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CORRECTION

Correction to: Comparative clinical outcomes between direct oral anticoagulants and warfarin among elderly patients with non-valvular atrial fibrillation in the CMS Medicare population

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Correction to:
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In the article by Amin et al., "Comparative clinical outcomes between direct oral anticoagulants and warfarin among elderly patients with non-valvular atrial fibrillation in the CMS Medicare population" which was published online on March 28, 2019 (J Thromb and Thrombolysis 48:240–249), 2019, corrections are needed.

Due to an error in the underlying data cut received by the authors for the CMS Medicare database, a proportion of Medicare patients who should have been included in the analysis were inadvertently excluded. Specifically, those excluded patients were newly diagnosed with atrial fibrillation and initiated anticoagulation therapy in the same calendar year (2014 or 2015).

The authors have corrected the analyses by adding back those inadvertently excluded patients (Figs. 1, 2, 3, Tables 1, 2, and Supplemental Table 1). These corrections have increased the sample size from 198,321 to 366,425 patients.

Overall, the updated results were consistent with the original analyses. One change in statistical significance was observed for dabigatran versus warfarin: while directionally consistent with the original analysis, this updated analysis showed a lower risk of stroke/SE for dabigatran compared with warfarin. No other changes were observed

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s11239-020-02161-0) contains supplementary material, which is available to authorized users.

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Fig. 1 Patient selection criteria. *Edoxaban was not included in the analysis given the small sample size. *AF* atrial fibrillation, *ICD-9-CM* international classification of diseases, ninth revision, clinical modification, *ICD-10-CM* international classification of diseases, tenth revision, clinical modification, *OAC* oral anticoagulant

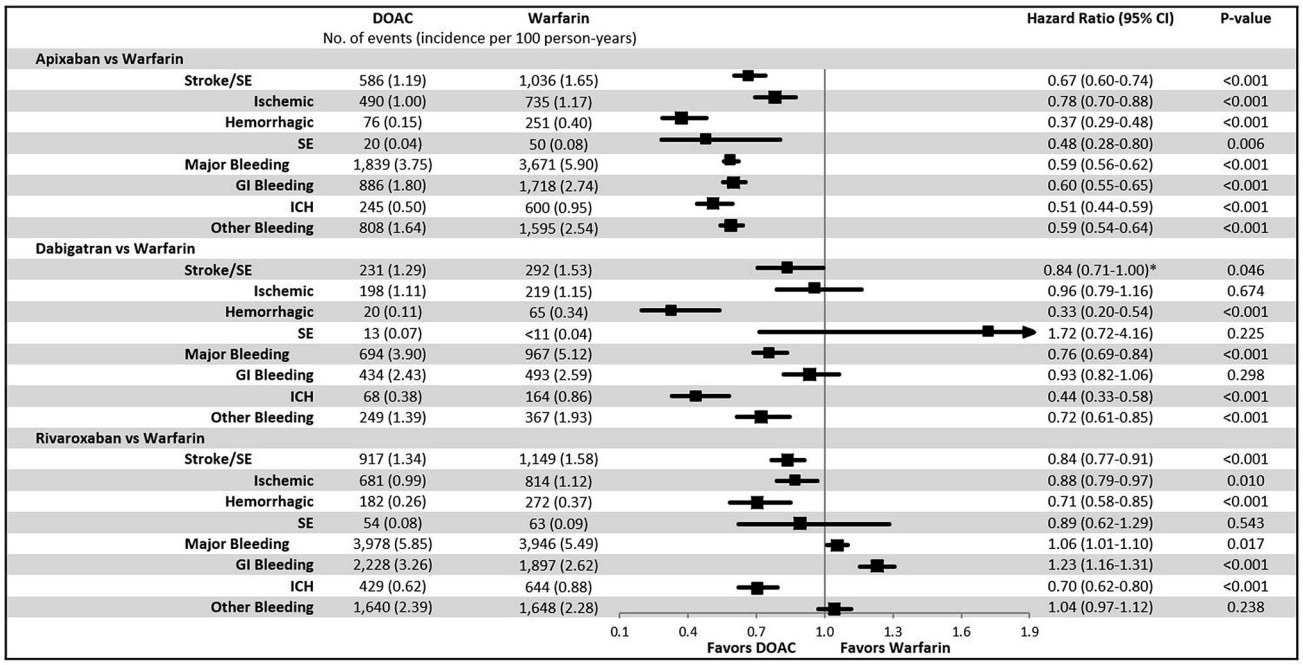

Fig. 2 Incidence rate and hazard ratio of stroke/SE and major bleeding for propensity score-matched patients. *CI* confidence interval, *DOAC* direct oral an-coagulant, *GI* gastrointesnal, *ICH* intracranial hemorrhage, *SE* systemic embolism. *Upper limit of 95% CI was rounded from 0.997 to 1.00

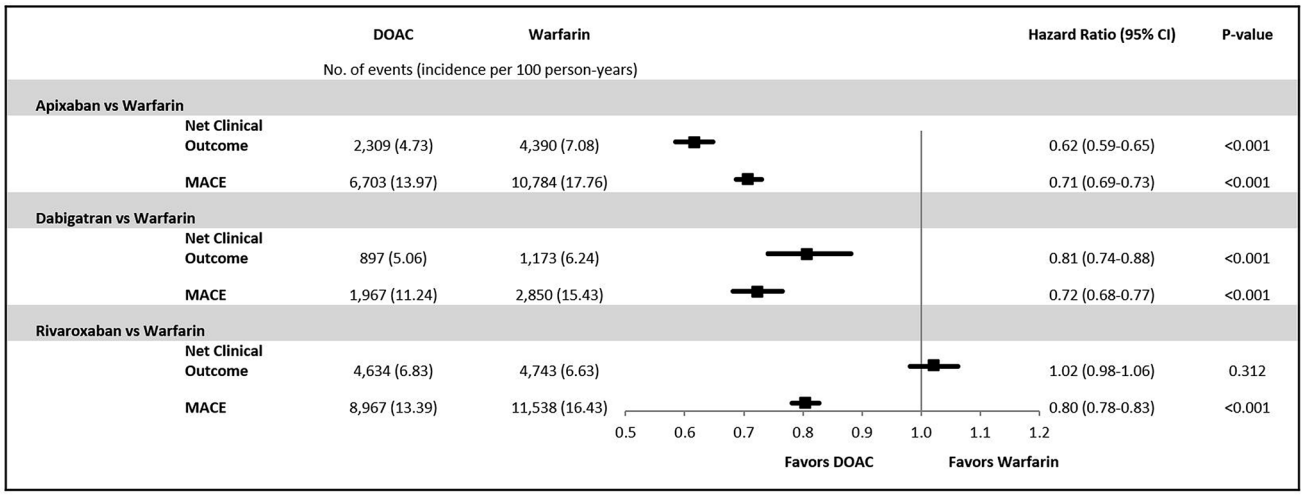

Fig. 3 Incidence rates and hazard ratios of net clinical outcome and MACE for propensity score-matched patient. *CI* confidence interval, *DOAC* direct oral an-coagulant, *MACE* major adverse cardiac events

Table 1 Baseline descriptive table before PSM

	Warfarin (N = 133,779)		Apixaban (N = 93,660)			Dabigatran Cohort (N = 26,306)			Rivaroxaban (N = 112,205)		
	N/Mean	%/SD	N/Mean	%/SD	STD[a]	N/Mean	%/SD	STD[a]	N/Mean	%/SD	STD[a]
Age	78.6	7.4	78.3	7.4	4.2	76.9	7.0	***23.7***	77.5	7.2	***15.9***
65–74	44,180	33.0%	32,873	35.1%	4.4	10,979	41.7%	***18.1***	43,954	39.2%	***12.8***
75–84	57,523	43.0%	39,415	42.1%	1.9	10,976	41.7%	2.6	47,188	42.1%	1.9
≥ 85	32,076	24.0%	21,372	22.8%	2.7	4,351	16.5%	***18.6***	21,063	18.8%	***12.7***
Sex											
Male	66,636	49.8%	44,641	47.7%	4.3	13,478	51.2%	2.9	55,816	49.7%	0.1
Female	67,143	50.2%	49,019	52.3%	4.3	12,828	48.8%	2.9	56,389	50.3%	0.1
Race											
White	120,427	90.0%	84,965	90.7%	2.4	23,554	89.5%	1.6	101,400	90.4%	1.2
Black	7,553	5.6%	4,227	4.5%	5.2	1,176	4.5%	5.4	4,766	4.2%	6.5
Hispanic	1,796	1.3%	1,185	1.3%	0.7	422	1.6%	2.2	1,767	1.6%	1.9
Other	4,003	3.0%	3,283	3.5%	2.9	1,154	4.4%	7.4	4,272	3.8%	4.5
Geographic region											
Northeast	26,378	19.7%	17,112	18.3%	3.7	5,231	19.9%	0.4	20,544	18.3%	3.6
North Central	42,746	32.0%	20,311	21.7%	***23.3***	6,078	23.1%	***19.9***	26,262	23.4%	***19.2***
South	41,730	31.2%	41,348	44.1%	***27.0***	10,187	38.7%	***15.8***	45,170	40.3%	***19.0***
West	22,748	17.0%	14,820	15.8%	3.2	4,768	18.1%	2.9	20,031	17.9%	2.2
Other	177	0.1%	69	0.1%	1.8	42	0.2%	0.7	198	0.2%	1.1
Medicaid dual-eligibility	31,149	23.3%	18,305	19.5%	9.1	6,076	23.1%	0.4	23,887	21.3%	4.8
Part D low-income subsidy	35,211	26.3%	21,020	22.4%	9.0	6,868	26.1%	0.5	26,877	24.0%	5.5
Baseline comorbidity											
Deyo–Charlson comorbidity index	3.1	2.8	2.7	2.6	***12.1***	2.4	2.4	***25.4***	2.5	2.5	***20.7***
CHADS2 score	2.8	1.5	2.7	1.4	7.8	2.5	1.4	***18.6***	2.6	1.4	***16.8***
$CHAD_2S_2$-VASc score	4.7	1.8	4.5	1.7	6.6	4.3	1.7	***20.2***	4.4	1.7	***16.6***
HAS-BLED score[b]	3.3	1.3	3.3	1.3	1.3	3.1	1.2	***14.9***	3.2	1.3	9.4
Baseline prior bleed	38,488	28.8%	25,575	27.3%	3.3	6,484	24.6%	9.3	29,865	26.6%	4.8
Baseline prior stroke	19,792	14.8%	11,860	12.7%	6.2	2,977	11.3%	***10.3***	12,643	11.3%	***10.5***
Congestive heart failure	45,688	34.2%	27,432	29.3%	***10.5***	6,964	26.5%	***16.8***	29,632	26.4%	***16.9***
Diabetes	52,694	39.4%	33,366	35.6%	7.8	9,629	36.6%	5.7	39,273	35.0%	9.1
Hypertension	114,007	85.2%	80,932	86.4%	3.4	22,418	85.2%	0.0	95,731	85.3%	0.3
Renal disease	34,733	26.0%	19,989	21.3%	***10.9***	4,049	15.4%	***26.3***	18,525	16.5%	***23.3***
Myocardial infarction	20,082	15.0%	12,186	13.0%	5.8	2,768	10.5%	***13.5***	12,898	11.5%	***10.4***
Dyspepsia or stomach discomfort	27,291	20.4%	19,275	20.6%	0.4	4,948	18.8%	4.0	22,427	20.0%	1.0
Peripheral vascular disease	72,758	54.4%	50,442	53.9%	1.1	13,209	50.2%	8.4	57,597	51.3%	6.1
Peripheral artery disease	31,656	23.7%	20,307	21.7%	4.7	4,989	19.0%	***11.5***	22,908	20.4%	7.8
Transient ischemic attack	10,270	7.7%	7,869	8.4%	2.7	1,903	7.2%	1.7	8,147	7.3%	1.6
Coronary artery disease	62,365	46.6%	44,078	47.1%	0.9	11,401	43.3%	6.6	49,370	44.0%	5.3
Baseline medication use											
Angiotensin converting enzyme inhibitor	50,249	37.6%	33,904	36.2%	2.8	9,977	37.9%	0.8	40,801	36.4%	2.5
Amiodarone	7,574	5.7%	7,883	8.4%	***10.8***	2,098	8.0%	9.2	7,884	7.0%	5.6
Angiotensin receptor blocker	29,028	21.7%	25,181	26.9%	***12.1***	6,678	25.4%	8.7	28,861	25.7%	9.5
Beta blockers	69,112	51.7%	52,363	55.9%	8.5	14,076	53.5%	3.7	59,792	53.3%	3.3
H2-receptor antagonist	9,376	7.0%	6,590	7.0%	0.1	1,734	6.6%	1.7	7,538	6.7%	1.1
Proton pump inhibitor	39,757	29.7%	30,630	32.7%	6.4	7,771	29.5%	0.4	34,714	30.9%	2.7
Anti-platelets	25,318	18.9%	20,574	22.0%	7.5	4,864	18.5%	1.1	22,294	19.9%	2.4
Statins	75,587	56.5%	57,144	61.0%	9.2	15,306	58.2%	3.4	65,368	58.3%	3.6
Inpatient admission	63,005	47.1%	40,031	42.7%	8.8	9,912	37.7%	***19.1***	46,934	41.8%	***10.6***

Standardized difference greater than 10 is considered significant and is in bold italic

CHA_2DS_2-VASc congestive heart failure, hypertension, age ≥ 75 years, diabetes mellitus, prior stroke or transient ischemic attack or thromboembolism, vascular disease, age 65—74 years, sex category; *HAS-BLED* hypertension, abnormal renal and liver function, stroke, bleeding, labile INRs (international normalized ratio), elderly, drugs, and alcohol; *PSM* propensity score matching; *SD* standard deviation

[a]Std difference = 100 * |actual std diff|

[b]As the INR value was not available in the data, a modified HAS-BLED score was calculated using a range of 0 to 8

Table 2 Baseline descriptive and mean follow-up time table after PSM between warfarin and DOACs

	Apixaban–Warfarin Cohort				Dabigatran–Warfarin Cohort				Rivaroxaban–Warfarin Cohort			
	Apixaban		Warfarin		Dabigatran		Warfarin		Rivaroxaban		Warfarin	
	(N = 87,895)		(N = 87,895)		(N = 26,274)		(N = 26,274)		(N = 100,361)		(N = 100,361)	
	N/Mean	%/SD	N/Mean	%/SD	N/Mean	%/SD	N/Mean	%/SD	N/Mean	%/SD	N/Mean	%/SD
Age	78.4	7.4	78.4	7.4	76.9	7.0	77.0	7.1	77.9	7.2	77.9	7.3
65–74	30,401	34.6%	30,538	34.7%	10,952	41.7%	11,166	42.5%	36,689	36.6%	36,866	36.7%
75–84	37,215	42.3%	37,190	42.3%	10,971	41.8%	10,863	41.3%	43,279	43.1%	43,167	43.0%
≥ 85	20,279	23.1%	20,167	22.9%	4,351	16.6%	4,245	16.2%	20,393	20.3%	20,328	20.3%
Sex												
Male	42,231	48.0%	42,279	48.1%	13,454	51.2%	13,618	51.8%	49,837	49.7%	49,607	49.4%
Female	45,664	52.0%	45,616	51.9%	12,820	48.8%	12,656	48.2%	50,524	50.3%	50,754	50.6%
Race												
White	79,704	90.7%	78,734	89.6%	23,526	89.5%	23,543	89.6%	90,753	90.4%	90,356	90.0%
Black	3,964	4.5%	5,232	6.0%	1,175	4.5%	1,516	5.8%	4,253	4.2%	5,563	5.5%
Hispanic	1,112	1.3%	1,269	1.4%	422	1.6%	373	1.4%	1,550	1.5%	1,381	1.4%
Other	3,115	3.5%	2,660	3.0%	1,151	4.4%	842	3.2%	3,805	3.8%	3,061	3.0%
Geographic region												
Northeast	16,845	19.2%	16,874	19.2%	5,231	19.9%	5,333	20.3%	19,403	19.3%	19,201	19.1%
North Central	20,269	23.1%	20,159	22.9%	6,078	23.1%	5,845	22.2%	25,982	25.9%	26,147	26.1%
South	36,164	41.1%	36,339	41.3%	10,159	38.7%	10,325	39.3%	36,684	36.6%	36,591	36.5%
West	14,548	16.6%	14,457	16.4%	4,765	18.1%	4,729	18.0%	18,130	18.1%	18,267	18.2%
Other	69	0.1%	66	0.1%	41	0.2%	42	0.2%	162	0.2%	155	0.2%
Medicaid dual-eligibility	17,275	19.7%	20,231	23.0%	6,074	23.1%	5,701	21.7%	21,782	21.7%	22,317	22.2%
Part D low-income subsidy	19,787	22.5%	23,042	26.2%	6,865	26.1%	6,529	24.8%	24,444	24.4%	25,436	25.3%
Baseline comorbidity												
Deyo–Charlson comorbidity index	2.8	2.6	2.8	2.6	2.4	2.4	2.5	2.4	2.6	2.5	2.6	2.5
$CHADS_2$ Score	2.7	1.5	2.7	1.4	2.5	1.4	2.6	1.4	2.6	1.4	2.6	1.4
CHA_2DS_2-VASc Score	4.6	1.8	4.6	1.7	4.3	1.7	4.4	1.7	4.4	1.7	4.4	1.7
HAS-BLED Score[a]	3.3	1.3	3.3	1.3	3.1	1.2	3.2	1.3	3.2	1.3	3.2	1.3
Baseline prior bleed	24,128	27.5%	24,263	27.6%	6,483	24.7%	6,713	25.5%	26,875	26.8%	26,881	26.8%
Baseline prior stroke	11,478	13.1%	11,657	13.3%	2,975	11.3%	3,186	12.1%	12,102	12.1%	12,201	12.2%
Congestive heart failure	26,512	30.2%	26,830	30.5%	6,961	26.5%	7,221	27.5%	28,354	28.3%	28,491	28.4%
Diabetes	32,024	36.4%	32,178	36.6%	9,616	36.6%	10,017	38.1%	36,334	36.2%	36,250	36.1%
Hypertension	75,617	86.0%	75,865	86.3%	22,388	85.2%	22,796	86.8%	84,946	84.6%	85,215	84.9%
Renal disease	19,469	22.2%	19,730	22.4%	4,049	15.4%	4,290	16.3%	18,354	18.3%	18,527	18.5%
Myocardial infarction	11,678	13.3%	11,803	13.4%	2,768	10.5%	2,886	11.0%	12,198	12.2%	12,173	12.1%
Dyspepsia or stomach discomfort	17,944	20.4%	18,106	20.6%	4,941	18.8%	5,242	20.0%	19,837	19.8%	19,902	19.8%

Table 2 (continued)

	Apixaban–Warfarin Cohort				Dabigatran–Warfarin Cohort				Rivaroxaban–Warfarin Cohort			
	Apixaban		Warfarin		Dabigatran		Warfarin		Rivaroxaban		Warfarin	
	(N = 87,895)		(N = 87,895)		(N = 26,274)		(N = 26,274)		(N = 100,361)		(N = 100,361)	
	N/Mean	%/SD	N/Mean	%/SD	N/Mean	%/SD	N/Mean	%/SD	N/Mean	%/SD	N/Mean	%/SD
Peripheral vascular disease	47,097	53.6%	47,524	54.1%	13,185	50.2%	13,824	52.6%	51,730	51.5%	51,840	51.7%
Peripheral artery disease	19,279	21.9%	19,442	22.1%	4,987	19.0%	5,203	19.8%	21,134	21.1%	21,187	21.1%
Transient ischemic attack	7,170	8.2%	7,271	8.3%	1,896	7.2%	1,987	7.6%	7,262	7.2%	7,395	7.4%
Coronary artery disease	40,958	46.6%	41,260	46.9%	11,377	43.3%	11,966	45.5%	44,226	44.1%	44,271	44.1%
Baseline medication use												
Angiotensin converting enzyme inhibitor	32,268	36.7%	32,409	36.9%	9,967	37.9%	9,978	38.0%	37,005	36.9%	37,107	37.0%
Amiodarone	6,329	7.2%	6,357	7.2%	2,066	7.9%	2,083	7.9%	6,237	6.2%	6,245	6.2%
Angiotensin receptor blocker	22,291	25.4%	22,280	25.3%	6,659	25.3%	6,731	25.6%	23,825	23.7%	23,892	23.8%
Beta blockers	48,228	54.9%	48,390	55.1%	14,052	53.5%	14,300	54.4%	52,531	52.3%	52,812	52.6%
H2-receptor antagonist	6,147	7.0%	6,197	7.1%	1,730	6.6%	1,827	7.0%	6,775	6.8%	6,799	6.8%
Proton pump inhibitor	27,900	31.7%	28,105	32.0%	7,761	29.5%	7,929	30.2%	30,274	30.2%	30,442	30.3%
Anti-platelets	18,390	20.9%	18,499	21.0%	4,853	18.5%	5,059	19.3%	19,129	19.1%	19,243	19.2%
Statins	52,713	60.0%	52,630	59.9%	15,276	58.1%	15,522	59.1%	57,542	57.3%	57,523	57.3%
Inpatient admission	38,166	43.4%	38,674	44.0%	9,907	37.7%	10,404	39.6%	42,902	42.7%	43,115	43.0%
Patients on standard dose DOAC	62,790	71.4%			21,115	80.4%			66,918	66.7%		
Mean follow-up time (in days)	204.9	186.3	262.6	240.9	249.6	255.0	266.1	241.7	250.6	239.4	265.1	242.3

CHA_2DS_2-VASc congestive heart failure, hypertension, age ≥ 75 years, diabetes mellitus, prior stroke or transient ischemic attack or thromboembolism, vascular disease, age 65—74 years, sex category; *HAS-BLED* hypertension, abnormal renal and liver function, stroke, bleeding, labile INRs (international normalized ratio), elderly, drugs, and alcohol; PSM: propensity score matching; *SD* standard deviation

[a]As the INR value was not available in the data, a modified HAS-BLED score was calculated using a range of 0 to 8

in conclusions for either the direction of or the statistical significance for the comparative results.