Implementing machine learning techniques to estimate the impact of underdosed DOACs, and aim patients at high bleeding risk in an elderly frail population treated for atrial fibrillation

An AI based approach to assess the impact of underdosed DOACs, predict bleeding events, and improve patient care

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Background

- **Conventional bleeding risk scores** are consistenly high in our population, and as such **not informative**.
- As a result, the medical team is **under-dosing direct oral anticoagulants** (DOACs) beyond recommandations, to avoid a hypothetical bleeding risk they can't assess.
- We want to know **the impact of this practice**, and if we can **aim patients at high bleeding risk.**

Methods

Retrospective study between 2020 and 2022.

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Patients under DOACs for Atrial Fibrillation (n = 121).

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Clinical and biological variables collected.

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Statistical analysis using RStudio.

Results

Figure 1 :

- Underdosing DOACs is associated with a lower bleeding risk, but a higher thrombosis risk.
- No impact on hospitalization for hemorrhage nor thrombose events.
- **Underdosing DOACs has no clinical justification in our population.**

Figure 2 :

- We used an algorithm called stepwise regression to modelize risk factors among our population.
- 3 Risk Factors were identified : Sex, the DOAC used, and if the dosage is following guidelines or not.
- **Being a women, using Xarelto, and receveing guidelines dosage are associated with higher bleeding risk.**
- **Being a man, using Apixaban, and having underdosed DOAC are associated with lower bleeding risk.**

Figure 3 :

- To assess the predictiv performances of our risk factors, we build a predictive model using artificial intelligence.
- **Our model outperform conventional scores.**

Outcome	Compliance to guidelines	N	Odds ratio	p
Hemorrahge	Yes	89	Reference	
	No	30	0.30 (0.07, 0.96)	0.07
Thrombosis	Yes	89	Reference	
	No	30	6.69 (1.24, 50.27)	0.03
Hospitalization	Yes	89	Reference	
	No	30	1.50 (0.07, 16.22)	0.74
Death	Yes	89	Reference	
	No	30	0.61 (0.21, 1.58)	0.33

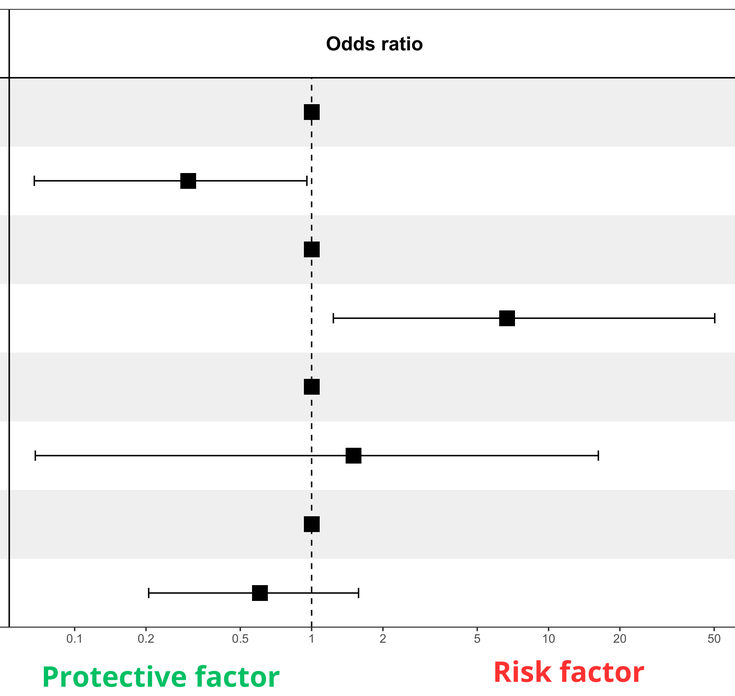
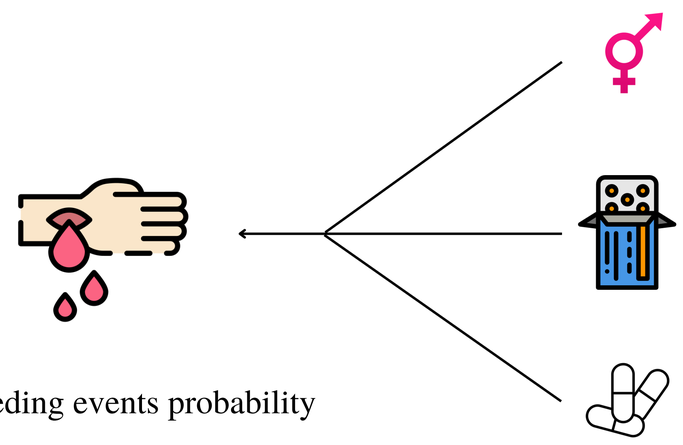


Figure 1 : Impact of underdosed DOAC on selected outcomes



Sex (Being a women is a risk factor)

DOAC used (Using Xarelto is a risk factor)

Dosage (Using guidelines is a risk factor)

Figure 2 : Most explanatory variables, determined by stepwise regression

MODEL / SCORE USED	AUC	SPECIFICITY	SENSIBILITY
Our AI-based model using a RandomForest algorithm	0.70	60%	90%
Conventional bleeding risk scores	0.32	25%	95%

Table 1 : Performances of our model *vs* HAS-BLED assessment score

Discussion and key messages

1. Under-dosing DOACs **has no clinical benefits** for the patient, and this practice should be **discontinuated**.
2. We found that **sex, the DOAC used** and **dosage** were risk factors of bleeding events, and we validated their predictive power using artificial intelligence.
3. Patients at high risk will receive a **dedicated medical management**.
4. Assessment scores are not suitable for our elderly and frail population. Outliers populations and minorities are generally excluded during the scores elaboration, and therefore benefit less from these clinical tools.

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