Reducing the Carbon Footprint of Intravitreal Injections

Rita Mary Tomy, Daniel Dinarvand, Neil Finer

NHS
Ashford and
St. Peter's Hospitals
NHS Foundation Trust

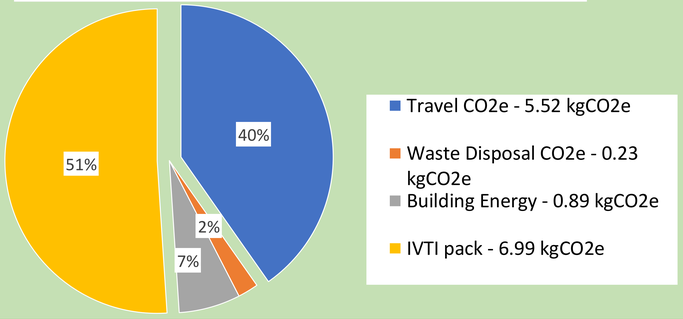
PURPOSE

- To compare the carbon footprint of a single intravitreal injection at two sites within a single NHS Trust with different demographic characteristics.
- This study uniquely focuses on a UK NHS setting serving distinct urban and semi-urban populations.

METHOD

- A hybrid (weight-based) Life Cycle Analysis and (cost-based) Input-Output Model was used to calculate the carbon footprint of intravitreal injections.
- A questionnaire captured mode of transport for patients and staff to calculate travel-related carbon emissions.
- The data on building energy use per square metre was obtained from the Trust's Estates & Facilities department. Emissions from dedicated injection service spaces at both sites were calculated using the latest UK Government Greenhouse Gas (GHG) conversion factors. 1
- Weight-based waste emissions were estimated using GHG conversion factors.
- Cost based Input-Output modelling was used to calculate carbon emissions associated with procurement of injection packs.
- Although we know that anti-VEGF drugs contribute significantly to carbon emissions, there is no reliable data on which to base differential emission estimates for the various drugs. A cost-based Input-Output model is misleading due to wide variation in costs. In common with previous studies, we have therefore excluded the contribution of anti-VEGF agents from this audit.
- Carbon footprints were compared between the two centres to assess the impact of population density and other demographic factors (eg, levels of affluence).

Figure 1: Carbon Footprint of a Single Intravitreal Injection divided into Primary Sectors of GHG Emissions



RESULTS

- A single intravitreal injection was estimated to produce 13.63kg CO2 eq, after excluding the contribution of the anti-VEGF agent. (Figure1)
- The largest carbon contributor in our study was the IVTI pack (6.99 kgCO2e), accounting for 51% of the total carbon emissions. (This is calculated by means of a cost-based Input-Output model, which can result in overestimation.)
- Patient travel contributed 40% of carbon emissions (5.52 kgCO2e). A significant difference was noted between the two centres studied: 6.56kgCO2e (urban) vs 5.81kgCO2e (semi-urban, Figs 2-3). The average roundtrip distance for the urban population was 24.1 miles, vs 21.5 miles for the semi-urban population.
- Through observation of injectors, it was noted that the commonest method of waste disposal was incineration, which is significantly more carbon-intensive than recycling. Waste emissions contributed 2% of the (0.23 kgCO2e) of the total IVTI carbon footprint (higher than previous studies), prompting a review of our practices and our recycling strategy.

REFERENCES
1. Department for Energy Security and Net Zero (2024) *Greenhouse gas reporting: conversion factors 2024*. Available at: https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2024
2. Power B, Brady R, Connell P. Analyzing the carbon footprint of an intravitreal injection. *J Ophthalmic Vis Res*. 2021 Jul 29;16(3):367–376. doi:10.18502/jovr.v16i3.9433

Figure 2: Travel data aggregate of Ashford hospital (Urban population)

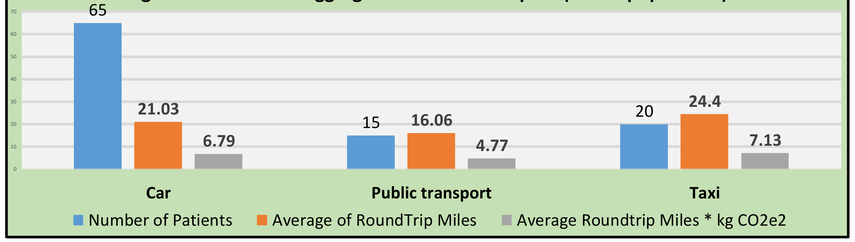
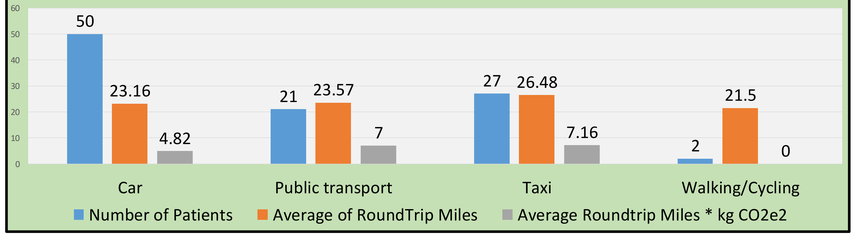


Figure 3: Travel data aggregate of St Peter's Hospital (Semi Urban population)



CONCLUSION

Whilst previous studies have identified patient travel as the primary source of IVTI-related carbon emissions, the contribution of travel is not uniform. Our findings show considerable discrepancies even as between neighbouring areas, influenced by variable travel distances and uptake of electric vehicles, which in turn reflect differences in population density and affluence. It is also noteworthy that, in our setting, patient travel accounts for 40% of the total carbon footprint. This is considerably lower than the 77% reported by Power et al.2 This highlights the need for localised assessments by units to guide effective carbon reduction strategies.

Since completing this audit, we have switched to a new intravitreal injection pack comprising some biodegradeable materials and containing only essential items, with the goal of reducing waste-related emissions. Additional measures under consideration include greater use of one-stop injection clinics, more effective distance-based appointment scheduling, and piloting of mobile injection units. A re-audit is planned to assess the environmental impact of these interventions.