

Supplementary table 1: Quality scores of included studies using Newcastle-Ottawa Scale

study	Selection				Comparability		outcome		NOS
	representativeness of the expose cohort	Selection of the non- exposed cohort	Ascertainment of atrial fibrillation	Demonstration that outcomes was not present at start of study	Comparability on the basis of the design or analysis	Assessment of outcome	Adequate follow-up duration	Adequate follow-up rate	overall scores
Hui-Chin Lai	1	1	1	1	2	1	1	1	9
Christopher X. Wong	1	1	1	1	1	1	1	1	8
Erin R. Wallace	1	1	1	0	2	1	1	1	8
Daehoon kim	1	1	1	1	2	1	1	1	9
Jason A. Sherer	1	1	1	0	2	1	1	1	8

Supplementary table 2: Sensitivity analysis for all included studies

Excluding study	OR and 95% CI	P-value	Heterogeneity (%)	P-value for heterogeneity
Hui-Chin Lai	1.05 (0.44, 2.55)	0.91	99%	P<0.00001
Christopher X. Wong	0.93 (0.50, 1.74)	0.82	97	P<0.00001
Erin R. Wallace	1.45 (0.80, 2.63)	0.22	98	P<0.00001
Dachoon kim	1.10 (0.45, 2.67)	0.84	99	P<0.00001
Jason A. Sherer	1.38 (0.69, 2.79)	0.36	99	P<0.00001

Supplementary table 3: Sensitivity analysis for all Caucasian population

Excluding study	OR and 95% CI	P-value	Heterogeneity (%)	P-value for heterogeneity
Christopher X. Wong	0.53 (0.44, 0.63)	P<0.00001	5	0.3
Erin R. Wallace	1.30 (0.26, 6.47)	0.75	99	P<0.00001
Jason A. Sherer	1.18 (0.19, 7.21)	0.85	100	P<0.00001

Supplementary table 4: Limitations of included studies

Study Author	Limitations
Hui-Chin Lai	Minor bone fracture without the need for hospitalization were not collected in National Health Insurance Research Database (NHIRD) of Taiwan; All cases of osteoporosis were not documented in National Health Insurance Research Database (NHIRD) of Taiwan; Data on time in therapeutic range was not included in NHIRD so proportion of days covered for anticoagulant were included to represent treatment adequacy of oral anticoagulant; Causal link could not be established between fracture and osteoporotic fractures.
Christopher X. Wong	Study was not adjusted for all possible risk factors of osteoporotic fracture e.g. body weight, bone mineral density, and vitamin D levels; Delay in diagnosis of atrial fibrillation due to its episodic nature; Use of databases which is subjected to errors and inconsistencies; Underestimation of medications and comorbidities because dataset could not linked to primary care source and hospital data; Results were not generalizable due to majority of participants were Caucasians.
Erin R. Wallace	Under ascertainment of incident atrial fibrillation due to its episodic nature; Use of administrative data with random and systemic errors; Included cases of atrial fibrillation were not categorized into persistent or paroxysmal; Atrial fibrillation was not categorized into paroxysmal or persistent.
Daehoon kim	Study was not adjusted for all possible risk factors of osteoporotic fracture e.g. bone mineral density, vitamin D levels, falls, frailty , and non-vitamin K antagonist oral anticoagulant prescription; Administrative dataset subjected to errors and inaccuracies; Included cases of atrial fibrillation were not categorized into persistent or paroxysmal; Minor bone fractures not requiring hospitalization were not included; No causality was established due to observational nature of study; Only Asian population was included in the study.
Jason A. Sherer	There may be misclassification between the atrial fibrillation and the non-atrial fibrillation; The ascertainment of non-hip fractures prior to 2002 was not confirmed via medical records; Included cases of atrial fibrillation were not categorized into persistent or paroxysmal or others; The participants of the study were mostly European ancestry.