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Analysis of treatment sequences from the French national SNIIRAM database:

case study of incident people living with HIV in 2013

Objectives

The purpose of the study was to describe the changes and discontinuations of antiretroviral combination therapy (cART[6]) (number of treatments, occurrence, duration) over the cohort of incident people living with HIV[4] (PLWHIV[5]) in 2013, included in the SNIIRAM[7] database. It also aims to experiment data mining methods to study treatment sequences.

96,423
PLWHIV in 2013/2014

3,373
Incident patients in 2013

Follow up 2 years
to describe antiretroviral drugs

Methods

From the SNIIRAM[7], we extracted PLWHIV[5] affiliated to the general insurance scheme (N=96,423) through specific chronic diseases status and/or reimbursement of HIV[4] laboratory tests and/or HIV-related hospitalizations and/or reimbursements of antiretroviral drugs in 2013. **Incident patients** (N=3,373) were followed for 2 years to **identify their cART[6]**, categorized as single, double, triple or quadruple+ combination therapies.

The treatment sequences were arranged according to a similarity criterion. It was performed by an Agglomerative Clustering algorithm configured with the Hamming distance and the Ward linkage method. The result is a graph containing one discretized timeline per patient. The lines were put in order one above the other and follow the 2-year follow-up. Finally, a smoothing was applied to the image to homogenize and highlight distinctive patterns.

The combination of Agglomerative Clustering and image processing forms an innovative methodology called **TAK[8]: Time-sequence Analysis through K-clustering.**

Results

Over the 3,373 incident patients,

- 77% started a cART in the 6 months ; for most of them it was a triple therapy (70% of the whole cohort).
- 50% initiated a triple therapy that was maintained over the two years follow-up (without window > 6 months).
- 11% received no antiviral drugs during the 2-year follow-up, 11% were only treated after 6 months and 8% stopped cART[6] at least one period during follow-up.

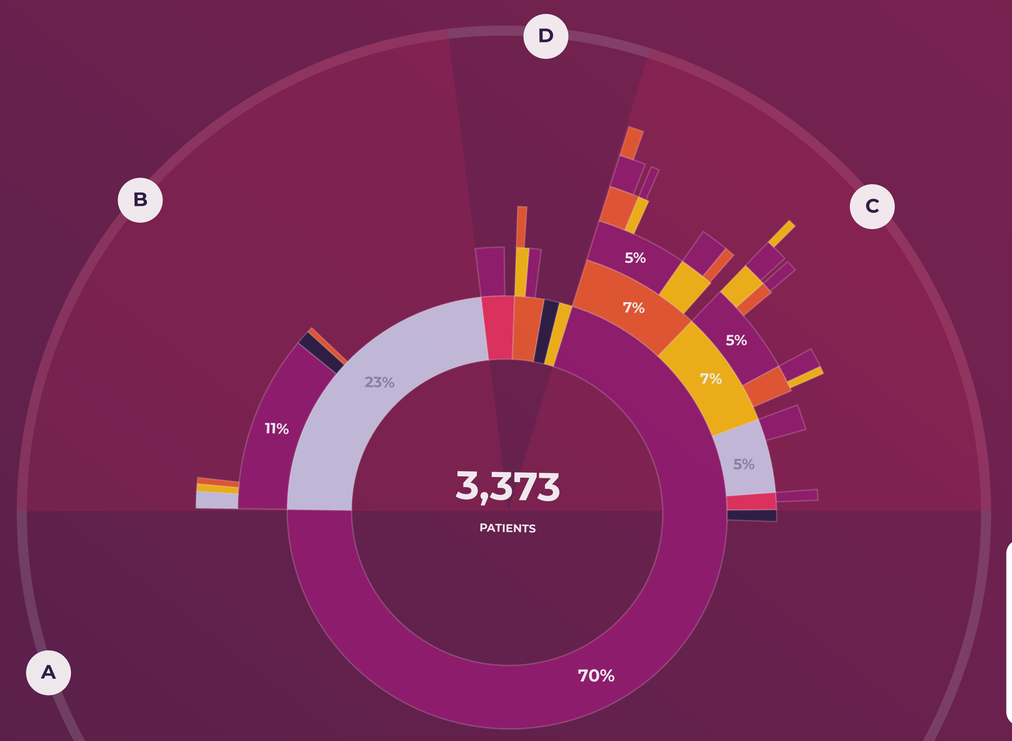
Conclusions

In 2013, a triple therapy was the reference treatment and 30% of the patients had a 6-month period without any cART[6].

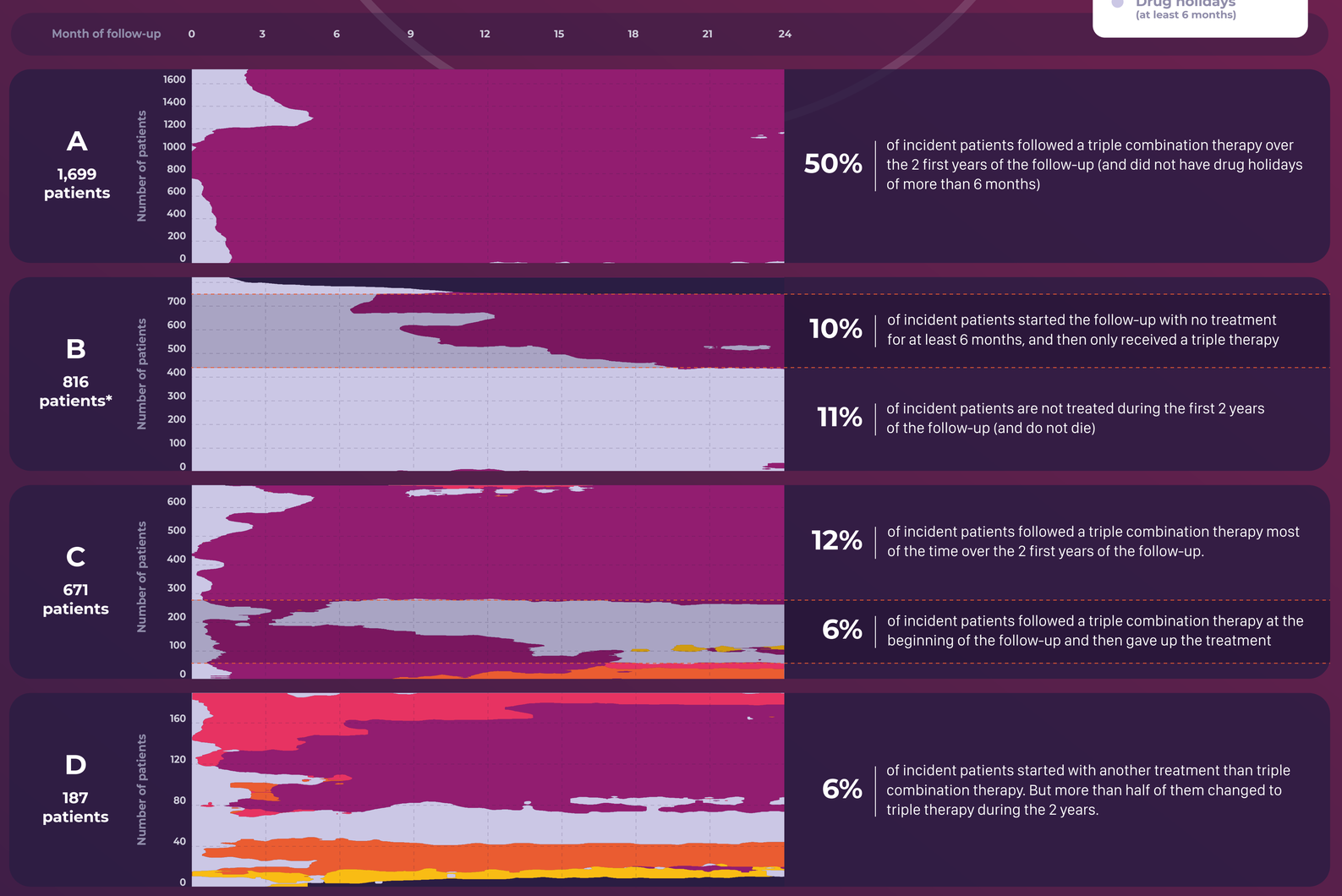
This study validates the relevance of combining clustering methods with image processing to visualize the treatment sequences of a cohort in a clear and synthetic way.

Results

SUNBURST OF TREATMENT SEQUENCES

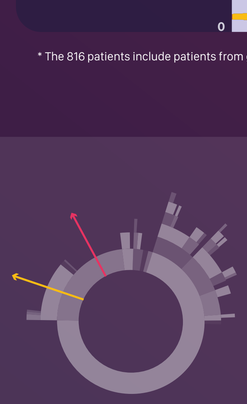


TAK[8] OF TREATMENT TIME-SEQUENCES



* The 816 patients include patients from group B and patients from group D that died during the follow-up

How to read the sunburst graph ?



The sunburst graph represents the treatment sequences of each patient of the cohort in a circular graph. Each patient starts the follow-up at the middle of the sunburst, takes a radius as a direction and moves outwards from the sunburst. However, it does not provide any information on the duration of each treatment phase.

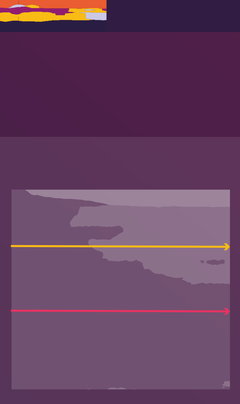
Example of patient 1

The radius representing this patient intersects only one circle, so the patient underwent only one treatment phase (which lasted the entire duration of the follow-up).

Example of patient 2

The radius representing this patient intersects 2 different circles, so he underwent 2 treatment phases. The inner-circle the radius intersects is the first phase, the second (and last) circle is the second (and last) phase.

How to read the TAK graph ?



The TAK graph represents the treatment sequences of each patient of the cohort in a linear graph. Each patient starts the follow-up on the vertical axe at the left of the graph. Then it moves horizontally to the right, over the course of the 2-year follow-up. Compared to the sunburst graph, the TAK graph specifies the temporality: we can read what patients' treatment was at each moment of the follow-up.

Example of patient 1

The arrow representing the patient goes over only one color, so he underwent only one treatment phase (which lasted the entire duration of the follow-up)

Example of patient 2

The arrow representing the patient goes over 2 different colors, so he underwent 2 treatment phases. The moment of change between the phases can be read on the horizontal scale thanks to the color change.

[4] **HIV:** Human Immunodeficiency Virus [5] **PLWHIV:** people living with HIV [6] **cART:** combinaison antiretroviral combination therapy
[7] **SNIIRAM:** French national Health Insurance database [8] **TAK:** Time-sequence Analysis through K-clustering