

Persistence and compliance of the French metastatic breast cancer population, Analysis from the French National Health Data System

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INTRODUCTION

Oral anti-cancer treatments have been shown to be effective when followed carefully. However, these treatments are frequently poorly adhered to : for instance, 14% of patients taking Tamoxifen stop their treatment within a year [1].
To determine the categories of patients at risk and know which ones need extra attention, we developed predictive models. These models are trained on anonymised reimbursement data extracted from the **French Health Insurance database**. Only oral treatments and community pharmacy purchases are considered.

SNDS DATABASE

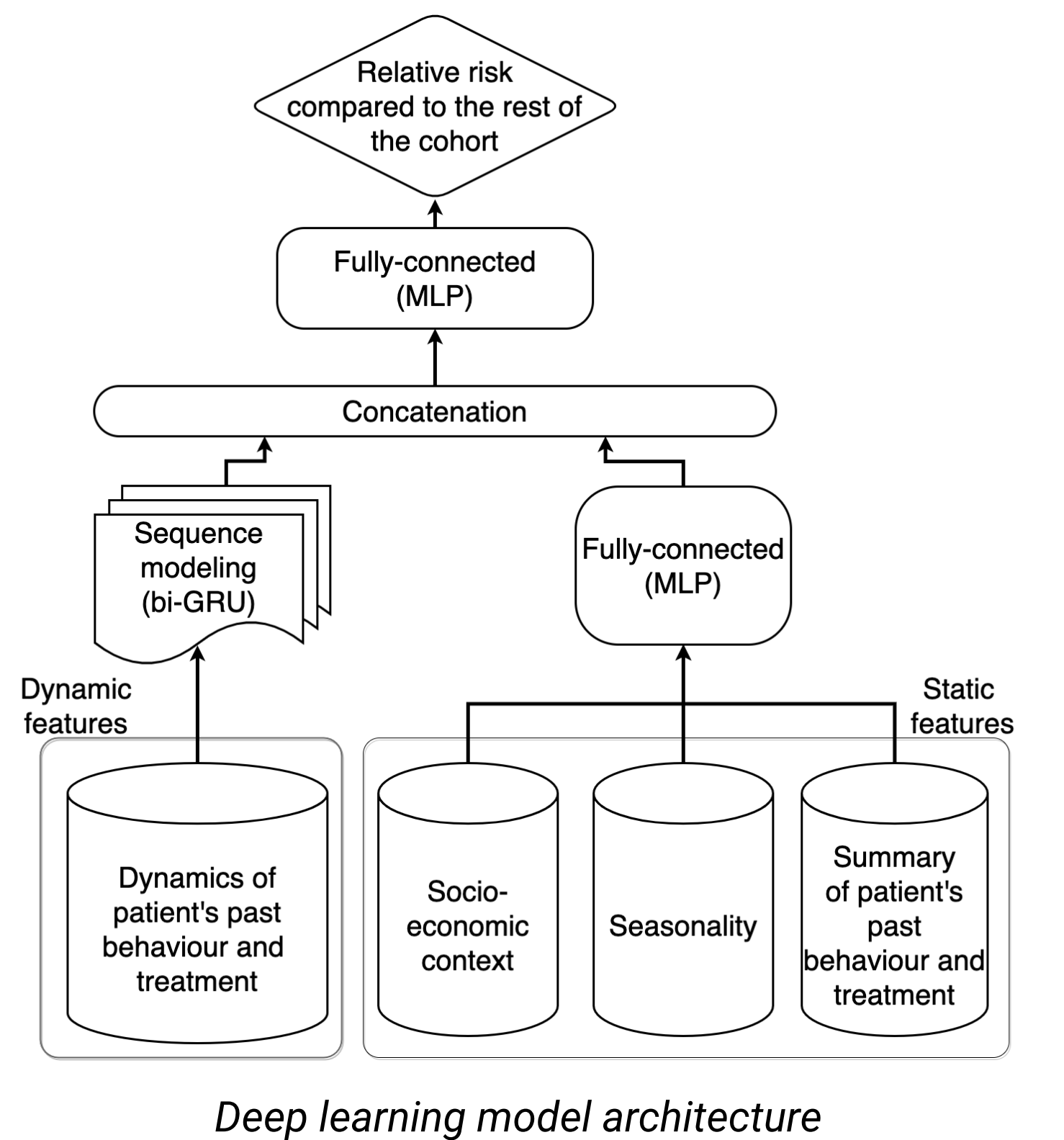
The SNDS (Système National des Données de Santé) is one of the largest structured databases of health data in the world. It contains reimbursement data of the French Health System, **covering 98% of the French population (66 millions people)**. From this database, patients were selected on the basis of a diagnosis of metastatic breast cancer (if hospital stay observed) or on the basis of specific treatments for metastatic breast cancer. Males are excluded.

OBJECTIVES

Model a metastatic breast cancer patient's **persistence** and **compliance** to the treatment. We aim at detecting unwanted episodes (non-persistence and non-compliance) six months before they happen.

METHOD

A patient is considered non persistent if they hold no treatment stock for 2 months (for targeted therapy or oral chemotherapy) or 3 months (for endocrine therapy) and if no change in treatment, entry into palliative care or death is observed.
The compliance is labelled through the **MPR** (Medication Possession Ratio) : a patient is considered non-compliant if the 3-months MPR is below 80%.
Models are trained on a population of **38 806 patients**. Collected data is from the years 2013 to 2019
Non-persistence risk is predicted using a **logistic regression**, while non-compliance risk is predicted using a **deep learning model**.



Deep learning model architecture

RESULTS - PERSISTENCE (GINI 0.35)

Model's odds ratio are as followed (a higher odds-ratio means a higher risk of a non-persistence episode) :

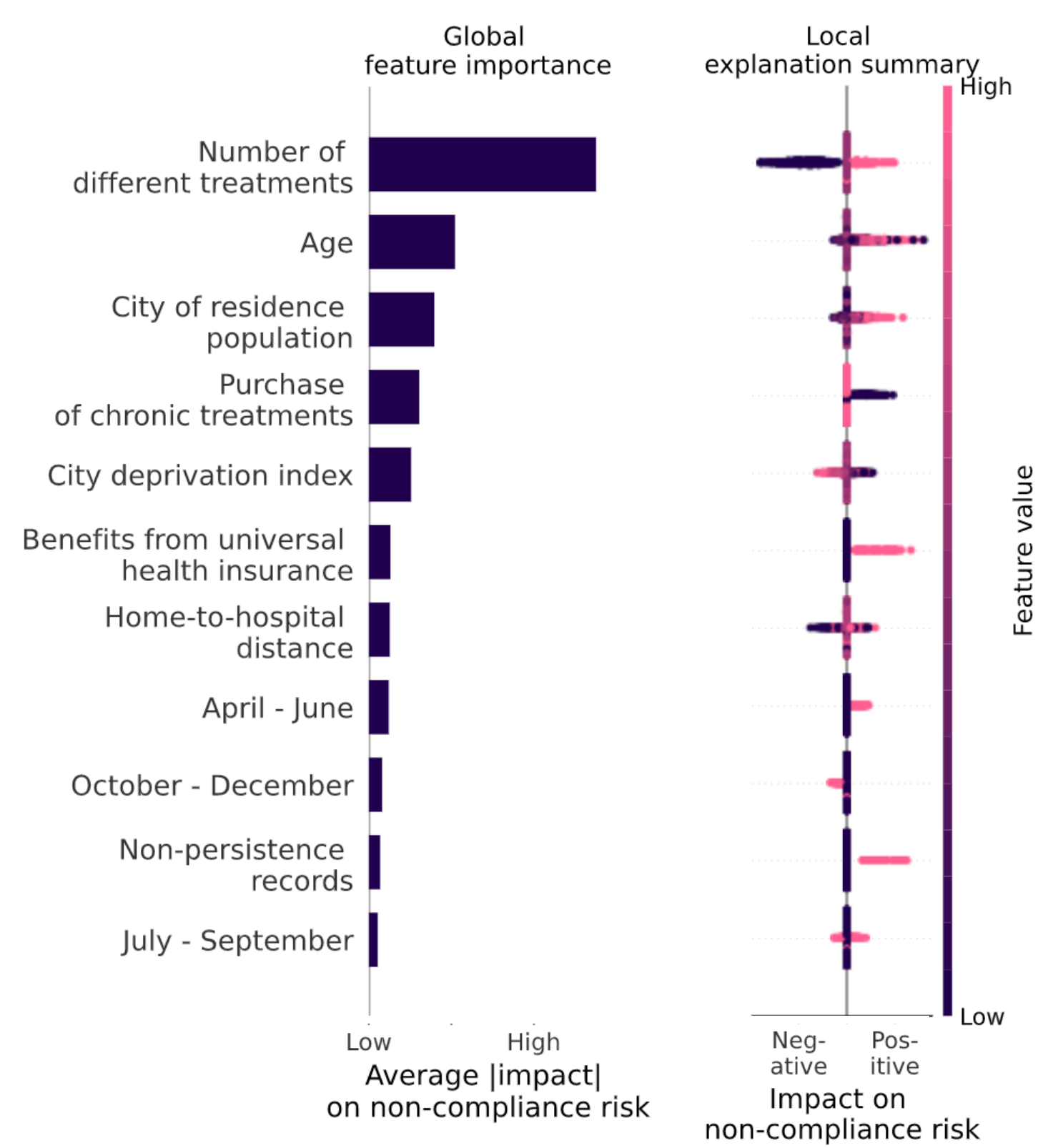
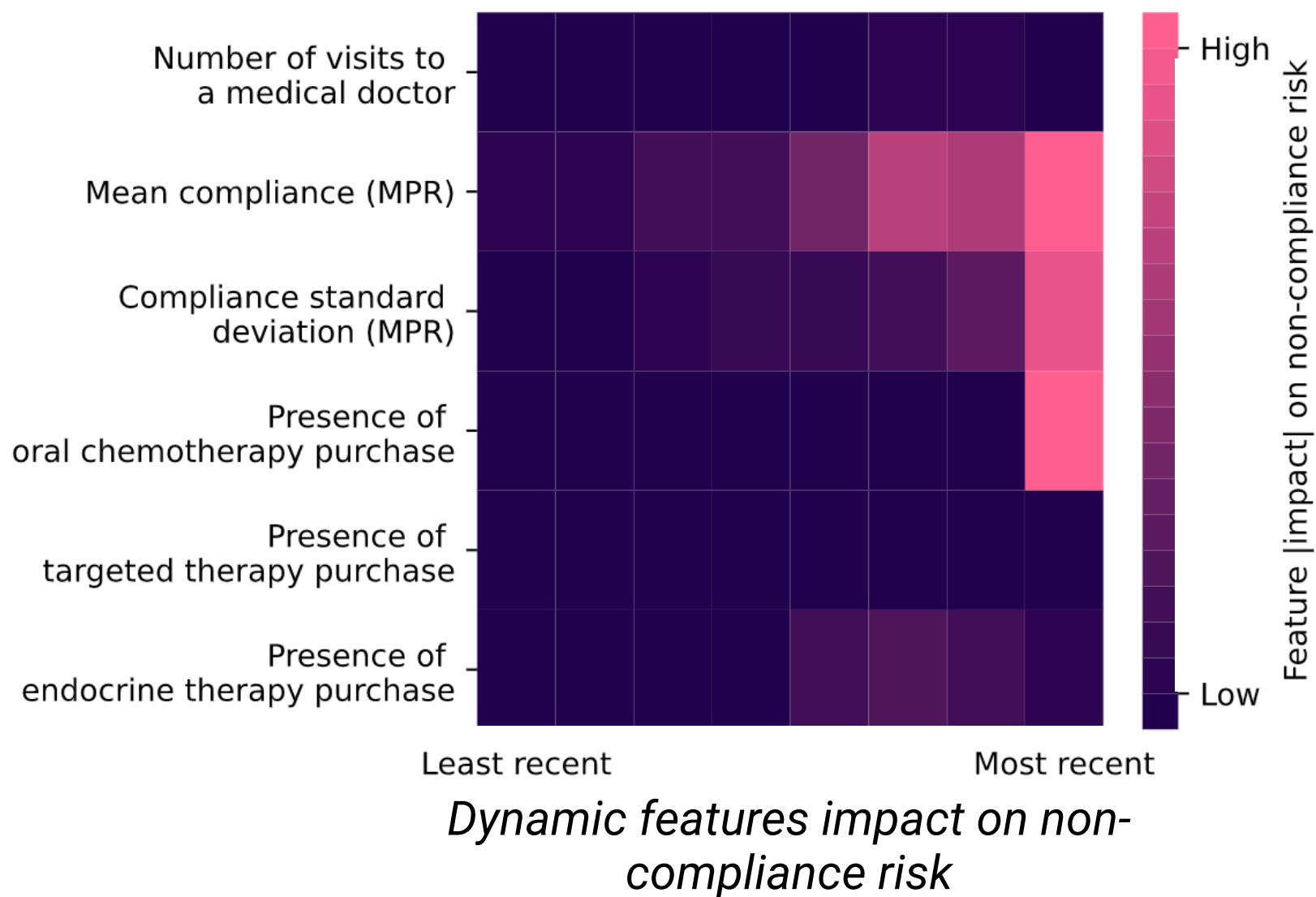
Feature	Odds-ratio	p-value
Current treatment		
Endocrine therapy	0.6	≤ 0.01
Targeted therapy	1.06	0.32
Oral chemotherapy	1.76	≤ 0.01
Other antineoplastics	1.37	0.02
Other chronic treatments	0.8	≤ 0.01
Number of treatments taken within the last year	1.03	0.14
Past behaviour		
10% MPR increase	0.98	≤ 0.01
Non persistence records	1.52	≤ 0.01
Seasonality		
April - June	0.92	0.03
July - September	0.95	0.26
October - December	1.01	0.85
Socio-economic context		
Age (quadratic modelisation)	Minimal risk at 51	
Universal health insurance*	1.49	≤ 0.01
City of residence population (log10)	1.07	≤ 0.01
Home-to-hospital distance (log10)	1.11	≤ 0.01
City deprivation index* (higher means more deprivation) [2]	0.96	≤ 0.01

*Indicators of patient's income

Logistic regression odds ratio

RESULTS - COMPLIANCE (GINI 0.37)

For the deep learning model, we can use the **Shap values** to see how much a feature impacts the non-compliance risk. A high impact can mean a positive or a negative correlation.



CONCLUSION

- Middle aged patients are more likely to be persistent and compliant.
- Past adherence and future events are highly correlated.
- Regular time interval between treatment purchases lead to an increase in compliance and persistence compared to irregular purchases.
- Consumption of oral chemotherapy in comparison to oral endocrine and targeted therapy is linked to an increased risk in both studies.
- Seasonality's impact on compliance and persistence is low, but exists.
- Patients with low incomes or living in a large urban area have higher non-persistence and non-compliance risks.
- Living far away from an hospital increases the risk of non-persistence.

REFERENCES

[1] L. Huiart, *Hormonal therapy for breast cancer : measuring adherence in medical and administrative databases* (2013)
[2] <https://www.cepidc.inserm.fr/documentation/indicateurs-ecologiques-du-niveau-socio-economique>

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