower screening communities and screening accessibility. Since bowel screening is freely available to a substantial portion of at-risk Australians, the nation is primed to achieve extensive screening coverage with sufficient investment in programme promotion.

A mass media campaign promoting NBCSP participation ran in selected Australian states and territories in mid-2014. A subsequent evaluation found a significant increase in iFOBT kit returns during campaign weeks in states with substantial television-led campaign activity, while only marginal effects were observed in states that lacked a television component and had significantly less campaign activity across other channels.¹⁴ In mid-2017, a similar campaign in the state of Victoria prompted a significant increase in iFOBT kit returns during campaign weeks, with no effect observed in a control state.¹⁵ Effects were evident across age, sex and socioeconomic status (SES) subgroups; however, greater relative increases in iFOBT kit returns among those who had never previously participated in the NBCSP were observed, compared with prior participants.¹⁵ The campaign was also highly cost-effective, reinforcing the unique potential of campaigns to encourage health-related behaviour change.¹⁶

This study examines the effects of a subsequent large national integrated multimedia campaign promoting NBCSP participation, run across 2019. Consistent with recommendations described in a comprehensive review,⁹ the new campaign was television led, repeated in three waves to facilitate engagement with fresh sets of participants as they received their iFOBT invitation throughout the year and spanned all Australian states and territories. The campaign incorporated supporting media, with targeted interventions for traditionally lower screening communities and comprehensive engagement with GPs. The current study aimed to evaluate campaign impact by assessing the iFOBT kit return rates during and following each campaign wave. Since examinations of the differing impact of such campaigns by sociodemographic characteristics had not yet been investigated at a national level,^{14 15} the current study examined whether iFOBT

kit return rates differed between lower versus higher screening subgroups: gender×age group, socioeconomic area and previous NBCSP participation. It was hypothesised that iFOBT kit return rates would increase during and soon after each campaign wave, given the employment of campaign strategies and messages previously found to be effective.

METHODS

The campaign

The 2019 NBCSP campaign comprised three major waves of integrated paid, earned and owned media activity. Wave one ran from 3 March to 20 April and due to prebooked state-based campaign activity excluded the most populated Australian state (New South Wales (NSW)); wave two ran from 19 May to 6 July and excluded two large Australian states (NSW and Queensland), also due to prebooked state-based campaign activity; wave three ran from 21 July to 14 September and included all Australian states and territories. Each wave consisted of 30, 15 and 6 s television and digital video advertisements, along with radio advertisements, digital banners, social media engagement, online native website advertising, out-of-home content and advertorial features within popular television programmes. The campaign also included GP engagement strategies and campaign material created for Aboriginal and/or Torres Strait Islander populations and culturally and linguistically diverse communities targeting Greek, Mandarin, Cantonese, Italian and Arabic-speaking audiences.

The centrepiece of the campaign was the video advertisement emphasising the importance of early detection. It ran during the first two waves in almost all states and territories and consisted of a testimonial-style advertisement featuring real stories of people losing family members to bowel cancer, where a woman shares the loss of a close relative, saying ‘if he had done the test, he’d probably be alive today’ (see also: <https://www.youtube.com/watch?v=9DEffgTZwyY>). The third campaign wave featured a narrative-style video advertisement showing a 50-year-old man receiving his first NBCSP iFOBT kit in the mail (see also: https://youtu.be/eIY_gzse5Es). The voiceover explains that he has early-stage bowel cancer but does not know it. The man puts off doing the test and contemplates disposing it before eventually deciding to do it. The text on the final screen reads ‘Don’t throw away the chance to save your life. Do the test.’

Campaign evaluation

To assess NBCSP participation, the Australian Institute of Health and Welfare (AIHW) provided anonymised data on the total number of invitations, defined as the number of tests sent to homes and the total number of completed tests returned by those eligible for the NBCSP each week from 1 January 2018 to 30 October 2019. The cleaned data were stratified by age (50–59; 60–74 years) and gender (male; female), socioeconomic

area (low; mid-high) and previous programme participation status (no previous NBCSP iFOBT returned; at least one NBCSP iFOBT returned in the past). Participants' residential postcode was used to determine SES according to the Socio-Economic Index for Areas Index of Relative Socio-economic Disadvantage.¹⁷ To maximise the applicability and practical relevance of the study findings, the data were dichotomised into lower SES (corresponding to quintiles one and two) and mid-higher SES (corresponding to quintiles three to five) to match the classification approach used by the AIHW to monitor the impact of the bowel cancer screening programme.

Statistical analysis

Data were analysed using Stata MP V.16.1.¹⁸ Negative binomial regression models determined the rate ratio (RR) of extra iFOBT kits returned at each campaign wave and intervening period compared with 2018 (baseline) in relevant states and territories, as undertaken in a previous comparable study.¹⁵ Interaction terms were added to determine whether the effect differed by gender×age group, SES and previous NBCSP participation status, and stratified analyses were conducted. All models included an offset term to account for variation in the number of invitations sent in the past 16 weeks, along with state and territory (Victoria as the reference) and additional covariates to adjust for public holidays, the 2019 national election and relevant state-based campaigns broadcast in the 2018 baseline period. Unadjusted negative binomial regression models estimated the number of iFOBT kits returned at each campaign wave and the average weekly number of invitations sent out in the prior 16 weeks. Unadjusted iFOBT kit return estimates were divided by invitation estimates to determine the unadjusted iFOBT kit return rate. To calculate estimates for the number of extra iFOBT kits returned associated with the campaign, invitations sent out during those periods were tallied and the likely returns if there had been no campaign were determined by multiplying these invites by the baseline iFOBT kit return rate. This value was then subtracted from the estimated number of iFOBT kits returned at each campaign wave to estimate the number of extra kits returned associated with the campaign.

Patient and public involvement

Public representatives were not directly involved in the design or conduct of this study, as this study was based on the analysis of routine data collected by the NBCSP. As part of creating the campaign messages and materials evaluated in this study, extensive exploratory and developmental research was conducted involving people eligible for the NBCSP (Australians aged 50–74 years). Along with insights from those eligible for the test, the study findings will be used to inform the design of future campaigns disseminated to the public to promote cancer screening.

RESULTS

Overall iFOBT kit returns

Compared with baseline, there was a significant increase in the iFOBT kit return rate during wave one (43.3% cf. 52.9%; RR=1.28, 95% CI=1.20–1.37, $p<0.001$; table 1), wave two (44.7% cf. 57.1%; RR=1.30, 95% CI=1.21–1.41, $p<0.001$) and wave three of the campaign (42.1% cf. 49.4%; RR=1.16, 95% CI=1.09–1.23, $p<0.001$). There was no significant change compared with baseline in the iFOBT kit return rate during the 4-week period following wave one ($p=0.050$) or the 2-week period following wave three ($p=0.445$); however, there was evidence for an effect in the 2-week period following wave two (44.7% cf. 51.8%; RR=1.15, 95% CI=1.07–1.23, $p<0.001$).

Using these same models, the estimated total extra kits returned associated with the campaign was 93 075 among all eligible Australians (table 2).

iFOBT kit returns by gender and age group

Compared with baseline, iFOBT kit return rates increased significantly during all three campaign waves among both men and women aged 50–59 years, with evidence for carry-forward effects of wave two and wave three (all $p<0.001$; table 1). Among men and women aged 60–74 years, iFOBT kit return rates were significantly greater than baseline during wave two ($p=0.006$ and $p=0.027$), while men in this age group also observed significant increases in iFOBT kit return rates during wave one ($p=0.021$).

Interaction tests found that across all three campaign waves, iFOBT kit return rates did not differ by gender ($\chi^2=5.36$, $p=0.616$), yet did differ by age group ($\chi^2=182.97$, $p<0.001$), with greater relative increases observed among the younger compared with older age group across all campaign periods (all $p<0.001$). Reflecting this trend, figure 1 outlines the iFOBT kit return rates during and following each campaign wave among men and women within each age group.

iFOBT kit returns by socioeconomic area

iFOBT kit return rates increased significantly during all three campaign waves compared with baseline among respondents residing in lower and mid-higher socioeconomic areas (all $p<0.01$; table 1), with evidence for carry-forward effects of wave two among each of these subgroups (both $p<0.05$).

Interaction tests found that increases in iFOBT kit return rates were greater among participants residing in mid-higher compared with lower socioeconomic areas ($\chi^2=31.31$, $p<0.001$), particularly during wave two (RR=1.33, 95% CI=1.11–1.60, $p=0.003$) and the following 2-week period (RR=1.27, 95% CI=1.10–1.47, $p=0.001$). The pattern of return rates among lower and mid-higher socioeconomic areas is shown in figure 2.

iFOBT kit returns by previous programme participation

Among both respondents who had and had not previously returned an NBCSP iFOBT kit, there was a significant

Table 1 Relative increases in iFOBT kit return rates during each wave of the 2019 NBCSP campaign compared with 2018 (baseline)

	Wave one	Mid-break one	Wave two	Mid-break two	Wave three	Post-campaign
	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)
Overall	1.28 (1.20–1.37)***	1.17 (1.00–1.37) [^]	1.30 (1.21–1.41)***	1.15 (1.07–1.23)***	1.16 (1.09–1.23)***	0.96 (0.87–1.06)
Gender×age group						
Male 50–59 years	1.35 (1.23–1.49)***	1.17 (0.88–1.55)	1.62 (1.43–1.82)***	1.53 (1.36–1.72)***	1.51 (1.39–1.64)***	1.26 (1.14–1.41)***
Male 60–74 years	1.10 (1.01–1.19)*	0.89 (0.72–1.11)	1.14 (1.04–1.24)**	1.04 (0.94–1.14)	1.00 (0.93–1.07)	0.96 (0.86–1.06)
Female 50–59 years	1.33 (1.21–1.46)***	1.13 (0.87–1.47)	1.49 (1.35–1.66)***	1.58 (1.39–1.79)***	1.41 (1.31–1.52)***	1.27 (1.12–1.43)***
Female 60–74 years	1.09 (1.00–1.19) [^]	0.88 (0.70–1.09)	1.10 (1.01–1.20)*	1.00 (0.92–1.09)	0.97 (0.91–1.04)	0.99 (0.89–1.10)
Socioeconomic area						
Lower	1.18 (1.06–1.30)**	1.06 (0.87–1.29)	1.24 (1.14–1.35)***	1.16 (1.03–1.30)*	1.16 (1.08–1.24)***	0.95 (0.86–1.05)
Mid-higher	1.27 (1.16–1.39)***	1.28 (0.85–1.93)	1.35 (1.16–1.57)***	1.21 (1.11–1.31)***	1.21 (1.12–1.31)***	1.02 (0.91–1.13)
Previous NBCSP participation						
Never	1.24 (1.13–1.36)***	1.13 (0.94–1.36)	1.31 (1.19–1.45)***	1.31 (1.17–1.47)***	1.29 (1.21–1.38)***	1.00 (0.90–1.11)
At least once	1.20 (1.11–1.30)***	1.05 (0.84–1.31)	1.21 (1.12–1.30)***	1.14 (1.04–1.25)**	1.12 (1.05–1.18)***	1.00 (0.90–1.11)

Significant difference compared with the 2018 baseline (reference category) at [^]p<0.10, *p<0.05, **p<0.01, ***p<0.001.

Rate ratios adjusted for variation in the number of invitations sent, state and territory, public holidays, the 2019 national election and relevant state campaigns broadcast in the 2018 baseline period.

Bolded values denote statistical significance at p<0.05.

iFOBT, immunochemical faecal occult blood test; NBCSP, National Bowel Cancer Screening Program; RR, rate ratio.

Table 2 Estimated number of extra iFOBT kits returned associated with the 2019 NBCSP campaign

	Total	Wave one	Mid-break one	Wave two	Mid-break two	Wave three	Post-campaign
	N (95% CI)	N (95% CI)	N (95% CI)	N (95% CI)	N (95% CI)	N (95% CI)	N (95% CI)
Overall	93 075 (84 333–101 817)	23 489 (21 547–25 431)	NS	25 931 (22 080–29 782)	4 367 (4178–4556)	39 289 (36 528–42 049)	NS
Gender and age group							
Male 50–59 years	40 662 (36 422–44 902)	5999 (4953–7045)	NS	9650 (8834–10 467)	2 367 (2318–2415)	20 026 (17 945–22 106)	2620 (2275–2965)
Male 60–74 years	4009 (2988–5031)	1270 (582–1958)	NS	2739 (2405–3073)	NS	NS	NS
Female 50–59 years	40 539 (36 228–44 850)	6610 (5343–7876)	NS	8794 (8336–9251)	2947 (2806–3087)	19 245 (17 336–21 154)	2944 (2406–3482)
Female 60–74 years	3119 (2723–3515)	1113 (553–1674)*	NS	2006 (1841–2170)	NS	NS	NS
Socioeconomic area							
Lower	30 054 (28 099–32 010)	4502 (3933–5071)	NS	7536 (7367–7704)	1535 (1058–2012)	16 482 (14 788–18 177)	NS
Mid-higher	59 703 (56 175–63 231)	12 176 (10 975–13 376)	NS	16 574 (15 562–17 587)	3820 (3603–4036)	27 133 (24 010–30 257)	NS
Previous NBCSP participation							
Never	35 146 (30 409–39 882)	5129 (4078–6179)	NS	7964 (7012–8915)	2370 (2218–2523)	19 683 (16 797–22 569)	NS
At least once	47 434 (43 332–51 536)	10 815 (9634–11 996)	NS	12 856 (12 489–13 223)	2814 (2547–3081)	20 949 (18 127–23 770)	NS

Rate ratios adjusted for variation in the number of invitations sent, state and territory, public holidays, the 2019 national election and relevant state campaigns broadcast in the 2018 baseline period.

*Marginal effect ($p < 0.10$).

iFOBT, immunochemical faecal occult blood test; NBCSP, National Bowel Cancer Screening Program; NS, no significant effect.

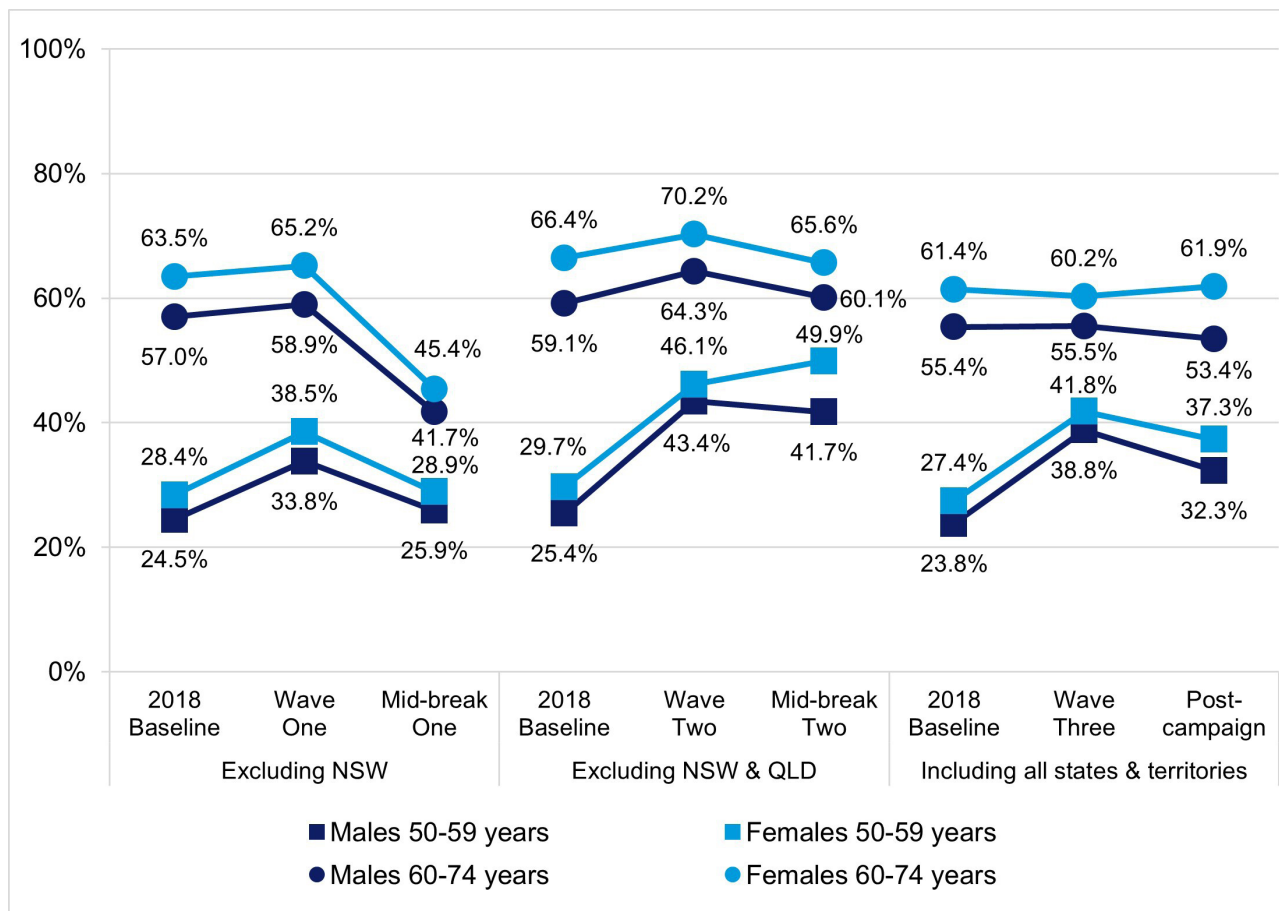


Figure 1 iFOBT kit return rates at each wave of the 2019 NBCSP campaign compared with 2018 (baseline), by gender×age group. iFOBT kit return rates adjusted for public holidays, state and territory, and relevant state campaigns. iFOBT, immunochemical faecal occult blood test; NBCSP, National Bowel Cancer Screening Program; NSW, New South Wales; QLD, Queensland.

increase in the iFOBT kit return rate during all campaign waves (all $p < 0.001$; table 1), as well as the period following wave two (both $p < 0.01$) compared with baseline.

Interaction tests found a significant difference in iFOBT kit return rates by previous NBCSP participation status ($\chi^2 = 31.68$, $p < 0.001$), showing that the increase in the iFOBT kit return rate during wave three compared with baseline was significantly greater among respondents who had not previously participated (RR=0.89, 95% CI=0.84–0.95, $p = 0.001$). Corresponding iFOBT return rates by previous NBCSP participation status during and following each campaign wave are shown in figure 2.

DISCUSSION

Overall, this national bowel screening campaign increased the rate of iFOBT kits returned during all three campaign waves, with evidence of carry-over effects of the second wave of campaign activity. This consolidates previous evaluations of state-based campaigns promoting participation in the NBCSP,^{14 15} suggesting likely cost-effectiveness of the 2019 NBCSP campaign,¹⁶ and further emphasises the efficacy of media campaigns of sufficient reach, duration and intensity in promoting behaviour

change related to cancer screening.⁷ Carry-over effects following the second campaign wave may be associated with the concurrent mail-out to GPs during this period, given GP endorsements are known to play a vital role in engaging individuals within both the general population and priority communities.^{19–22} These findings suggest the effect of integrated multimedia campaign activity upon NBCSP participation may be amplified or prolonged by regular and ongoing reminders of the importance of bowel screening through various supplementary earned and owned communication avenues (eg, public relations, website promotion through social and digital channels), consistent with recommendations described in a recent and comprehensive review.⁹

There was a significant increase in iFOBT kit return rates during almost all campaign waves among men and those in the lower age group (50–59 years), who are historically lower screening groups in Australia⁵ and internationally.^{23–26} Consistent with previous state-based evaluations of NBCSP campaigns,¹⁵ these increases did not differ significantly by gender, yet men historically engage in the programme to a lesser extent and therefore the campaign may have aided in counteracting this

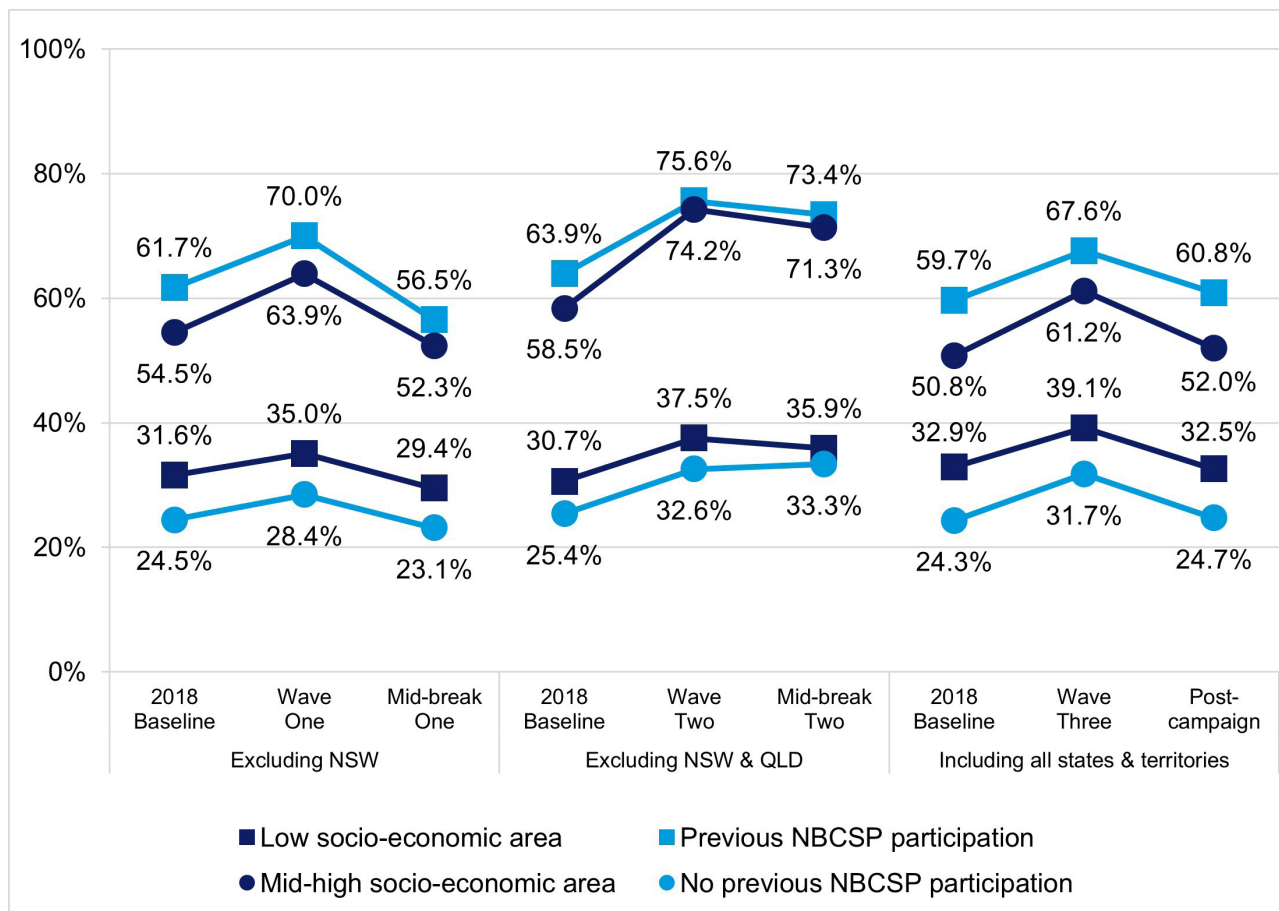


Figure 2 iFOBT kit return rates at each wave of the 2019 NBCSP campaign compared with 2018 (baseline), by socioeconomic area and previous participation in the NBCSP. iFOBT kit return rates adjusted for public holidays, state and territory, and relevant state campaigns. iFOBT, immunochemical faecal occult blood test; NBCSP, National Bowel Cancer Screening Program; NSW, New South Wales; QLD, Queensland.

typically lower participation level. The increases did however differ significantly by age group, suggesting that while the campaign did not have a consistent effect on iFOBT kit return rates among the 60–74 year age group, it boosted engagement among those aged 50–59 years who had more recently entered eligibility for the programme. The campaign’s ability to engage these lower screening groups following the third campaign wave may reflect the relevance of the new television advertisement that aired for the first time during this final wave, which featured a man aged 50 years and was designed specifically to be relevant for the younger male demographic. Adding weight to this finding, evaluations of the 2017 NBCSP campaign in Victoria, which featured the testimonial-style video advertisement not tailored to the younger age demographic, found no evidence of differing effect by age on iFOBT kit return rates,¹⁵ suggesting that the new narrative-style video advertisement was particularly effective among the younger age group. It must also be noted that future campaigns should be cognisant of the distinct nature of media engagement within the two age groups assessed, along with the ongoing evolution of the media landscape more broadly. In recent years, the frequency of viewing digital and social media, streaming programmes,

podcasts and music has grown substantially, especially among Generation X but also to a lesser extent among Boomers, although for those aged 50+ years, broadcast television is still currently dominant.²⁷

Replicating findings from the previous state-based NBCSP 2017 campaign,¹⁵ the national 2019 NBCSP campaign prompted a significantly greater rate of increase in iFOBT kit returns among those who had never previously participated in the NBCSP during wave three, compared with previous programme participants. This notable effect is encouraging since 81% of those who return their iFOBT kit will also participate in the programme upon their next invitation,⁵ a trend also observed overseas.²⁸ This may partly be explained by the inclusion of the Australian state of NSW for the first time during wave three as NSW had a lower baseline participation rate and a generally younger demographic profile, and hence a greater proportion of those who had not previously participated in the programme, comparative with other states and territories.

Significant increases in iFOBT kit return rates were observed following campaign activity among both SES groups; however, more moderate increases were observed among lower SES, particularly during the second



campaign wave. This suggests that the testimonial-style video advertisement aired during wave two may have been particularly resonant among those residing in mid-higher SES areas, while the narrative-style video advertisement aired during wave three resonated with Australians regardless of SES area. However, this is inconsistent with a previous evaluation that found similar effects across SES of the testimonial-style video advertisement aired during a state-based NBCSP campaign.¹⁵ Equal effects across SES were also observed following a mass media campaign to promote the national cervical screening programme.²⁹ Future research should investigate whether those residing in lower socioeconomic areas experience specific barriers and facilitators to iFOBT participation given that knowledge in this area is still emerging. Results from a population survey following the 2019 NBCSP campaign found that confidence to complete the iFOBT kit was lower among respondents residing in lower compared with higher SES areas, suggesting that strategies to help eligible Australians overcome barriers around self-efficacy may improve effectiveness of future programme promotion among this subgroup.³⁰ Other studies within Australia³¹ and overseas^{24 32} have proposed increasing confidence and screening-related knowledge, along with decreasing emotional and attitudinal barriers, as potentially effective strategies to promote bowel screening participation among those residing in lower socioeconomic areas.

A number of study limitations should be noted. First, the period preceding campaign activity was used as a baseline in the absence of an unexposed control state or territory, which was not possible due to the national roll-out of the campaign. Second, the estimated number of iFOBT kit returns associated with the campaign may be slightly overestimated as this was assessed only among those who had received an invitation to participate in the programme in the past 16 weeks. However, the majority of iFOBT kits are returned within 16 weeks after the invite is mailed out, after which return rates tend to plateau.³³ Furthermore, the overall campaign effect on bowel screening may be slightly underestimated as the current study did not capture bowel screening completed outside the NBCSP, for example, using an iFOBT kit purchased at a pharmacy or screening via colonoscopies, yet exposure to the campaign may have prompted individuals to pursue bowel screening through these alternative avenues. It should be noted that this study was unable to assess campaign effects among other potentially lower screening groups, given that measures to capture this information are self-reported on completion of an iFOBT and not comprehensively described within the NBCSP data available. Importantly, some lower screening groups not captured in this study, such as those who identify as Aboriginal or Torres Strait Islander and those with severe or profound activity limitation, experience higher rates of positive screens requiring further medical assessment and therefore should be prioritised for targeted interventions and communications to overcome additional barriers within these communities.⁵ Lastly, various unidentified

confounding factors may have influenced NBCSP participation, such as unexpected special events or celebrity endorsements.^{8 34}

Despite these limitations, the findings of the current study are strengthened by the use of an objective measure of programme participation, as well as statistical adjustment for seasonality, concurrent campaigns, participating states and territories and number of invitations sent out. Notably, the data permitted analyses within sociodemographic subgroups, expanding upon previous evaluations that focused on state-based campaigns¹⁵ or overall campaign effects.¹⁴

CONCLUSIONS

Consistent with previous evaluations of campaigns promoting NBCSP participation, the current study found a significant positive effect of the 2019 national NBCSP campaign on iFOBT kit return rates during all campaign waves, particularly among some traditionally lower screening groups. These findings justify ongoing investment in integrated multimedia promotion of bowel screening programmes, particularly broad-reaching campaigns of sufficient duration and intensity, alongside consideration of ongoing supplementary communication strategies to maximise the longevity of campaign effects. The current study highlights a need for further investigation into specific barriers and facilitators of programme participation among other lower screening groups, alongside potential targeted interventions and communications to reduce existing inequities in participation.

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Contributors KB, BM, KW, EF and SJD made substantial contributions to the conception of the work. CG, BM, EF and SJD designed the study. SJD coordinated data acquisition and data management. CG and SJD conducted data analysis. CG, KB, BM, KW, EF and SJD were involved in data interpretation and drafting of the manuscript. SJD is the guarantor of this article. All authors have approved the final version of the manuscript.

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Competing interests CG, KB, BM, KW, EF and SJD are employed by non-profit organisations that conduct research, public health interventions and advocacy aimed at increasing cancer screening and reducing cancer health harms in the community.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not required.

Ethics approval This study was approved by Cancer Council Victoria's Institutional Research Review Committee (QA 1702).

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data were obtained from the Australian Institute of Health and Welfare (AIHW). For additional information on requesting AIHW data that are not already publicly available, see: <https://www.aihw.gov.au/our-services/data-on-request>.

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