Using State Sequence Analysis Alongside a Cost of Illness Study: Application to the Pathway of Heart Transplant Candidates in a French Heart **Transplant Center**

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Study design: A single-center (Lyon University Hospital) retrospective cohort study







Heart transplantation (HT) is the standard of care for selected end-stage heart failure patients, with a reported median survival of 12.5 years post HT¹.

However here is still a large **imbalance** between organ **supply** and **demand** for HT.

Data on the costs and healthcare trajectories of patients listed for HT are lacking.

These could highlight the economic burden of organ shortage and the potential of strategies to expand the heart donor pool to help alleviate it 2 .

Our objective was to evaluate the economic burden and healthcare trajectories of patients awaiting HT in a French heart transplant center.

A state sequence analysis (SSA) was conducted alongside a **cost of** illness (COI) study to assess economic outcomes according to patients' pathways.



Population : †,†,†,† †,†,† †,†,†,† †,†,†,†

Adults newly scheduled on the HT waiting list from 2018/01/01 to 2020/12/31 Followed until HT surgery, death or end of the study period (2022/06/30)



Data collection from computerized medical records Baseline patient clinical characteristics Direct hospital resource consumption



- Evaluation of the economic burden of the disease: COI study Health system perspective (production costs) Costs expressed in € at 2023 price year and adjusted for inflation
- **Evaluation of healthcare trajectories: SSA**
- Six predefined states
 - Optimal Matching and agglomerative hierarchical clustering

RESULTS

92 patients included, 67 (73%) underwent HT within 2 months (median)

Mean cost per patient = €21,324



Average of 2.71 hospitalizations (main cost component)

J1 J121 J271 J421 J571 J721 J871 J1021 J1201 J1381 J1561

Four clusters identified:

<u>Type 1</u> (n=43): HT within **1 month** - €5,820 and 1 hospitalization <u>Type 2</u> (n=16): HT within **30 months** - **€22,285** and 4.12 hospitalizations <u>Type 3</u> (n=20): HT within **10 months** - $\in 27,541$ and 5 hospitalizations <u>Type 4</u> (n=13): Death within **3 months** - $\in 61,858$ and 3 hospitalizations





Fig 2: Chronograms of patient healthcare trajectories by cluster type

The X-axis represents the time from registration on the waiting list (time step = day). The Y-axis represents the relative frequency (Rel.Freq) of patients in the different states.

Chronograms were obtained from a State Sequence Analysis with six states predefined: hospitalization, medical procedure, medical consultation, heart transplantation, death, waiting list.

Optimal Matching was chosen as the dissimilarity measure method with an insertion/deletion cost of 1 and a substitution cost matrix estimated based on observed transition rates between states.

Agglomerative hierarchical clustering using Ward's criterion on the dissimilarity matrix was then performed to create homogeneous clusters of patients and optimal number of clusters was chosen using the inertia curve. Four homogeneous clusters of patients were identified (referred as "Types").

CONCLUSIONS

First economic evaluation in this indication, using waiting list enrolment as the entry point

First study characterizing patient clusters in end-stage failure, based on their healthcare trajectories

Limitations:

Data on changes in priority status while waiting for HT unavailable

Single center study, but a fairly good reflection on the national situation in terms of access to HT³ Hospital care only

Highlights the need to support strategies that can expand the heart donor pool.

REFERENCES

(1) Singh TP, Cherikh WS, Hsich E, et al. Graft survival in primary thoracic organ transplant recipients:. J Heart Lung Transplant Off Publ Int Soc Heart Transplant. 2023;42(10):1321-1333.

(2) Schroder JN, Patel CB, DeVore AD, et al. Increasing Utilization of Extended Criteria Donor Hearts for Transplantation: The OCS Heart EXPAND Trial. JACC Heart Fail. 2024;12(3):438-447. doi:10.1016/j.jchf.2023.11.015

(3) Legeai C, Coutance G, Cantrelle C, et al. Waitlist Outcomes in Candidates With Rare Causes of Heart Failure After Implementation of the 2018 French Heart Allocation Scheme. Circ Heart Fail. 2024;17(2):e010837

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