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TREATMENT COMPLETION AND IMPLEMENTATION BY PATIENTS INITIATING TICAGRELOR

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ABSTRACT

Background

In secondary prevention of adverse events and death following acute coronary syndrome, patients may benefit from adhering to a ticagrelor treatment.

Objectives

The authors assessed the proportion of new ticagrelor users who completed 12 months of treatment, explored the factors associated with treatment completion and, among the completers, evaluated the 12-month treatment implementation.

Methods

A retrospective administrative health database inception cohort study was conducted in a population that included Quebec residents ≥18 years of age who initiated ticagrelor between January 1, 2012 and March 31, 2014. A patient still on ticagrelor at the end of the 12-month period after treatment initiation was considered to have completed the treatment. Factors associated with treatment completion were identified using log-binomial regression. Implementation was assessed using the proportion of days covered (PDC).

Results
Of the 3,600 patients, 2,235 (62.1%) completed 12 months of treatment. The patients who were more likely to complete their treatment included those who had visited a general practitioner, had a percutaneous coronary intervention, used a statin or fibrate, and those who used an antihypertensive drug during the year preceding the ticagrelor treatment initiation. Older patients, those with atrial fibrillation, those who had ≥ 6 physician visits and those who used an anticoagulant were less likely to complete the 12-month treatment. The median PDC was 96.2%.

Conclusion
Treatment completion might be improved. Among patients who completed the treatment, implementation was high. The factors associated with completion could help to identify patients who might benefit from interventions that aim to optimize treatment completion.

Keywords: *drug utilization, adherence, ticagrelor, acute coronary syndrome*

The use of the selective adenosine diphosphate receptor $P2Y_{12}$ inhibiting (ADRPi) oral antiplatelet agent clopidogrel, in addition to low-dose acetylsalicylic acid, has improved the clinical outcomes of patients suffering from acute coronary syndrome (ACS).[1] Since 2011, another oral antiplatelet drug of the same class, ticagrelor, has been available in many countries, including Canada. The Study of Platelet Inhibition and Patient Outcomes demonstrated that ACS patients who were treated with ticagrelor experienced a lower mortality rate than those on clopidogrel.[2] To benefit from using ticagrelor, patients must adhere to the treatment (i.e., demonstrate persistence or treatment completion and adequate implementation).[3,4] The current guidelines recommend maintenance of ticagrelor treatment for at least 12 months.[5] In addition to completing 12 months of treatment, it is also expected that patients will appropriately implement the treatment (i.e., take the expected daily number of doses).

To the best of our knowledge, thus far, only two studies[6,7] have focused on ticagrelor completion. A study conducted in Saskatchewan used a registry of patients initiated on ticagrelor, and 20.7% of the patients discontinued the use of ticagrelor before reaching 12 months of treatment.[6] In an administrative data analysis conducted in the US, the mean number of days on ticagrelor was 150.2; however, the proportion of patients completing 12 months of treatment was not specifically reported.[7] None of these studies assessed the factors associated with completion. In addition, to the best of our knowledge, the level of treatment implementation by patients completing ticagrelor treatment has never been assessed.

Therefore, we conducted a study of the patterns of drug use of patients initiating ticagrelor treatment. More specifically, the objectives were to (1) assess the proportion of ticagrelor users who completed 12 months of ticagrelor treatment, (2) explore the factors associated with treatment completion, (3) evaluate the level of treatment implementation among the completers, and (4) among those who did not complete treatment, assess treatment completion and implementation with any ADRPi.

METHODS

Design and Data Source

We conducted a population-based inception cohort study using administrative databases from the Quebec Health Insurance Board (RAMQ), the Quebec registry of hospitalizations and the death registry of the Institut de la Statistique du Québec (ISQ). These databases include information on patient demographics and vital statistics, as well as hospital and physician services pertaining to all permanent residents of the province of Quebec (population, approximately 7.5 million). The RAMQ pharmaceutical services database also contains information on prescription drugs for all beneficiaries of the provincial public drug plan (approx. total of 3.6 million): Quebec residents who are not eligible for a private drug insurance plan (n = 1.81 million), welfare recipients (n = 0.45 million) and people 65 years of age and older (n = 1.33 million). The beneficiaries' financial contribution varies according to

whether they receive partial or maximum guaranteed income supplement (GIS) or welfare. For example, in 2017, the maximum monthly contribution varied from $87.16 for those who do not receive a GIS or welfare to $0 for those who receive at least 94% of the GIS or welfare.[8] In general patients on long-term drug treatment are given supplies for 30 days. However, at the initiation of a new drug treatment, pharmacists are allowed by RAMQ to fractionate the initial prescription by dispensing a first supply for 7 days and, if the medication is tolerated, to refill it by dispensing the remaining 3-week supply. The drug plan database is known to be accurate for prescription claims.[9]

Population

The cohort included all Quebec residents ≥ 18 years of age who had at least one claim for ticagrelor (only one DIN marketed: 02368544) registered in the pharmaceutical services database between January 1, 2012 and March 31, 2014, had been continuously eligible for the Quebec public drug plan during the 365 days preceding their first ticagrelor claim and had at least 365 days of follow-up.

Data and Variables

For each member of the cohort, RAMQ sent data registered in databases during the period beginning 365 days before the first ticagrelor claim until the patient's death, the end of eligibility for the drug plan, or March 31, 2015, whichever event came first. In addition, RAMQ provided the date of death obtained from ISQ for all cohort members who died during the follow-up period.

We measured the 12-month ticagrelor treatment completion using the treatment anniversary method.[10] This method identifies the most recent claim of ticagrelor, prior to the 12-month treatment initiation anniversary date. An individual was considered to have completed 12 months of treatment if the number of days of supply on the date of the more recent claim allowed him/her to be covered at the 12-month anniversary date. A permissible gap of 0.5 times the number of days of supply was added to take into account less than the optimal treatment implementation. If an individual was hospitalized at the 12-month anniversary date, we searched for the date of the hospital admission and set the treatment completion as that date.

Many patient-related, health-related and treatment-related characteristics were considered to be potential factors associated with ticagrelor treatment completion. The following patient-related characteristics were assessed at the date of the first ticagrelor claim: patient age, sex and socioeconomic status (type of beneficiary for the public drug plan). Health-related characteristics were assessed in the year before the first ticagrelor claim, based on the inpatient (ICD-10) and outpatient diagnosis codes (ICD-9) found in the hospitalization registry and physician services database, respectively. Individuals with a pertinent inpatient or outpatient diagnosis code were considered to have a history of health problems. Health problems included ACS, anemia, atrial fibrillation, cardiac dysrhythmia, cardiomyopathy, chronic heart failure, chronic renal failure, chronic obstructive pulmonary disease, deep venous thrombosis, dementia, diabetes, dyslipidemia, dyspnea, hypertension, ischemic stroke, non-skin neoplasia, peptic ulcer, peripheral arterial disease and upper gastrointestinal bleeding. Treatment-related characteristics were either assessed using the day of the first ticagrelor claim (i.e., calendar year and specialty of the practitioner who prescribed ticagrelor), or in the year before the first ticagrelor claim (total number of days of hospitalization, total number of physician visits, visits to a general practitioner [yes/no], visits to a cardiologist [yes/no] and history of coronary artery bypass graft and percutaneous coronary intervention). In the year before the first ticagrelor claim, we also assessed the use of drugs likely to influence the use of ticagrelor (acetylsalicylic acid, anticoagulant, clopidogrel or prasugrel, statin or fibrate, antihypertensive), the number of distinct drugs claimed (distinct international non-proprietary name codes), the cost of drugs claimed by the pharmacists and the cost shared by the patients.

The level of treatment implementation among individuals who had reached 12 months of treatment was calculated using the proportion of days covered (PDC)[10] by ticagrelor during the 12 months following initiation (the number of days covered divided by 365). As drugs taken in the hospital are not registered in the RAMQ database (note that hospitals dispense only inpatient prescriptions), we removed the number of days spent in the hospital from the PDC denominator.

We also removed from the PDC numerator the number of days of supply of ticagrelor available during the hospital stays.

Among those who did not complete the 12-month ticagrelor treatment, we identified the patients who had switched to clopidogrel or prasugrel, as these ADRPis are also recommended following an ACS.[5] We then assessed the 12-month treatment completion for any of these three drugs, as well as the PDC for any drug among the patients who completed treatment.

Statistical Analysis

The proportion of patients who completed 12 months of ticagrelor treatment was calculated. The patient-related, health-related, and treatment-related characteristics associated with completion were identified using multivariable log-binomial regression analysis. Using the stepwise procedure, characteristics with a *P*-value < 0.05 were kept in the model. Adjusted prevalence ratios (PR), with 95% confidence intervals, were calculated. There was no issue of multicollinearity, which was assessed using multiple regression analysis. The mean and median PDCs were calculated. Analyses were performed using SAS, version 9.4.

Ethical Considerations

To ensure anonymity, RAMQ assigned a unique encrypted number to each individual. The research protocol was approved by the *CHU de Québec* Research Ethics Committee. The Quebec Commission on Access to Personal Information (*Commission d'accès à l'information du Québec)* granted approval for the data to be transferred.

Results

A total of 4,131 Quebec residents insured by the public drug plan had at least one ticagrelor claim registered in the pharmaceutical services database during the study period and met the other inclusion criteria. Of the residents, 222 (5.4%) died, and 309 (7.5%) lost their eligibility for the drug plan in the 12-month period following the first ticagrelor claim. The remaining 3,600 individuals were included in our study population.

A total of 2,235 (62.1%) individuals completed the 12-month ticagrelor treatment. In the year following treatment initiation, the mean duration of ticagrelor treatment was 9.1 ± 4.5 months [median, 12 months (lower quartile: 5.7, upper quartile: 12.0)]. Eight factors had a statistically significant association with ticagrelor treatment completion (Table 1). Older individuals, those with a history of atrial fibrillation, those for whom the number of visits to a physician was in the second or third tertile (vs. the first) and those who used an anticoagulant were less likely to complete the 12-month ticagrelor treatment. In contrast, individuals who, in the year prior to ticagrelor initiation, visited a general practitioner, had a percutaneous coronary intervention, used a statin or fibrate and those who used an antihypertensive drug were more likely to complete treatment (Table 1).

Among the 2,235 individuals who completed the 12-month ticagrelor treatment, the median PDC of ticagrelor was 96.2% (mean ± SD = 94.5% [±6.6]; lower quartile, 93.3; upper quartile, 98.1). A total of 1,018 (45.5%) individuals who completed the treatment had at least one 7-day period without ticagrelor. The maximum duration of time without ticagrelor was 7 days for 139 patients (13.7% of those who persisted), between 8 and 30 days for 755 patients (74.1%) and 30 days for 124 patients (12.2%).

Among the 1,365 patients who did not complete 12 months of ticagrelor treatment, 675 (49.5%) switched to another ADRPi before the end of the 12-month period following ticagrelor initiation: 572, 101 and 2 switched to clopidogrel, prasugrel or both, respectively. The length of time between discontinuing ticagrelor and starting another ADRPi was less than 8 days for 589 (87.3%) of the switchers. A total of 537 (79.6%) of those who switched were still undergoing ADRPi treatment one year after the date of their first ticagrelor claim. They had a mean PDC (by any ADRPi) of 93.1% (SD ± 10.6; median = 96.2%, (lower quartile: 93.2, upper quartile: 98.1).

Overall, 2,772 (77.0%) patients were using ticagrelor, clopidogrel or prasugrel at the end of the 12-month recommended minimum period of treatment for ADRPi. The mean time on treatment was 10.4 ± 3.3 months (median = 12; lower quartile: 11.5, upper quartile: 12.0). The mean PDC for any of the three drugs was 94.3% (± 7.5), with a median of 96.2 (lower quartile: 93.4, upper quartile: 98.1).

TABLE 1 Patient-Related, Health-Related and Treatment-Related Characteristics Associated with Completion Of A 12-Month Ticagrelor Treatment (N = 3,600)

Characteristics	12-month Treatment Completion				Crude PR*	95% CI*	Adjusted PR	95% CI
	Yes		No					
	N 2,235	(%) (62.1)	N 1,365	(%) (37.9)				
Patient-related (at treatment initiation)								
Age (mean ± standard deviation)	(66.9±10.5)		(69.0±10.6)		0.97*	0.96–0.98	0.98	0.97–0.99
Sex								
Women	729	32.6	471	34.5	1.00			
Men	1,506	67.4	894	65.5	1.03	0.98–1.09		
Socioeconomic status								
No guaranteed income supplement (GIS)	1,330	59.5	762	55.8	1.00			
Partial GIS	604	27.0	459	33.6	0.89	0.84–0.95		
Welfare or maximum GIS	301	13.5	144	10.6	1.06	0.99–1.14		
Health-related (in the year before the treatment initiation)								
Acute coronary syndrome	1,981	88.6	1,150	84.3	1.17	1.07–1.28		
Anaemia	307	13.7	247	18.1	0.88	0.81–0.95		
Atrial fibrillation	117	5.2	137	10.0	0.73	0.64–0.83	0.84	0.73–0.96
Cardiac dysrhythmia	541	24.2	408	29.9	0.89	0.84–0.95		

TABLE 1 Patient-Related, Health-Related and Treatment-Related Characteristics Associated with Completion Of A 12-Month Ticagrelor Treatment (N = 3,600) *(Continued)*

Characteristics	12-month Treatment Completion				Crude PR*	95% CI*	Adjusted PR	95% CI
	Yes		No					
	N 2,235	(%) (62.1)	N 1,365	(%) (37.9)				
Cardiomyopathy	51	2.3	43	3.2	0.87	0.72–1.05		
Chronic heart failure	395	17.7	280	20.5	0.93	0.87–1.00		
Chronic renal failure	251	11.2	187	13.7	0.91	0.84–0.99		
Chronic obstructive pulmonary disease	277	12.4	206	15.1	0.91	0.84–0.99		
Deep venous thrombosis	5	0.2	2	0.2	1.15	0.72–1.84		
Dementia	30	1.3	28	2.1	0.83	0.65–1.07		
Diabetes	677	30.3	429	31.4	0.98	0.93–1.04		
Dyslipidaemia	1,561	69.8	899	65.9	1.07	1.01–1.14		
Dyspnoea	244	10.9	215	15.8	0.84	0.77–0.92		
Hypertension	1,455	65.1	887	65.0	1.00	0.95–1.06		
Ischaemic stroke	94	4.2	66	4.8	0.94	0.83–1.08		
Non-skin neoplasia	340	15.2	218	16.0	0.98	0.91–1.05		
Peptic ulcer	15	0.7	22	1.6	0.65	0.44–0.96		
Peripheral arterial disease	247	11.1	176	12.9	0.93	0.86–1.02		
Upper gastro-intestinal bleeding	41	1.8	46	3.4	0.75	0.60–0.94		
Treatment-related (in the year before treatment initiation)								

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Characteristics	12-month Treatment Completion				Crude PR*	95% CI*	Adjusted PR	95% CI
	Yes		No					
	N 2,235	(%) (62.1)	N 1,365	(%) (37.9)				
Calendar year at ticagrelor drug treatment initiation								
2012	383	17.1	226	16.6	1.00			
2013	1,397	62.5	876	64.2	0.98	0.91–1.05		
2014	455	20.4	263	19.3	1.01	0.93–1.09		
Specialty of practitioner who prescribed ticagrelor								
General practitioner	776	34.7	467	34.2	1.00			
Cardiologist	1,232	55.1	783	57.4	0.98	0.93–1.04		
Internist	177	7.9	91	6.7	1.06	0.96–1.16		
Other or missing	50	2.2	24	1.8	1.08	0.92–1.27		
Number of days of hospitalization in the 365 days before treatment initiation								
0	91	4.1	90	6.6	1.00			
1st tertile (1–2)	577	25.8	305	22.3	1.30	1.12–1.52		
2nd tertile (3–5)	925	41.4	499	36.6	1.29	1.11–1.50		
3rd tertile (6–189)	642	28.7	471	34.5	1.15	0.98–1.34		

TABLE 1 Patient-Related, Health-Related and Treatment-Related Characteristics Associated with Completion Of A 12-Month Ticagrelor Treatment (N = 3,600) *(Continued)*

Characteristics	12-month Treatment Completion				Crude PR*	95% CI*	Adjusted PR	95% CI
	Yes		No					
	N 2,235	(%) (62.1)	N 1,365	(%) (37.9)				
Number of physician visits								
1st tertile (0–5)	782	35.0	358	26.2	1.00		1.00	
2nd tertile (6–10)	761	34.1	451	33.0	0.92	0.86–0.97	0.94	0.89–0.99
3rd tertile (11–224)	692	31.0	556	40.7	0.81	0.76–0.86	0.85	0.80–0.91
Visits to a general practitioner	2,138	95.7	1,278	93.6	1.19	1.03–1.36	1.24	1.08–1.42
Visits to a cardiologist	1,681	75.2	1,058	77.5	0.95	0.90–1.01		
Coronary artery bypass graft	21	0.9	23	1.7	0.77	0.56–1.05		
Percutaneous coronary intervention	1,812	81.1	977	71.6	1.25	1.16–1.34	1.20	1.12–1.29
Use of acetyl salicylic acid	2,148	96.1	1,302	95.4	1.07	0.93–1.23		
Use of an anticoagulant	70	3.1	98	7.2	0.66	0.55–0.79	0.73	0.61–0.87
Use of clopidogrel or prasugrel	378	16.9	280	20.5	0.91	0.85–0.98		
Use of statins or fibrates	2,176	97.4	1,294	94.8	1.38	1.14–1.67	1.26	1.04–1.52
Use of an anti-hypertensive drug	2,169	97.1	1,307	95.8	1.17	0.99–1.39	1.21	1.03–1.43

TABLE 1 Patient-Related, Health-Related and Treatment-Related Characteristics Associated with Completion Of A 12-Month Ticagrelor Treatment (N = 3,600) *(Continued)*

Characteristics	12-month Treatment Completion				Crude PR*	95% CI*	Adjusted PR	95% CI
	Yes		No					
	N 2,235	(%) (62.1)	N 1,365	(%) (37.9)				
Use of oestrogen (women only, N = 1,200)	26	3.6	25	5.3	0.83	0.63–1.09		
Use of an antidiabetic drug	540	24.2	341	25.0	0.98	0.93–1.04		
Use of nitrates	1,588	71.1	933	68.4	1.05	0.99–1.11		
Use of a proton pomp inhibitor	1,372	61.4	900	65.9	0.93	0.88–0.98		
Use of a nonsteroidal anti-inflammatory drug (other than acetyl salicylic acid)	255	11.4	156	11.4	1.00	0.92–1.08		
Total number of different drugs used								
1st tertile (1–9)	750	33.6	375	27.5	1.00			
2nd tertile (10–15)	834	37.3	517	37.9	0.93	0.87–0.98		
3rd tertile (16–50)	651	29.1	473	34.7	0.87	0.81–0.93		
Cost of drugs in the 365-day period before the first ticagrelor claim								
1st quintile ($5–$476)	470	21.0	250	18.3	1.00			
2nd quintile ($477–$1,095)	451	20.2	269	19.7	0.96	0.89–1.04		

TABLE 1 Patient-Related, Health-Related and Treatment-Related Characteristics Associated with Completion Of A 12-Month Ticagrelor Treatment (N = 3,600) *(Continued)*

Characteristics	12-month Treatment Completion				Crude PR*	95% CI*	Adjusted PR	95% CI
	Yes		No					
	N 2,235	(%) (62.1)	N 1,365	(%) (37.9)				
3rd quintile ($1,096–$1,998)	459	20.5	261	19.1	0.98	0.90–1.05		
4th quintile ($1,999–$3,689)	428	19.2	292	21.4	0.91	0.84–0.99		
5th quintile ($3,690–$47,889)	427	19.1	293	21.5	0.91	0.84–0.98		
Cost of contribution of the patient (in Can $)								
1st quintile (0–82)	498	22.3	239	17.5	1.00			
2nd quintile (83–362)	426	19.1	277	20.3	0.90	0.83–0.97		
3rd quintile (363–566)	466	20.9	254	18.6	0.96	0.89–1.03		
4th quintile (567–686)	406	18.2	314	23.0	0.83	0.77–0.91		
5th quintile (687–1,142)	439	19.6	281	20.6	0.90	0.84–0.97		

**PR = prevalence ratio; CI = confidence interval*
*** PR for age is by 5-year intervals*

DISCUSSION

Of the 3,600 patients who initiated ticagrelor, 62% reached 12 months of treatment on that drug. This proportion is lower than the 80% observed by Dehghani et al.[6] in a registry study of patients initiating ticagrelor. The higher proportion observed in the latter study is likely due to the study design which was different from ours. In the Dehghani et al. study, patients had to consent to be included in the study, which was performed by their cardiologist,who collected data prospectively. Therefore, as op-posed to our study, which was a retrospective sec-ondary analysis of administrative ("real life") data, the patients knew that they were being observed. Note that in a study using a design similar to ours, Boggon et al.[11] conducted a secondary analysis of clinical and administrative data for individuals initiating clopidogrel. The proportion of patients still on clopidogrel one year after treatment initiation was 66%; a proportion similar to the one that we observed for ticagrelor patients.

One would not expect that 100% of patients who begin taking ticagrelor would complete a 12-month treatment because this drug may need to be discontinued for some patients, as is the case for patients who suffer from exacerbated dyspnea[12] and, perhaps, for patients developing atrial fibrillation, for whom it is recommended to prescribe an oral anticoagulant. For these patients, continuing ticagrelor in addition to oral anticoagulants and acetylsalicylic acid may substantially increase the risk of bleeding[13]. This issue was further explored in *a posteriori* analysis. We observed that among the 1,365 people who did not complete their ticagrelor treatment, 444 (32,5%) had a diagnosis of dyspnea or atrial fibrillation in the 365 days following their ticagrelor treatment initiation compared to 392 (17.5%) of the 2,235 who were still on treatment 12 months after initiation ($P < 0.0001$).

To the best of our knowledge, the factors specifically associated with the completion of 12 months of ticagrelor treatment have never been assessed. However, it has been observed that some of the factors we identified are also related to the treatment completion of any ADRPi. For example, as in our study, the following factors were also observed to be associated with ADRPi non-completion: older age,[14,15] atrial fibrillation[14] and the use of an anticoagulant in the year before the ADRPi initiation.[15] Likewise, as in our study, a percutaneous coronary intervention in the year prior to ADRPi initiation was associated with treatment completion.[15] Nonetheless, the factors we have observed should be interpreted as exploratory rather than definitive, as many clinical factors could not be assessed because they are not captured in the administrative database.

Among those who completed a 12-month treatment with ticagrelor, the high median PDC (96%) suggests that the treatment implementation was high. This finding is in line with the results observed in a Finnish medico-administrative database study of patients initiating an ADRPi after hospital discharge for an ACS.[15] Among those who initiated the ticagrelor treatment, the median PDC by ticagrelor from initiation to the last day of medication was 100%.[15]

Overall, when considering the exposure of patients to any ADRPi 12 months after ticagrelor initiation, the proportion of those still on any ADRPi after one year was high (77%). This result aligns with the findings of two studies.[14,16] In a retrospective study conducted in Belgium.[16] cardiologists completed case report files for 295 patients who were discharged from the hospital after an ACS, 147 of whom were started on ticagrelor. The proportion of patients still on any ADRPi after 360 days was 80%. In addition, treatment completion with different classes of medication, including ADRPi, was studied in a US registry study of myocardial infarction patients who were treated with percutaneous coronary intervention and gave consent to record their medication changes in a diary.[14] Although the proportion of patients completing a treatment with ADPRi was higher (92%) than in ours, the discrepancy is likely because completion was assessed over a shorter period of time (6 months as opposed to 12 months) and was self-reported rather than objectively assessed through pharmacy claims. Finally, although in the current study 33% of patients discontinued the ADPRi treatment before reaching 12 months of treatment, the overall completion rate was excellent for most patients, as illustrated by the median time of 12 months on any ADRPi, which is the duration recommended by guidelines.[5]

This study has some limitations inherent to the use of RAMQ administrative data. First, we assumed that the drugs acquired in pharmacies were taken. We may, therefore, have overestimated the proportion of patients who completed the treatment, as well as the proportion of days covered. Next, although we have included in our model a large number of factors likely to be associated with treatment completion, our exploration was limited to the factors available in the administrative database. Therefore, some factors potentially associated with treatment adherence (e.g., patient-related attitudes and beliefs, self-efficacy, perceived side effects, level of disability and patient-provider relationship) were not considered, as they are not captured in the RAMQ databases. In addition, it was not possible to separate those patients who discontinued ticagrelor by themselves from those for whom physicians discontinued the treatment. Finally, as we measured treatment implementation using PDC, results could have been different if a different measure had been used, for example, a medication event monitoring system.

In conclusion, the results of this study suggest that treatment completion might be improved in this population on new ticagrelor users, although it is unknown to what extent it should be emphasized, as the use of ticagrelor must be balanced with the bleeding risks and side effects associated with concomitant treatments or conditions. The factors associated with ticagrelor treatment completion could help to identify the individuals who might benefit from interventions that aim to optimize treatment completion.

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