Assessing the Environmental Value of Semaglutide: GHG Emissions Reduction Resulting from the Treatment of Obese Individuals with Type 2 Diabetes

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HSD8

01 BACKGROUND

- Obesity is a significant issue faced by modern day society, with 64.5% of adults in England being overweight (body mass index [BMI] 25 – 29.9) or obese (BMI >30).[1]
- Obese individuals have a greater risk of co-morbidities, such as coronary heart disease and type 2 diabetes (T2D).[2]
- Healthcare resource utilisation (HCRU) and associated healthcare costs increase with BMI, which is largely driven by co-morbid conditions.[3]
- Semaglutide treatments (glucagon-like peptide-1 [GLP-1] receptor agonists) have been approved for the management of obesity and T2D in England.[4]
- These treatments reduce BMI by ~15% within 68 weeks and improve cardiometabolic risk factors.[5–7]
- Healthcare is a significant contributor to greenhouse gas (GHG) emissions.
- The National Health Service in England has set the target of becoming net-zero by 2045 for direct and indirect emissions.[8]

02 OBJECTIVE

- The objective of this study was to evaluate the environmental impact of semaglutide treatment by estimating the GHG emissions, measured as carbon dioxide equivalents (CO_2e), associated with HCRU in obese individuals with T2D, with and without semaglutide treatment.

03 METHODS

Table 1. Data inputs, assumptions, and source references used to inform key study inputs.

Data	Data value	Assumptions	Reference(s)
Eligible patient population	3,400,000	Tirzepatide has a similar eligible patient population (comparable marketing authorisation patient eligibility criteria to semaglutide)	National Institute for Health and Care Excellence (2024)[11]
BMI relative distribution	Extrapolated from graph: "Trend in the distribution of adult BMI", 2016-2018 data	BMI relative distribution has not significantly changed since 2016-2018	Hancock (2021)[12]
BMI reduction over 1 year	15%	BMI reductions observed in clinical trials will translate into real-world outcomes	Wilding *et al.* (2021),[5] Davies *et al.* (2021),[6] Wadden *et al.* (2021)[7]
HCRU per BMI category	Data from Table 2.c., "T2D population baseline characteristics (n = 68,489)"	N/A	le Roux *et al.* (2018)[2]

BMI, body mass index; HCRU, healthcare resource use; N/A, not applicable; T2D, type 2 diabetes.

- The functional unit of this study was defined as the annual GHG emissions arising from HCRU per an obese individual (BMI ≥30) with T2D in England, with and without semaglutide treatment.
- Data for the eligible patient population, BMI distribution, BMI reduction with semaglutide treatment, and HCRU per BMI category were sourced from published literature (**Table 1**).
- CO_2e values for GP visits, accident and emergency (A&E) visits, hospitalisations, and patient travel were sourced from the Sustainable Healthcare Coalition and published literature (**Table 2**).
- Prescription costs were converted to CO_2e using an emissions factor of 0.546.[9]

Table 2. Data sources and assumptions for calculating GHG emissions resulting from HCRU

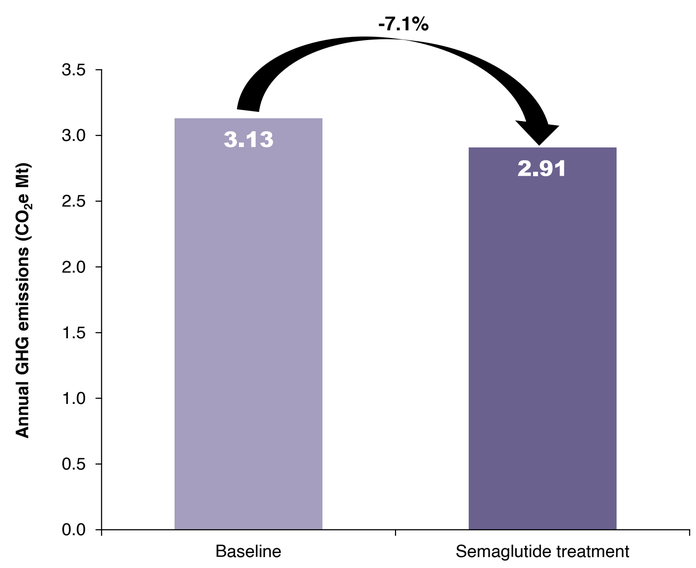
Care pathway component	Care pathway sub-component	GHG emissions (CO_2e) per care pathway sub-component	Unit	Total GHG emissions (CO_2e) per care pathway component	Assumptions	Reference(s)
GP visit	GP appointment	1.10	Per visit	2.22	N/A	SHC Carbon Factors Table[13]
	Patient travel to GP	1.12	Per round trip		Travel value multiplied by 2 to equate to a round trip.	SHC Carbon Factors Table[13]
Hospital inpatient – low intensity (acute)	A&E visit	14.00	Per visit	318.33	N/A	SHC Carbon Factors Table[13]
	Inpatient admission - low intensity	292.60	Per inpatient stay		7.7 days average inpatient admission.	SHC Carbon Factors Table,[13] Statista (2024)[14]
	Travel - non-emergency	4.03	Per round trip		Travel values weighted for 80% non-emergency, 20% emergency travel. Average round-trip distance 14.4 km. DEFRA emission conversion factor used for medium petrol-fueled car.	SHC Carbon Factors Table,[13] Roberts *et al.* (2014),[15] DEFRA (2025)[16]
	Travel - emergency	7.70	Per round trip		Travel values weighted for 80% non-emergency, 20% emergency travel. One-way emergency, one-way non-emergency travel.	SHC Carbon Factors Table[13]
Hospital in patient – high intensity (ICU)	A&E visit	14.00	Per visit	806.42	N/A	SHC Carbon Factors Table[13]
	Inpatient admission - high intensity	468.00	Per inpatient stay		5.2 days average length of stay in ICU.	SHC Carbon Factors Table,[13] NHS England (2022)[17]
	Inpatient admission - low intensity	292.60	Per inpatient stay		7.7 days average inpatient admission. Patients will be discharged from ICU to low intensity wards.	SHC Carbon Factors Table,[13] Statista (2024)[14]
	Travel - non-emergency	1.01	Per round trip		Travel values weighted for 20% non-emergency, 80% emergency travel. Average round-trip distance 14.4 km. DEFRA emission conversion factor used for medium petrol-fueled car.	SHC Carbon Factors Table,[13] Roberts *et al.* (2014),[15] DEFRA (2025)[16]
	Travel - emergency	30.81	Per round trip		Travel values weighted for 20% non-emergency, 80% emergency travel. One-way emergency, one-way non-emergency travel.	SHC Carbon Factors Table[13]
Prescriptions	Prescriptions	0.546	Per £ spent on prescriptions	0.546	Spending data directly correlates with GHG emissions.	University of Leeds (2022)[9]

A&E, accident and emergency; CO_2e, carbon dioxide equivalents; DEFRA, Department for Environment, Food and Rural Affairs; GP, general practice; GHG, greenhouse gas; ICU, intensive care unit; SHC, Sustainable Healthcare Coalition; N/A, not applicable.

04 RESULTS

- Among the population of obese individuals with T2D in England without semaglutide treatment, annual GHG emissions associated with HCRU were estimated at 3.1 megatonnes (Mt) of CO_2e (**Figure 1**).
- In the eligible patient population, a 15% reduction in BMI following semaglutide treatment corresponded to a 7% reduction in GHG emissions resulting from HCRU over one year (**Figure 1**).

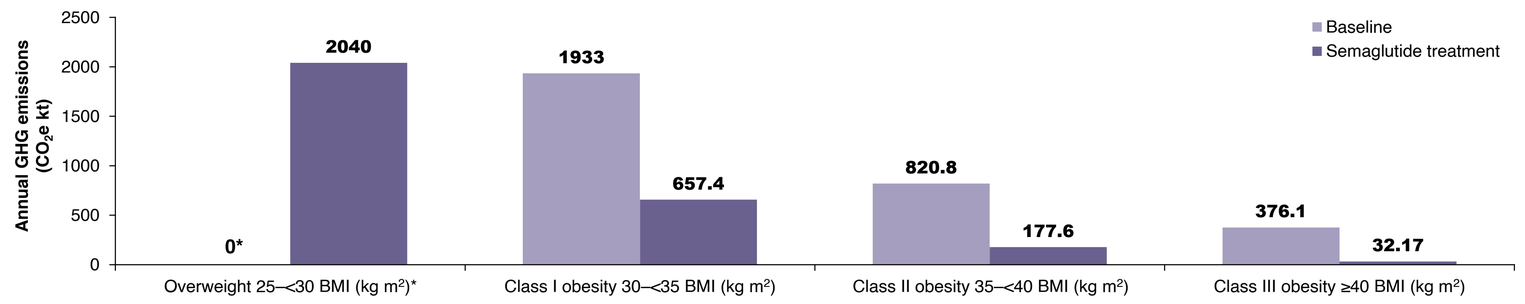
Figure 1: Annual GHG emissions resulting from HCRU in obese individuals with T2D, with and without semaglutide treatment



CO_2e, carbon dioxide equivalents; GHG, greenhouse gas; HCRU, healthcare resource utilisation; T2D, type 2 diabetes.

- GHG emissions positively correlated with increasing BMI at the per patient level, with an estimated 0.88, 0.97 and 1.04 tonnes of CO_2e resulting from HCRU per patient annually for class I (30–<35 BMI), class II (35–<40 BMI) and class III obesity (≥40 BMI), respectively, at baseline.
- Without semaglutide treatment (baseline), individuals with class I obesity were the largest contributor to GHG emissions, reflecting the higher prevalence of this health state within the eligible patient population. In the semaglutide treatment scenario, many individuals moved to the overweight category, which therefore became the main source of annual GHG emissions (**Figure 2**).

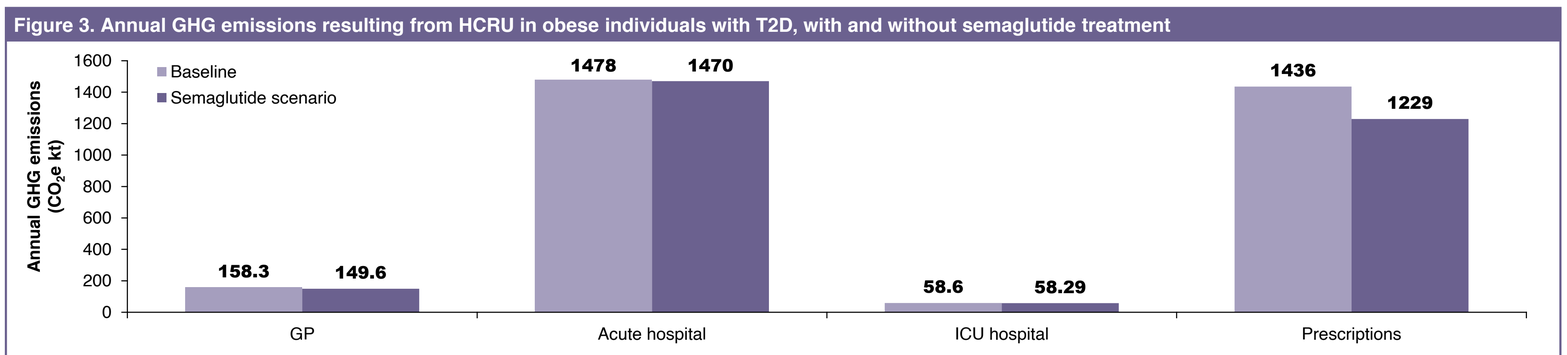
Figure 2. Annual GHG emissions resulting from HCRU by obesity category, with and without semaglutide treatment



*No patients included in the overweight BMI category for the baseline as only the eligible patient population (BMI >30) was assessed. Patients are present in the overweight BMI category following semaglutide treatment due to patients in the higher BMI categories of the eligible patient population experiencing a 15% reduction in BMI, which then moved them into the overweight category.
BMI, body mass index; CO_2e, carbon dioxide equivalents; GHG, greenhouse gas; HCRU, healthcare resource utilisation; T2D, type 2 diabetes.

- Semaglutide treatment led to GHG emission reductions of 6% for general practice visits, 1% for hospital admissions and a 14% reduction for prescriptions, relative to the baseline population (**Figure 3**).
- Prescriptions were the key driver of reductions in GHG emissions following semaglutide treatment. When pharmaceuticals were excluded, the overall relative reduction in GHG emissions annually for the eligible patient population was 1%, indicating that pharmaceuticals accounted for 86% of the total estimated reductions in GHG emissions following semaglutide treatment.

Figure 3. Annual GHG emissions resulting from HCRU in obese individuals with T2D, with and without semaglutide treatment



CO_2e, carbon dioxide equivalents; GP, general practitioner; GHG, greenhouse gas; HCRU, healthcare resource utilisation; ICU, intensive care unit; T2D, type 2 diabetes.

Limitations:

- Semaglutide treatments are associated with side effects which may incur additional HCRU. This was not captured within this study.
- This study was informed using HCRU data on obese individuals with T2D. Other comorbidities commonly experienced by obese individuals may result in different patterns of HCRU to those observed in T2D patients.
- Prescriptions were the main driver of GHG emissions reductions. However, these estimates carry substantial uncertainty due to reliance on economic input data combined with emission factors to quantify their environmental impact.
- GHG emissions from semaglutide injections were excluded from this study due to a lack of reliable data.

05 CONCLUSIONS

- **Semaglutide treatment in obese individuals with T2D could lead to substantial GHG emissions savings resulting from reduced HCRU due to decreased BMI and improvements to cardiometabolic risk factors.**
- **The estimated 223.2 kt CO_2e savings resulting from semaglutide treatment is equivalent to 1% of the total annual CO_2e emissions reported for the NHS in 2024/2025.[10]**
- **Future research could build on the findings of this study by modelling the environmental impact of semaglutide injections, quantifying the effects of treatment-related side effects, and extending the analysis to longer treatment durations.**

References

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