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Supporting Information

Supplementary methods and results

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Appendix to: Tran DT, Falster MO, Pearse J, et al. The Australian Health Care Homes trial: quality of care and patient outcomes. A propensity score-matched cohort study. *Med J Aust* 2024; doi: 10.5694/mja2.52266.

Part 1. Data sources

Practice data extracts

Practice data extracts were electronic medical records extracted from general practice clinical information systems which provide information about patient demographic characteristics, service encounters, diagnoses, clinical measurements, pathology results, prescriptions, vaccinations and Medicare Benefits Schedule (MBS) billing.

For patients enrolled in the Health Care Homes (HCH), data were obtained on a monthly basis from 151 HCH practices (including Aboriginal Medical Services and Aboriginal Community Controlled Health Services) through third party software (Pen CS or Population Level Analysis and Reporting [POLAR])[1,2] or provided directly from head offices of corporate practices. Of those, extracts from 117 practices included flags that enabled identification of 10 174 HCH patients. HCH practices provided data until they withdrew from the program or 30 June 2021, as well as for 24 months prior to HCH registration; extracts from some practices therefore covered longer timespans than others.

For the usual care group, data were obtained from 403 practices that joined the NPS MedicineWise's MedicineInsight program[3] but did not participate in the HCH. Extracts from usual care practices covered the period from 1 December 2015 to 30 June 2021.

Linked data

The Australian Institute of Health and Welfare (AIHW) Data Integration Services Centre linked the HCH registration database to the Medicare Enrolment database, National Death Index (NDI), MBS, Pharmaceutical Benefit Scheme (PBS), Admitted Patient Care, Non-admitted Emergency Department (ED) Patient Care, National Non-Admitted Patient Care, and National Aged Care Data Clearing House.

Usual care group participants were identified in the Medicare Enrolment database (16 years and older and postcode in the catchment areas of the 10 Primary Health Networks [PHN] that participated in the HCH program). While all usual care participants in the PHNs in Victoria and South Australia were included in the linkage, for each other PHN a sample of 100 000 usual care individuals were randomly selected.

The MBS, PBS, and NDI data covered a six-year period (1 July 2015 to 30 June 2021); all other data collections (hospital and aged care) covered a five-year period (1 July 2015 to 30 June 2020). Admitted Patient Care, Non-admitted Emergency Department Patient Care, National Non-Admitted Patient Care data collections were available for five states (New South Wales, Victoria, Queensland, South Australia and Tasmania).

Part 2. Study variables

This section describes the definitions of study variables related to the characteristics of patients (before enrolment) and the outcomes of the study (post-enrolment period). As practice extract data and linked data were analysed separately, we used variables specific to each data source.

Table 1. Description of variables derived from practice extracts

Variables	Definition of variables, time intervals and methods*
Demographic characteristics	
Age	Age at time of enrolment (an integer number).
Sex	Male or female
Aboriginal and/or Torres Strait Islander status	A patient was categorised as of Aboriginal and/or Torres Strait Islander origin if this was ever recorded in the extracts. For HCH patients, this was based on all extract records provided for the evaluation. For usual care patients, this was based on the latest extract provided in August 2021
Beneficiary status	Beneficiary status was categorised as having any of Department of Veterans' Affairs (DVA), pension or health care card. For HCH patients, this was based on health care card status and DVA status recorded in the extract associated with time of enrolment. For usual care patients, this was based on the latest extract provided in August 2021, thus reflecting the most recent beneficiary status
Remoteness by geographic practice location	Remoteness categories included major cities, inner regional, outer regional, remote or very remote Australia, according to Australian Statistical Geography Standard (ASGS) 2016 classification of Remoteness Areas.[4] For HCH practices, remoteness categories were mapped according to Statistical Area Level 2 (SA2) of the practice location. For non-HCH practices, remoteness categories were obtained directly from MedicineInsight extracts where remoteness categories were mapped according to postcode of the practice location.
Index of Relative Socioeconomic Disadvantage (IRSD) quintiles by geographic practice location	IRSD quintiles were derived based on IRSD deciles, with quintile 1 indicating the most disadvantage and quintile 5 indicating the least disadvantage status. For HCH practices, 2016 IRSD deciles ranking within Australia[5] were mapped according to SA2 of the practice location. For non-HCH practices, 2016 IRSD deciles were obtained directly from MedicineInsight extracts where the 2016 deciles were mapped according to postcode of the practice location.
Health risk profile pre-enrolment	
Chronic health conditions	Nineteen individual health conditions were derived, including asthma, chronic obstructive pulmonary disease (COPD), atrial fibrillation, coronary heart disease, stroke, congestive heart failure, osteoarthritis, osteoporosis, anxiety, depression, bipolar disorder, schizophrenia, dementia, cancer (any), high blood pressure, high cholesterol, diabetes type 1, diabetes type 2, and chronic kidney disease. These conditions must have been flagged as "active" in the clinical information system and date of onset was any time prior to enrolment. See Table 2 for further descriptions of the search for these diagnoses in practice extracts. These individual health conditions were grouped into cardiovascular (atrial fibrillation, coronary heart disease, stroke, congestive heart failure, high blood pressure and high cholesterol); joint/bone disorder (osteoarthritis or osteoporosis); diabetes (type 1 or type 2); mental health (anxiety, depression, bipolar disorder, schizophrenia); respiratory (asthma or COPD); cancer; chronic kidney disease; and dementia
Number of conditionss	The number of the above-listed nine individual conditions identified for a patient, ranging from 0 to 19

Variables	Definition of variables, time intervals and methods*
Use of medication for specific conditions	Medicines used in the 12 months prior to enrolment were grouped into medications for diabetes, antithrombotic therapies, cardiovascular medications, medications for nervous system, and medications for respiratory system. See Table 3 for further descriptions of the search for these medicines in practice extracts
Access to general practitioner services pre- and post-enrolment	
Number of GP encounters	GP encounters can be of any mode (e.g. face-to-face, telephone, email, non-visit) and can include GP consultation, GP reviewing and updating a patient record. For POLAR and MedicineInsight extracts, this was calculated as the total number of patient encounters with GP/doctor providers where the date of the encounter was within 12 months pre-enrolment, first year and second year post-enrolment. In instances where there were multiple encounters in one day with the same provider and same encounter mode, only one encounter was counted. With Pen CS extracts, a variable aggregating the total numbers of GP encounters in a twelve-month period was provided instead of individual unit records of GP encounters. We used the extracts associated with date of patient enrolment, and first year and second year anniversary of enrolment. Extracts provided directly from corporate HCH practices did not contain information about type of provider; for these practices this measure was not calculated.
Process of care pre- and post-enrolment	
Receipt of influenza vaccination	This was based on presence of an immunisation record for influenza where date of service was within 12 months pre-enrolment, first year and second year post-enrolment
Recording of blood pressure	This was based on presence of blood pressure recording with date of service within 12 months pre-enrolment, first year and second year post-enrolment
Recording of lipid test	This was based on presence of a lipid test (total cholesterol, high-density lipoprotein, low-density lipoprotein or triglycerides) with date of service within 12 months pre-enrolment, first year and second year post-enrolment
Recording of glycated haemoglobin (HbA_{1c}) test †	Among patients with type 2 diabetes, this was based on presence of HbA_{1c} pathology test with date of service within 12 months pre-enrolment, first year and second year post-enrolment
Recording of kidney function test ‡	Among patients with type 2 diabetes and/or cardiovascular disease, this was based on presence of either estimated glomerular filtration rate (eGFR), serum creatinine, urinary creatinine or albumin-creatinine ratio test with date of service within 12 months pre-enrolment, first year and second year post-enrolment
Diabetes clinical control pre- and post-enrolment	
Most recent HbA_{1c} ≤7% (≤53 mmol/mol) †	Among patients with type 2 diabetes and having a HbA_{1c} test recorded within 12 months pre-enrolment, first year and second year post-enrolment; results were categorised as HbA_{1c} ≤7% (≤53 mmol/mol) or HbA_{1c} >7% (>53 mmol/mol). In instances where there were multiple tests in the respective interval, the most recent measurement was selected.
Most recent blood pressure ≤130mmHg †	Among patients with type 2 diabetes and having blood pressure recorded within 12 months pre-enrolment, first year and second year post-enrolment; blood pressure was classified as ≤130/80 mmHg (i.e. systolic pressure ≤130mmHg and diastolic pressure ≤80mmHg), greater than 130/80 mmHg (i.e. systolic pressure >130mmHg or diastolic pressure >80mmHg). In instances where there were multiple measurements in the respective interval, the most recent measurement was selected.

* *For patients enrolled in the Health Care Homes trial, date of enrolment was ascertained from practice extracts; for usual care group the first day of each calendar month in the patient enrolment period (1 October 2017 to 30 June 2019) was used as potential date of enrolment. From hereby, date of Health Care Homes*

enrolment and potential date of enrolment were collectively referred to as date of enrolment. The 12 months prior to enrolment were defined as a period from 1 day to 365 days prior to date of enrolment. The first year and second year post enrolment were defined as the period from 0 to 365 days, and 366 to 730 days, respectively, following the date of enrolment.

† *Calculated in patients with type 2 diabetes.*

‡ *Calculated among patients with type 2 diabetes and/or cardiovascular diseases.*

Table 2. Keywords used to identify health conditions in practice data extracts

Chronic health conditions*	Keywords for diagnosis†
Asthma	Acute asthma, acute exacerbation of asthma, allergic asthma, asthma, asthma attack, asthmatic bronchitis, childhood asthma, chronic obstructive airway disease with asthma, cough variant asthma, eosinophilic asthma, exacerbation of asthma, exercise-induced asthma, hay fever with asthma, late onset asthma, occupational asthma, seasonal asthma, severe asthma, thunderstorm asthma, viral exacerbation of asthma.
Chronic obstructive pulmonary disease (COPD)	Acute exacerbation of chronic obstructive airways disease, COPD, chronic lung disease, chronic obstructive airway disease with asthma, interstitial lung disease, pulmonary fibrosis, restrictive lung disease.
Atrial fibrillation	Atrial fibrillation, atrial fibrillation and flutter, chronic atrial fibrillation, controlled atrial fibrillation, non-rheumatic atrial fibrillation, paroxysmal atrial fibrillation, rapid atrial fibrillation.
Coronary heart disease	Acute ST segment elevation myocardial infarction, acute coronary syndrome, acute myocardial infarction, acute non-ST segment elevation myocardial infarction, angina, cardiac arrest, coronary angioplasty, coronary artery bypass graft, coronary artery bypass graft, myocardial infarction, percutaneous transluminal coronary angioplasty, Prinzmetal angina, silent myocardial infarction, stable angina.
Stroke	Brain stem infarction, brainstem stroke syndrome, cerebral embolism, cerebral haemorrhage, cerebral infarction, cerebrovascular accident, embolic stroke, haemorrhagic cerebral infarction, intracranial haemorrhage, left sided cerebral hemisphere cerebrovascular accident, subarachnoid haemorrhage, subdural haemorrhage, thalamic infarction, thrombotic stroke.
Congestive heart failure	Biventricular congestive heart failure, chronic heart failure, congestive heart failure, diastolic heart failure, heart failure, heart failure with reduced ejection fraction, hypertensive heart failure, left ventricular diastolic dysfunction, right heart failure.
Osteoarthritis	Patellofemoral osteoarthritis, osteoarthritis.
Osteoporosis	Osteoporosis, osteoporosis due to corticosteroids, osteoporotic fracture, posttraumatic osteoporosis, postmenopausal osteoporosis.
Anxiety	Adjustment disorder with anxious mood, anxiety, anxiety attack, anxiety disorder, anxiety neurosis, anxious personality disorder, chronic anxiety, generalised anxiety disorder, mixed anxiety and depressive disorder, separation anxiety disorder of childhood, social phobia.
Depression	Adjustment disorder with depressed mood, agitated depression, chronic depression, depressed mood, depression, endogenous depression, major depressive disorder, mixed anxiety and depressive disorder, recurrent depression, severe depression, severe major depression with psychotic features, symptoms of depression.
Bipolar disorder	Bipolar, bipolar i disorder, bipolar ii disorder, bipolar disorder, schizoaffective disorder, bipolar type.
Schizophrenia	Catatonic schizophrenia, chronic paranoid schizophrenia, chronic schizophrenia, paranoid schizophrenia, psychotic disorder, schizoaffective disorder, schizophrenia.
Dementia	Dementia, dementia associated with alcoholism, dementia of frontal lobe type, frontotemporal dementia, senile dementia of the Lewy body type, senile dementia with psychosis multi-infarct dementia, vascular dementia.
High blood pressure	Antihypertensive therapy, diastolic hypertension, essential hypertension, hypertensive, malignant hypertension, ocular hypertension, portal hypertension, pulmonary hypertension, renal hypertension, renovascular hypertension, systolic hypertension.
High cholesterol	Cholesterol, dyslipidaemia, familial combined hyperlipidaemia, familial hypercholesterolaemia, hypercholesterolaemia, hyperlipidaemia, mixed hyperlipidaemia.

Chronic health conditions*	Keywords for diagnosis†
Diabetes type 1	Diabetes mellitus type 1
Diabetes type 2	Diabetes mellitus type 2
Chronic kidney disease	Anaemia of chronic renal failure, chronic kidney disease, chronic renal impairment, end stage renal disease, hypertensive renal disease, immunoglobulin A nephropathy, medullary sponge kidney, renal dialysis, transplant of kidney
Cancer	Cancer, malignant, metastatic, carcino, leukaemia, neoplasm, neoplastic, lymphoma, melanoma, blastoma, mesothelioma, sarcoma, seminoma.

* *Pen CS derived flags for these chronic health conditions.*

† *These keywords were searched in a field containing textual descriptions of diagnosis in other practice extract sources. The search considered common spelling variations e.g., diabetes type 2, diabetes type ii, NIDDM. The search did not include an unconfirmed diagnosis i.e., text descriptions contain terms such as "likely", "possible", "suspected", "investigation", a question mark, or other similar terminology.*

Table 3. Keywords to identify medication use and influenza vaccination in practice data extracts

Type of medications *	Keywords for medicines †
Medication for diabetes	acarbose, alogliptin, canagliflozin, dapagliflozin, dulaglutide, empagliflozin, ertugliflozin, exernatide, glibenclamide, gliclazide, glimepiride, glipizide, glyburide, insulin, linagliptin, liraglutide, metformin, pioglitazone, repaglinide, rosiglitazone, saxagliptin, sitagliptin, vildagliptin
Antithrombotic agents	abciximab, apixaban, aspirin, bivalirudin, clopidogrel, dabigatran, dalteparin, danaparoid, dipyridamole, enoxaparin, eptifibatide, fondaparinux, heparin, nadroparin, prasugrel, rivaroxaban, , ticagrelor, ticlopidine, tirofiban, warfarin
Medications for cardiovascular disease	
Diuretics	bumetanide, ethacrynic acid, frusemide, hydrochlorothiazide, hydrochlorothiazide amiloride, indapamide hemihydrate
Beta blockers	atenolol, bisoprolol fumarate, carvedilol, esmolol hydrochloride, labetalol hydrochloride, metoprolol succinate, metoprolol tartrate, oxprenolol hydrochloride, pindolol, propranolol hydrochloride, sotalol
Calcium channel blockers	amlodipine, atorvastatin, diltiazem hydrochloride, felodipine, lercanidipine hydrochloride, nifedipine, verapamil hydrochloride
Agents acting on the renin-angiotensin system	candesartan cilexetil, captopril, enalapril, eprosartan mesylate, fosinopril sodium, irbesartan, lisinopril, losartan potassium, imesartan medoxomil, perindopril, perindopril arginine, quinapril, ramipril, telmisartan, trandolapril, valsartan
Lipid modifying agents	atorvastatin, alirocumab, cerivastatin, cholestyramine, clofibrate, colestipol, evolocumab, ezetimibe, fenofibrate, fluvastatin, gemfibrozil, policosanol, pravastatin sodium, probucol, rosuvastatin, simvastatin
Medications for nervous system	
Analgesics- opioids	buprenorphine, codeine, hydromorphone, morphine, oxycodone, pentanyl, tapentadol, tramadol
Antidepressants	carbamazepine, amitriptyline hydrochloride, citalopram, hydrobromide, clomipramine hydrochloride, desvenlafaxine, dothiepin hydrochloride, doxepin hydrochloride, duloxetine, escitalopram oxalate, fluoxetine hydrochloride, fluvoxamine maleate, imipramine hydrochloride, lithium carbonate, mianserin hydrochloride, mirtazapine, moclobemide, nortriptyline hydrochloride, paroxetine hydrochloride, phenelzine sulfate, reboxetine mesylate, tranylcypromine sulfate, trimipramine maleate
Anti-anxiety	clonazepam, alprazolam, bromazepam, clobazam, diazepam, flunitrazepam, lorazepam, midazolam, nitrazepam, oxazepam, temazepam, triazolam
Antipsychotics	amisulpride, aripiprazole, asenapine, brexpiprazole, chlorpromazine hydrochloride, clozapine, clozapine, flupenthixol decanoate, haloperidol, haloperidol decanoate, levomepromazine, olanzapine, paliperidone, periciazine, quetiapine, risperidone, thioridazine, ziprasidone, zuclopenthixol decanoate
Stimulants	atomoxetine hydrochloride, dexamphetamine sulfate, methylphenidate
Medications for respiratory system	aclidinium, budesonide, eformoterol fumarate dihydrate, fluticasone, fluticasone propionate, glycopyrronium, indacaterol, salbutamol sulfate, salmeterol xinafoate, terbutaline sulfate, tiotropium, umeclinium
Influenza vaccine	flu vaccine, influenza vaccine, agrippal, afluria quad, fluad, fluad quad, fluquadri, fluarix, luarix tetra, fluvax, fluvirin, fluzone high dose, influvac tetra, vaxigrip, vaxigrip tetra

* *Pen CS derived flags for these types of medications.*

† These keywords were searched in a field textual description of generic or brand names of prescribed medicines.

Table 4. Description of variables derived from linked data

Variables	Definition of variables, time intervals and methods*
Patient demographics characteristics	
Age	Age at time of enrolment (an integer number).
Sex	Male or female.
Remoteness of residential location	Remoteness categories included major cities, inner regional, outer regional, remote or very remote Australia, according to Australian Statistical Geography Standard 2016 classification of Remoteness Areas.[4] Remoteness categories were mapped to Statistical Area 2 of patient's residential areas.
Index of Relative Socioeconomic Disadvantage (IRSD) quintiles of residential area	IRSD quintiles were derived based on IRSD deciles, with quintile 1 indicating the most disadvantage and quintile 5 indicating the least disadvantage status. The 2016 IRSD deciles ranking within Australia[5] were mapped to Statistical Area 2 of patient's residential areas.
PBS beneficiary status	Among those with one or more PBS items dispensed in the pre-enrolment period, beneficiary status was categorised as "always concessional" if the patient's entitlement status was recorded as "C0- Concessional Safety Net prescription" or "C1-Concessional non-Safety Net prescription" for all PBS items dispensed in this period, otherwise, "ever general", which was equivalent to presence of one or more dispensed items where entitlement status was recorded as "G1-General Safety Net prescription" or "G2-General non-Safety Net prescription". Patient entitlement status at the time the PBS item was supplied was recorded as per the AIHW METeOR identifier 604103.[6]
Health risk profile pre-enrolment	
Morbidity diagnoses recorded in hospital admissions †	Patient morbidities included hypertension, cardiovascular diseases, digestive disorders, mental health, diabetes, chronic airway, joint or bone disorders, neurological disorder, cancer and chronic renal disease, which were recorded in the principal diagnosis and four additional diagnosis fields. Hospital diagnoses were coded according to the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification [ICD-10-AM]) in hospital admissions that occurred in the 12 months prior to enrolment. We used the Johns Hopkins Adjusted Clinical Group (ACG) System software-version 12.0,[7] the Charlson Comorbidity Index [8, 9] and previously reported methods [10-12] to identify these morbidities. The condition was assigned if it was flagged by any one of these methods.
Use of medications for specific health conditions	Medications were used for hyperlipidaemia, hypertension, cardiovascular diseases, pain relief, digestive disorders, mental health, diabetes, chronic airway, coagulation disorders, joint or bone disorders, inflammation, hypothyroidism, neurological disorder, cancer and chronic renal disease. These medicines (coded according to the Anatomical Therapeutic Chemical [ATC] classification system) were identified from PBS dispensing records where date of dispensing was in the 12 months prior to enrolment. The Johns Hopkins ACG System software-version 12.0 [7] and the Rx-Risk grouping methods[13] were used to derive the use of these medications. The use of medications for specific health condition was assigned if it was flagged by any one of these methods.
Number of unique medicines pre- and post-enrolment	
Number of unique medicines	Numbers of unique medicines dispensed in the 12 months pre-enrolment, first year and second year post-enrolment was calculated. Unique medicine was defined according to the fifth level of their ATC code, which represents the chemical substance of the medicine e.g. A10AB04 is for insulin lispro, A10AB06 is for insulin glulisine. Each active component of a combination therapy was counted separately.[14] We also calculated this measure using six-monthly and three-monthly intervals to account for seasonal fluctuations in medicine dispensing.

Variables	Definition of variables, time intervals and methods*
Access to MBS-funded services pre- and post-enrolment	
Number of MBS claims for GP-type attendances	The total number of MBS claims for GP-typed attendances in the 12 months prior to enrolment were quantified. We used all MBS items[15, 16] in Groups A1, A2, A5, A6, A7, A11, A14, A15 Subgroup 1, A12 Subgroup 2 (items 735-758), A17, A18, A19, A20, A22, A23, A23, A30, and all items in Groups M2, M12, and M14.
Number of MBS claims for specialist consultation	The total number of MBS claims for consultations with specialist providers in the 12 months prior to enrolment, first year and second year post-enrolment was calculated. We used all MBS items[17] in Groups A3, A4, A8, A9, A12, A13, A15 Subgroup 2 (only item 820-880) A16, A21, A24, A26, A28, A29, A32, and T6 Subgroup1.
Number of MBS claims for allied health services	The total number of MBS claims for any allied health services in the 12 months prior to enrolment, first year and second year post-enrolment was quantified. We used all MBS items[16] in Groups M3, M6, M7, M8, M9, M10, M11, M15.
Number of MBS claims for any pathology services	The total number of MBS claims for any pathology services in the 12 months prior to enrolment, first year and second year post-enrolment was quantified. We used all MBS items[16] in Groups P01 to P09.
Number of MBS claims for any imaging services	The total number of MBS claims for any imaging services in the 12 months prior to enrolment, first year and second year post-enrolment was quantified. We used all MBS items[16] in Groups I01 to I05.
Usual provider score (UPC) continuity of care	The UPC continuity of care index[18] is the proportion of consultations that are with the most frequently attended provider. The calculation was based on MBS claims for GP consultations (Medicare items in Groups A1 and A2) in the 12 months prior to enrolment. We categorised UPC continuity of care as having no GP visit, having 1 to 3 visits, and among those with 4 or more claims, we defined low continuity as $0<UPC<0.75$, high continuity as $0.75 \leq UPC<1$, and perfect continuity as $UPC=1$.
Use of hospital-based services pre- and post-enrolment†	
Number of emergency department (ED) presentations	This was calculated as the total number of presentations to any hospital EDs where date of presentation was within the 12 months prior to enrolment, first year and second year post-enrolment.
Emergency admission	This was calculated as the total number of hospital admission episodes where the urgency status of the admission was recorded as “emergency” and where date of admission was within the 12 months prior to enrolment, first year and second year post-enrolment.
Potentially preventable hospitalisations	This was calculated as the total number of hospital admission episodes for potentially preventable conditions where date of admission was within the 12 months prior to enrolment, first year and second year post-enrolment. Potentially preventable conditions were defined according to the 2019 National Healthcare Agreement.[16]
Total length of stay in hospital	This was calculated as the total number of hospital bed-days associated with hospital admissions for any cause, excluding renal dialysis and transfers, cumulative over the 12 months prior to enrolment, first year and second year post-enrolment.
Mortality	
Death	Presence of a death record by 30 June 2021.

* *For patients enrolled in the Health Care Homes trial, date of enrolment was ascertained from practice extracts; for usual care group the first day of each calendar month in the patient enrolment period (1 October 2017 to 30 June 2019) was used as potential date of enrolment. From hereby, date of Health Care Homes enrolment and potential date of enrolment were collectively referred to as date of enrolment. The 12 months prior to enrolment were defined as a period from 1 day to 365 days prior to date of enrolment. The first year and second year post enrolment were defined as the period from 0 to 365 days, and 366 to 730 days, respectively, following the date of enrolment.*

† *Calculated in patients residing in five States (New South Wales, Victoria, Queensland, South Australia and Tasmania).*

Part 3. Statistical analyses

As practice data extracts and linked data were not integrated, we conducted propensity score matching separately for each data source using slightly different sets of variables to calculate propensity score.

Propensity score matching using practice data extracts

Among 10 174 patients enrolled in the HCH identified through practice extracts, 205 patients were excluded from propensity score matching because of missing data for date of enrolment (49), missing sex (38) and age <15 years (118). In addition to pre-enrolment patient characteristics presented in Table 1, to account for potential differences in patient assessment in the period leading to HCH enrolment, we further matched patients on process of care measures and achievement of HbA_{1c} and blood pressure clinical targets in the six months prior to enrolment, remoteness and IRSD quintiles by practice geographic location. As result of matching, 9811 of 9969 (98.4%) HCH patients who had any diagnosis, 2816 of 3058 (92.1%) patients with type 2 diabetes, and 6811 of 7135 (95.5%) patients with type 2 diabetes or cardiovascular disease were matched to usual care patients. Most of the unmatched HCH patients came from a small number of practices and were enrolled in the second quarter of 2019. Absolute standardised differences in all pre-enrolment patient characteristics were each <0.1 (Table 5).

Propensity score matching using linked data

In the HCH program, there were a total 11 334 HCH enrollees, of whom 175 were not included in propensity score matching. These included 125 people aged under 16 years of age, 28 who were enrolled after completion of data linkage, and 22 with inconsistent dates in linked records (eg, dates of health service use after date of death). In addition to the pre-enrolment patient characteristics in Table 4, people were also matched on continuity of care (usual provider score), number of unique medicines dispensed in six months and three months prior to enrolment, all-cause hospital admissions, and total National Weighted Activity Units in the twelve months prior to enrolment (proxy for intensity of hospital care, based on calculator developed by the Independent Hospital Pricing Authority for financial year 2018-2019[19]). Absolute standardised differences in all pre-enrolment patient characteristics were each <0.1 (Table 6).

Table 5. Pre-enrolment characteristics of Health Care Homes and usual care group patients, derived from practice data extracts, before and after propensity score matching

Characteristic	Before matching			After matching (1:1)		
	Health Care Homes*	Usual care†	Std Diff	Health Care Homes*	Usual care†	Std Diff
Number of people	9969	3 465 102		9811	9811	
Sex (female)	5437 (54.5%)	1 906 936 (55.0%)	0.01	5332 (54.3%)	5262 (53.6%)	0.01
Age (years), mean (SD)	62.6 (16.9)	43.9 (19.1)	1.04	62.8 (16.9)	63.6 (16.9)	0.05
Aboriginal and Torres Strait Islander people	1535 (15.4%)	71 676 (2.1%)	0.49	1379 (14.1%)	1316 (13.4%)	0.02
Pension, health care card, Department of Veterans' Affairs	6343 (63.6%)	925 381 (26.7%)	0.79	6342 (64.6%)	6638 (67.7%)	0.06
Practice remoteness						
Major cities	6575 (66.0%)	2 340 113 (67.5%)	0.03	6573 (67.0%)	6701 (68.3%)	0.03
Inner regional	1316 (13.2%)	774 134 (22.3%)	0.24	1316 (13.4%)	1340 (13.7%)	0.01
Outer region, remote, very remote	2078 (20.8%)	350 855 (10.1%)	0.30	1922 (19.6%)	1770 (18.0%)	0.04
Practice Index of Relative Socioeconomic Disadvantage quintile						
Quintile 1 (most disadvantaged)	3219 (32.3%)	547 389 (15.8%)	0.39	3063 (31.2%)	3053 (31.1%)	0.00
Quintile 2	2153 (21.6%)	650 769 (18.8%)	0.07	2151 (21.9%)	2161 (22.0%)	0.00
Quintile 3	2198 (22.0%)	751 399 (21.7%)	0.01	2198 (22.4%)	2116 (21.6%)	0.02
Quintile 4	1545 (15.5%)	725 989 (21.0%)	0.14	1545 (15.7%)	1626 (16.6%)	0.02
Quintile 5 (least disadvantaged)	854 (8.6%)	789 556 (22.8%)	0.40	854 (8.7%)	855 (8.7%)	0.00
Health conditions, total number‡, mean (SD)	2.8 (1.9	0.6 (1.2)	1.39	2.8 (1.9)	2.8 (1.9)	0.00
Cardiovascular	6604 (66.2%)	585 465 (16.9%)	1.16	6479 (66.0%)	6589 (67.2%)	0.02
Osteoarthritis, osteoporosis	3224 (32.3%)	237 023 (6.8%)	0.68	3207 (32.7%)	3268 (33.3%)	0.01
Diabetes	3187 (32.0%)	129 415 (3.7%)	0.79	3065 (31.2%)	3068 (31.3%)	0.00
Mental health	2757 (27.7%)	414 331 (12.0%)	0.40	2746 (28.0%)	2796 (28.5%)	0.01
Respiratory	2566 (25.7%)	281 859 (8.1%)	0.48	2521 (25.7%)	2408 (24.5%)	0.03
Cancer	1232 (12.4%)	132 563 (3.8%)	0.32	1232 (12.6%)	1234 (12.6%)	0.00
Chronic renal disease	1314 (13.2%)	25 485 (0.7%)	0.50	1165 (11.9%)	1056 (10.8%)	0.04
Dementia	178 (1.8%)	9775 (0.3%)	0.15	175 (1.8%)	194 (2.0%)	0.01

Characteristic	Before matching			After matching (1:1)		
	Health Care Homes*	Usual care†	Std Diff	Health Care Homes*	Usual care†	Std Diff
Use of medicine in 12 months pre-enrolment						
Medicine for cardiovascular disease	3496 (35.1%)	156 227 (4.5%)	0.83	3444 (35.1%)	3408 (34.7%)	0.01
Medicine for nervous system	3215 (32.2%)	287 530 (8.3%)	0.62	3210 (32.7%)	3272 (33.4%)	0.01
Medicine for respiratory system	1866 (18.7%)	109 723 (3.2%)	0.51	1843 (18.8%)	1816 (18.5%)	0.01
Medicine for diabetes	1631 (16.4%)	43 113 (1.2%)	0.55	1573 (16.0%)	1502 (15.3%)	0.02
Antithrombotic therapies	1335 (13.4%)	52 230 (1.5%)	0.46	1283 (13.1%)	1259 (12.8%)	0.01
General practitioner encounters in 12 months pre-enrolment, mean (SD)§	13.4 (9.9)	2.6 (5.2)	1.37	13.4 (9.9)	13.3 (9.7)	0.00
Influenza vaccination in 12 months pre-enrolment	5675 (56.9%)	362 189 (10.5%)	1.13	5628 (57.4%)	5769 (58.8%)	0.03
Clinical test recorded and diabetes control in 12 months pre-enrolment						
Blood pressure recorded	8260 (82.9%)	941 139 (27.2%)	1.35	8254 (84.1%)	8353 (85.1%)	0.03
Lipid test recorded	7498 (75.2%)	573 080 (16.5%)	1.46	7408 (75.5%)	7473 (76.2%)	0.02
HbA_{1c} recorded**	2557 (83.6%)	72 834 (62.0%)	0.50	2414 (85.7%)	2436 (86.5%)	0.02
Kidney function recorded††	6285 (88.1%)	343 196 (56.0%)	0.77	6044 (88.7%)	6048 (88.8%)	0.00
Most recent HbA_{1c} ≤7% (≤53 mmol/mol)***	1391 (54.4%)	43 037 (59.1%)	0.09	1355 (56.1%)	1371 (56.3%)	0.01
Most recent blood pressure ≤130/80 mmHg†††	1054 (40.3%)	28 143 (34.7%)	0.16	1017 (40.2%)	1005 (39.3%)	0.01
Clinical test recorded and diabetes control in six months pre-enrolment						
Blood pressure recorded	7491 (75.1%)	678 621 (19.6%)	1.34	7486 (76.3%)	7580 (77.3%)	0.02
Lipid test recorded	5626 (56.4%)	343 760 (9.9%)	1.14	5558 (56.7%)	5658 (57.7%)	0.02
HbA_{1c} recorded **	2189 (71.6%)	56 096 (47.8%)	0.50	2063 (73.3%)	2094 (74.4%)	0.03
Kidney function recorded††	5120 (71.8%)	231 900 (37.8%)	0.73	4925 (72.3%)	4941 (72.5%)	0.01
Most recent HbA_{1c} ≤7% (≤53 mmol/mol)***	1155 (52.8%)	31 961 (57.0%)	0.08	1126 (40.0%)	1151 (40.9%)	0.02
Most recent blood pressure ≤130/80 mmHg†††	989 (40.1%)	23 565 (34.1%)	0.12	953 (40.1%)	932 (38.7%)	0.02

Std Diff= Absolute standardised differences; SD=standard deviation.

* *In Health Care Homes patients pre-enrolment characteristics, in both before-matching and after-matching samples reflected the period prior to date of enrolment.*

† *In usual care group, pre-enrolment characteristics in the before-matching sample reflect the period before 1 October 2017; in the after-matching sample, these characteristics reflected the period before month/year when their matched Health Care Homes patients were enrolled in the trial.*

‡ *Nineteen conditions assessed relating to cardiovascular disease (atrial fibrillation, coronary heart disease, heart failure, stroke, hypertension, hyperlipidaemia), osteoarthritis/osteoporosis, diabetes (type 1 diabetes, type 2 diabetes), mental health disorders (anxiety, depression, bipolar disorder, schizophrenia), respiratory disorders (asthma, chronic obstructive pulmonary disease), cancer, chronic kidney disease, and dementia.*

§ *General practitioner encounters of any mode (e.g. face-to-face, telephone, email, non-visit) which can include consultation, reviewing and updating a patient record. Extracts provided directly from corporate Health Care Homes practices did not contain information about type of provider; for these practices this measure was not calculated.*

** *Among patients with type 2 diabetes.*

†† *Among patients with type 2 diabetes or cardiovascular disease.*

*** *Among patients with type 2 diabetes and having HbA_{1c} test recorded.*

††† *Among patients with type 2 diabetes and having blood pressure recorded.*

Table 6. Pre-enrolment characteristics of Health Care Homes and usual care patients, derived from linked data, before and after propensity score matching

Characteristic	Before matching			After matching		
	Health Care Homes*	Usual care†	Std Diff	Health Care Homes*	Usual care†	Std Diff
Number of people	11 159	3 332 270		10 682	10 682	
Sex (female)	6036 (54.1%)	1 711 845 (51.4%)	0.05	5752 (53.8%)	5842 (54.7%)	0.02
Age (years), mean (SD)	62.8 (16.4)	47.0 (18.9)	0.89	63.3 (16.3)	63.0 (16.4)	0.02
PBS beneficiary status						
Ever general	3321 (29.8%)	1672,142 (50.2%)	0.43	3256 (30.5%)	3338 (31.2%)	0.02
Always concession	6852 (61.4%)	818 753 (24.6%)	0.80	6732 (63.0%)	6657 (62.3%)	0.01
No dispensing in 12 months	986 (8.8%)	841 375 (25.2%)	0.45	694 (6.5%)	687 (6.4%)	0.00
Remoteness of residential area						
Major cities	7206 (64.6%)	2 628 990 (78.9%)	0.32	7171 (67.1%)	7074 (66.2%)	0.02
Inner regional	1582 (14.2%)	346 417 (10.4%)	0.12	1572 (14.7%)	1838 (17.2%)	0.07
Outer region, remote, very remote	1999 (17.9%)	338 400 (10.2%)	0.22	1939 (18.2%)	1770 (16.6%)	0.04
Index of Relative Socioeconomic Disadvantage quintile of residential area						
Quintile 1 (most disadvantaged)	3111 (27.9%)	615 657 (18.5%)	0.22	2784 (26.1%)	3064 (28.7%)	0.06
Quintile 2	2705 (24.2%)	615 132 (18.5%)	0.14	2678 (25.1%)	2669 (25.0%)	0.00
Quintile 3	2664 (23.9%)	632 325 (19.0%)	0.12	2602 (24.4%)	2523 (23.6%)	0.02
Quintile 4	1579 (14.2%)	740 385 (22.2%)	0.21	1575 (14.7%)	1400 (13.1%)	0.05
Quintile 5 (least disadvantaged)	1049 (9.4%)	728 485 (21.9%)	0.35	1043 (9.8%)	1026 (9.6%)	0.01
Diagnoses in hospital admissions ‡						
Hypertension	244 (2.6%)	17 471 (0.5%)	0.17	241 (2.6%)	258 (2.8%)	0.01
Cardiovascular diseases	661 (7.2%)	46 884 (1.4%)	0.29	652 (7.1%)	610 (6.7%)	0.02
Digestive disorders	477 (5.2%)	70 664 (2.1%)	0.16	464 (5.1%)	458 (5.0%)	0.00
Mental health	648 (7.0%)	85 664 (2.6%)	0.21	615 (6.7%)	609 (6.7%)	0.00
Diabetes	1074 (11.6%)	54 272 (1.6%)	0.41	1061 (11.6%)	971 (10.6%)	0.03

Characteristic	Before matching			After matching		
	Health Care Homes*	Usual care†	Std Diff	Health Care Homes*	Usual care†	Std Diff
Chronic airway	303 (3.3%)	15 553 (0.5%)	0.21	290 (3.2%)	248 (2.7%)	0.03
Joint or bone disorders	788 (8.5%)	83 384 (2.5%)	0.27	783 (8.6%)	793 (8.7%)	0.00
Neurological disorder	83 (0.9%)	7405 (0.2%)	0.09	82 (0.9%)	81 (0.9%)	0.00
Cancer	197 (2.1%)	20 118 (0.6%)	0.13	197 (2.2%)	182 (2.0%)	0.01
Chronic renal disease	224 (2.4%)	10 948 (0.3%)	0.18	220 (2.4%)	185 (2.0%)	0.03
Use of medications for specific health conditions						
Hyperlipidaemia	5700 (51.1%)	527 973 (15.8%)	0.80	5622 (52.6%)	5526 (51.7%)	0.02
Hypertension	6770 (60.7%)	742 336 (22.3%)	0.85	6672 (62.5%)	6588 (61.7%)	0.02
Cardiovascular diseases	5251 (47.1%)	526 761 (15.8%)	0.71	5170 (48.4%)	5010 (46.9%)	0.03
Pain relief	5219 (46.8%)	809 974 (24.3%)	0.48	5154 (48.2%)	5109 (47.8%)	0.01
Digestive disorders	4770 (42.7%)	573 118 (17.2%)	0.58	4695 (44.0%)	4701 (44.0%)	0.00
Mental health	4546 (40.7%)	625 553 (18.8%)	0.49	4462 (41.8%)	4370 (40.9%)	0.02
Diabetes	3248 (29.1%)	206 703 (6.2%)	0.63	3195 (29.9%)	3112 (29.1%)	0.02
Chronic airway	2994 (26.8%)	386 797 (11.6%)	0.39	2946 (27.6%)	2856 (26.7%)	0.02
Coagulation disorders	2518 (22.6%)	207 024 (6.2%)	0.48	2463 (23.1%)	2323 (21.7%)	0.03
Joint or bone disorders	1803 (16.2%)	149 891 (4.5%)	0.39	1786 (16.7%)	1902 (17.8%)	0.03
Inflammation	2373 (21.3%)	279 241 (8.4%)	0.37	2342 (21.9%)	2188 (20.5%)	0.04
Hypothyroidism	1224 (11.0%)	141 020 (4.2%)	0.26	1210 (11.3%)	1259 (11.8%)	0.01
Neurological disorder	1027 (9.2%)	89 474 (2.7%)	0.28	985 (9.2%)	938 (8.8%)	0.02
Cancer	673 (6.0%)	65 328 (2.0%)	0.21	665 (6.2%)	658 (6.2%)	0.00
Chronic renal disease	301 (2.7%)	15 776 (0.5%)	0.18	288 (2.7%)	253 (2.4%)	0.02
Number of unique medicines dispensed pre-enrolment						
In twelve months, mean (SD)	9.0 (6.4)	4.0 (4.8)	0.88	9.2 (6.3)	9.2 (6.5)	0.00
In six months, mean (SD)	7.1 (5.3)	2.9 (3.8)	0.90	7.3 (5.2)	7.1 (5.3)	0.02
In three months, mean (SD)	5.7 (4.5)	2.2 (3.2)	0.90	5.8 (4.4)	5.7 (4.4)	0.03
MBS claims for GP-typed attendance, mean (SD)	15.0 (10.0)	6.6 (7.1)	0.97	15.0 (9.9)	14.8 (9.9)	0.01

Characteristic	Before matching			After matching		
	Health Care Homes*	Usual care†	Std Diff	Health Care Homes*	Usual care†	Std Diff
MBS claims for specialist, mean (SD)	3.3 (6.7)	1.5 (4.7)	0.30	3.4 (6.8)	3.3 (6.6)	0.01
MBS claims for allied health services, mean (SD)	2.0 (2.7)	0.6 (1.8)	0.60	2.1 (2.7)	1.9 (2.7)	0.04
MBS claims for pathology services, mean (SD)	11.1 (13.5)	4.6 (8.5)	0.58	11.0 (13.1)	10.9 (12.8)	0.01
MBS claims for imaging services, mean (SD)	2.6 (3.5)	1.2 (2.2)	0.47	2.6 (3.5)	2.6 (3.5)	0.01
Usual provider score (UPC) continuity of care						
No GP visit	150 (1.3%)	435 376 (13.1%)	0.47	116 (1.1%)	108 (1.0%)	0.01
1 to 3 visits	1463 (13.1%)	1 137 073 (34.1%)	0.51	1327 (12.4%)	1257 (11.8%)	0.02
Low continuity (0<UPC<0.75)	5216 (46.7%)	1 048 198 (31.5%)	0.32	4964 (46.5%)	4880 (45.7%)	0.02
High continuity (0.75≤UPC<1)	2841 (25.5%)	424 328 (12.7%)	0.33	2803 (26.2%)	2869 (26.9%)	0.01
Perfect continuity (UPC=1)	1489 (13.3%)	287 295 (8.6%)	0.15	1472 (13.8%)	1568 (14.7%)	0.03
Presentations to emergency departments‡						
Had a presentation	2589 (28.1%)	485 576 (20.2%)	0.19	2543 (27.9%)	2605 (28.6%)	0.02
Number of ED presentation, mean (SD)	0.6 (1.7)	0.2 (0.9)	0.25	0.6 (1.5)	0.5 (1.4)	0.01
Emergency admissions‡						
Had an emergency admission	1697 (18.4%)	244 204 (7.8%)	0.32	1665 (18.3%)	1664 (18.3%)	0.00
Emergency admissions, mean (SD)	0.3 (1.0)	0.1 (0.5)	0.26	0.3 (0.9)	0.3 (0.8)	0.02
Potentially preventable hospitalisations‡						
Had a preventable hospitalisation	505 (5.4%)	53 441 (1.6%)	0.20	500 (5.5%)	425 (4.7%)	0.04
Preventable hospitalisations, mean (SD)	0.1 (0.5)	0.0 (0.2)	0.16	0.1 (0.4)	0.1 (0.3)	0.03
Total number of bed-days, mean (SD)‡	2.3 (9.5)	0.8 (6.2)	0.18	2.2 (9.1)	2.1 (8.2)	0.01
All-cause admissions‡						
Had an admission	2519 (27.3%)	470 797 (19.7%)	0.18	2481 (27.2%)	2500 (27.4%)	0.00
All-cause admissions, mean (SD)	0.5 (1.5)	0.2 (1.0)	0.23	0.5 (1.4)	0.5 (1.6)	0.01
Total National Weighted Activity Units, mean (SD) ‡	0.8 (2.7)	0.3 (1.6)	0.22	0.8 (2.5)	0.7 (2.4)	0.02

Std Diff= Absolute standardised differences; SD=standard deviation. PBS=Pharmaceutical Benefits Scheme; MBS=Medicare Benefits Schedule; UPC=Usual provider score

* *In Heath Care Homes patients, pre-enrolment characteristics in both before-matching and after-matching samples reflected the period prior to date of enrolment.*

† *In usual care group, pre-enrolment characteristics in the before-matching sample reflect the period before 1 October 2017; in the after-matching sample, these characteristics reflected the period before month/year when their matched Health Care Homes patients were enrolled in the trial.*

‡ *Calculated in patients residing in five States (New South Wales, Victoria, Queensland, South Australia and Tasmania).*

Part 4. Results

Table 7. Hospitalisations by Health Care Homes (HCH) and usual care patients in twelve months preceding enrolment and during the first year and second years after HCH enrolment*

Outcome	Patients included in analyses		Patients hospitalised		Mean number (SD)			
	Health Care Homes	Usual care	Health Care Homes	Usual care	Health Care Homes	Usual care	Rate ratio (95% CI)	P
Emergency department presentation								
Pre-enrolment	9120	9120	2543 (27.9%)	2605 (28.6%)	0.56 (1.47)	0.54 (1.35)	1.03 (0.96-1.11)	0.38
First year	8925	8922	2479 (27.8%)	2382 (26.7%)	0.58 (1.57)	0.53 (1.31)	1.09 (1.02-1.18)	0.02
Second year	2693	2710	699 (27.0%)	756 (27.9%)	0.52 (1.47)	0.56 (1.34)	0.92 (0.81-1.06)	0.26
Emergency admission								
Pre-enrolment	9120	9120	1665 (18.3%)	1664 (18.3%)	0.31 (0.91)	0.29 (0.78)	1.06 (0.99-1,15)	0.11
First year	8925	8922	1615 (18.1%)	1485 (16.6%)	0.31 (0.88)	0.28 (0.82)	1.13 (1.04-1.22)	0.006
Second year	2693	2710	459 (17.0%)	506 (18.7%)	0.31 (0.94)	0.33 (0.94)	0.94 (0.81-1.10)	0.46
Potentially preventable hospitalisations								
Pre-enrolment	9120	9120	500 (5.5%)	425 (4.7%)	0.08 (0.36)	0.07 (0.33)	1.05 (1.00-1.33)	0.05
First year	8925	8922	487 (5.5%)	443 (5.0%)	0.08 (0.40)	0.07 (0.38)	1.10 (0.95-1.28)	0.21
Second year	2693	2710	133 (4.9%)	151 (5.6%)	0.08 (0.59)	0.08 (0.39)	1.02 (0.73-1.42)	0.91
Total days of hospital stay (any reason)								
Pre-enrolment	9120	9120	2543 (27.9%)	2605 (28.6%)	2.22 (9.13)	2.08 (8.20)	1.07 (0.95-1.20)	0.23
First year	8925	8922	2479 (27.8%)	2382 (26.7%)	2.28 (9.47)	2.27 (10.8)	1.00 (0.88-1.14)	0.92
Second year	2693	2710	699 (27.0%)	756 (27.9%)	2.46 (10.94)	2.48 (10.38)	0.99 (0.79-1.25)	0.94

CI=confidence interval; SD = standard deviation.

** New South Wales, Victoria, Queensland, South Australia, and Tasmania only.*

** Health Care Homes and usual care patients matched (1:1) according to propensity score, year and month of enrolment; those with follow-up of less than one or two years were excluded from the respective comparison.*

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