Innovative approach for a visual display of treatment sequences in early stage HER2 positive breast cancer patients treated with trastuzumab in the French national hospital database

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Background

We aimed to investigate subcutaneous adoption by displaying the treatment sequences of patients treated by intravenous or subcutaneous trastuzumab for HER2+ early breast cancer (eBC) in 2016.

To get an exhaustive and comprehensive overview of these treatment sequences, we used a data-science methodology on the French national hospital database (PMSI).

Method

PMSI database

It contains information linked to **all hospital stays in France** (medical procedures, costly drugs dispensed) as well as information on the patients (diagnostic codes, demographics).

Main patients inclusion criteria (in the PMSI)

- An hospitalization with a **malignant breast tumor** code and a **breast surgery** in 2016 (60,160 patients)
- **Without any codes for metastases** during the follow-up (44,645 patients)
- And with at least one **trastuzumab administration, IVT or SCT,** during the follow-up (3,353 patients)

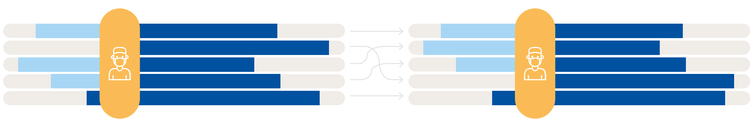
Cohort definition

- **Adjuvant cohort (AC):** 2,477 patients
  Patients without any treatment during the neoadjuvant period
- **Neoadjuvant cohort (NC):** 876 patients
  Patients with at least one treatment during the neoadjuvant period

TAK® methodology [1], in 3 steps

1. **Model** each patient treatment sequence as a timeline

2. Algorithmically **arrange** timelines through a similarity criterion (using an Agglomerative Clustering configured with the Hamming distance and the Ward linkage method)



3. **Smooth** the image to highlight distinctive patterns

How to read the TAK® graph?

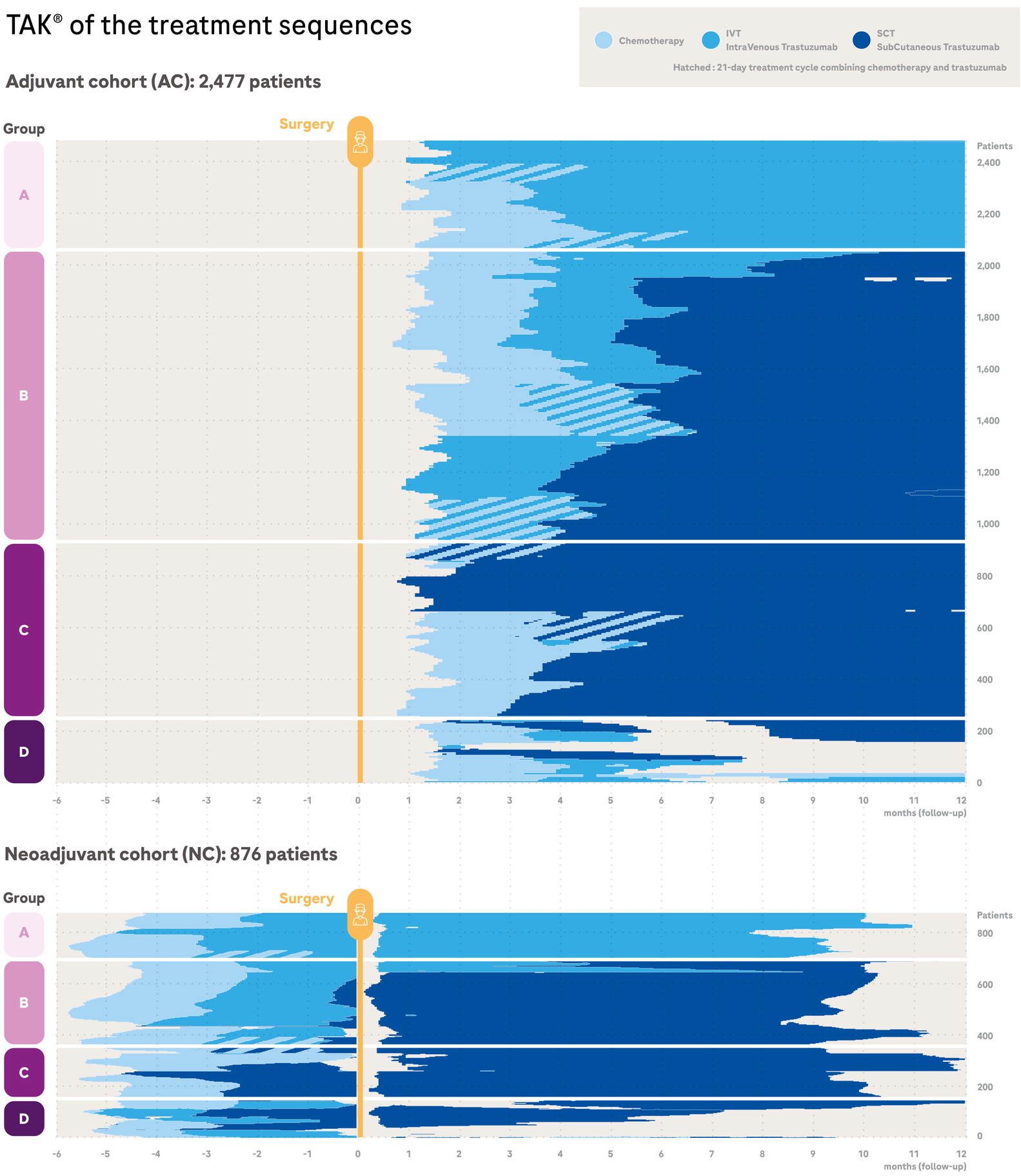
Each patient is a single horizontal line which starts 6 months before the surgery on the vertical axe at the left of the graph, and moves horizontally to the right, over the course of the 18-month follow-up.

Main limits

- The PMSI does not include oral therapies (i.e. hormonotherapy) administered outside of hospitals, which are usually part of these patients' therapy.
- Some decisions rules according to patients selection in cohorts were defined. For example, patients with a new sequence of treatment during the year after surgery were assumed to be metastatic and so were not included in the cohort.

Results

TAK® of the treatment sequences



Summary of subcutaneous adoption deduced from the TAK®

	Group A only IVT	Group B switched from IVT to SCT	Group C only SCT	Group D early treatment discontinuation
AC:	17%	45%	28%	10%
NC:	21%	39%	23%	17%

SCT have been adopted for 73% of the AC and 62% of the NC (**groups B and C**)

Among patients with early treatment discontinuation, a large proportion also adopted **SCT** (among **group D** of AC: 83% ; of NC: 87%).

Conclusion

Methodology
Machine learning approach provided a telling visual display of treatment sequences.

RWE
In this RWD study, we can highlight the large adoption of **SCT** in French HER2+ eBC patients.

Glossary

AC: Adjuvant cohort
NC: Neoadjuvant cohort
TAK®: Time-sequence Analysis through K-clustering
RWD: Real-World Data
RWE: Real-World Evidence
PMSI: Programme de médicalisation des systèmes d'information
SCT: SubCutaneous Trastuzumab
IVT: IntraVenous Trastuzumab
eBC: early breast cancer

Reference

1 C. Chouaïd et al., « Machine Learning–Based Analysis of Treatment Sequences Typology in Advanced Non–Small-Cell Lung Cancer Long-Term Survivors Treated with Nivolumab », JCO Clin. Cancer Inform., Feb. 2022, doi: 10.1200/CCI.21.00108.

Data sources

PMSI bases provided by ATIH,
Data controller: Roche; Processing implementation officer: HEVA.

Study registered under MR006 with the Health Data Hub on 24/09/2019 (Declaration of conformity n° 5209240919 of 11/09/2018).