Supplemental Material

Factors influencing blood pressure control in patients with atrial fibrillation and hypertension in Australian primary care

Table S1. Antihypertensive drug classes grouped by active ingredients

Anti-hypertensive drug class	Active Ingredients
ACE inhibitors	Captopril; Enalapril; Fosinopril; Lisinopril; Perindopril; Quinapril; Ramipril; Trandolapril
Angiotensin Receptor Blockers	Candesartan; Eprosartan; Irbesartan; Losartan; Olmesartan; Telmisartan; Valsartan
Beta-blockers	Atenolol; Bisoprolol; Carvedilol; Labetalol; Metoprolol; Nebivolol
Calcium channel blockers	Amlodipine; Clevidipine; Diltiazem; Felodipine; Lercanidipine; Nifedipine; Nimodipine; Verapamil
Thiazide and related diuretics	Chlortalidone; Hydrochlorothiazide; Indapamide
Other diuretics	Amiloride; Spironolactone
Other antihypertensives	Diazoxide; Hydralazine; Methyldopa; Minoxidil; Moxonidine; Prazosin

Table S2. Conditions grouped by body systems categories for multimorbidity calculation

Body system categories	Conditions	Dataset condition flags
Cardiovascular diseases and risk factors	Atrial fibrillation/flutter	Atrial fibrillation (f_AF); Atrial flutter (f_AFL)
	Atherosclerotic disease (same as 'Vascular Disease' component of CHA_2DS_2-VASc score)	Carotid Artery Stenosis (f_CASTEN); Carotid Artery Stenosis Related Procedure (f_CASTEN_PR); Coronary Heart Disease and Atherosclerosis (f_CHD_ATH); Coronary Heart Disease Related Procedure (f_CHD_ATH_PR); Peripheral Vascular Disease (f_PVD); Renal Artery Stenosis (f_RASTEN); Renal Artery Stenosis Related Procedure (f_RASTEN_PR)
	Heart failure	Heart failure (f_HF)
	Rheumatic heart disease	Rheumatic heart disease (f_RHEUHEAR)
	Stroke	Stroke All (f_str_all); Haemorrhagic (f_STR_H); Ischaemic (f_STR_I); Lacunar (f_STR_L); Migrainous (f_STR_M); Thrombotic (f_STR_T); Unspecified (f_STR_US); Transient Ischaemic Attack (f_TIA)
	Dyslipidaemia	Dyslipidaemia (f_DYS); Hypercholesterolaemia (f_HYPERC); Hyperlipidaemia (f_HYPERLI); Hypertriglyceridemia (f_HYPERTRIG)
	Hypertension	Hypertension (f_HYPT)
Endocrine diseases	Diabetes	Diabetes Mellitus Type 1 (f_DM_T1); Diabetes Mellitus Type 2 (f_DM_T2); Diabetes Mellitus Type 3 (f_DM_T3); Diabetes Mellitus Unspecified (f_DM_US)
	Polycystic ovarian syndrome	Polycystic ovarian syndrome (f_PCOS)
	Thyroid disorders	Hyperthyroidism (f_THYROID_HYPER); Hypothyroidism (f_THYROID_HYPO); Thyroid Disorder Unspecified (f_THYROID_UNSPEC)
Chronic kidney disease	Chronic kidney disease	Chronic Kidney Disease - Stage 1 (f_CKD_1); Chronic Kidney Disease - Stage 2 (f_CKD_2); Chronic Kidney Disease - Stage 3 (f_CKD_3); Chronic Kidney Disease - Stage 4 (f_CKD_4); Chronic Kidney Disease - Stage 5 (f_CKD_5); Chronic Kidney Disease - Unspecified (f_CKD_UNSP)
Cancer	Cancer	Cancer (f_CANC)
Musculoskeletal diseases	Arthritis	Arthritis (f_ARTH)
	Chronic pain	Chronic Pain (f_PAIN_CHR); Lower Back Pain (f_PAIN_BACK_L)
	Osteoarthritis	Osteoarthritis (f_OSTEO)
	Osteoporosis	Osteoporosis (f_OP)
	Rheumatoid arthritis	Rheumatoid Arthritis (f_ARTH_RH); Juvenile Rheumatoid Arthritis (f_ARTH_JRA)

Mental and neurological conditions	Anxiety and depression	Anxiety (f_ANX); Depression (f_DEPR)
	Bipolar	Bipolar Disorder (f_BIPOL)
	Dementia	Dementia (f_DEMEN)
	Epilepsy	Epilepsy (f_EPIL)
	Schizophrenia	Schizophrenia (f_SCHIZ)
	Substance abuse	Substance Abuse (f_ABU_SUB)
Lung diseases	Asthma	Asthma (f_ASTH)
	COPD	Chronic Obstructive Pulmonary Disease (f_COPD)
Gastro-intestinal diseases	Chronic Liver Disease	Chronic Liver Disease (f_CLD)
	Coeliac Disease	Coeliac Disease (f_COELIAC)
	Crohn's Disease	Crohn's Disease (f_CROHNS)
	Ulcerative Colitis	Ulcerative Colitis (f_COLI_ULC)

Table S3. Characteristics of 34, 815 AF patients with hypertension grouped by achievement of blood pressure control (controlled BP defined as <140/90 mmHg)

	Controlled BP	Uncontrolled BP	Total
	N = 21,583 (62.0%)	**N = 13,232** (38.0%)	**N = 34,815**
Age Mean (SD)	76.8 (±10.0)	77.1 (±10.5)	76.9 (±10.2)
Age Median (IQR)	78.0 (71.0 - 84.0)	78.0 (71.0 - 85.0)	78.0 (71.0 - 84.0)
< 65 years old	2,440 (11.3%)	1,585 (12.0%)	4,025 (11.6%)
65-74 years old	5,811 (26.9%)	3,206 (24.2%)	9,017 (25.9%)
≥ 75 years old	13,332 (61.8%)	8,441 (63.8%)	21,773 (62.5%)
Sex	**N=21,580**	**N=13,229**	**N=34,809**
Male	12,181 (56.4%)	6,558 (49.6%)	18,739 (53.8%)
Female	9,399 (43.6%)	6,671 (50.4%)	16,070 (46.2%)
Indigenous Status	**N=19,406**	**N=11,627**	**N=30,763**
Aboriginal/Torres Strait Islander	405 (2.1%)	166 (1.4%)	571 (1.9%)
Non- Aboriginal/Torres Strait Islander	18,731 (97.9%)	11,461 (98.6%)	30,192 (98.1%)
Remoteness Area	**N=21,510**	**N=13,202**	**N=34,712**
Major Cities of Australia	6,435 (29.9%)	4,073 (30.9%)	10,508 (30.3%)
Inner Regional Australia	11,904 (55.3%)	7,175 (54.3%)	19,079 (55.0%)
Outer Regional Australia	2,840 (13.2%)	1,736 (13.1%)	4,576 (13.2%)
Remote Australia	224 (1.0%)	136 (1.0%)	360 (1.0%)
Very Remote Australia	107 (0.5%)	82 (0.6%)	189 (0.5%)
Australian State/Territories			
New South Wales	9,226 (42.7%)	5,438 (41.1%)	14,664 (42.1%)
Victoria	3,811 (17.7%)	2,332 (17.6%)	6,143 (17.6%)
Queensland	3,668 (17.0%)	2,073 (15.7%)	5,741 (16.5%)
South Australia	494 (2.3%)	389 (2.9%)	883 (2.5%)
Western Australia	2,000 (9.3%)	1,332 (10.1%)	3,332 (9.6%)
Tasmania	1,595 (7.4%)	1,231 (9.3%)	2,826 (8.1%)
Northern Territory	229 (1.1%)	78 (0.6%)	307 (0.9%)
Australian Capital Territory	560 (2.6%)	359 (2.7%)	919 (2.6%)
Social Economic Status (IRSAD)	**N=21,511**	**N=13,202**	**N=34,713**
1 = most disadvantaged	4,767 (22.2%)	2,705 (20.5%)	7,472 (21.5%)
2	4,459 (20.7%)	2,914 (22.1%)	7,373 (21.2%)
3	4,823 (22.4%)	2,854 (21.6%)	7,677 (22.1%)
4	3,244 (15.1%)	2,066 (15.6%)	5,310 (15.3%)
5 = most advantaged	4,218 (19.6%)	2,663 (20.2%)	6,881 (19.8%)
Education and Occupation (IEO)	**N=21,511**	**N=13,202**	**N=34,713**
1 = low education	5,080 (23.6%)	2,869 (21.7%)	7,949 (22.9%)
2	5,183 (24.1%)	3,313 (25.1%)	8,496 (24.5%)
3	3,845 (17.9%)	2,278 (17.3%)	6,123 (17.6%)
4	3,507 (16.3%)	2,126 (16.1%)	5,633 (16.2%)
5 = high education	3,896 (18.1%)	2,616 (19.8%)	6,512 (18.8%)
Blood Pressure			

Systolic Mean (SD)	127.6 (±8.8)	149.1 (±9.4)	135.8 (±13.8)
Systolic Median (IQR)	129.2 (122.4 - 134.5)	147.0 (142.7-153.3)	135.4 (126.7-144.1)
Diastolic Mean (SD)	73.9 (±7.5)	80.3 (±9.9)	76.3 (±9.1)
Diastolic Median (IQR)	74.3 (69.0 - 79.5)	80.1 (73.7 - 86.9)	76.2 (70.3 - 82.0)
Body Mass Index (BMI)	N=19,216	N=11,649	N=30,865
Mean (SD)	30.5 (±8.8)	29.9 (±8.0)	30.3 (±8.5)
Median (IQR)	29.3 (25.8 - 33.8)	28.9 (25.4 - 33.1)	29.1 (25.6 - 33.5)
Healthy	214 (1.1%)	160 (1.4%)	374 (1.2%)
Underweight	3,693 (19.2%)	2,445 (21.0%)	6,138 (19.9%)
Overweight	6,534 (34.0%)	4,138 (35.5%)	10,672 (34.6%)
Obese	8,775 (45.7%)	4,906 (42.1%)	13,681 (44.3%)
Smoking Status	N=20,848	N=12,724	N=33,572
Non-smoker	11,031 (52.9%)	7,363 (57.9%)	18,394 (54.8%)
Smoker	9,817 (47.1%)	5,361 (42.1%)	15,178 (45.2%)
CHA2DS2-VASc Mean (SD)	4.2 (±1.6)	4.0 (±1.6)	4.1 (±1.6)
Score ≥ 3	18,372 (85.1%)	11,012 (83.2%)	29,384 (84.4%)
CHA2DS2-VASc components			
Heart Failure	5,901 (27.3%)	2,441 (18.4%)	8,342 (24.0%)
Hypertension	21,583 (100.0%)	13,232 (100.0%)	34,815 (100.0%)
Stroke	4,647 (21.5%)	2,571 (19.4%)	7,218 (20.7%)
Vascular Disease [a]	7,847 (36.4%)	4,241 (32.1%)	12,088 (34.7%)
Diabetes type 2	3,239 (15.0%)	1,587 (12.0%)	4,826 (13.9%)
Multimorbidity by body systems [b]			
CVD & Risk Factors	21,583 (100.0%)	13,232 (100.0%)	34,815 (100.0%)
Endocrine Disease	8,681 (40.2%)	4,697 (35.5%)	13,378 (38.4%)
Chronic Kidney Disease	2,717 (12.6%)	1,525 (11.5%)	4,242 (12.2%)
Cancer	10,047 (46.6%)	5,943 (44.9%)	15,990 (45.9%)
Musculoskeletal Diseases	17,444 (80.8%)	10,413 (78.7%)	27,857 (80.0%)
Neurological Diseases	8,420 (39.0%)	4,809 (36.3%)	13,229 (38.0%)
Lung Diseases	6,808 (31.5%)	3,616 (27.3%)	10,424 (29.9%)
Gastrointestinal Diseases	550 (2.5%)	286 (2.2%)	836 (2.4%)
Body systems sum Mean (SD)	3.5 (±1.3)	3.4 (±1.2)	3.5 (±1.3)
Multimorbidity ≥ 3 body systems	17,017 (78.8%)	9,875 (74.6%)	26,892 (77.2%)
Antihypertensives	20,579 (97.5%)	12,599 (98.1%)	33,178 (97.7%)
ACE inhibitors	8,183 (38.8%)	5,126 (39.9%)	13,309 (39.2%)
Angiotensin Receptor Blockers	10,299 (48.8%)	7,123 (55.4%)	17,422 (51.3%)
Beta-blockers	13,314 (63.1%)	7,154 (55.7%)	20,468 (60.3%)
Calcium channel blockers	8,635 (40.9%)	7,000 (54.5%)	15,635 (46.1%)
Thiazide and related diuretics	4,951 (23.5%)	4,232 (32.9%)	9,183 (27.1%)
Other diuretics	3,835 (18.2%)	1,384 (10.8%)	5,219 (15.4%)
Other antihypertensives	1,621 (7.7%)	1,868 (14.5%)	3,489 (10.3%)
Mean (SD)	2.4 (±1.2)	2.6 (±1.3)	2.5 (±1.2)
≥ 2 antihypertensive medications	16,419 (77.8%)	10,444 (81.3%)	26,863 (79.1%)
Missing	486	386	872

GP visits	**N = 21,582**	**N = 13,231**	**N = 34,814**
Mean (SD)	33.3 (±22.2)	29.8 (±20.4)	32.0 (±21.6)
Median (Q1, Q3)	29.0 (18.0 - 43.0)	25.0 (15.0 - 39.0)	27.0 (17.0 - 42.0)
Q1 (1-17)	5,091 (23.6%)	4,024 (30.4%)	9,115 (26.2%)
Q2 (18-27)	5,053 (23.4%)	3,265 (24.7%)	8,318 (23.9%)
Q3 (28-42)	5,800 (26.9%)	3,186 (24.1%)	8,986 (25.8%)
Q4 (43+)	5,638 (26.1%)	2,757 (20.8%)	8,395 (24.1%)
Regularity	**N = 21,410**	**N = 13,070**	**N = 34,480**
Mean (SD)	0.5 (±0.1)	0.5 (±0.1)	0.5 (±0.1)
Median (Q1, Q3)	0.5 (0.4 - 0.5)	0.5 (0.4 - 0.5)	0.5 (0.4 - 0.5)
Q1 (0-0.45)	7,084 (33.1%)	4,176 (32.0%)	11,260 (32.7%)
Q2 (0.46-0.49)	5,210 (24.3%)	3,094 (23.7%)	8,304 (24.1%)
Q3 (0.50-0.53)	4,580 (21.4%)	2,836 (21.7%)	7,416 (21.5%)
Q4 (0.54+)	4,536 (21.2%)	2,964 (22.7%)	7,500 (21.8%)
Continuity of Care	**N = 21,582**	**N = 13,231**	**N = 34,814**
Mean (SD)	0.5 (±0.2)	0.4 (±0.2)	0.4 (±0.2)
Median (Q1, Q3)	0.4 (0.3 - 0.6)	0.4 (0.3 - 0.6)	0.4 (0.3 - 0.6)
Q1 (0-0.27)	5,595 (25.9%)	3,810 (28.8%)	9,405 (27.0%)
Q2 (0.28-0.41)	5,223 (24.2%)	3,209 (24.3%)	8,432 (24.2%)
Q3 (0.42-0.61)	5,559 (25.8%)	3,421 (25.9%)	8,980 (25.8%)
Q4 (0.62+)	5,205 (24.1%)	2,792 (21.1%)	7,997 (23.0%)

SD = Standard Deviation; IQR = Interquartile Range; IRSAD = Index of Relative Socio-Economic Advantage and Disadvantage; CHA_2DS_2-VASc = Congestive heart failure, Hypertension, Age ≥75 years [double weight], Diabetes, previous Stroke [double weight], Vascular disease, Age 65–74 years, female Sex category score; ACE Inhibitors = Angiotensin-converting-enzyme Inhibitors; GP = General Practice; Q1 – 4 = quartiles. Controlled blood pressure was defined as <140/90 mmHg(1).

[a] Multimorbidity classes – Cardiovascular Diseases & Risk Factors (Atrial fibrillation/flutter, Atherosclerotic disease, Heart failure, Rheumatic heart disease, Stroke, Dyslipidaemia, Hypertension); Endocrine diseases (Diabetes, Polycystic ovarian syndrome, Thyroid disorders); Chronic kidney disease; Cancer; Musculoskeletal diseases (Arthritis, Chronic pain, Osteoarthritis, Osteoporosis, Rheumatoid arthritis); Mental and neurological conditions (Anxiety, depression, Bipolar, Dementia, Epilepsy, Schizophrenia, Substance abuse); Lung diseases (Asthma, Chronic obstructive pulmonary disease); Gastro-intestinal diseases (Chronic Liver Disease, Coeliac Disease, Crohn's Disease). [b] Vascular disease – Carotid Artery Stenosis, Coronary Heart Disease and Atherosclerosis, Peripheral Vascular Disease and Renal Artery Stenosis.

GP visits – total number of GP visits (any professional interchange between a patient and a general practioner/practice nurse, these excluded any non-clinical/ administrative encounters) within the observation period. Regularity – consistency of each patients' GP visits within the observation period (i.e. index assessing whether visits are on a regular basis)(2). Continuity of Care – measuring whether patients see the same clinician – values range from 0 (i.e., all visits to different clinicians = low CoC) to 1 (i.e., all visits to the same clinician = high CoC)(3)

Table S4. Factors influencing controlled blood pressure in AF patients with hypertension using multivariable logistic regression model (random effects for GP clinic, reference levels are indicated in brackets).

	Odds Ratio	OR 95% CI Lower	OR 95% CI Upper	p-value
Sex (Male)				
Female	0.72	0.68	0.76	<0.001
Age groups (<65)				
65-74	0.96	0.86	1.07	0.427
≥75	0.78	0.7	0.86	<0.001
Body Mass Index (Healthy)				
Underweight	0.91	0.72	1.15	0.434
Overweight	1.01	0.94	1.08	0.888
Obese	1.12	1.04	1.2	0.002
Smoking status (Non-smoker)				
Smoker	1.11	1.05	1.17	<0.001
Indigenous status (Non-Indigenous)				
Aboriginal/Torres Strait Islander	1.44	1.18	1.76	<0.001
Social Economic Status (IRSAD = 1)				
2	0.92	0.83	1.02	0.129
3	0.99	0.87	1.13	0.938
4	0.94	0.8	1.11	0.481
5 = most advantaged	1.19	0.97	1.45	0.097
Index of Education & Occupation (1)				
2	0.92	0.83	1.02	0.117
3	0.92	0.81	1.05	0.219
4	0.86	0.74	1.01	0.06
5 = high education	0.69	0.57	0.84	<0.001
CHA2DS2-VASc Score				
score ≥3	1.48	1.26	1.73	<0.001
Multimorbidity				
≥ 3 body systems affected	1.14	1.07	1.21	<0.001
GP visits (0-17)				
18-27	1.24	1.15	1.34	<0.001
28-42	1.5	1.39	1.62	<0.001
43+	1.71	1.58	1.85	<0.001
Regularity (0-0.45)				
0.46-0.49	0.98	0.91	1.05	0.508
0.50-0.53	0.93	0.87	1	0.04
0.54+	0.91	0.84	0.97	0.006
Continuity of Care (0-0.27)				
0.28-0.41	1.1	1.03	1.18	0.007
0.42-0.61	1.09	1.02	1.17	0.014
0.62+	1.29	1.2	1.4	<0.001

IRSAD = index of Relative Socio-Economic Advantage and Disadvantage; CHA_2DS_2-VASc = Congestive heart failure, Hypertension, Age ≥75 years [double weight], Diabetes, previous Stroke [double weight], Vascular disease, Age 65–74 years, female Sex category score; GP = General Practice.

Table S5. Factors influencing treatment with ≥2 antihypertensive medications for AF patients with hypertension using multivariable logistic regression model (random effects for GP clinic, reference levels are indicated in brackets).

	Odds Ratio	OR 95% CI Lower	OR 95% CI Upper	p-value
Blood Pressure				
Systolic	1.01	1.01	1.02	<0.001
Diastolic	0.99	0.98	0.99	<0.001
Sex (Male)				
Female	0.96	0.9	1.02	0.206
Age groups (<65)				
65-74	1.1	0.97	1.25	0.149
≥75	0.99	0.87	1.13	0.914
Body Mass Index (Healthy)				
Underweight	1.04	0.79	1.37	0.756
Overweight	1.29	1.19	1.4	<0.001
Obese	1.83	1.69	1.99	<0.001
Smoking status (Non-smoker)				
Smoker	0.99	0.93	1.05	0.675
Indigenous status (Non-Indigenous)				
Aboriginal/Torres Strait Islander	1.08	0.86	1.36	0.514
Social Economic Status (IRSAD=1)				
2	0.9	0.79	1.02	0.106
3	0.97	0.83	1.14	0.732
4	0.95	0.78	1.15	0.61
5 = most advantaged	0.9	0.71	1.13	0.353
Index of Education and Occupation (1)				
2	1.13	1	1.28	0.056
3	1.05	0.9	1.23	0.507
4	0.99	0.82	1.19	0.912
5 = high education	0.9	0.72	1.13	0.356
CHA_2DS_2-VASc Score				
score ≥3	1.35	1.12	1.62	0.001
Multimorbidity				
≥ 3 body systems	0.97	0.9	1.05	0.517
GP visits (0-17)				
18-27	1.27	1.16	1.38	<0.001
28-42	1.59	1.45	1.74	<0.001
43+	1.8	1.63	1.98	<0.001
Regularity (0-0.45)				

0.46-0.49	1	0.92	1.09	0.992
0.50-0.53	1.04	0.96	1.14	0.342
0.54+	0.96	0.88	1.05	0.362
Continuity of Care (0-0.27)				
0.28-0.41	1.09	1	1.19	0.038
0.42-0.61	1.19	1.1	1.3	<0.001
0.62+	1.12	1.03	1.23	0.011

IRSAD = index of Relative Socio-Economic Advantage and Disadvantage; CHA_2DS_2-VASc = Congestive heart failure, Hypertension, Age ≥75 years [double weight], Diabetes, previous Stroke [double weight], Vascular disease, Age 65–74 years, female Sex category score; GP = General Practice.

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