Family Medicine and Community Health

# Absolute cardiovascular risk assessment by Australian early-career general practitioners: a cross-sectional study

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**To cite:** Morgan T, Ralston A, Davey A, *et al*. Absolute cardiovascular risk assessment by Australian early-career general practitioners: a cross-sectional study. *Fam Med Com Health* 2023;**11**:e002251. doi:10.1136/fmch-2023-002251

► Additional supplemental material is published online only. To view, please visit the journal online (http://dx.doi.org/10.1136/fmch-2023-002251).



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## ABSTRACT

**Objective** To determine the prevalence and associations of general practice registrars' performing absolute cardiovascular risk (ACVR) assessment (ACVRa).

**Design** A cross-sectional study employing data (2017–2018) from the Registrar Clinical Encounters in Training project, an ongoing inception cohort study of Australian GP registrars. The outcome measure was whether an ACVRa was performed. Analyses employed univariable and multivariable regression. Analysis was conducted for all patient problems/diagnoses, then for an 'at-risk' population (specific problems/diagnoses for which ACVRa is indicated).

**Setting** Three GP regional training organisations (RTOs) across three Australian states.

**Participants** GP registrars training within participating RTOs.

**Results** 1003 registrars (response rate 96.8%) recorded details of 69 105 problems either with Aboriginal and/or Torres Strait patients aged 35 years and older or with non-Indigenous patients aged 45 years and older. Of these problems/diagnoses, 1721 (2.5% (95% CI 2.4% to 2.6%)) involved an ACVRa. An ACVRa was 'plausibly indicated' in 10 384 problems/diagnoses. Of these, 1228 (11.8% (95% CI 11.2% to 12.4%)) involved ACVRa. For 'all problems/diagnoses', on multivariable analysis female gender was associated with reduced odds of ACVRa (OR 0.61 (95% CI 0.54 to 0.68)). There was some evidence for Aboriginal and/or Torres Strait Islander people being more likely to receive ACVRa (OR 1.40 (95% CI 0.94 to 2.08), p=0.10). There were associations with variables related to continuity of care, with reduced odds of ACVRa: if the patient was new to the registrar (OR 0.65 (95% CI 0.57 to 0.75)), new to the practice (OR 0.24 (95% CI 0.15 to 0.38)) or the problem was new (OR 0.68 (95% CI 0.59 to 0.78)); and increased odds if personal follow-up was organised (OR 1.43 (95% CI 1.24 to 1.66)). For 'ACVRa indicated' problems/diagnoses, findings were similar to those for 'all problems/diagnoses'. Association with Aboriginal and/or Torres Strait Islander status, however, was significant at p<0.05 (OR 1.60 (95% CI 1.04 to 2.46)) and association with female gender was attenuated (OR 0.88 (95% CI 0.77 to 1.01)).

**Conclusion** Continuity of care is associated with registrars assessing ACVR, reinforcing the importance of care continuity in general practice. Registrars' assessment of an individual patient's ACVR is targeted to patients with individual risk factors, but this may entail ACVRa underutilisation in female patients and younger age groups.

### WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Despite improved management of cardiovascular disease (CVD) in recent years, CVD produces enormous global burden. Absolute cardiovascular risk (ACVR) assessment (ACVRa) is the best means for stratifying CVD risk and is recommended in directing therapy. Despite this, ACVRa remains underutilised in general practice, particularly in younger people.

### WHAT THIS STUDY ADDS

⇒ Australian general practice registrars are significantly less likely to carry out ACVRa in female patients, and in younger patients, and may be more likely to calculate ACVR in Aboriginal and/or Torres Strait Islander people and in regular patients (of the registrar or the practice).

### HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ There is considerable scope to improve implementation of ACVRa among appropriate patient populations (Aboriginal and/or Torres Strait Islander patients and female patients). Better targeted education and training of registrars in the provision of ACVRa should be prioritised to bridge evidence-practice gaps and contribute to equity in CVD outcomes.

## INTRODUCTION

### Cardiovascular disease burden

Cardiovascular disease (CVD) is the leading global cause of disability-adjusted life-years and mortality, accounting for approximately one-third of deaths globally.[1] In Australia, CVD carries a significant burden of disease.[2 3] Internationally, CVD-related morbidity and mortality rates have improved significantly in recent decades. Between 2010 and 2019, there was an 11.1% decrease in age-standardised rates of death due to CVD (14.7% for

cerebrovascular disease and 9.7% for ischaemic heart disease).[4 5] Despite these improvements, the global decline in CVD incidence and mortality has faltered, and even reversed in younger people.[6 7] A further aspect of the Australian context is that Aboriginal and/or Torres Strait Islander peoples experience CVD at higher rates than non-Indigenous Australians but are undertreated for risk factors and receive poorer ongoing management,[8 9] outcomes reflected in First Nations populations in Canada[10] and the USA.[11]

## Absolute cardiovascular risk assessment

Modifiable risk factors for CVD are well established (including high blood pressure, high blood cholesterol, smoking and diabetes). Better management of these risk factors has been a major reason for declines in rates of CVD in advanced countries in recent years. Nine potentially modifiable risk factors have been deemed to account for 90% of the Population Attributable Risk of myocardial infarction in men and 94% in women in a major international study.[12]

The additive effects of individual risk factors in CVD and a need to target preventive treatment to those patients at greatest risk of CVD has led to the concept of a management tool based on absolute cardiovascular risk (ACVR) rather than independent management of individual risk factors.[13] Calculation of ACVR involves the use of multivariable risk assessment tools (CVD risk scores or calculators) to estimate an individual's CVD risk. These scores or calculators incorporate relevant CVD risk factors and arrive at a summary estimate of the individual's personal absolute risk of experiencing a major cardiovascular event (typically, in the following 5 or 10 years).[14] The intensity of management (including antihypertensive and lipid-lowering treatment) should then be considered accordingly.[15] As long ago as 1993, recommendations have been made for antihypertensive and lipid-lowering treatment decisions to be based on ACVR calculation rather than relative risk.[16 17]

ACVR algorithms include those for estimating risk of fatal or non-fatal coronary heart disease developed from Framingham, USA data,[18] for estimating risk of any CVD mortality from European data,[19] and for estimating risk of incident CVD (coronary heart disease, stroke and transient ischaemic attack) from the UK data.[20] In Australia, use of the Australian cardiovascular risk calculator, based on the Framingham Risk Equation and recalibrated for the Australian population, is recommended by the National Heart Foundation.[14]

## Implementation of ACVRa in general practice

General practice is the primary mechanism for CVD risk identification and management in Australia.[21] All GPs and GP registrars (vocational specialist trainees in family medicine/general practice) will have access to ACVR risk calculators in their practice software, plus easily accessible online availability. Hardcopy ACVR risk calculation algorithms (using colour-coded charts) are also widely available.[22] Australian GP practice software programs (and online ACVR calculators) produce a percentage estimate of ACVR (eg, % risk of incident CVD in the next 5 years) based on Framingham data. Printed materials (and some online sites) produce an ACVR risk stratification classification, for example, 'low risk' (less than 10% risk of CVD within the next 5 years), 'moderate risk' (10%–15%) and high risk' (greater than 15%).[14]

Routine use of ACVRa has been shown to promote better health outcomes through improved cardiovascular management.[23–25] However, implementation in Australian general practice has proved problematic: a 2020 survey found that 78% of Australian GPs use ACVRa, with just 45% reporting high assessment rates.[26] In baseline audits of general practice in a recent Australian RCT, only 48% of patients aged 45–69 had ACVRa recorded in their notes.[27] Thus, there appears to be only modest uptake of ACVRa in Australian general practice. Available literature demonstrates similarly poor utilisation of CVD risk assessment tools among primary care practitioners internationally, with reported rates of frequent/regular use as low as 17% in the USA[28] and 32.4% in Ireland.[29] In Belgium, 53% of GPs reported never using a global (absolute) CVD risk assessment tool.[30] While a 2020 survey in the UK revealed high self-reported utilisation of CVD risk assessment among GPs across a number of CVR risk tools, how frequently these tools are used remains unclear.[31]

GPs continue to focus on individual risk factors (blood pressure and cholesterol) rather than absolute CVD risk.[32 33] This represents a significant evidence-practice gap in CVD management.[34 35] It has been estimated that only 7% of Australians aged 45–74 years attending general practice have had an ACVR score calculated.[36] Qualitative Australian research suggests that implementing ACVR-based management in general practice is complex and may require multifaceted approaches.[37 38] There remains significant scope for increasing the proportion of eligible patients receiving ACVRa.

With the disease burden of CVD projected to increase significantly in this decade,[39] 'increased efforts are needed to tackle these major risk factors'.[40] GP registrars (specialist vocational trainees in general practice/family practice) are a group of particular interest given that registrars (during their 18 months of general practice-based training) comprise approximately 13% of current GP workforce by head count[41] and are at a career stage when they are establishing clinical approaches and practices that may be long-lasting. Exploring the use of ACVRa by GP registrars will be valuable in determining uptake and understanding associations of ACVRa. An understanding of these and other contextual aspects of ACVR use will inform the multifaceted approaches required to increase the use of ACVRa in primary care, including during the vocational training of GPs.

In this study, we aimed to establish the prevalence and associations of GP registrars performing in-consultation ACVRa.

## METHODS

This was an analysis nested within the Registrar Clinical Encounters in Training (ReCEnT) study.

### Registrar Clinical Encounters in Training

ReCEnT is an ongoing inception cohort study of GP registrars and the content of their consultations. It is a multisite study, conducted since 2010. The data for this analysis were collected from 2017 to 2018.

For this analysis, participants were GP registrars training with three of Australia's nine then-current regional training organisations (RTOs) across three Australian states (New South Wales, Victoria and Tasmania) and the Australian Capital Territory. RTOs were government-funded, not-for-profit, geographically defined educational and training organisations. They delivered regular education sessions for their registrars and co-ordinated and managed registrars' placement in individual training practices where training is conducted within an apprenticeship-like model with supervision by experienced GPs. Registrars spend 18 months to 2 years of their training in the practice environment. Though they have recourse to supervisor advice and assistance, they practice with considerable clinical autonomy. The participating RTOs were responsible for the training of 44% of Australian GP registrars during the period of data collection.[42]

The ReCEnT methodology has been reported elsewhere.[43] Briefly, registrars collect data on 60 consecutive office-based consultations, at approximately the midpoint of each of three 6-month (full-time equivalent) general practice-based training terms. Data collection is via dedicated Case Report Forms (CRFs). The CRFs are composed of an extensive set of items which are ongoing. There is also capacity to add items exploring new topics for a limited number of rounds of data collection. In the case of ACVR, this item was included for three rounds of data collection in 2017 and 2018. ReCEnT is a routine component of registrars' educational programme, with individual written feedback provided to prompt individual registrars' reflection on their clinical and educational experiences.[44] Registrars may consent for their data to be also used for research purposes.

In addition to the in-consultation data, registrar demographic data and training practice characteristics are collected (via questionnaire) 6 monthly.

### Study population

The study population included all registrars from participating RTOs who were in one of their first three (6-month full-time equivalent) GP training terms.

### Outcome

The outcome of interest was whether an ACVRa was performed.

Registrars were also asked to record whether the ACVRa outcome was categorised as low risk (<10% 5-year risk), moderate risk (10%–15%), high risk (>15%) or whether the risk was deemed to be 'automatically clinically categorised as high risk' (eg, if the patient had a pre-existing condition that categorised them as high risk).

This data were obtained via items included in the ReCEnT CRF for a limited number of rounds of data collection.

### Independent variables

Independent variables related to registrar, practice, patient, consultation and consultation actions.

Registrar factors were age, gender, part-time or full-time status, training term, number of years since graduation, whether they worked at the practice previously, and if they qualified as a doctor in Australia. Practice factors included size of practice (number of full-time equivalent GPs), billing practice (does the practice bulk bill, ie, routinely do not charge the patient a consultation fee at the point of care), rurality (based on the Australian Standard Geographical Classification Remoteness Area classification),[45] practice location Socio-Economic Index for Area (SEIFA-IRSD) relative index of disadvantage decile[46] and RTO region. Patient factors were age, gender, identification as Aboriginal and/or Torres Strait Islander, non-English speaking background and patient/practice status (whether the patient was an existing patient of the practice, new to the registrar or new to the practice). Consultation factors were duration of consultation, number of problems/diagnoses addressed in each consultation, if the problem/diagnosis was new, and if the registrar sought information or assistance for diagnosis and/or management of the problem (if they consulted their supervisor and/or other sources of information). The consultation action factors were if medication was prescribed, pathology or imaging ordered, referrals made, follow-up organised and if any learning goals were generated by the registrar.

### Statistical analysis

Analysis was at the level of the individual problem/diagnosis and performed on data from three rounds of data collection 2017–2018.

Analysis was confined to Aboriginal and Torres Strait Islander patients aged 35 years and older, and to non-Indigenous patients aged 45 years and older, reflecting National Vascular Disease Prevention Alliance (NVDPA) guidelines for ACVRa.[14]

Proportions of problems/diagnoses that involved an ACVRa were calculated with 95% CIs, adjusted for clustering of observations within registrars.

The main analyses used logistic regression, within the generalised estimating equations framework to account for repeated measures within registrars. An exchangeable working correlation structure was assumed.

Four models were constructed, all were with the outcome ACVRa performed/ACVRa not performed.

1. The first two models included 'all problems/diagnoses'.

   The first model included patient-related, practice-related and registrar-related covariates. The

second model included these same covariates plus consultation-related and consultation-related covariates. The rationale for the sequential models is that whether the registrar performs an ACVRa will plausibly be influenced by patient, registrar and practice factors, but evaluation of these influences may be compromised by inclusion in the multivariable model of factors operating once the consultation is progressing.
2. The third and fourth models included only specific problems/diagnoses for which an ACVRa could plausibly be indicated. These problems/diagnoses were determined by a panel of GP study investigators to be atrial fibrillation, chronic kidney disease, diabetes mellitus type I, diabetes mellitus type II, hyperlipidaemia, hypertension, obesity, smoking and 'check-up'.

Univariable analyses were conducted on each covariate, with the outcome. Covariates with a univariable p<0.20 were considered for inclusion in the multiple regression model.

Once the model with all significant covariates was fitted, model reduction was assessed. Covariates which were no longer significant (at p<0.2) in the multivariable model were tested for removal from the model. If the covariate's removal did not substantively change the resulting model, the covariate was removed from the final model. A substantive change to the model was defined as any covariate in the model having a change in the effect size (OR) of greater than 10%.

Diagnostic tests were conducted to assess goodness of fit, using the Hosmer-Lemeshow test for logistic models.

The regressions modelled the log-odds that ACVRa was performed during the consultation. Effects were expressed as ORs with 95% CI. Significance was declared at the conventional 0.05 level, with the magnitude and precision of effect estimates also used to interpret results.

Analyses were programmed by using STATA V.16.0 and SAS V.9.4.

## Patient and public involvement

There was no patient involved. The participants in the ReCEnT study are registrars. Registrars were involved in the design of the study (in 2009) and participating registrars regularly provide feedback on the ongoing study. Results are disseminated to study participants in monthly GP training newsletters.

## RESULTS

A total of 1003 individual registrars (response rate 96.8%), during 1713 registrar-rounds of data collection, recorded details of 69 105 problems/diagnoses of patients in the included age-groups. See table 1 for characteristics of participating registrars and their practices.

Of these problems/diagnoses, 1721 (2.5% (95% CI 2.4% to 2.6%)) involved an ACVRa.

There were 10 384 problems/diagnoses for which 'an ACVRa is plausibly indicated'. Of these problems, 1228 (11.8% (95% CI 11.2% to 12.4%)) involved an ACVRa being performed.

Of ACVRa performed, 40.3% were determined to be low risk, 21.3% moderate risk, 22.7% high risk and 15.7% were 'clinically categorised as high risk'.

**Table 1** Characteristics of participating registrars and their practices

| Registrar variables (n=1003) | | n (%) |
|---|---|---|
| Registrar gender | Male | 399 (39.78) |
| | Female | 604 (60.22) |
| Qualified as doctor in Australia | No | 181 (18.06) |
| | Yes | 821 (81.94) |
| College enrolled in | RACGP | 957 (96.76) |
| | ACCRM | 27 (2.73) |
| | Both | 5 (0.51) |
| Registrar round/practice variables (n=1713) | | |
| Registrar age (years) | Mean (SD) | 32.48 (6.22) |
| Registrar works FT or PT | PT | 359 (21.82) |
| | FT | 1286 (78.18) |
| Registrar training term | Term 1 | 611 (35.67) |
| | Term 2 | 759 (44.31) |
| | Term 3 | 343 (20.02) |
| Practice SEIFA index (decile) | Mean (SD) | 5.50 (2.88) |
| Practice rurality | Major city | 1073 (64.64) |
| | Inner regional | 434 (26.14) |
| | Outer regional or remote | 153 (9.22) |

FT, full time; PT, part time; SEIFA, Socio-Economic Indexes for Areas.

## Associations of an ACVRa being performed

The characteristics associated with an ACVRa being performed for 'all problems/diagnoses' in the included age groups are presented in online supplemental table 1. The associations with an ACVRa being performed (logistic regression models) are presented in table 2.

Significant multivariable associations of an ACVRa being carried out included patient age 55–64 years (OR 1.19 (95% CI 1.00 to 1.41)), and age 65–74 years (OR 1.18 (95% CI 1.00 to 1.39). Patient age 75+ was associated with a considerably lesser odds of an ACVRa being carried out (OR 0.66 (95% CI 0.52 to 0.83)) (all compared with age <55 years). Female gender was associated with reduced odds of ACVRa being carried out (OR 0.61 (95% CI 0.54 to 0.68)). There was some evidence (p=0.10) that Aboriginal and/or Torres Strait Islander people in the general population may be more likely to receive ACVRa (OR 1.40 (95% CI 0.94 to 2.08)). There were also associations with variables related to continuity of care with reduced odds of ACVRa if the patient was new to the registrar (OR 0.65 (95% CI 0.57 to 0.75)) new to the practice (OR 0.24

**Table 2** Associations with an ACVRa being performed (logistic regression models)

| | | | Univariate | | Adjusted | |
|---|---|---|---|---|---|---|
| **Factor group** | **Covariate** | **Class** | **OR (95% CI)** | **P value** | **OR (95% CI)** | **P value** |
| Model 1 (including patient, registrar and practice variables) | | | | | | |
| Patient factors | Patient age group Referent: 45–54 | 55–64 years | 1.20 (1.02 to 1.42) | 0.027 | 1.19 (1.00 to 1.41) | 0.044 |
| | | 65–74 years | 1.21 (1.04 to 1.42) | 0.016 | 1.18 (1.00 to 1.39) | 0.044 |
| | | 75+years | 0.74 (0.60 to 0.91) | 0.005 | 0.66 (0.52 to 0.83) | <0.001 |
| | Patient gender | Female | 0.59 (0.53 to 0.66) | <0.001 | 0.61 (0.54 to 0.68) | <0.001 |
| | Aboriginal and/or Torres Strait Islander | Yes | 1.48 (1.03 to 2.13) | 0.034 | 1.40 (0.94 to 2.08) | 0.100 |
| | Non-English-speaking background | Yes | 1.19 (0.97 to 1.46) | 0.092 | 1.23 (0.98 to 1.55) | 0.070 |
| | Patient/practice status Referent: existing patient | New to registrar | 0.66 (0.58 to 0.76) | <0.001 | 0.65 (0.57 to 0.75) | <0.001 |
| | | New to practice | 0.27 (0.17 to 0.42) | <0.001 | 0.24 (0.15 to 0.38) | <0.001 |
| Registrar factors | Qualified as doctor in Australia | Yes | 0.67 (0.50 to 0.89) | 0.005 | 0.80 (0.59 to 1.08) | 0.140 |
| | Registrar age (years) | | 1.03 (1.00 to 1.05) | 0.026 | 1.00 (0.98 to 1.02) | 0.98 |
| | Years worked prior to GP training | | 1.05 (1.00 to 1.10) | 0.031 | 1.03 (0.99 to 1.08) | 0.147 |
| Practice factors | Region Referent: region 1 | Region 2 | 1.45 (0.96 to 2.19) | 0.081 | 1.34 (0.84 to 2.15) | 0.22 |
| | | Region 3 | 1.29 (0.94 to 1.75) | 0.114 | 1.32 (0.95 to 1.82) | 0.100 |
| | | Region 4 | 1.14 (0.83 to 1.56) | 0.42 | 0.99 (0.68 to 1.43) | 0.95 |
| | | Region5 | 1.58 (1.08 to 2.31) | 0.017 | 1.43 (0.99 to 2.07) | 0.057 |
| | Practice routinely bulk bills | Yes | 1.24 (0.99 to 1.56) | 0.064 | 1.25 (0.97 to 1.61) | 0.083 |
| Model 2 (including all above variables+consultation variables) | | | | | | |
| Consultation factors | New problem seen | Yes | 0.60 (0.53 to 0.68) | <0.001 | 0.68 (0.59 to 0.78) | <0.001 |
| | Sought help any source Referent: no help sought | Other sources | 1.64 (1.36 to 1.98) | <0.001 | 1.57 (1.25 to 1.99) | 0.001 |
| | | Supervisor | 0.94 (0.75 to 1.18) | 0.60 | 0.79 (0.58 to 1.06) | 0.117 |
| | Consultation duration (minutes) | | 1.02 (1.01 to 1.02) | <0.001 | 1.01 (1.00 to 1.01) | 0.034 |
| | No of problems | | 1.35 (1.27 to 1.44) | <0.001 | 1.26 (1.17 to 1.36) | <0.001 |
| | Pathology ordered | Yes | 1.72 (1.52 to 1.93) | <0.001 | 1.66 (1.43 to 1.92) | <0.001 |
| | Follow-up ordered | Other GP in the practice | 0.89 (0.67 to 1.17) | 0.39 | 0.95 (0.67 to 1.34) | 0.76 |
| | Referent: no follow-up | With themselves | 1.61 (1.43 to 1.80) | <0.001 | 1.43 (1.24 to 1.66) | <0.001 |
| | Learning goals generated | Yes | 1.47 (1.26 to 1.72) | <0.001 | 1.19 (0.98 to 1.44) | 0.086 |
| | Medication prescribed | Yes | 0.80 (0.71 to 0.90) | <0.001 | 0.85 (0.74 to 0.97) | 0.014 |

ACVRa, absolute cardiovascular risk assessment; GP, general practice.

(95% CI 0.15 to 0.38)); or the problem was new (OR 0.68 (95% CI 0.59 to 0.78)); and increased odds if personal follow-up was organised (OR 1.43 (95% CI 1.24 to 1.66)). Consultations in which an ACVRa was conducted were statistically significantly longer, but the effect size was small.

Regression diagnostics for the final model showed no violations of the assumptions of heteroscedasticity or normality. Goodness-of-fit tests indicated good model fit and there were no influential observations.

### Associations with an ACVRa being performed for problems/diagnoses for which an ACVRa is indicated

The characteristics associated with an ACVRa being performed for problems/diagnoses for which an ACVRa is indicated are presented in online supplemental table

**Table 3** Associations with an ACVRa being performed for a problem for which an ACVRa is indicated (logistic regression models)

| | | | Univariate | | Adjusted | |
|---|---|---|---|---|---|---|
| **Factor group** | **Covariate** | **Class** | **OR (95% CI)** | **P value** | **OR (95% CI)** | **P value** |
| **Model 1 (including patient, registrar and practice variables)** | | | | | | |
| Patient factors | Patient age group Referent: 45–54 | 55–64 years | 1.02 (0.85 to 1.22) | 0.87 | 1.05 (0.88 to 1.27) | 0.59 |
| | | 65–74 years | 0.89 (0.74 to 1.07) | 0.21 | 0.88 (0.73 to 1.07) | 0.20 |
| | | 75+ years | 0.55 (0.43 to 0.70) | <0.001 | 0.48 (0.37 to 0.63) | <0.001 |
| | Patient gender | Female | 0.84 (0.74 to 0.96) | 0.012 | 0.88 (0.77 to 1.01) | 0.070 |
| | Aboriginal and/or Torres Strait Islander | Yes | 1.71 (1.15 to 2.55) | 0.008 | 1.60 (1.04 to 2.46) | 0.031 |
| | Patient/practice status | New to registrar | 0.59 (0.51 to 0.70) | <0.001 | 0.57 (0.48 to 0.67) | <0.001 |
| | | New to practice | 0.24 (0.15 to 0.39) | <0.001 | 0.19 (0.11 to 0.33) | <0.001 |
| Practice factors | Region Referent: region 1 | Region 2 | 1.50 (0.98 to 2.29) | 0.060 | 1.27 (0.77 to 2.10) | 0.34 |
| | | Region 3 | 1.54 (1.12 to 2.12) | 0.008 | 1.52 (1.10 to 2.10) | 0.011 |
| | | Region 4 | 1.27 (0.91 to 1.76) | 0.155 | 1.17 (0.84 to 1.64) | 0.343 |
| | | Region 5 | 1.74 (1.19 to 2.54) | 0.004 | 1.69 (1.16 to 2.48) | 0.007 |
| Registrar factors | Registrar age | | 1.02 (0.99 to 1.04) | 0.165 | 1.00 (0.98 to 1.02) | 0.90 |
| | Years worked prior to GP training | | 1.04 (0.99 to 1.09) | 0.148 | 1.04 (0.99 to 1.10) | 0.080 |
| Model 2 (including all above variables+consultation variables) | | | | | | |
| Consultation factors | New problem seen | Yes | 1.37 (1.17 to 1.61) | <0.001 | 1.43 (1.20 to 1.71) | <0.001 |
| | Sought help any source | Other sources | 2.61 (2.10 to 3.24) | <0.001 | 2.06 (1.54 to 2.76) | <0.001 |
| | Referent: no help sought | Supervisor | 1.38 (1.02 to 1.86) | 0.038 | 0.80 (0.53 to 1.21) | 0.30 |
| | Consultation duration (minutes) | | 1.02 (1.01 to 1.02) | <0.001 | 1.01 (1.01 to 1.02) | 0.001 |
| | Pathology ordered | Yes | 0.87 (0.75 to 1.00) | 0.047 | 0.77 (0.64 to 0.91) | 0.003 |
| | Follow-up ordered | Other GP in the practice | 0.86 (0.61 to 1.20) | 0.36 | 0.89 (0.58 to 1.36) | 0.58 |
| | Referent: no follow-up | With themselves | 1.63 (1.43 to 1.86) | <0.001 | 1.31 (1.11 to 1.55) | 0.002 |
| | Learning goals generated | Yes | 2.15 (1.78 to 2.60) | <0.001 | 1.40 (1.09 to 1.81) | 0.009 |
| | Referral ordered | Yes | 1.57 (1.23 to 2.00) | <0.001 | 1.41 (1.06 to 1.88) | 0.019 |

ACVRa, absolute cardiovascular risk assessment; GP, general practice.

2. The associations with an ACVRa being performed (logistic regression models) are presented in table 3.

For the analysis of problems/diagnoses for which an ACVRa is indicated, findings were broadly similar to those for 'all problems/diagnoses', above. One difference was that the association with Aboriginal and/or Torres Strait Islander status was now significant at the p<0.05 level (OR 1.60 (95% CI 1.04 to 2.46)). There was also evidence of regional variability with two of the five regions having significantly greater odds of ACVRa performance (OR 1.69 (95% CI 1.16 to 2.48) and 1.52 (95% CI 1.10 to 2.10) compared with the referent region). The age groups 55–64 and 65–74 were no longer significantly different to the referent age group (<55). The effect size of the association with female gender was less (OR of 0.88 compared with 0.61) and no longer significant at the p<0.05 level (OR (95% CI 0.77 to 1.01), p=0.070).

Regression diagnostics for the final model showed no violations of the assumptions of heteroscedasticity or normality. Goodness-of-fit tests indicated good model fit and there were no influential observations.

## DISCUSSION

### Summary of main findings

Registrars conducted an ACVRa in patients 45 years or older (or 35 years and older in Aboriginal and/or Torres Strait Islander patients) for 2.5% of 'all problems/diagnoses' and, for problems/diagnoses for which an ACVRa is plausibly indicated, in 11.8% of instances.

We found that registrars are significantly less likely to conduct ACVRa in female patients, but this was attenuated when limited to the 'at-risk problem/diagnosis' population. In the 'all problems/diagnoses' population,

there is some evidence that Aboriginal and/or Torres Strait Islander patients are more likely to have ACVRa carried out. The effect size increased and was statistically significant at the 0.05 level when confined to the 'at-risk' problems/diagnoses population. In the 'all problems/diagnoses' population, registrars are more likely to carry out ACVRa with increasing age of the patient (55–64 years and 65–74 years), but less likely after the age of 75 years. These findings are attenuated when confined to 'at-risk' problems, but those over 75 years of age were still significantly less likely to receive ACVRa. Follow-up being arranged to see the registrar (but not other GPs in the practice) is significantly associated with ACVRa. A patient being new to the practice, being new to the registrar, and the patient presenting with a new problem is associated with reduced odds of ACVRa. Association of ACVRa with increased consult duration is statistically significant but was of modest effect size.

## Interpretation of findings and comparison with existing literature

The findings of frequency of ACVRa in our study are of limited import. Our data does not elucidate what proportion of patients for who an ACVRa is indicated have already received one at some time (and in a timely manner). Intuitively, 11.8% of appropriate problems/diagnoses prompting an ACVRa at individual presentations suggests registrars are proactively performing risk assessments, but the extent of potential for improvement is unclear. The findings regarding associations of performing an ACVRa, however, are relevant and potentially important to clinical GP and to GP vocational training:

### Reduced rate of ACVRa in female patients

To our knowledge, the finding that registrars are 39% less likely to carry out ACVRa for female patients is novel. It may be a contributor to undertreatment of CVD in those women for who risk reduction is indicated. Internationally, significant inequities exist in the diagnosis and management of CVD burden in women when compared with men.[47 48] Healthcare providers have been shown to poorly understand or underestimate cardiovascular risk in women,[49] with a recent study of Australian GP revealing female patients are significantly less likely to have documented risk factors than male patients.[50] Women with risk factors are less likely to be on recommended treatment than men.[47 51 52] The caveat to our findings is, that, as male gender is a risk factor for CVD (and incorporated in ACVRa tools), individual women (especially those with a single risk factor) may be at risk of overtreatment if an ACVRa is not performed.

Gender disparities may reflect registrars' being cognizant of men's higher risk for CVD. But, while women demonstrate a favourable risk profile,[51] CVD is the leading cause of mortality for women worldwide.[47 48] Our findings provide nuance to a body of evidence suggesting that women's cardiovascular health is undermanaged. Underassessment of ACVR may result in undermanagement in some women. But it could also result in overmanagement in some women (eg, with a modestly elevated cholesterol but no other risk factors). Optimal management mandates assessment of ACVR.

### Increased ACVRa with patient age

Patient ages 55–64 years and 65–74 years were associated with a 19% and 18% increase in likelihood of ACVRa, respectively, compared with those aged 45–54. This suggests registrars correctly recognise increased absolute risk with age.[53] But it does not necessarily follow that overall lower risk in patient aged 55–74 years means lesser need for risk assessment. The Australian NVDPA guidelines for ACVRa and management recommend ACVRa calculation for all adults, commencing at age 45[14] and the UK National Institute for Health and Care Excellence (NICE) guidelines encourage ACVRa for those aged over 24 without existing CVD.[54]

Those aged over 74 were less likely (34%) to receive ACVR calculation than those aged 45–55. Registrars may perceive patients aged over 74 as inherently high-risk and formal ACVRa to be unnecessary in this group. Alternatively, for people over 74 years, quality of life, comorbidities and life expectancy may have influenced (validly or not) perceptions of the appropriateness of managing ACVR, so discouraging ACVR calculation.[14] Another consideration is that, while ACVR calculation is still recommended for estimating risk in people over 74 years, ACVR algorithms have not been validated in this age group and Australian ACVR guidelines use 74 years as the upper age limit for calculating risk (and caution that calculated risk for older patients may be an underestimate).[14] This may possibly tend to discourage ACVRa in this age group. The NICE guidelines recommend ACVRa for patients up to and including 84 years old and consider those aged over 84 to be high risk.[54]

### Aboriginal and/or Torres Strait Islander patients

Our finding of some evidence that Aboriginal and/or Torres Strait Islander patients are more likely to receive ACVRa (statistically significant when confined to the 'at-risk' problems/diagnoses population), is consistent with the higher ACVR of Aboriginal and/or Torres Strait Islander peoples.[14] ACVRa of Aboriginal and/or Torres Strait Islander people has been endorsed by the Australian Institute of Health and Welfare as a national key performance indicator for preventive health.[55] Our finding is somewhat reassuring, given literature demonstrating wide health centre variability for ACVRa in Aboriginal and/or Torres Strait Islander patients.[56] The Aboriginal and/or Torres Strait Islander population continues to experience far poorer cardiovascular health outcomes than the non-Indigenous population, with far higher rates of modifiable risk factors,[57] and mortality from CVD occurring 10–20 years earlier than the non-Indigenous population.[9] CVD is the largest contributor to the gap in burden of disease between Aboriginal and/or Torres Strait Islander and non-Indigenous populations.[58] This disparity is also

true for provision of treatment; a 2018 Australian study found 58% of high-risk Aboriginal and/or Torres Strait Islander patients were not receiving recommended lipid-lowering therapy.[9] These outcomes are comparable for Aboriginal people of Canada, who suffer increased CVD burden compared with non-Aboriginal Canadians.[59] While our findings suggest registrars make an extra effort to identify and manage ACVR in Aboriginal and/or Torres Strait Islander patients, there may still be considerable scope for broader provision of ACVRa, particularly in the population without obvious risk factors, to reduce disparities in disease burden by encouraging early detection and intervention.[56]

### Registrars conduct ACVRa in patients with individual indicators of higher risk

When focused to the 'at-risk' problems/diagnoses population, registrars' reduced likelihood of carrying out ACVRa for female patients was attenuated, and they were significantly more likely to carry out ACVRa for Aboriginal and/or Torres Strait Islander patients. Registrars are more likely to carry out ACVRa if individual risk factors are identified during the consultation (the 'ACVRa plausibly indicated' population in our analyses), in line with current recommendations.[14] Apparent shortcomings in targeting of ACVRa appear to be mitigated in this population. The context is existing evidence of overtreatment of low-risk patients and undertreatment of high-risk patients.[32] A 2009 study describes a marked undertreatment of high-risk patients, particularly in management of lipids, ascribed to insufficient collection of patient information, and focus on individual risk factors rather than ACVR.[35] Our findings provide evidence for registrars focussing ACVRa on patients with indicators of potential higher risk. Whether this focused risk assessment translates to more focused therapy is a topic for further research.

### ACVRa more likely to be carried out for regular patients

Patient being new to the registrar or new to the practice was associated with ACVRa being 25% and 73% less likely, respectively. The effect sizes were greater when analysis was confined to 'at-risk' problems (the patient being 'new to registrar' and 'new to practice' were 34% and 79% less likely to receive ACVRa, respectively). The patient's relevant problem/diagnosis being new was associated with ACVRa being 32% less likely to be performed. These results imply ACVRa is perceived by registrars as a tool for regular patients under continuing care.

These findings may also stem from clinical time constraints. Consulting new patients or new presenting problems may often be too time-consuming for inclusion of ACVRa, consistent with literature demonstrating higher ACVRa rates in GPs who think there is sufficient time in the consult.[26] A majority of GPs (77%) believe there is sufficient time to carry out ACVRa assessment during a routine consult,[26] but this may not be viable when seeing a new patient or presentation. International literature lists time constraints as an established barrier to implementation of CVD risk scoring among GPs.[60] A new patient to the practice is also unlikely to have previous pathology results and repeated blood pressure measurements to facilitate ACVR calculation.

Further, GPs are more likely to carry out ACVRa when perceiving their patient as being willing to undertake lifestyle modification,[26] which may be more likely for patients with an existing rapport with their GP registrar, as in regular patients (not new to the practice). These implications—that GP registrars employ ACVRa in regular patients—is also supported by our finding that ACVRa being carried out is associated with 43% increased likelihood of follow-up with the same registrar. That is, ACVRa is used within the context of continuity of care.

While this is clinically very appropriate, ACVRa should also be employed in the context of registrars seeing new patients or patients of their more senior colleagues as a preventive care opportunity to proactively address cardiovascular risk.

## Implications for education and training

These findings have implications for GP Training. While there is some evidence of ACVRa being employed effectively by registrars in the 'at-risk' problems/diagnoses population, in the wider population ACVRa of female patients is poorer—potentially contributing to mismanagement (either undermanagement or overmanagement). Also, ACVRa of Aboriginal and/or Torres Strait Islander patients could be improved to contribute to greater equity in CVD outcomes. A concerted effort to improve ACVRa performance in these groups within clinical practice is warranted. Improved education of registrars in provision of ACVRa must be prioritised to bridge evidence-practice gaps.[35]

## Strengths/limitations

To our knowledge, this was the first study exploring ACVRa among GP registrars/trainees. The large number of consultations, high response rate for studies of GPs[61] and geographical coverage (classifications of rurality from major city to remote) were strengths of this study. The findings have good generalisability to Australian GP vocational training and other apprenticeship-like practice-based GP training programmes internationally.[62]

A limitation is that, as the analyses are cross-sectional, association only (not causality) can be inferred.

A further limitation of our data is that it is a 'snapshot' of what occurred in the consultation, and we do not have patients' medical histories or medicines regimens. The data being confined to single consultations, so not allowing calculation of proportion of patients having had an ACVRa within a specified time period, is thus a limitation of our study.

As the data are self-recorded, there is potential for social desirability bias, but this should be minimal given that the registrars record a large number of potential

### QUESTIONS

⇒ To determine the prevalence of general practice (GP) registrars' performing Absolute Cardio-Vascular Risk assessments.

⇒ To determine the associations of GP registrars' performing Absolute Cardio-Vascular Risk assessments.

### FINDINGS

⇒ While GP registrars are actively conducting absolute cardiovascular risk (ACVR) assessment, this study reveals the possible underutilisation of ACVR assessment (ACVRa) in female patients and younger people. While we found evidence that Aboriginal and/or Torres Strait Islander people are more likely to have ACVRa carried out, there may be considerable scope to improve assessment in this group.

### MEANING

⇒ This research indicates the desirability of further education and training of GP registrars to improve management of cardiovascular disease (CVD) within clinical practice and contribute to equity in CVD outcomes. Our findings also contribute nuance to a body of evidence around the undermanagement of CVD in women by finding underascertainment of risk in female patients—which may contribute to undertreatment or overtreatment in individual patient management not guided by ACVR.

clinical actions in every consultation, so ACVRa would not be a particular area of focus.

## CONCLUSION

GP registrars are proactively carrying out ACVRa, and there is evidence of targeting of ACVRa to groups with higher probability of elevated ACVR (males, Aboriginal and Torres Strait Islander people, patients aged 55–74). But there remains scope for higher rates of assessment in female patients and younger people. Assessment of ACVR may be more likely in regular patients, reinforcing the importance of care continuity in general practice. While this study found some evidence for higher rates of ACVRa in Aboriginal and/or Torres Strait Islander people, further efforts to improve CVD management will be crucial in contributing to equity in health outcomes.

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**Contributors** PM and JP conceived the study. PM, AD, AR, MvD, AT, JP and NS provided methodological and clinical input into study design. AF was responsible for overall management of the study. AT and AR were responsible for data management. EGH provided analysis planning and overall supervision of statistical analyses. JB conducted the main analyses, AR contributed to the analyses. All authors contributed to interpretation of the findings. TM and PM wrote the first manuscript draft, and all authors contributed to and approved the final manuscript.

**Funding** The ReCEnT project was funded from 2016 to 2019 by an Australian Department of Health-commissioned research grant and supported by the GP Synergy Regional Training Organisation.

**Competing interests** MN is co-chair of the Australian Chronic Disease Prevention Alliance the 'Guidelines for assessing and managing cardiovascular disease risk.

**Patient and public involvement** Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

**Patient consent for publication** Not applicable.

**Ethics approval** This study involves human participants and was approved by the Human Research Ethics Committee (HREC) from the University of Newcastle (reference, H-2009-0323). Participants gave informed consent to participate in the study before taking part.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** No data are available. The data that support this study cannot be publicly shared due to ethical or privacy reasons.



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