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# **Calculating screening rates for bowel cancer**

**Technical paper**

**Methodology for the  
National Bowel Cancer Screening Program  
and the National Healthcare Agreement  
performance indicators explained**

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# Abbreviations

ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
AIHW	Australian Institute of Health and Welfare
CI	confidence interval (see Appendix D)
DoHA	Australian Government Department of Health and Ageing
FOBT	faecal occult blood test
NBCSP	National Bowel Cancer Screening Program
NSW	New South Wales
NT	Northern Territory
Qld	Queensland
SA	South Australia
Tas	Tasmania
Vic	Victoria
WA	Western Australia

# Symbols

..	not applicable
n.a.	not available
n.p.	not publishable because of small numbers, confidentiality concerns or other concerns about the quality of the data



# 1 Background

As part of the annual monitoring of the National Bowel Cancer Screening Program (NBCSP), the Cancer and Screening Unit at the Australian Institute of Health and Welfare (AIHW) produce program participation rates based on data from the program register maintained by Medicare Australia. These rates are made publicly available in the annual monitoring reports released by the AIHW.

In 2009, the AIHW were also asked to produce national rates for bowel cancer screening for the Council of Australian Government (COAG) National Healthcare Agreement key performance indicators. The method of calculating this screening rate was determined by the National Health Information Standards and Statistics Committee (NHISSC) independent of the NBCSP. These national rates are available in the *National Healthcare Agreement: Baseline performance report for 2008–09* released in June 2010.

Although these are similar concepts, the rates produced in each case are measures of different indicators, and consequently produce different results. This paper describes and explains the differences between the two indicators.

## 2 NBCSP participation indicator

The indicators in the NBCSP monitoring reports are a measure of the performance of the NBCSP. The participation indicator determines participation in the NBCSP by those people who are eligible to participate. Eligibility is determined by Medicare Australia.

Due to the unique implementation of the NBCSP, methods for calculating participation were designed by the AIHW in conjunction with the Program Advisory Group to account for the following peculiarities:

- only people invited by Medicare Australia are able to participate, and
- the time lag between invitation and participation.

As a result, the AIHW produce two statistics related to participation: a crude participation rate and an estimated participation rate adjusted for the time lag between invitation and participation. The methods and rationale for each are outlined below.

### 2.1 Crude participation

Crude participation is a simple measure of the proportion of people invited to participate in the program in a given year that have completed the Faecal Occult Blood Test (FOBT) kit. In the 2009 NBCSP annual monitoring report, crude participation was based on data available as at 31 January 2009.

## Algorithm

$$\frac{\text{The number of people invited in a calendar year that have participated in the NBCSP}}{\text{The number of people invited to participate in the NBCSP in a calendar year}} * 100$$

## Numerator

**The number of people invited in a calendar year that have participated in the NBCSP.**

This includes all those who were invited in the calendar year that returned a completed FOBT kit, as recorded in the NBCSP register.

### Numerator exclusions

The numerator excludes the following people:

- those who were not in the NBCSP specified 50, 55 or 65 year age cohorts.
- those people who did not reside within the 8 states and territories.
- people who had opted off or suspended from the program (even if they returned a kit before opting off or suspending). This is due to privacy considerations.

## Denominator

**The number of people invited in a calendar year to participate in the NBCSP.**

The denominator for crude participation in the NBCSP for a calendar year includes those people invited in the calendar year, as recorded in the NBCSP register.

### Denominator exclusions

The numerator excludes the following invitations:

- those who were not in the NBCSP specified 50, 55 or 65 year age cohorts.
- those people who did not reside within the 8 states and territories.
- people who had opted off or suspended from the program (even if they returned a kit before opting off or suspending). This is due to privacy considerations.

## Discussion

As the monitoring indicator is a measure of program performance, it was decided that the most appropriate denominator for calculating annual participation is the number of people invited by the program in the given year. Although it could be expected that the number of people invited should be equivalent to the population counts of the target age groups, the unique implementation of the NBCSP means that this is not necessarily true.

Secondly, due to the time taken between an invitation being sent and a person completing and returning the FOBT kit (usually around 12–16 weeks), data for people invited in the last 3 months of the year being analysed may be incomplete when the data is extracted on 31 January of the following year. Crude rates for previous years are considered complete as sufficient time has passed for all people invited in those years to have participated. The results of crude participation in the program for the years 2006–2008 are shown in Table 1.



**Table 1: Crude participation, by state and territory: 2006–2008**

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Australia
2006	41.8	..	44.2	..	..	..	45.8	..	42.0
95% CI	41.4–42.1	..	42.5–45.9	..	..	..	43.8–47.7	..	41.7–42.4
2007	41.2	44.1	44.4	48.4	47.7	48.6	47.3	35.9	44.2
95% CI	40.9–41.4	43.9–44.4	44.1–44.7	48.1–48.8	47.2–48.2	47.8–49.4	46.2–48.3	34.5–37.2	44.0–44.3
2008	32.9	37.1	38.5	38.9	40.8	43.2	39.1	22.3	36.6
95% CI	32.7–33.1	36.8–37.3	38.2–38.7	38.6–39.3	40.4–41.2	42.5–43.9	38.1–40.0	21.3–23.3	36.5–36.7

Source: National Bowel Cancer Screening Program annual monitoring report 2009

#### Notes

1. Crude participation for all years is based on data available as at 31 January 2009.
2. Crude participation rates are calculated as the number of people who returned a completed FOBT kit as a proportion of the total number of the eligible population who were invited to screen, excluding people who suspended or opted off the Program.
3. Only New South Wales, Queensland and the Australian Capital Territory had started the NBCSP in 2006; therefore, 2006 data is only available for these jurisdictions.
4. Data for people invited in the last 3 months of 2008 may be incomplete as at 31 January 2009. Hence, 2008 crude rates may be an underestimate of the true participation rate.
5. People aged 50 years were invited to screen from 1 July 2008.

## 2.2 Estimated participation

To account for the time lag between invitation and participation, an estimated participation rate is calculated using Kaplan-Meier survival techniques. These techniques are standard statistical techniques to model time to an event and represent valid estimates of true participation rates. More information on the methodology used to calculate Kaplan-Meier estimates is available in Appendix D of the NBCSP annual monitoring report 2009 (AIHW & DoHA 2009).

The estimated Kaplan-Meier participation rates for 2008 are shown in Table 2 and can be compared with crude participation rates in Table 1.

**Table 2: Estimated 52 week Kaplan-Meier participation, by state and territory: 2008**

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Australia
2008	35.5	40.0	40.4	42.4	43.6	45.3	42.2	23.7	39.3
95% CI	35.3–35.7	39.7–40.3	40.2–40.7	42.0–42.8	43.2–44.1	44.5–46.0	41.1–43.3	22.6–24.8	39.2–39.4

Source: National Bowel Cancer Screening Program annual monitoring report 2009

#### Notes

1. Estimated participation is based on data available as at 31 January 2009.
2. Rates for 2008 equal the estimated Kaplan-Meier participation rate at 52 weeks of people who returned a completed FOBT kit as a proportion of the total number of the eligible population who were invited to screen in 2008, excluding people who suspended or opted off the Program.
3. People aged 50 years were invited to screen from 1 July 2008 which lowered overall participation rates for 2008.

### 3 National Healthcare Agreement: PI 12–Bowel cancer screening rates

Bowel cancer screening as recorded for the National Healthcare Agreement indicator is a measure of the proportion of the Australian population that were screened for bowel cancer in a calendar year. The NHA indicator recognises that FOBT screening for bowel cancer occurs both through the NBCSP as well as through opportunistic screening and other campaigns (such as BowelScreen, BowelCheck and Rotary Bowelscan); however, as national data are currently only available through the NBCSP, these data are used as a proxy measure for all bowel cancer screening. A Data Quality Statement outlining the issues associated with use of the NBCSP data accompanies the NHA PI 12 indicator.

The NHA PI 12 bowel screening indicator is calculated using the following method:

#### Algorithm

$$\frac{\text{The number of people who were screened for bowel cancer in a specified year}}{\text{The age-specific estimated resident population of Australia for the same year}} * 100$$

#### Numerator

##### The number of people who were screened for bowel cancer in a specified year

The number of people deemed to have been screened for bowel cancer in a calendar year is measured as the number of people that returned a completed NBCSP FOBT kit in that year, regardless of when they were invited into the program. For example, for 2008, any person recorded in the NBCSP register who first returned a completed (either correctly or incorrectly) FOBT kit between 1 January 2008 and 31 December 2008 is deemed to have been screened in 2008.

It is important to note that this is a slightly different “window” of data to the NBCSP participation indicator. It is also important to note that because of the age-cohort definitions of the NBCSP, the distribution methods of invitations by the NBCSP, and the time taken to respond to screening, this numerator may include people who are no longer 50, 55 or 65 years of age.

#### Numerator exclusions

The numerator excludes the following people:

- those who were not in the NBCSP specified 50, 55 or 65 year age cohorts at time of invitation; and
- those people who did not reside within the 8 Australian states and territories.

Unlike the NBCSP participation indicator, people who had opted off or suspended from the program are included.

## **Denominator**

### **The age-specific estimated resident population of Australia for the same year**

The denominator for participation in bowel cancer screening for a calendar year is based on the Australian Bureau of Statistics (ABS) Estimated Resident Population (ERP) for that year, by single-year age group (i.e. those aged 50, 55 and 65 in that year) and jurisdiction.

### **Denominator exclusions**

There are no people excluded from the ERP-based denominator for the NHA indicator.

## **Discussion**

Invitation to participate in the NBCSP is only extended to those people who hold a Medicare card, or a Department of Veterans Affairs gold card; however, the ERP, as calculated by the ABS includes those people resident in Australia (as opposed to foreign tourists) that are not eligible for Medicare benefits.

## 4 Methods comparisons

Table 3 shows comparisons between the rates produced by the different methods. This highlights that while the numerators are similar between the two methods, the denominator can be markedly different. This is especially evident in New South Wales and Victoria where the numbers of invitations issued to both males and females were well below the ERP for the target age groups. Conversely in Queensland and South Australia the numbers of invitations issued to both males and females were higher than the ERP for the target age groups.

**Table 3: Example comparison of NBCSP monitoring report 2009 and NHA PI 12 2008–2009 bowel screening rates, by state and territory**

State	Measure	Males			Females		
		Numerator	Denominator	Proportion	Numerator	Denominator	Proportion
NSW	NBCSP	33,015	110,247	29.9	39,280	109,749	35.8
	NHA PI 12	33,857	118,319	28.6	40,301	120,639	33.4
Vic	NBCSP	24,572	73,011	33.7	29,645	73,252	40.5
	NHA PI 12	26,001	88,425	29.4	31,333	90,970	34.4
Qld	NBCSP	26,453	75,149	35.2	30,871	73,837	41.8
	NHA PI 12	27,909	72,845	38.3	32,380	72,915	44.4
WA	NBCSP	13,484	37,835	35.6	15,575	36,804	42.3
	NHA PI 12	14,316	37,433	38.2	16,318	36,790	44.4
SA	NBCSP	11,512	30,873	37.3	13,776	31,116	44.3
	NHA PI 12	12,159	28,551	42.6	14,646	29,623	49.4
Tas	NBCSP	3,556	8,995	39.5	4,210	8,982	46.9
	NHA PI 12	3,927	9,399	41.8	4,567	9,549	47.8
ACT	NBCSP	1,694	4,711	36.0	2,083	4,955	42.0
	NHA PI 12	1,798	5,485	32.8	2,192	5,810	37.7
NT	NBCSP	735	3,378	21.8	691	3,021	22.9
	NHA PI 12	834	3,415	24.4	768	2,986	25.7
Australia	NBCSP	<b>115,021</b>	<b>344,199</b>	<b>33.4</b>	<b>136,131</b>	<b>341,716</b>	<b>39.8</b>
	NHA PI 12	<b>120,801</b>	<b>363,937</b>	<b>33.2</b>	<b>142,505</b>	<b>369,322</b>	<b>38.6</b>

### Notes

1. Numerators relate to screening data for 2008 derived from the National Bowel Cancer Screening Register.
2. NBCSP denominators are derived from invitations issued by the National Bowel Cancer Screening Register.
3. NHA PI 12 denominators are derived from Estimated Resident Populations for 2008.

## 5 Discussion

It is important to recognise that the NBCSP participation indicator and the NHA PI 12 indicator are measures of different things.

The participation indicator reported in the NBCSP monitoring reports is a valid and accurate measure of the program's performance. The unique implementation of the NBCSP to screen through invitation only means that an exact numerator and denominator can be determined, rather than estimated through population data. It allows for variations in distribution of FOBT kits by Medicare Australia – such as the inclusion of people aged 50 part way through 2008 (many of whom weren't invited until the last quarter of 2008) and the suspension of the NBCSP between May and October 2009 where many people who were eligible to screen in 2009 will not return a FOBT until 2010 – to be accounted for. Until the NBCSP is offered continuously to all age-groups, use of population-based data as a denominator would make monitoring of program performance extremely inaccurate.

The NHA PI 12 indicator is not intended as a measure of the performance of the NBCSP – rather it is a measure of bowel cancer screening by the Australian population. As such, the use of population data as the denominator for this indicator is entirely appropriate. Unfortunately, as the NBCSP is currently the only nationally available data source, FOBT completion in the NBCSP is used solely as the numerator. As a result, screening rates for people aged 50, 55 and 65 are used as a proxy for national bowel screening, thus leading to comparability problems between the two rates. Alternatively, if national data capturing other bowel screening activity in Australia become available, there will be no issues around comparability.

Many of the comparability problems between the two indicators produced in 2009 (using data from 2008) arise due to the phased in nature of the NBCSP – specifically the distribution methods of kits and the late introduction of 50-year olds into the program. This problem will be exacerbated for indicators produced in 2010 and 2011 as a result of the suspension and remediation of the NBCSP due to the faulty FOBT introduced in December 2008. It would be expected that as the problems created by the rollout of the NBCSP are overcome, and screening offered to all age groups, the differences in the two indicators will become less significant.

# References

Australian Institute of Health and Welfare & Australian Government Department of Health and Ageing 2009. National Bowel Cancer Screening Program: annual monitoring report 2009. Cancer series no. 49. Cat. no. CAN 45. Canberra: AIHW.