Appendix

Supplementary Methods

This study assessed whether or not risk factor assessments had been recorded and where relevant, performed within timeframes as per RACGP recommendations[9] as follows. Smoking status needed to have been recorded at any point in time. Body Mass Index (BMI) needed to have been recorded within 2 years, except for people in the following categories: Aboriginal or Torres Strait Islander peoples (within 12 months); people with previous BMI >25 kg/m^2 (within 6 months). Blood pressure needed to have been recorded for people without an existing diagnosis of IHD, PVD or IS from age 18: at least every two years in those with a low absolute CVD risk, every 12 months in those with a moderate absolute risk and every 3 months in those with a high absolute risk. Lipid profile needed to be recorded for people without an existing diagnosis of IHD, PVD or IS from age 45 or from age 35 in Aboriginal or Torres Strait Islander peoples at the following frequencies: at least every five years in those with a low absolute CVD risk, every two years in those with a moderate absolute risk and every 12 months in those with a high absolute risk. Aboriginal or Torres Strait Islander origin status needed to be recorded in all patients.

Risk factor presence was assessed based on the most recently entered information, with no time limit on how long ago this data was entered. The following risk factors were assessed: Daily smoking; obesity (body mass index (BMI) ≥ 30 kg/m^2); coded diagnosis of hypertension entered into the medical record; hypertensive reading (most recent systolic blood pressure (SBP) >140 mmHg or diastolic blood pressure (DBP) >90 mmHg with no coded diagnosis recorded; Aboriginal or Torres Strait Islander status recorded in the medical record. A coded diagnosis is

one that has been selected from a drop-down menu in the EMR, rather than having been entered using free-text.

The presence of risk factors for chronic diseases were defined as follows. CKD risk factor/s were considered present if there was no coded diagnosis of CKD and a patient was recorded to have any of: Aboriginal or Torres Strait Islander >30 years; BMI ≥30 kg/m2; current smoker; a coded diagnosis of hypertension; SBP >140 mmHg; DBP >90 mmHg; a coded diagnosis of ischaemic CVD; a coded diagnosis of type 1 or type 2 diabetes; fasting blood glucose (FBG) ≥7 mmol/L; random blood glucose (RBG) ≥11.1 mmol/L; HbA1c ≥6.5%. T2D risk factor/s were considered present if there was no coded diagnosis of T2D and a patient was recorded to have any of: FBG ≥7 mmol/L; RBG ≥11.1 mmol/L; HbA1c ≥6.5%; age >40 years and a coded diagnosis of hypertension or SBP >140 mmHg or DBP >90 mmHg or BMI ≥30 kg/m2; a coded diagnosis of ischaemic CVD; a coded diagnosis of gestational diabetes; a coded diagnosis of polycystic ovarian syndrome; prescribed antipsychotic medication. CVD risk factor/s were considered present if there was no coded diagnosis of CVD and a patient was recorded to have any of: Age >60 years and either a coded diagnosis of type 1 or type 2 diabetes or tests indicating possible diabetes (FBG ≥7 mmol/L, RBG ≥11.1 mmol/L, HbA1c ≥6.5%); a coded diagnosis of CKD or tests indicating possible CKD (eGFR <60 ml/min/1.73m2, uACR ≥3.5 mg/mmol in females or ≥2.5 mg/mmol in males); SBP ≥140 mmHg; DBP ≥90 mmHg; coded diagnosis FH; LDL >2; total cholesterol >7.5 mmol/L; current smoker. Testing of those at risk of CKD with a kidney health check required all of eGFR, uACR and BP having been completed within 2 years, or within 1 year if hypertension or diabetes present. Testing of those at risk of T2D required FBG or HbA1c having been completed within 3 years.

Chronic diseases were assessed based upon there being a coded diagnosis entered in the medical record system. Pathology tests were assessed to see if there were any cases of possible CKD, T2D or FH where no coded diagnoses of these conditions had been entered in the medical records, but pathology tests (from any point in time) indicated the possibility of disease presence. Possible CKD presence was considered if any of the following were present: eGFR <60 ml/min/1.73m2, uACR ≥2.5 mg/mmol in men, uACR ≥3.5 mg/mmol in women. Possible T2D presence was considered if any of the following were present: FBG ≥7 mmol/L; RBG ≥11.1 mmol/L; HbA1c ≥6.5%. Possible FH presence was considered if LDL >6.5 mmol/L or if LDL >5 in the presence of a statin prescription. For patients with a coded diagnosis of CKD, T2D, IHD, HF, IS, PVD, FH and AF, guideline recommended monitoring/pharmacological management strategies were assessed as per Appendix Table 1.

Appendix Table 1: Guidelines used to determine study algorithms and variations due to data extraction limitations

Guideline Source	Original guideline	Study algorithm
Blood Pressure		
RACGP (Royal Australian College of General Practitioners)[9]	Blood pressure measurement from age 18 with frequency at least: every two years in those with a low absolute CVD risk, ***every 6-12 months*** in those with a moderate CVD risk and ***every 6-12 weeks*** in those with a high absolute risk	Blood pressure measurement from age 18 with frequency at least: every two years in those with a low absolute CVD risk, ***every 12 months*** in those with a moderate CVD risk and ***every 12 weeks*** in those with a high absolute risk
Lipids		
RACGP[9]	Fasting lipid profile measurement from age 45 or from age 35 in Aboriginal and Torres Strait Islander peoples. Recommended frequency is every five years in those with a low absolute CVD risk, every two years in those with a moderate absolute CVD risk and every 12 months in those with a high absolute CVD risk	Original guideline not modified for algorithm
BMI		

RACGP[9]	BMI measurement from age 18 every two years in general; every 12 months in Aboriginal and Torres Strait Islander peoples, ***in people of Pacific Islander background or if diabetes, CVD, gout or liver disease present*****;** every 6 months if already overweight or obese	BMI measurement from age 18 every two years in general; every 12 months in Aboriginal and Torres Strait Islander peoples; every 6 months if already overweight or obese
CKD		
Kidney Health Australia[8]	Testing in people at risk of CKD with a kidney health check (comprising all three of blood pressure, estimated glomerular filtration rate (eGFR) and urine albumin:creatinine ratio (uACR)) every two years, or every year if diabetes or hypertension present	Original guideline not modified for algorithm
Kidney Health Australia[8]	***Unless contraindicated*****,** prescription of an Angiotensin Converting Enzyme Inhibitor (ACEi) or Angiotensin Receptor Blocker (ARB) for all patients with CKD ***if hypertensive***	Prescription of an ACEi or ARB for all patients with CKD
Kidney Health Australia[8]	***Unless contraindicated*****,** prescription of a statin for all patients with CKD ***if ≥50 years or if <50 years if existing CHD,***	Prescription of a statin for all patients with CKD

	stroke or diabetes or Australian absolute CVD risk score >10% (moderate or high risk)	
T2D		
RACGP[9]	Testing in people at risk of diabetes with fasting blood glucose (FBG) or HbA1c every 3 years	Original guideline not modified for algorithm
RACGP[18]	Monitoring in patients with diabetes with an HbA1c, uACR and eGFR every 12 months	Original guideline not modified for algorithm
RACGP[18]	Monitoring in patients with diabetes with a foot check every 12 months and an eye check every 24 months or within 12 months in Aboriginal and Torres Strait Islander peoples	Original guideline not modified for algorithm
CVD		
National Heart Foundation[19]	***Unless contraindicated,*** prescription of an ACEI/ARB, a beta blocker, a statin and an antiplatelet in all patients with CHD	Prescription of an ACEI/ARB, a beta blocker, a statin and an antiplatelet in all patients with CHD
National Heart Foundation[20]	***Unless contraindicated,*** prescription of an ACEI/ARB and a beta blocker in all patients with ***systolic*** heart failure	Prescription of an ACEI/ARB and a beta blocker in all patients with heart failure

National Stroke Foundation[21]	***Unless contraindicated,*** prescription of a statin for all patients with IS, an antiocoagulant for all patients ***with a cardio-embolic IS or IS with atrial fibrillation*** **and an antiplatelet** ***for all patients with IS who are not prescribed an anticoagulant***	Prescription of a statin and an antiplatelet or anticoagulant in all patients with IS
American College of Cardiology /American Heart Association[22]	***Unless contraindicated*****,** prescription of an anti-platelet and statin for all patients with PVD	Prescription of an anti-platelet and statin for all patients with PVD
FH		
Australian Atherosclerosis Society[5]	***Unless contraindicated*****,** prescription of a statin for all patients with FH	Prescription of a statin for all patients with FH
AF		
American College of Cardiology / American Heart Association[23]	***Unless contraindicated,*** prescription of anticoagulants for all patients with AF and an elevated CHA2DS2-VASc score of 2 or greater in men or 3 or greater in women.	Prescription of anticoagulants for all patients with AF and an elevated CHA2DS2-VASc score of 2 or greater in men or 3 or greater in women.

Appendix Table 2: Risk factor assessments recorded as per national recommendations

Risk factor assessed (n=total assessed)	**Raw number / denominator (proportion)**	**Partial pooling proportion (CI)**
Smoking status	34,059 / 37,946 (90%)	92% (69-98)
Body Mass Index (BMI) *	11,025 / 37,946 (29%)	30% (12-56)
Blood pressure†	15,175 / 35,506 (43%)	46% (22-73)
Lipid profile‡	12,156 / 17,616 (69%)	69% (39-88)
Aboriginal or Torres Strait Islander origin status	32,384 / 37,946 (85%)	91% (28-99.7)

*Measurement required as per RACGP guidelines[9] every 2 years except for people in the following categories: Aboriginal or Torres Strait Islander peoples, required every 12 months; people with previous BMI >25 kg/m^2, required every 6 months.

†Testing as per RACGP guidelines[9] for people without an existing diagnosis of IHD, PVD or IS from age 18: at least every two years in those with a low absolute CVD risk, every 12 months in those with a moderate absolute risk and every 3 months in those with a high absolute risk. Denominator used is people with no coded diagnosis of IHD, PVD or IS.

‡Testing as per RACGP guidelines[9] for people without an existing diagnosis of IHD, PVD or IS from age 45 or from age 35 in Aboriginal or Torres Strait Islander peoples: at least every five years in those with a low absolute CVD risk, every two years in those with a moderate absolute risk and every 12 months in those with a high absolute risk. Denominator used is people without a coded diagnosis of IHD, PVD or IS who are ≥45 or ≥35 years in Aboriginal or Torres Strait Islander peoples.

Appendix Table 3: Risk factor presence and disease testing in those at risk

Risk factor present	Raw number / denominator* (proportion)	Partial pooling proportion (CI)
Daily smoking	5,384 / 37,946 (14%)	14% (5.6-31)
Obesity (BMI ≥ 30 kg/m^2)	9,409 / 37,946 (25%)	25% (13-44)
Coded hypertension	7,561 / 37,946 (20%)	21% (4.6-58)
Hypertensive reading† with no coded hypertension diagnosis	4,522 / 37,946 (12%)	10% (3.2-27)
Aboriginal or Torres Strait Islander origin	476 / 37,946 (1.3%)	0.85% (0.04-14)
Risk factor/s present for CKD‡	18,698 / 36,237 (52%)	54% (27-78)
Risk factor/s present for T2D§	12,180 / 35,231 (35%)	36% (14-67)
Risk factor/s present for CVD‖	23055 / 35346 (65%)	69% (29-92)
CKD diagnostic testing¶ in those at risk	3,630 / 18,698 (19%)	17% (1.3-76)
T2D diagnostic testing** in those at risk	4,143 / 12,180 (34%)	37% (5.2-85)

*When assessing the presence of risk factors, the whole study population has been used as a denominator, not just people with up--to-date tests, as we have included older tests as well. We have assumed that all patients with no data recorded do not have the outcome of interest.

†Most recent systolic blood pressure (SBP) >140 mmHg or diastolic blood pressure (DBP) >90 mmHg.

‡CKD risk factor considered present if no coded diagnosis CKD and recorded to have any of: Aboriginal or Torres Strait Islander >30 years; BMI ≥30 kg/m^2; current smoker; coded diagnosis hypertension; SBP >140 mmHg; DBP >90 mmHg; coded diagnosis ischaemic CVD; coded diagnosis type 1 or type 2 diabetes; fasting blood glucose (FBG) ≥7 mmol/L; random blood glucose (RBG) ≥11.1 mmol/L; HbA1c ≥6.5%.

§T2D risk factor considered present if no coded diagnosis T2D and recorded to have any of: FBG ≥7 mmol/L; RBG ≥11.1 mmol/L; HbA1c ≥6.5%; age >40 years and any of coded diagnosis hypertension, SBP >140 mmHg, DBP >90 mmHg or BMI ≥30 kg/m^2; coded diagnosis ischaemic CVD; coded diagnosis gestational diabetes; coded diagnosis polycystic ovarian syndrome; prescribed antipsychotic medication.

‖CVD risk factor present if no coded diagnosis CVD and recorded to have any of: Age >60 years and either coded diagnosis type 1 or type 2 diabetes or tests indicating possible diabetes (FBG ≥7 mmol/L, RBG ≥11.1 mmol/L, HbA1c ≥6.5%); coded diagnosis CKD or tests indicating possible CKD (eGFR <60 ml/min/1.73m^2, uACR ≥3.5 mg/mmol in females or ≥2.5 mg/mmol in males); SBP ≥140 mmHg; DBP ≥90 mmHg; coded diagnosis FH; LDL >2; total cholesterol >7.5 mmol/L; current smoker.

¶Kidney health check comprising all of eGFR, uACR and BP for those at risk of CKD within 2 years, or within 1 year if hypertension or diabetes present.

**Diabetes testing comprising any of FBG or HbA1c within 3 years.

Appendix Table 4: Chronic disease diagnosis

Chronic disease status/testing	Raw number / denominator (proportion)	Partial pooling proportion (CI)
CKD		
Tests indicating possible CKD* but no coded diagnosis	2,300 / 36,237 (6.3%)	6.7% (1.6-23)
Coded CKD diagnosis	1,709 / 37,946 (4.5%)	3.8% (0.31-33)
T2D		
Tests indicating possible diabetes† but no coded diagnosis	558 / 35,231 (1.6%)	1.6% (0.34-6.9)
Coded T2D diagnosis	2,715 / 37,946 (7.2%)	6.6% (1.3-28)
CVD		
Coded IHD diagnosis	1,703 / 37,946 (4.5%)	4.2% (0.76-20)
Coded HF diagnosis	415 / 37,946 (1.1%)	1% (0.09-10)
Coded IS diagnosis	793 / 37,946 (2.1%)	1.7% (0.12-19)
Coded PVD diagnosis	199 / 37,946 (0.52%)	0.46% (0.07-2.9)
FH		
Tests indicating possible FH‡ but no coded diagnosis	125 / 37,920 (0.33%)	0.33% (0.19-0.55)
Coded FH diagnosis	26 / 37,946 (0.06%)	0.06% (0.01-0.18)
AF		
Coded AF diagnosis	863 / 37,946 (2.3%)	2% (0.2-15)

Overlapping conditions		
Coded diagnosis of CKD, T2D and CVD	62 / 37,946 (0.16%)	0.12% (0-2.6)
Coded diagnosis of CKD and T2D	585 / 37,946 (1.5%)	1.2% (0.09-13)
Coded diagnosis of CKD and CVD	162 / 37,946 (0.43%)	0.26% (0.01-10)
Coded diagnosis of T2D and CVD	105 / 37,946 (0.28%)	0.2% (0.01-5)

*Possible CKD based on any of: eGFR <60 ml/min/1.73m^2, uACR ≥2.5 mg/mmol in men, uACR ≥3.5 mg/mmol in women.

†Possible diabetes based on any of: FBG ≥7 mmol/L; RBG ≥11.1 mmol/L; HbA1c ≥6.5%.

‡ Possible FH based on either: LDL >6.5 mmol/L; LDL >5 and prescribed a statin.

Appendix Table 5: Chronic disease management

Chronic disease intervention	Raw number / denominator (proportion)	Partial pooling proportion (CI)
CKD		
CKD and prescribed ACEI/ARB	1,105 / 1,709 (65%)	65% (45-81)
CKD and prescribed statin	953 / 1,709 (56%)	56% (39-71)
T2D		
T2D and HbA1c within 12 months	2,205 / 2,715 (81%)	80% (54-93)
T2D and uACR within 12 months	1,508 / 2,715 (56%)	47% (5.6-92)
T2D and eGFR within 12 months	2,202 / 2,715 (81%)	80% (47-95)
T2D and eye exam within 24 months or within 12 months in Aboriginal or Torres Strait Islander People	1,046 / 2,715 (39%)	19% (0.29-95)
T2D and foot exam within 12 months	1,073 / 2,715 (40%)	17% (0.18-95)
CVD		
IHD and prescribed ACEI/ARB	1,155 / 1,703 (68%)	67% (60-73)
IHD and prescribed beta blocker	772 / 1,703 (45%)	44% (33-54)
IHD and prescribed statin	1,339 / 1,703 (79%)	77% (54-90)
IHD and prescribed antiplatelet	1,256 / 1,703 (74%)	70% (39-89)
HF and prescribed ACEI/ARB	263 / 415 (63%)	62% (36-81)
HF and prescribed beta blocker	221 / 415 (53%)	56% (26-85)
IS and prescribed statin	521 / 793 (66%)	66% (53-76)
IS and prescribed antiplatelet or anticoagulant	629 / 793 (79%)	78% (47-92)

PVD and prescribed statin	139 / 199 (70%)	69% (26-94)
PVD and prescribed antiplatelet	120 /199 (60%)	58% (14-92)
FH		
FH and prescribed statin	19 / 26 (73%)	73% (24-96)
AF		
AF with CHA2DS2VASC >1 in males or >2 in females and prescribed anticoagulant	468 / 676 (69%)	69% (52-69)