INTEGRATING THE CARBON FOOTPRINT INTO HEALTH TECHNOLOGY ASSESSMENT IN FRANCE: THE EXAMPLE OF THE HEALTHCARE PATHWAY FOR CHRONIC LYMPHOCYTIC LEUKAEMIA

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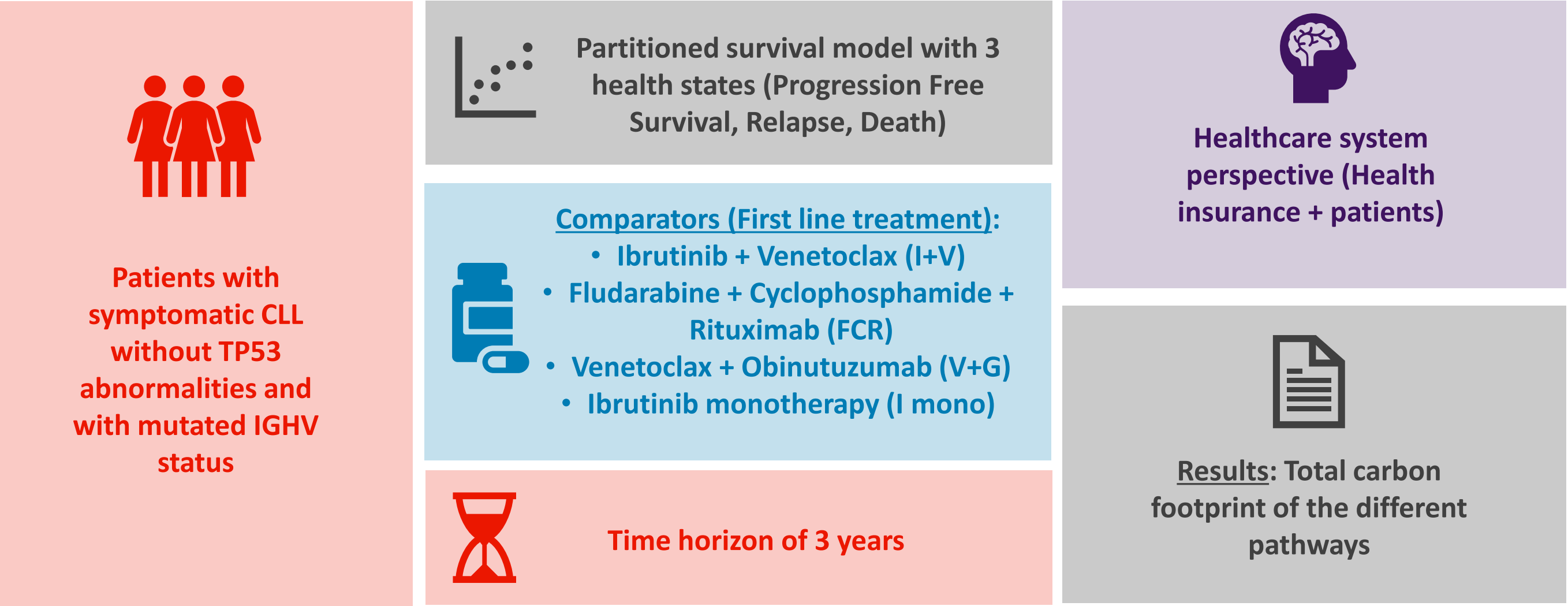7 – UVSQ, UFR Santé, Montigny le Bretonneux; CESP, Villejuif

CONTEXT

❑ Nowadays, the **carbon footprint** of a healthcare product is not included in the health technology assessment (HTA) process in Europe as in France. The European Regulation did not incorporate this environmental criterion in the five non-clinical assessment areas of HTA. However, it will become increasingly important in the decisions taken by health authorities, as the recently published institutional roadmaps suggest.

❑ This type of study would inform healthcare professionals about the impact of their therapeutic choices. For example, it is interesting to compare the carbon footprints of different oncology treatments, which do not necessarily have the same duration or the same mode of administration.

8% Of total greenhouse gas (GHG) emissions in France comes from the healthcare system, equivalent to

50M Tonnes of CO2 equivalent (The Shift Project, 2023) [1]

OBJECTIVES

The aim of this research is to assess the feasibility of integrating the carbon footprint indicator into health technology assessment and to illustrate such an approach on the example of the first line chronic lymphocytic leukaemia (CLL) pathways in France.

METHODS

❑ The various methods of integrating carbon impact into the results of an HTA study were analysed through a literature review, which also facilitated the **structural choices** for the modelling (see Figure 1).

FIGURE 1: Structural choices of the carbon footprint model

Patients with symptomatic CLL without TP53 abnormalities and with mutated IGHV status

Partitioned survival model with 3 health states (Progression Free Survival, Relapse, Death)

Comparators (First line treatment):
• Ibrutinib + Venetoclax (I+V)
• Fludarabine + Cyclophosphamide + Rituximab (FCR)
• Venetoclax + Obinutuzumab (V+G)
• Ibrutinib monotherapy (I mono)

Time horizon of 3 years

Healthcare system perspective (Health insurance + patients)

Results: Total carbon footprint of the different pathways

→ **A model integrating carbon emissions** was developed to compare various healthcare pathways associated with the different treatment options in first line of chronic lymphocytic leukaemia (CLL).

❑ In order to estimate the overall carbon footprint of the pathway (see Figure 2), **emission factors** associated with the various activity data were collected (see Table 1).

FIGURE 2: Estimation of carbon footprint

Carbon emissions (Carbon footprint of a health product/pathway) = **Activity data** (€, km, day, unit,...) X **Emission factor** (kgCO2e/activity data)

TABLE 1: Emission factors associated to activity data

Activity data	Emission factor	Unit	Source
Hospital stays	220,40	kgCO2e / hosp. day	AP-HP carbon assessment [2]
Home hospitalisation stays	9,24	kgCO2e / hosp. day	The Shift Project / ADEME [1]
Medical consultations	3,80	kgCO2e / consultation	Coustal thesis, 2023 [3]
Imaging procedures	2,53	kgCO2e / procedure	AP-HP carbon assessment [2]
Transport (to lab)	2,09	kgCO2e / transport	Laville et al., 2016 [4]
Pharmacy consultations	1,20	kgCO2e / consultation	The Shift Project, 2023 [1]
Biological tests	0,19	kgCO2e / test	Spoyalo et al., 2023 [5]
Mailing	0,049	kgCO2e / mailing	La Poste / Quantis [6]

As drugs carbon footprint (CF) contributes to an important part of the overall healthcare pathway CF, various estimation methods for estimating the drug emission factor have been explored:

➢ **Proxy by monetary ratio: 0.5 kgCO2e/euro** → Value based on an average basket of medicines and therefore difficult to apply to a specific treatment [7]

➢ **Medicine Carbon Footprint method:** Unreliability because methodology doesn't integrate all stages of the life cycle [8]

➢ **Common method for calculating drugs CF** such as Life Cycle Assessment/EcoVamed database/Standardised drugs CF methodology: Data not yet available [9]

However, these methods have significant limitations or are not available, preventing their use to robustly estimate drugs CF.

RESULTS

❑ As a preliminary remark, we draw your attention to the fact that these results do not take into account the drugs CF but only the pathways CF.

❑ The carbon footprint (CF) of the various CLL pathways expressed in kgCO2 equivalent, was calculated and shows variability between treatments. The estimated carbon footprint of the I mono and I+V pathways is lower than that of the V+G or FCR pathway (see Figure 3 and Table 2).

FIGURE 3: Carbon footprint of the different pathways, without drugs CF, for each treatment, in kgCO2e [10]

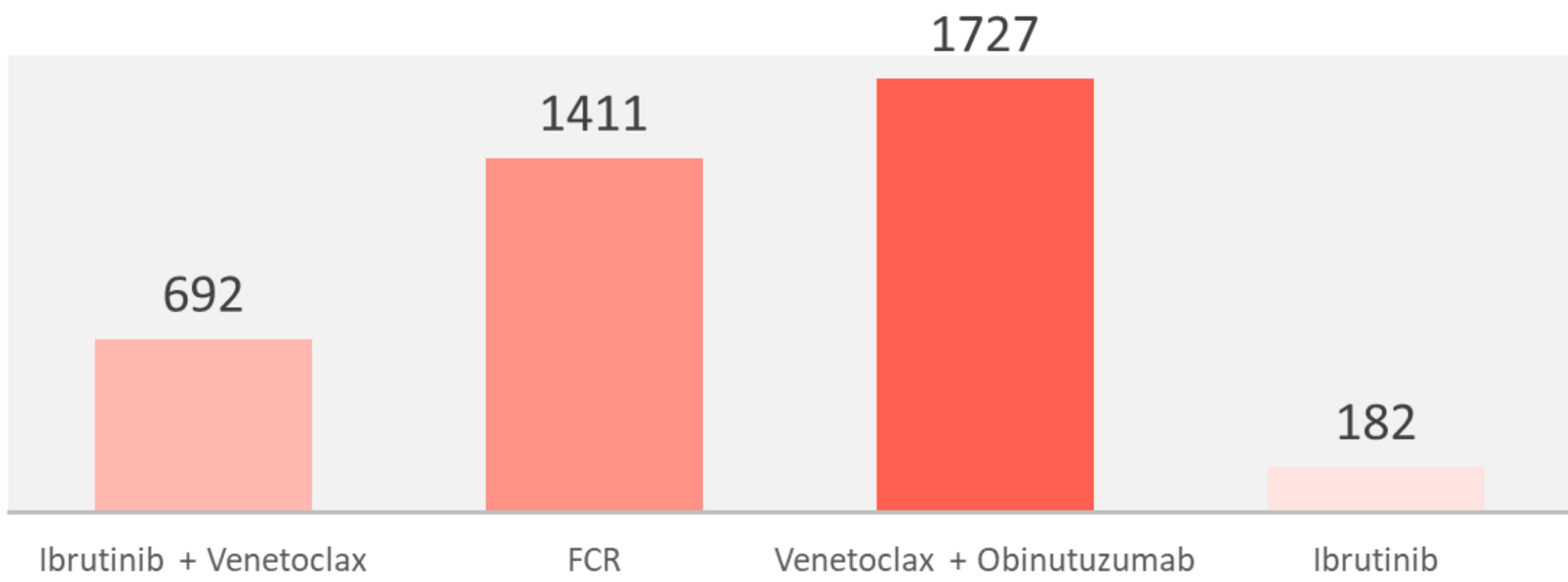| Ibrutinib + Venetoclax	FCR	Venetoclax + Obinutuzumab	Ibrutinib
692	1411	1727	182

TABLE 2: Disaggregated results in terms of life years and carbon footprint of each pathway (for an average patient over 3 years)

	I+V	FCR	V+G	I mono
Life years	2,72	2,51	2,51	2,72
Carbon footprint (kgCO2e)	692	1411	1727	182

❑ Pending the adoption of the common methodology for estimating the drugs CF, it is preferable to exclude it in order to avoid misinterpretation. **Consequently, the results concerning the global environmental impact of each pathway cannot be used as a basis for decision-making.**

DISCUSSION

To date, this study is **one of the first examining the carbon footprint of a hematology treatment pathway**. Determining CF in our emitting specialities will constitute major challenges in the future. [11]

Drugs CF are currently associated with **high degree of uncertainty** or not available. Standard methods and tools that are pragmatic and easy to understand for healthcare decision-makers are therefore required.

The adoption of the common methodology by the French administration in February 2025 will make it easier to compare drugs CF. However, its implementation is a medium-term perspective, as it will require time for industrials to adopt and deploy it.

New methods are under investigation to calculate aggregated ratios directly including the usual incremental cost-effectiveness ratio and the carbon footprint, in order to obtain a fully-fledged "medico-economic-environmental" analysis (as suggested by the HAS "Health-Environment" roadmap), but **comparison and interpretability remain limited.** The final decision between different care pathways requires a potential trade-off between the effectiveness and low environmental impact of a treatment.

CONCLUSION

Without drugs carbon footprint, the carbon impact of CLL pathways is mainly determined by the administration of IV treatments (if any) requiring hospitalisation. However, these results should be interpreted with caution and **cannot be used as they stand. Moreover, the availability of more comprehensive emission factors data should enable to obtain and compare the carbon impact of complete CLL healthcare pathways.**

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