

Supplementary Material S3

Socioeconomic inequality in oral anticoagulation therapy initiation in atrial fibrillation patients with high risk of stroke: a register-based observational study
by

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S3a. ICD- and ATC-codes used in this study

If not specified below, we registered the surgical procedures and diagnoses occurring within 10 years prior to baseline (AF diagnosis), and drug prescriptions should be claimed within one year prior to baseline (1).

Diagnosis	Classification system	Codes
Atrial fibrillation ¹	ICD-10	I48 (we did not include emergency department diagnoses)
Hypertension ² One ICD-code and/or at least two different classes of antihypertensive drugs and/or minimum one antihypertensive combination drug.	ICD-8	400-404
	ICD-10	I10-15
	ATC	α adrenergic blocker: C02A; C02B and C02C Non-loop diuretics: C07C; C07D; C08G; C09BA; C09DA; C09XA52; C02DA; C02L; C03A; C03B; C03D C03E Vasodilators: C04; C02DB; C02DD; C02DG β blocker: C07 Calcium channel blockers: C07F; C08; C09BB and C09DB Renin-angiotensin system inhibitors: C09 Antihypertensive combination drug: C09BB04; C09DA; C09DB; C09DX01; C07B; C09BA02; C09BA03; C09BA04 and C09BA05
Moderate to severe liver disease ³	ICD-8	4560; 57300; 07000; 07002; 07004; 07006; 07008
	ICD-10	B15.0; B16.0; B16.2; B19.0; I85; K70.4; K72; K76.6
Moderate to severe renal disease ³	ICD-8	7531; 792; 403-404; 580-584; 59009; 59319
	ICD-10	N00-N05; N07; N11; N14; N17; N18; N19; Q61, I12; I13;
Ischemic stroke ⁴	ICD-8	43690; 43601; 43309; 43399; 43409; 43499
	ICD-10	I63 (not I63.6), I64
Transient ischemic attack ⁵	ICD-8	435
	ICD-10	G45
	ICD-8	444

Systemic arterial embolism ⁶	ICD-10	I74
Ischemic heart disease ⁷	ICD-8	410-414
	ICD-10	I20-I25
Myocardial infarction ⁷	ICD-8	410
	ICD-10	I21; I22; I23
Peripheral artery diseases and aortic plaque ⁸	ICD-8	44009; 44020; 44030; 44500; 44509; 44590; 44599
	ICD-10	I700; I702; I739
Bleeding ⁹	ICD-8	430; 431; 45601; 53098; 53190; 53192; 53195; 53290; 53390; 53490; 53501; 56915; 28001; N852-N853
	ICD-10	I60; I61; I62; K250; K252; K254; K256; K260; K262; K264; K266; K270; K272; K274; K276; K280; K282; K284; K286; K290; K625; K921; K922; I850; D62; J942; N02; R04; R31; R58; S064-S066
Congestive heart failure ¹⁰	ICD-8	78249; 42719; 42709; 42710; 42711; 42899;
	ICD-10	I110; I130; I132; I420; I50
	ATC	C03C
Diabetes mellitus ¹¹	ICD-8	249; 250
	ICD-10	E10; E11
	ATC	A10
Alcoholism ¹²	ICD-8	291; 303; 57110; 57710
	ICD-10	G621; G721; F10; G312; K860; K292; K70; Z714, Z502; Z721; K852; I426; E244; O354; Z502; K852; Z721
Thyrotoxicosis ¹³	ICD-8	242
	ICD-10	E05
	ATC	H03B
Venous thromboembolism (VTE) (deep venous thrombosis (DVT) and/or lung embolism (LE)) ¹⁴	ICD-8	45099; 45100; 45108; 45109; 45190; 45192; 45199; 45302; 45304; 67101-67109; 67309; 67399
	ICD-10	I801; I802; I803; I808; I809; I828; I822; I829; I823; I26; O223; O229; O871; O882; O879 Within six months prior to baseline.
Hip or knee arthroplastic surgery ¹⁵	NCSP	KNFB, KNFC, KNGB, KNGC Within two months prior to baseline.
Valvular heart diseases (in relation to AF) - Exclusion criteria) ¹⁶	ICD-8	39400; 39401; 39402; 39408; 39409; 39490; 39492; 39600; 39601; 39602; 39604; 39608, 39609; 39690; 39691; 42400
	ICD-10	Z952; I05; I342
	NCSP	FCA60; FGE00; FJF00; FKD00; FMD00; FKA
	DCSP	31130; 31269; 30358; 31100; 31101

VKA -Warfarin -Phenprocoumon	ATC	B01AA03 B01AA04 Outcome: -30 days to + 90 days of baseline.
Aspirin		B01AC06
NOAC -Rivaroxaban -Apixaban -Edoxaban -Dabigatran		B01AF01 (from 2013), B01AX06 before 2013) B01AF02 B01AF03 B01AE07 Outcome: -30 days to + 90 days of baseline.
Antiplatelet therapy - Aspirin - Clopidogrel, - Prasugrel - Ticagrelor - Dipyridamol	ATC	B01AC06, N02BA01 B01AC04 B01AC22 B01AC24 B01AC07, B01AC30
NSAID	ATC	M01A

Link to the codes used in this study (Accessed: August 5 2019)

ICD-8	https://sundhedsdatastyrelsen.dk/-/media/sds/filer/rammer-og-retningslinjer/klassifikationer/sks-download/lukkede-klassifikationer/icd-8-klassifikation.txt?la=da
ICD-10	https://icd.who.int/browse10/2016/en
NOMESCO	https://norden.diva-portal.org/smash/get/diva2:970547/FULLTEXT01.pdf
DCSP	ftp://filer.sst.dk/filer/sks/data/skscomplete/OPRklass_1995.txt
ATC	https://pro.medicin.dk/ and https://www.whocc.no/atc_ddd_index/

Abbreviations: ICD; International Classification of Diseases system, ATC: Anatomical Therapeutic Chemical Classification System, NCSP: NOMESCO Classification of Surgical Procedures (NOMESCO: Nordic Medico-Statistical Committee), DCSP: Danish Classification of Surgical Procedures and Therapies, 3 edition, VKA; Vitamin K antagonists, NOAC; non-vitamin K antagonist oral anticoagulants

Validation and background for choice of diagnoses codes used in this study:

¹The positive predictive value (PPV) of atrial fibrillation and/or atrial flutter combined was 92.6 % (2).

²The definition of hypertension by medication (with two classes of antihypertensive drugs) had a positive predictive value (PPV) of 80 % and a specificity of 94.7 % (3) (we did not include C03X and C05) or one antihypertensive combinations drug which is also used by others (4). The PPV of the ICD-codes was 92 % (5).

³The PPV of the ICD-10 codes for moderate/severe liver and renal disease were 100 % (6) and the corresponding ICD-8 codes have previously been used by others but not validated (7).

⁴The predictive value of the ICD-10 codes for ischemic stroke (I63) was 87.6 % and for unspecified stroke (I64) 76.0 % (8). We excluded I63.6 as this diagnosis is of venous origin (1).

⁵The PPV of the ICD-10 code for transient ischemic attack were 60.4 % in one study (8).

⁶We did not find any validation study on the diagnosis of systemic arterial embolism.

⁷PPV for the ICD-10 codes I21, I22, I23 for myocardial infarct were 98 % (6). Some of the other ICD-codes have been validated: PPV for I20 (not I200), I251, I259 and I413 for stable angina pectoris was 93% and I200 and I411 for unstable angina pectoris 88 % (5).

⁸PPV of the ICD-10 codes I702, I702A, I7139A+B+C for peripheral artery disease were 69.4% (9). We also included the ICD-10 code I7000 and ICD-8 code (44009) (“atherosclerosis of aorta”) as aortic plaque as it is included under “Vascular disease” in the CHA₂DS₂-VASc score (10).

⁹Some of the diagnosis codes have previously been used in several studies (1,11,12) but to our knowledge, not validated.

¹⁰The PPV of ICD-10 I50 was 81% (13) and many of the other ICD-10 codes used had a PPV of 84 % (14). The ICD-8 codes have previously been used (7). We included a prescription of loop diuretics as also used by others (1,3,4) to increase the likelihood of the heart failure diagnosis.

¹¹The PPV of ICD- and/or ATC-codes of diabetes and antidiabetic drugs have been estimated to be 97 % (15–17).

¹²It is likely that only the most severe cases of alcoholism are registered.

¹³The validity of ICD-codes of hyperthyroidism (and hypothyroidism) was found to be high; less than 2% of the 900 patients screened in the study were misclassified (18). We also included the ATC-code for anti-thyroid drugs (ICD-code and/or ATC-code) (19).

¹⁴We used the ICD-10 codes for VTE as suggested by others (20). Some of the ICD codes have been validated in several studies and showed low but varying validity (15).

¹⁵To our knowledge, procedure codes are not validated but have previously been used in other studies (21).

¹⁶There is not consensus regarding the term “valvular AF” but “mitral stenosis and artificial heart valves” are often referred to as “valvular AF” (22). However, guidelines have not been consistent throughout the years (23–27). Consequently, we defined “non-valvular AF” as AF or atrial flutter (I48) excluding rheumatic mitral valve disease, mitral stenosis and/or mechanical heart valve.

S3b. The CHA₂DS₂-VASc score and HAS-BLED score

The CHA₂DS₂-VASc score	
Risk factors	Points
C for Congestive heart failure	1
H for Hypertension	1
A for Age ≥ 75 years old	2
D for Diabetes mellitus	1
S for Stroke (ischemic stroke/transient ischemic attack/systemic arterial embolism)	2
V for Vascular disease (myocardial infarction/peripheral artery disease/aortic plaque)	1
A for Age 65-75 years old	1
Sc for Sex category (female)	1

We indicated the CHA₂DS₂-VASc score (10,28) of the participants as above using diagnoses codes as described Supplementary Material S3a.

The HAS-BLED score	
Risk factors	Points
H for Hypertension	1
A - for A bnormal liver and renal function (1 point each)	1 or 2
S for S troke (we included: ischemic stroke)	1
B for B leeding (we included: Intracerebral hemorrhage/Intracranial bleeding due to trauma/gastrointestinal bleeding/other bleeding)	1
L for L abile INR (not included - information about INR are not available in our data)	
E for E lderly (>65 years old)	1
D for D rugs (antiplatelet or NSAIDs) or alcohol	1 or 2

We indicated the HAS-BLED score (29,30) of the participants as described above using diagnoses codes as described in Supplementary table S3a.

Note, some of the things referred to are found in the supplementary material of the articles given bellow.

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