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Brief Report

Estimates of the eligible population for Australia's targeted National Lung Cancer Screening Program, 2025–2030

Stephen Wade[a], Preston Ngo[a], Yue He[a], Michael Caruana[a], Julia Steinberg[a], Qingwei Luo[a], Michael David[a,b], Annette McWilliams[c], Kwun M Fong[d,e], Karen Canfell[f], Marianne F Weber[a,g]

[a] The Daffodil Centre, The University of Sydney, a joint venture with Cancer Council NSW, Woolloomooloo, NSW, Australia
[b] School of Medicine and Dentistry, Griffith University, Gold Coast, QLD, Australia
[c] Fiona Stanley Hospital, Perth, WA, Australia
[d] Prince Charles Hospital, Chermside, QLD, Australia
[e] The University of Queensland Thoracic Research Centre, The Prince Charles Hospital, Brisbane, QLD, Australia
[f] School of Public Health, The University of Sydney, Sydney, NSW, Australia
[g] Corresponding author: marianne.weber@sydney.edu.au

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Abstract

Australia's National Lung Cancer Screening Program will commence in July 2025, targeted at individuals aged 50–70 years with a 30 pack-year smoking history (equivalent to 20 cigarettes per day for 30 years), who either currently smoke or have quit within the past 10 years. We forecasted the number of screening-eligible individuals over the first 5 years of the program using data from the 2019 National Drug Strategy Household Survey and the 2022 Australian Bureau of Statistics population projections. Multiple imputation integrated with predictive modelling of future or unmeasured smoking characteristics was used to address missing data and, simultaneously, to project individuals' smoking histories to 2030. In 2025, 930 500 (95% prediction interval 852 200–1 019 000) individuals were estimated to be eligible, with the number meeting the criteria declining slightly during the years 2025–2030 in all Australian jurisdictions. Overall, 26–30% of those eligible will have quit smoking, and 70–74% will currently smoke. These estimates can be used in resource planning and as an indicative denominator to track participation rates for the program over time.

Introduction

Australia is preparing to launch a targeted National Lung Cancer Screening Program starting in July 2025.[1] The program will be open to individuals aged 50–70 years with a 30 pack-year smoking history (equivalent to a pack of 20 cigarettes per day for 30 years), who either currently smoke or have quit within the past 10 years. These criteria were recommended by Australia's Medical Services Advisory Committee based on evidence from effectiveness trials and economic modelling.[1] Eligibility will be assessed by primary care providers (GPs, Aboriginal and Torres Strait Islander Health Workers, etc) who will refer participants to receive a low-dose computed tomography scan of the chest every 2 years.[2] Estimates of the number of people who qualify for lung cancer screening are important for understanding the impact of screening on resource use across the screening and assessment pathway and for program evaluation over time. Since there is no comprehensive collection of data on smoking behaviours at a population level, we forecasted the number of screening-eligible individuals over the first 5 years of the program using a statistical modelling approach.

Methods

The number of individuals who meet the lung cancer screening age and smoking history eligibility criteria over the period 2025–2030 was estimated using data from the 2019 National Drug Strategy Household Survey[3] and 2022 Australian Bureau of Statistics population projections.[4] Multiple imputation integrated with predictive modelling of future or unmeasured smoking characteristics was used to address missing data and, simultaneously, to project individuals' smoking histories to 2030.

For each respondent, we required calculations of: 1) The age that they started smoking daily and the age that they stopped (if they stopped); 2) The duration that they had smoked or will smoke (if they started or start); 3) The lifetime average number of cigarettes per day, both factory made and roll-your-own (past and future). Pack-years were calculated as the number of years smoked multiplied by the number of cigarette packs smoked per day, assuming 20 cigarettes per pack.

Values of key smoking-related variables were imputed/predicted using demographic factors and other covariates (see supplementary material, available from m9.figshare.27936513.v1). Age at smoking initiation and smoking duration were modelled with accelerated failure time models and all remaining variables were modelled with random forests. For each state and year, we predicted the proportion of the population eligible for screening using logistic regression. Weights were adjusted to sum to the effective sample size proposed by Kish[5], and 95% prediction intervals were estimated by sampling regression parameters from the asymptotic distribution in each imputed dataset, then pooling all predictions of the eligible population.

Detailed methods are reported in the supplementary material, available from m9.figshare.27936513.v1.

Results

Overall, between 12.8–14.1% of the Australian population aged 50–70 years were estimated to meet the National Lung Cancer Screening Program age and smoking criteria in the first 5 years of the program (30–33% of those with a history of smoking). In the first year, 930,500 (95% prediction interval 852,200–1,019,000) individuals were estimated to be eligible, with the number meeting the criteria in each state and territory declining slightly over the years 2025–2030 (see Table 1). Overall, 26-30% of those eligible will have quit smoking, and 70-74% will currently smoke.

Table 1. Estimated number (95% prediction interval) of individuals who meet the age and smoking history eligibility criteria for the National Lung Cancer Screening Program in Australia, 2025–2030

State	2025	2026	2027	2028	2029	2030
New South Wales	251 400 (215 600–291 600)	249 800 (215 200–288 300)	252 500 (217 800–291 100)	251 800 (215 900–291 200)	240 400 (206 100–277 600)	235 700 (203 600–272 400)
Victoria	203 000 (170 200–240 900)	198 000 (167 200–231 100)	197 000 (166 100–228 100)	197 400 (164 600–232 000)	189 600 (160 300–221 000)	187 100 (157 600–219 400)
Queensland	233 700 (198 100–271 300)	235 500 (200 200–272 100)	235 000 (200 000–273 800)	232 200 (198 400–270 400)	232 000 (197 700–269 000)	228 700 (195 500–266 800)
Western Australia	111 300 (86 100–139 500)	111 500 (85 700–138 700)	116 500 (94 200–143 100)	114 000 (91 000–141 000)	114 000 (90 400–142 200)	109 100 (85 600–137 500)
South Australia	84 900 (71 200–99 200)	82 600 (68 700–97 500)	81 400 (68 100–95 700)	78 800 (65 200–93 900)	76 600 (63 600–90 400)	76 100 (62 400–91 700)
Northern Territory	10 200 (7 700–13 100)	10 200 (7 500–13 200)	10 100 (7 400–13 200)	9 800 (7 200–12 900)	9 500 (7 000–12 600)	9 100 (6 500–12 000)
Tasmania	26 600 (19 700–34 400)	27 400 (20 700–35 500)	26 700 (19 400–35 200)	26 700 (19 700–35 000)	25 800 (18 800–34 000)	25 700 (18 800–33 700)
Australian Capital Territory	9 400 (5 600–14 200)	9 600 (5 800–14 400)	9 500 (5 400–14 500)	8 600 (5 200–13 100)	8 100 (4 800–12 100)	7 600 (4 300–11 800)
Total	930 500 (852 200–1 019 000)	924 400 (845 000–1 012 400)	928 800 (852 300-1 006 100)	919 200 (844 000–996 900)	896 000 (831 100–966 400)	879 100 (811 500–946 600)

Discussion

Using individual-level, nationally representative data about smoking status, duration, intensity and years since quitting smoking (if quit), we projected smoking characteristics for the Australian population up to the year 2030 by age. By applying the age and smoking eligibility criteria for the National Lung Cancer Screening Program, these estimates represent the total number of individuals who may qualify for screening in any particular year.

We find that around a third of the ever-smoking population would be eligible for lung cancer screening, which is in the ballpark of earlier, more conservative estimates based on varied screening eligibility criteria using data from cohort studies (estimated 17.9%–28.5%).[6,7]

The eligibility criteria for Australia's screening program preferentially select individuals who currently smoke. We report that more than seven in 10 people who will be eligible for lung screening would also benefit from smoking cessation support.

These estimates are subject to several caveats and limitations. They do not account for other screening exclusions, such as symptoms suggestive of lung cancer, or smoking-related mortality, so the true number of people eligible is likely to be somewhat fewer than the estimates presented here. Moreover, the prediction intervals account for uncertainties relating to missing data and model parameters, but not for uncertainty in the choice of modelling approach. Finally, eligibility for and attendance to screening may vary by demographic and social characteristics, which may be of interest for monitoring and evaluation of the program. Future work can extend the methods to address these limitations.

To help evaluate state-and territory-based resource requirements for the program, these estimates can be used to model a range of key performance indicators observed in the screening programs of other jurisdictions (e.g., Canada[8] , UK[9] , USA[10]) such as anticipated screening participation and adherence rates, as well as the resource implications for nodule management, actionable incidental findings, smoking cessation support, and lung cancer diagnoses. These estimates can also be used as an indicative denominator to track participation rates for the program over time.

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Peer review and provenance

Externally peer reviewed, not commissioned.

Competing interests

MC is an investigator on an investigator-initiated trial of cytology and primary HPV screening in Australia ('Compass') (ACTRN12613001207707 and NCT02328872), which is conducted and funded by the Australian Centre for the Prevention of Cervical Cancer, a government-funded health promotion charity. Australian Centre for the Prevention of Cervical Cancer has received equipment, a funding contribution for the Compass trial from Roche Molecular Systems, and operational support from the Australian Government. However, neither MC nor his institution on his behalf (the Daffodil Centre, a joint venture between Cancer Council NSW and The University of Sydney) receives direct or indirect funding from industry for Compass Australia or any other project.

KC is a coprimary investigator in an investigator-initiated trial of cervical screening, "Compass", run by the Australian Centre for Prevention of Cervical Cancer (ACPCC), a government-funded not-for-profit charity. Compass receives infrastructure support from the Australian Government; the ACPCC has received equipment, a funding contribution from Roche Molecular Diagnostics, and operational support from the Australian Government. KC is also a coprimary investigator in an investigator-initiated implementation program, Elimination of Cervical Cancer in the Western Pacific, which receives support from the Minderoo Foundation and equipment donations from Cepheid Inc. KC receives support for a range of other Australian and international projects related to cervical cancer control, including support from philanthropic organisations, the World Health Organization, and government agencies, together with contract funding for monitoring the safety of the National Cervical Screening Program. None of these are directly related to the study reported in this article. AM received travel funds from the International Association for the Study of Lung Cancer, the European Society for Medical Oncology, AstraZeneca, Olympus, and Roche for presentations at scientific conferences. KF received support with loan bronchoscopes for the purpose of a research trial, software licensing for Computer Aided Diagnosis research in the International Lung Screen Trial, and travel support for speaking/participation in scientific research meetings from meeting organisers/societies. All authors declare no competing interest.

Author contributions

SW conducted the analysis and drafted the supplementary material. MW drafted the main text. PN and YH reviewed the analysis code. All authors reviewed and approved the methods and manuscript.

References

1. Cancer Australia. Lung cancer screening; 2024 [cited 2024 May 6]. Available from: www.canceraustralia.gov.au/about-us/lung-cancer-screening
2. Australian Government Department of Health and Aged Care. National Lung Cancer Screening Program; 2024 [cited 2024 Nov 28]. Available from: www.health.gov.au/our-work/nlcsp/how-it-works
3. Australian Institute of Health and Welfare. National Drug Strategy Household Survey 2019. Drug statistics series no. 32. PHE 270. Canberra, ACT: AIHW, 2020 [cited 2024 Nov 28]. Available from: www.aihw.gov.au/reports/illicit-use-of-drugs/national-drug-strategy-household-survey-2019/contents/summary
4. Australian Bureau of Statistics. Population projections, Australia, 2022 (base) – 2071; 2018 [cited 2024 June 5]. Available from: www.abs.gov.au/statistics/people/population/population-projections-australia/2022-base-2071#data-downloads
5. Kish L. Open Library. Survey sampling; 1965 [cited 2024 June 21]. Available from: openlibrary.org/books/OL5947497M/Survey_sampling
6. Manners D, Hui J, Hunter M, James A, Knuiman MW, McWilliams A, et al. Estimating eligibility for lung cancer screening in an Australian cohort, including the effect of spirometry. Med J Aust. 2016;204(11):406.
7. Weber M, Yap S, Goldsbury D, Manners D, Tammemagi M, Marshall H. Identifying high risk individuals for targeted lung cancer screening: independent validation of the PLCOm2012 risk prediction tool. Int J Cancer. 2017;141(2):242–53.
8. Tammemägi MC, Darling GE, Schmidt H, Walker MJ, Langer D, Leung YW, et al. Risk-based lung cancer screening performance in a universal healthcare setting. Nat Med. 2024;30(4):1054–64.

9. Goodley P, Balata H, Alonso A, Brockelsby C, Conroy M, Cooper-Moss N, et al. Invitation strategies and participation in a community-based lung cancer screening programme located in areas of high socioeconomic deprivation. Thorax. 2023;79(1):58–67.

10. Bandi P, Star J, Ashad-Bishop K, Kratzer T, Smith R, Ahmedin J. Lung cancer screening in the US, 2022. JAMA Intern Med. 2024;184(8):882–91.

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