Poster 6934

Climate impact of CAR-T cell therapy in the Netherlands: A comparison on the use phase emission between standard of care and CAR-T cell therapy in hemato-oncology

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CONCLUSIONS

- Healthcare-related CO2e emissions from axi-cel and brexu-cel for various indications are comparable to those of the standard of care (SOC) over a 5-year use-phase horizon.
- Monitoring visits and patient travel are the largest contributors to emissions across all treatment pathways. Post-progression patients generate higher monthly CO2e emissions than progression-free patients.
- SOC emissions may be underestimated, as subsequent therapies were not included in the current analysis.
- A full life cycle assessment (LCA), encompassing all six cradle-to-grave phases, is needed to accurately capture the total environmental impact of CAR-T cell therapies.

PLAIN LANGUAGE SUMMARY

- This study looked at the carbon footprint of two CAR-T cell therapies – axi-cel and brexu-cel – used in the Netherlands for the treatment of various hemato-oncological indications.
- Over five years, the emissions from these treatments were similar to those from standard of care. Most emissions came from hospital check-ups and patients traveling to appointments.
- To fully understand the environmental impact of these therapies, a more complete analysis covering all phases, is needed.

BACKGROUND

- The healthcare sector is a major contributors to global greenhouse gas (GHG) emissions.[1]
- Health technology assessments (HTAs) are increasingly integrating environmental impact metrics to support sustainable decision-making in care delivery.[2]
- CAR-T cell therapies like axi-cel (Yescarta®) and brexu-cel (Tecartus®) offer innovative treatment options for hematological cancers. Despite their clinical value, the environmental impact of these therapies is not well understood.

OBJECTIVE

- This study aimed to quantify the CO2 equivalent (CO2e) emissions from the use phase, as one out of six cradle-to-grave phases of axi-cel and brexu-cel versus standard of care (SOC) in the Netherlands, with the goal of understanding their environmental impact within the healthcare sector.

METHODS

- This appraisal considers the use-phase CO2e emissions over a 5-year time horizon, focusing on healthcare-related activities such as hospitalizations, drug administrations, and patient travel.
- The functional unit for this appraisal is 1 patient undergoing a treatment in the Netherlands.
- Survival estimates and healthcare resource use (HCRU) were based on the published health technology assessments (HTA) of axi-cel as a second-line treatment for diffuse large B-cell lymphoma (2L DLBCL; **Table 2 and Figure 1**) and of brexu-cel as a mantle cell lymphoma (MCL) and acute lymphoblastic leukemia (ALL) and are based on primary data (data not shown).[3-5]
- Emissions data were based on secondary data from publicly available, mainly Netherlands-specific sources (**Table 1**).
- It is assumed that the average travel distance to hospitals is 14.2 km and 2.0 km to a GP.[6]

Table 1. Data sources used to inform GHG emissions

Healthcare resource use (HCRU)	GHG emissions (kg CO2e)	Source
Hospitalization day	29.00	Kaas *et al.* (2025)[7]
Outpatient visit	13.90	Kaas *et al.* (2025)[7]
Intensive care unit (ICU) day	70.90	Stobernack *et al.* (2024)[8]
General practitioner (GP) visit	0.26	Houziel *et al.* (2022)*[9]
Nurse visit	0.26	Assumption; same as GP
CT scan	5.10	Kaas *et al.* (2025)[7]
Complete blood count (CBC)	0.43	Moses *et al.* (2024)*[10]
Liver function test	0.23	Spoyalo *et al.* (2023)*[11]
Renal function test	0.10	Spoyalo *et al.* (2023)*[11]
Calcium phosphate	0.04	Spoyalo *et al.* (2023)*[11]
Immunoglobulin	0.04	Assumption; same as calcium phosphate
Serum LDH	0.04	Assumption; same as calcium phosphate
Car travel per km	0.15	Milieucentraal (2025)[12]

*These data sources are not specific to the Netherlands. No Netherlands-specific data sources could be identified.

Table 2. Healthcare resource use (HCRU) for axi-cel and SOC for 2L DLBCL used as input values[3]*

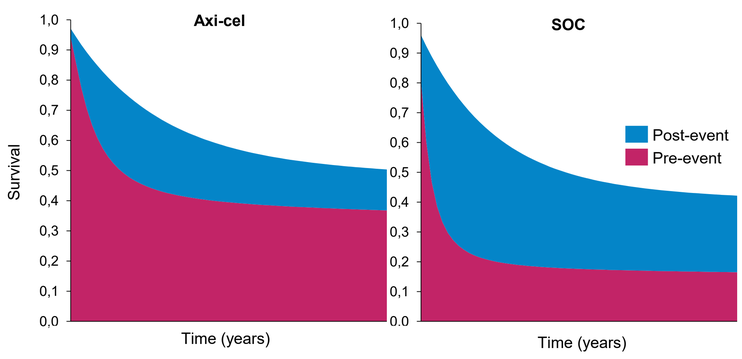
HCRU	Frequency per month	GHG emissions (kg CO2e)
Pre-event		
GP visit	0.94	0.24
Nurse visit	2.14	0.48
Outpatient visit (month 1-6)	0.69	9.59
Outpatient visit (month 7-12)	0.34	4.73
Outpatient visit (year 2-3)	0.20	2.78
Outpatient visit (year 4-5)	0.14	1.95
Inpatient hospital days	0.18	5.22
Diagnostics	-**	2.55
Post-event		
GP visit	2.50	0.64
Nurse visit	1.88	0.48
Outpatient visit	1.00	13.90
Inpatient hospital days	0.16	4.64
Diagnostics	-**	0.67

*HCRU is based on health state (pre-event and post-event; see Figure 1). It is assumed that the HCRU frequency is equivalent for both axi-cel and SOC in accordance with HTA reports.[3]
**Diagnostics concerns a combination of various tests (see Table 1) with varying frequencies.

Treatment phase	Number of hospital days	GHG emissions (kg CO2e)
Treatment – axi-cel		
Apheresis	1	29.00
CAR-T cell administration	29	290.00
Cytokine release syndrome	0.12 (2 days* x 6% of patients)	8.51
Treatment – SOC		
Chemotherapy	3.90	113.10
SCT	7.20 (20 days x 36% of patients)	208.80

*Management of cytokine release syndrome is assumed to result in 2 ICU days.

Figure 1. Survival estimates of 2L DLBCL as input values[3]

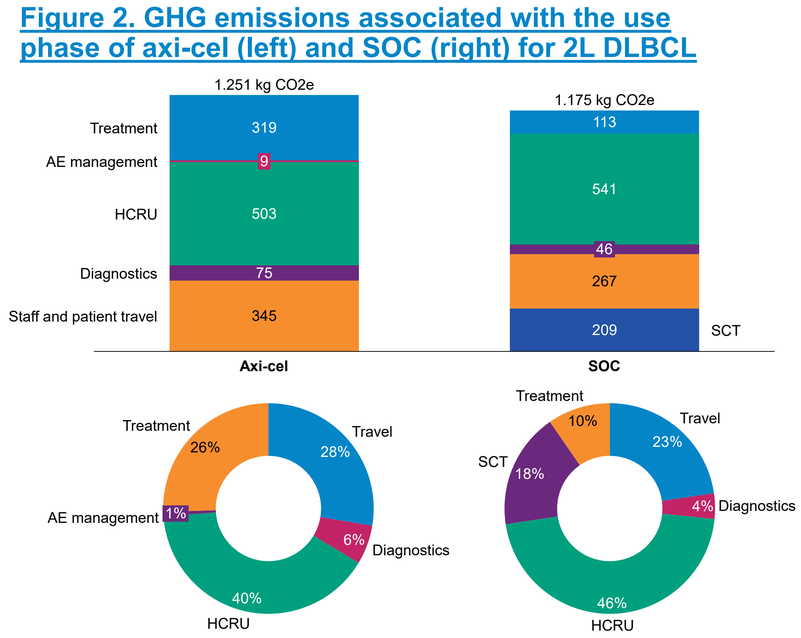


RESULTS

Axi-cel for 2L DLBCL

- Over a 5-year time horizon, the total use-phase CO2e emissions were 1,251 kg CO2e for axi-cel and 1,175 kg CO2e for SOC (**Figure 2**).
- Monthly emissions were higher for post-progression patients (27.1 kg CO2e) than for progression-free patients (20.7 kg CO2e).
- The main contributors to emissions for axi-cel were monitoring visits (40.2%; 503 kg CO2e), patient travel (27.3%; 345 kg CO2e), and infusion and hospitalization (25.5%; 319 kg CO2e).
- For SOC, the main contributors to emissions were monitoring visits (43.2%; 541 kg CO2e) and patient travel (21.3%; 267 kg CO2e).

Figure 2. GHG emissions associated with the use phase of axi-cel (left) and SOC (right) for 2L DLBCL



Brexu-cel for ALL and MCL

- The overall GHG emissions for brexu-cel in ALL were comparable to those reported for axi-cel in DLBCL, indicating that both treatments have a similar carbon footprint (data not shown).
- For ALL, the estimated GHG emissions were significantly higher for axi-cel (940 kg CO2e) compared to the SOC at 420 kg CO2e, using the same methodology applied to brexu-cel in 2L DLBCL (data not shown). This difference is attributed to the fact that SOC for MCL does not include stem cell transplantation, and there is a more notable difference in overall survival between the two treatment options (~15% at 5 years for SOC versus ~40% for axi-cel).[5]

AUTHOR CONTRIBUTIONS

Study design: all authors. Data collection and analysis: MvW. Interpretation: all authors. Drafting and final approval of abstract and poster: all authors.

DISCLOSURES

This study was funded by Gilead. MvW and RF were IQVIA employees at the time of the study execution. ABdR was a Gilead Sciences employee at the time of study execution.

CORRESPONDANCE

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