Environmental impact of switching from intravenous to subcutaneous infliximab in inflammatory bowel disease: a carbon footprint analysis in France

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BACKGROUND

- Inflammatory bowel disease (IBD) is a chronic disease involving long-term care with multiple therapeutic strategies.
- Infliximab is available in both intravenous (IV) and subcutaneous (SC) formulations, with equivalent clinical efficacy and reduced organizational burden for SC.
- The environmental footprint of switching from IV to SC across the IBD care pathway remains unexplored in the French context.
- This study compares carbon emissions across the IBD care pathway in France.

METHODS

- Based on the Shift Project framework and structured similarly to a budget impact model, a bottom-up approach was used to quantify carbon emissions across IBD care pathway over one-year time horizon.
- The model compared two scenarios (Figure 1):
  - No-switch scenario: All eligible IBD patients remaining on IV infliximab.
  - Switch scenario: Eligible IBD patients switching from IV to SC infliximab.
- Emissions sources assessed in the IBD pathway:
  - Infliximab carbon footprint: carbon emissions based on its formulation (IV or SC).
  - Treatment administration: carbon emissions associated with IV infusion sessions.
  - Patient transport: carbon emissions associated with travel to hospital or community pharmacy for treatment collection/administration.
- Data used:
  - The Shift Project report on healthcare system carbon emissions in 2023[1].
  - « *Empreinte®* » database of the French Agency for Ecological Transition (ADEME) for emission factors and published life cycle assessment (LCA) of biological drugs[2] and carbon footprint of IV infusions administration[3].
  - Clinical data of the target population and IV/SC switching rate based on the 2023 French report of « *Observatoire national des MICI* »[4].

RESULTS

- At the patient level, the annual carbon footprint was estimated at 542 kgCO2e for IV and 579 kgCO2e for SC infliximab (Figure 2). For a total target population of 327,635 IBD patients in France, with 9% treated with infliximab, switching from IV to SC resulted in an overall increase of 3% in total carbon emissions over one year equivalent to 524 tCO2e (Figure 3).
- Despite the higher overall carbon footprint associated with SC infliximab, this formulation reduced carbon emissions in patient transport (-22%) and treatment administration (-38%), driven by a lower frequency of hospital-based infusions (Figure 2).
- Sensitivity analyses, with a ± 20% variation, confirmed that the three parameters with the greatest influence on total carbon emissions were the number of IV infusions, the number of SC injections, and the SC formulation posology (Figure 4).

Figure 1. IBD care pathway scenarios

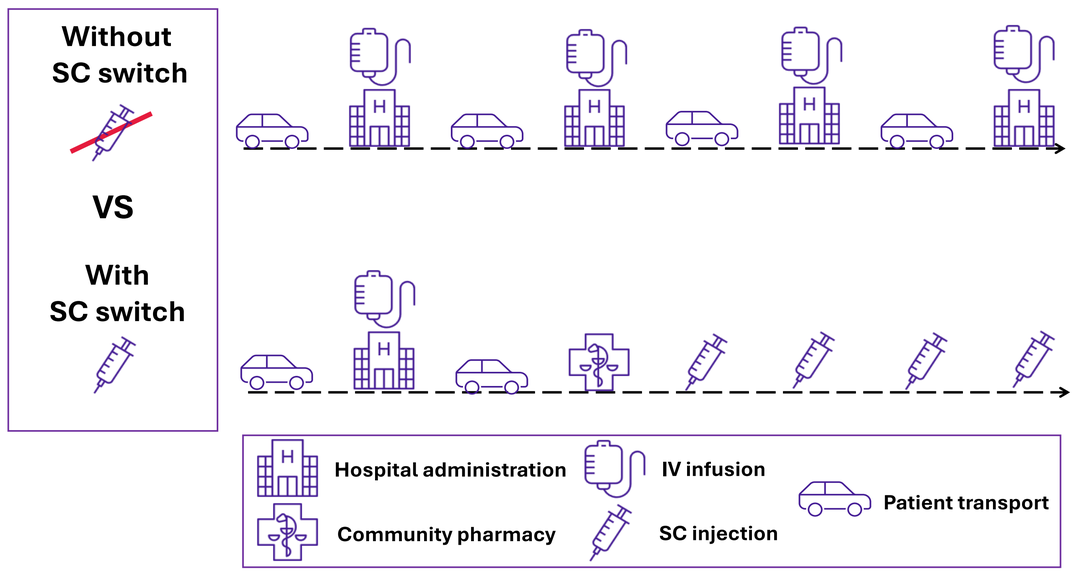


Figure 2. Carbon emissions per patient by source for IV and SC formulation over one year

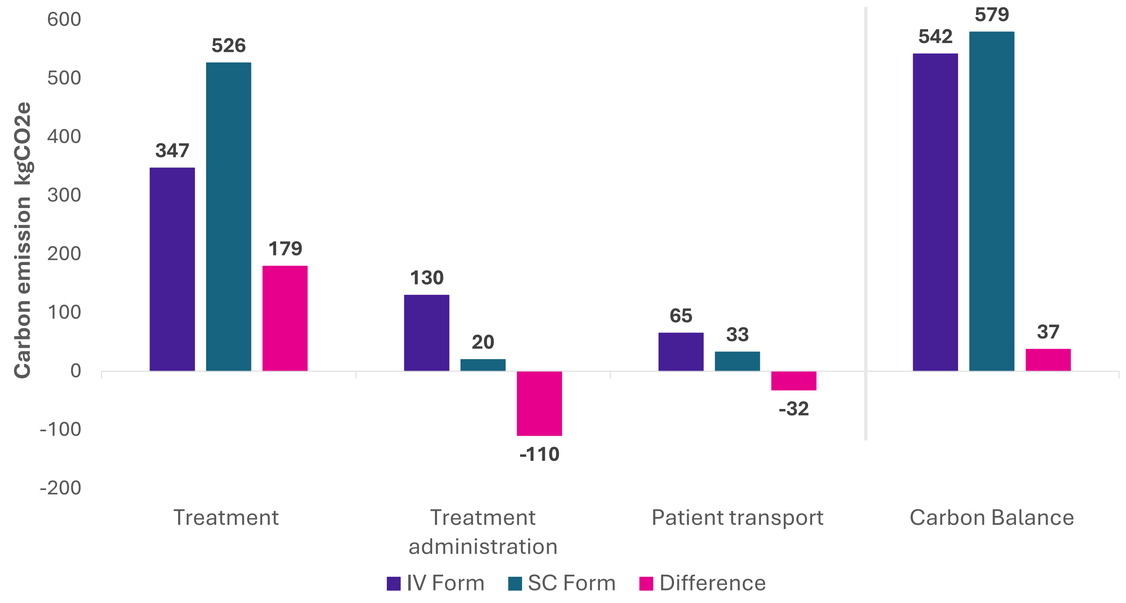


Figure 3. Total carbon emissions on the target population over one year

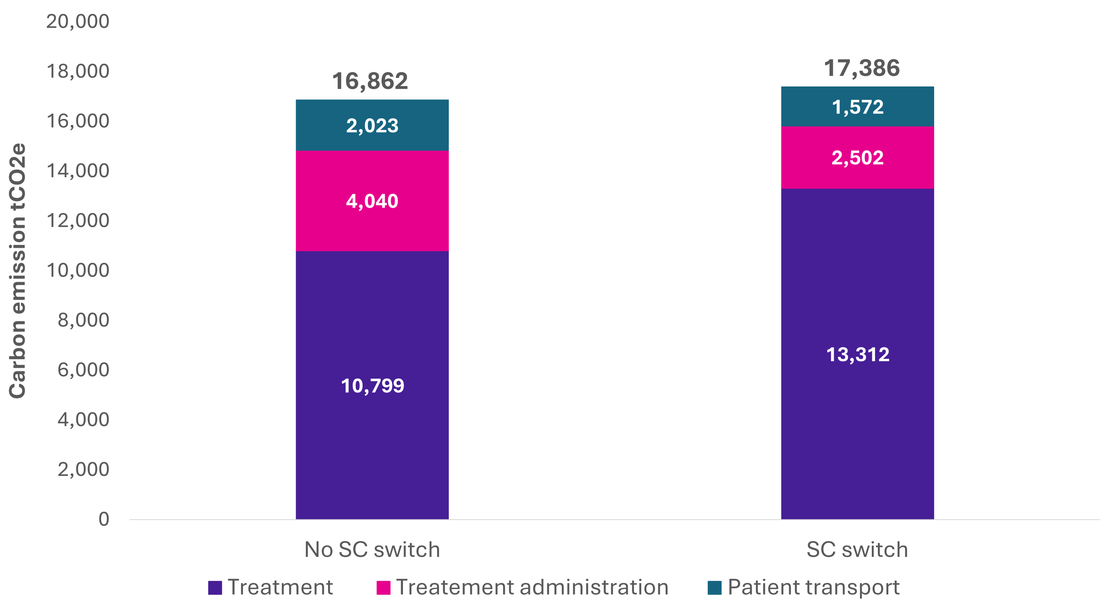
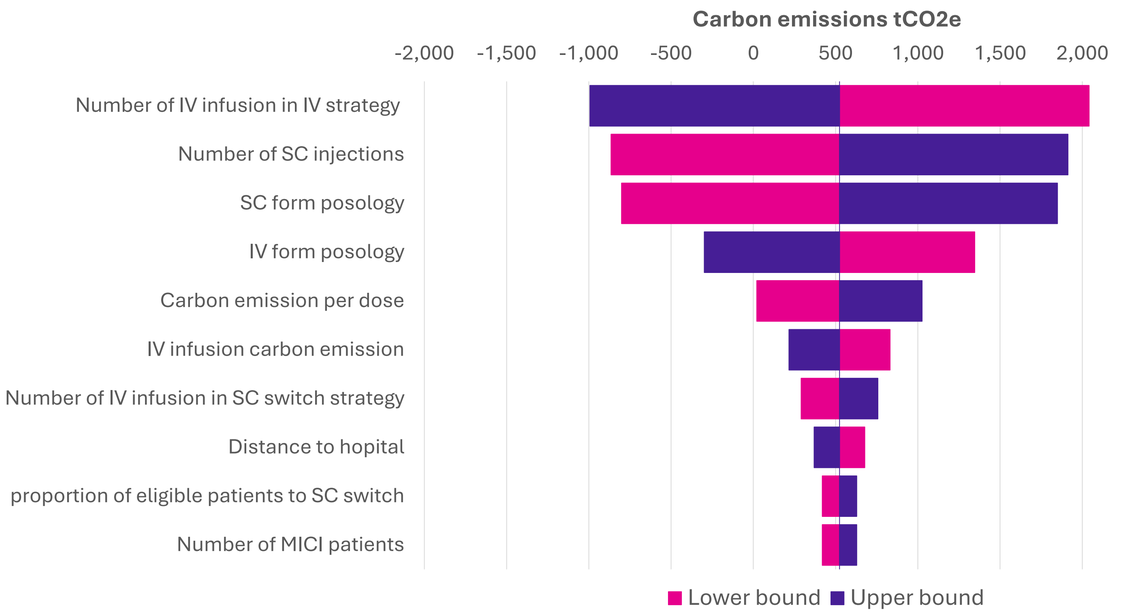


Figure 4. Deterministic sensitivity analysis



CONCLUSION

- Switching from IV to SC infliximab carried a higher overall carbon footprint than IV, resulting in a net increase in total carbon emissions and consistent with *Oliveira et al.*[5] analysis who reported a higher carbon footprint for SC compared to IV, 24.15 and 20.95 kgCO2e/patient over 6 months, respectively.
- Despite its higher total carbon footprint, SC infliximab was associated with reductions in transport and administration-related emissions driven by a lower infusion frequency. Similar observations were made by *Cartledge et al.*[6] with lower transport-related emissions for SC (0.018 kgCO2e/patient) than IV (6.10 kgCO2e/patient), suggesting the strong correlation between the drug dispensing practices and its environmental impact.
- A comprehensive environmental assessment integrating additional emission sources, such as day hospitalization and endoscopy, is required to fully capture the environmental impact of this intervention.

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ABBREVIATIONS

IBD, Inflammatory bowel disease
IV, Intravenous
SC, Subcutaneous

DISCLOSURES

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