Remote Consultations:

Do they reduce Greenhouse Gas Emissions?

Your Guide to Calculating the Answer

CENTRE *for* SUSTAINABLE HEALTHCARE
inspire • empower • transform

A connected community working together to improve health and care quality across the UK

Acknowledgements

The development of this guide and accompanying carbon calculator has been funded through Q by the Health Foundation and NHS England and NHS Improvement.

The accompanying carbon footprint calculator for (avoided) patient travel has been co-produced by the Centre for Sustainable Healthcare and PD Transformation.

We would like to thank the following healthcare organisations for piloting the guide and carbon footprint calculator: North Bristol NHS Trust, Barts Health NHS Trust, GPs from the Greener Practice network, Aneurin Bevan University Health Board Ty Byrn, SEE Sustainability and others.

The Travel Survey Template in the Appendix has been developed in partnership with six representatives of the Public and Patient Involvement in Research (PPIRes) group, Norfolk and Suffolk Primary and Community Care Research Office. We would like to thank the group for their input.

Aim

The main aim of this guide is to provide step-by-step guidance on how to calculate the greenhouse gas (GHG) emissions savings[a] of avoided patient travel due to switching from in-person outpatient appointments (OPAs) or GP appointments (GPAs) to remote consultations. It will describe three different methods.

In addition, this guide will provide an outline of how to estimate the carbon footprint of the change in resource use at the GP practice or hospital due to the switch to remote consultations.

Section 1: Step-by-step guidance on how to calculate the GHG emissions savings of avoided patient travel. Three different methods.

Section 2: Outline of how to measure the carbon footprint of the change in resource use at the GP practice or hospital

This guide has been developed for health professionals, quality improvement leads, estates, sustainability and practice managers at hospitals and GP practices. It can be used for a specific clinical pathway, a clinical department or the whole organisation.

A one-page summary of the guide can be found in appendix 3 as 'Pull-out instructions'

Introduction

The NHS has committed to reach net zero greenhouse gas emissions by 2045, five years ahead of the target enshrined in UK law.[1] To achieve a reduction to net zero in the next 25 years will require the NHS to transform the way health services are provided. The NHS Long-term plan has set an ambition for digitally enabled primary and outpatient care to become mainstream practice.[2] Enabling patients to access remote consultations via a computer, smartphone or telephone alongside in-person services would help to meet the rising demand for healthcare due to an aging population and complex chronic health needs. If suitable, remote consultations can offer increased flexibility and convenience for patients and their carers, potentially reducing the time they have to take off work or other activities.

Remote consultations will also help with the reduction of the NHS's carbon footprint, especially from patient travel related greenhouse gas (GHG) emissions. In 2020 the NHS carbon footprint[b] was 24.9 million tonnes of carbon dioxide equivalent (CO_2e), with patient travel contributing around 5%.[3] Within outpatient appointments, patient travel accounts for around 20% of the carbon footprint[4] as well as around 118 tonnes of particulate matter ($PM_{2.5}$) air pollutants and 2,602 tonnes of nitrogen oxides (NO_x).[5]

[a] In this Guide we use the terms carbon emissions, carbon footprint and greenhouse gas emissions interchangeably.

[b] The NHS carbon footprint plus includes the GHG emissions of the NHS's building energy use, water use, waste disposal, use of anaesthetic gases and metered dose inhalers, business travel and NHS fleet, staff commuting, patient and visitor travel, all the supply chain emissions and externally commissioned services.

Changing from in-person to remote appointments affects also other aspects of resource use and its carbon footprint apart from travel, such as reduced use of paper and clinical supplies (e.g. PPE), IT equipment purchasing/use, or change in number and location of investigations ordered.

The outbreak of COVID-19 has accelerated the digitalisation process as a means of reducing the spread of infection, with many health services, from GP to ophthalmic services, being offered online or over the phone. Remote consultations will never be the only form of appointments and work is being done to understand what the most appropriate services are to offer remotely and how to minimise negative effects. It offers a great opportunity to include not only clinical outcomes, but also the impact on greenhouse gas emissions in any evaluation of these services. For the NHS to achieve its net zero target, carbon needs to become an additional currency alongside money, understood by all working in the health system.

What is a carbon footprint?

A carbon footprint is the sum of greenhouse gas emissions which are attributable to a given process, product or organisation. It usually includes the seven greenhouse gases covered by the Kyoto Protocol.[c] As all greenhouse gases have different global warming potentials, they are normalised in respect to carbon dioxide with the carbon footprint expressed in carbon dioxide equivalents (CO_2e).

A carbon footprint can be estimated by converting activity data/resource use, for example, services, travel, other activities and products into kilograms of CO_2e.

Carbon footprint (kg CO2e) = activity or resource use x GHG emissions factor

In the case of travel, the carbon footprint is estimated by multiplying the distance travelled in kilometres or miles with the GHG emissions factor of the mode of transport used.

A GHG emissions factor[d] is the average emission rate of a given resource. It tells you the amount of GHG emissions released into the atmosphere per unit of resource/activity data. They are measured by weight (e.g. kg, tonne) of carbon dioxide equivalent per unit of resource. GHG emissions factors can be found in databases, some of which are publicly accessible (e.g. those published by the UK Government Department of Business, Energy & Industrial Strategy, BEIS). For travel, the UK Governments database includes GHG emissions factors for air, sea, road travel and freight.

[c] The seven greenhouse gases covered by the Kyoto Protocol are carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PCFs), sulphur hexafluoride (SF6) and nitrogen trifluoride (NF3).

[d] GHG emissions factors are also called carbon emissions factors and carbon conversion factors. These terms are used interchangeably in this guide.

Section 1: Calculating the carbon footprint of patient travel

There are five steps to consider when carrying out a carbon footprinting study. These steps also apply when calculating patient travel related greenhouse gas emissions savings due to switching from in-person appointments to remote consultations.

Step 1: Define the goal and scope of the study

Step 2: Identify the resources you will measure

Step 3: Collect and collate the activity data

Step 4: Attribute GHG emissions factors to the activity data/resource use

Step 5: Calculate the carbon footprint

Step 1: Define the goal and scope - choose the method

Before data collection can start, the following questions need considering when calculating the GHG emissions savings due to a reduction in patient travel:

- **Do you want to estimate patient travel related GHG emissions savings for the whole hospital, a clinical department or for one clinical pathway?**
- **How will you use the results?**

The answer to these questions will determine which of the three methods described in this guide to use and consequently, the accuracy of the result. At this point, it is also helpful to consider what data you will be able to access or how much time you have to collect data.

Method 1: A quick estimate based on the number of outpatient or GP appointments switched to remote consultations. You are able to access data on the number of outpatient or GP appointments which have been conducted remotely. If you would like to use method 1, go to page 6.

Advantages: Quickest method

Disadvantages: Dependent on national averages, less accurate, does not include the impact on air pollution

Method 2: A more accurate method based on known distances travelled and, if available, mode of transport. This method allows for the Trust, clinical department or clinical pathway specific data on patient travel and remote consultations to be used. You know or are able to collect either the distance the patients would have travelled if they had attended the appointment in person, or the patients' home postcodes and/or the mode of transport. If you would like to use method 2, go to page 7.

Advantages: Specific to your own situation, more accurate, can be tailored to specific patient groups

Disadvantages: Requires some data input

Method 3: A method that estimates the reduction in local air pollution as well as patient travel related greenhouse gas emissions. You are able to access data on the number of OPAs which have been conducted remotely. If you would like to use method 3, go to page 11.

> ***Advantages:*** Fairly quick, estimates the impact on greenhouse gas emissions and local air pollution
>
> ***Disadvantages:*** Less accurate than method 2 as unable to tailor to specific patient groups, not suitable for individual GP practices

Table 1: Summary of three different methods

Method	Advantages	Disadvantages	Data you'll need	Page in Guide
Method 1	Quickest method	Dependent on national averages, less accurate, does not include air pollution impact.	No. of OPAs/GPAs which have been conducted remotely.	6
Method 2	Most accurate method. Specific to your own situation. Can be tailored to specific patient groups.	Requires some data input.	Distance the patients would have travelled if they had attended the OPA/GPA in person or the patients' home postcodes and/or the mode of transport.	7
Method 3	Fairly quick, estimates the impact on GHG emissions and local air pollution.	Less accurate than method 2. Unable to tailor to specific groups, not suitable for individual GP practices.	You are able to access data on the number of OPAs which have been conducted remotely.	12

The following section describes Step 2 to 5 for each method in detail.

Method 1

Method 1 is the simplest way to calculate the GHG emissions savings associated with a reduction in patient travel due to a switch to remote consultations. It is based on the *Patient Travel Module*[6] published by the Sustainable Development Unit (SDU), now called the ***Greener NHS Team,*** as part of their ***Care Pathways: Guidance on Appraising Sustainability.*** The SDU estimated that on average patients travel 34km for a round trip to a hospital appointment, and 6.6km to a GP appointment. This translates to GHG emissions of 5.8 $kgCO_2e$ per hospital trip and 1.12 $kgCO_2e$ per trip to the GP.

The advantage of this method is, that it offers a quick and easy way to calculate the GHG emissions savings. As it is based on the national average distance that patients travel to hospitals/GPs and national information on transport modality for certain purposes, it might not reflect your local context.

Step 2: Identify the resources you will measure

This method requires the collection of, or access to, data on the number of outpatient, or GP appointments which have been switched from in-person to remote consultations – either for the whole hospital, a clinical department or clinical pathway.

Step 3: Collect the data

NHS Trusts and GPs routinely collect data on outpatient, or GP appointments. They may also capture which of these has been conducted in-person and which remotely. If not, you might have to gather additional data on how many of these appointments have been conducted remotely.

Step 4: Attribute a GHG emissions factor

If you are estimating the GHG emissions savings due to a reduction in patient travel:

- **for outpatient appointments, use the emissions factor of 5.8kgCO_2e per outpatient return journey**
- **for GP appointments, use the factor 1.12 kgCO_2e per GP return journey**

Step 5: Calculate the GHG emissions savings

Multiply the number of appointments which have been switched from in-person to remote consultations by the carbon emissions factor per appointment if the patient would have travelled to an in-person appointment.

GHG emissions savings = number of remote consultations x GHG emissions factor (kgCO2e)

Method 2

Method 2 provides a more accurate estimate of patient travel related GHG emissions savings based on data from **your own** hospital/GP, taking into account your local context. It is based on the distance **your** patients would have travelled to the hospital/GP if they would have come to an in-person appointment instead of attending a remote consultation. Therefore, the method is ideal to use for a GP practice or just one clinical service or pathway as it can be tailored to the specific patient group. However, it can also be used for the whole hospital.

To help with the calculation of the GHG emissions savings, we have developed an easy-to-use ***Carbon Footprint Calculator for (avoided) Patient Travel*** in form of an excel spreadsheet. The calculator can calculate the travel carbon footprint of 10,000 appointments. It provides step-by-step guidance on its **'How To'** tab on how to enter the required data and read the results.

Table 2: Structure of carbon calculator

Tab on excel spreadsheet	Function
How To	Detailed explanation of how the spreadsheet works
CO2e savings	Data entry sheet plus data analysis
Mass input	If you would like to choose a random sample from your data

If you have data for more than 10,000 patients' appointments, but want to only examine, for example, a sample size of 500, the carbon calculator has the option to select a random sample for you.

In addition to the distance travelled, the calculator offers you the option to enter information on the mode of transport that patients would have used to travel to the hospital/ GP, the number of carers[e] who would have accompanied your patients to their appointment and the cost of their journey.

If you do not know the mode of transport your patients would have used, the carbon calculator makes assumptions about transport modality based on information from the *National Travel Survey (NTS 0308) 'Average number of trips by trip length and main mode: England'*[7].

The table below shows the different information scenarios for which the calculator can be used. For example, it can be used if you only know your patients' home postcodes and hospital/GP postcode – scenario 1.

Table 3: Data scenarios for which the carbon calculator can be used

Scenarios	'From' and 'To' postcodes	Main mode of transport	Miles travelled
Scenario 1	✓	x	x
Scenario 2	✓	✓	x
Scenario 3	x	✓	✓
Scenario 4	x	x	✓

[e] In this guide we use the term 'carer' for parents, guardians, relatives and friends.

Step 2: Identify the resources you will measure

To use the calculator, you need data on the distance that patients will travel. Data on distances travelled can be directly entered into the calculator or calculated using postcode data which might be routinely recorded. The calculator along with support from the freemap tool,

https://www.freemaptools.com/distance-between-uk-postcodes.htm

will help you measure the distance between the patients' home and hospital/ GP postcodes.

You can also add information on the mode of transport your patients would have used to travel to the hospital/GP, the number of accompanying carers and costs of the journey.

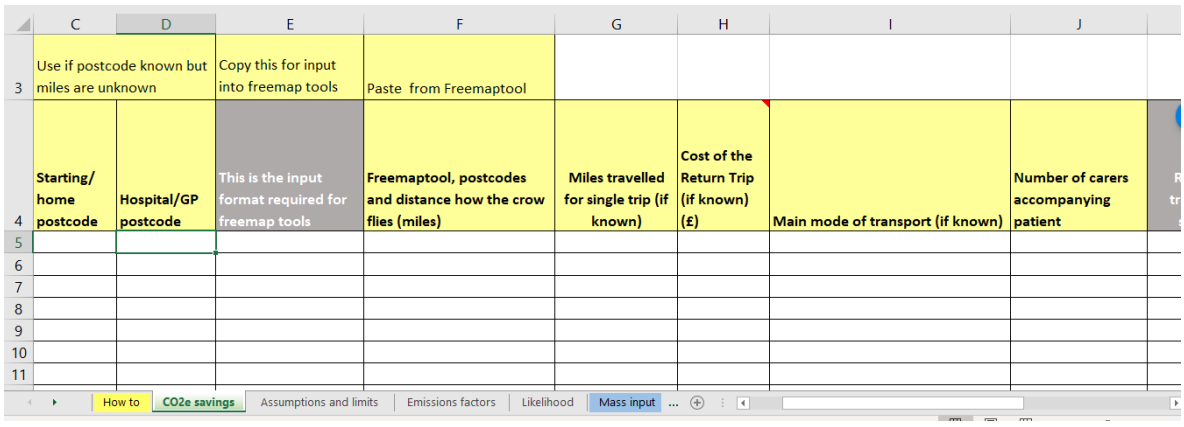
The carbon calculator caters for the following modes of transport:

- Walk
- Cycle
- Car (national mix of diesel, petrol and alternative fuels)
- Motorbike (average size)
- Taxi
- Local bus, London
- Local bus, not London
- Coach
- National rail
- Lightrail
- London Underground

Step 3: Collect and enter the data

'CO2e savings' is the data entry worksheet. Data can be entered in the cells of columns with yellow headings. The columns with grey headings are calculated automatically.

Figure 1: Screenshot of the carbon calculator's data entry sheet



Most data needed to calculate the GHG emissions savings with the *Carbon Footprint Calculator for (avoided)Patient Travel* is either found in patients records or can be collected via a travel survey (see survey template in Appendix 2). If you do not have time to carry out a travel survey, adding a few questions at the end of your Trust's routine patient experience questionnaire might provide you with sufficient data.

Calculating the distance based on postcodes: NHS Trusts and GPs routinely collect records of patients' postcodes which can be copied (in bulk) into the carbon calculator. The calculator will, with the help of the freemap tool,

https://www.freemaptools.com/distance-between-uk-postcodes.htm,

estimate the distance 'as the crow flies' between the postcodes and turn it automatically into road miles travelled by multiplying it by a factor of 1.45[f]. It will automatically double the road miles travelled to take into account the return journey.

Collecting information on distance travelled: If you have collected information on the distance travelled by patients in miles, it can be directly entered into the carbon calculator. The calculator asks you to enter the distance of the single journey as it doubles it automatically to account for the return journey.

Information on the cost of the journey can be entered into the calculator in the form of pounds (£). If the patient would have travelled by public transport, enter the cost of a return journey for the patient. If travelling by car or motorbike, you are only required to enter the cost for parking.

The calculator assumes a cost of 45p per mile for travelling by car and 24p per mile for travelling by motorbike. This gets automatically calculated and added to the parking fee. Though the potential cost of the journey is not required to calculate the GHG emissions savings, it can be used as an indicator for understanding the social impact of healthcare appointments.

If entering data on the number of carers, the carbon calculator automatically takes the number of carers into account when calculating the carbon footprint and cost of public transport, assuming the distance travelled, mode of transport and cost of journey would have been the same as that of the patient.

For a detailed explanation of how to enter the data, please have a look at the **'How To'** tab on the spreadsheet.

Step 4: Attribute a GHG emissions factor

The carbon calculator automatically selects the correct carbon emissions factor for the mode of transport entered. The table below shows the different modes of transport and their emissions factors, on which the carbon calculator is based.

[f] This factor is an average taking into accounts urban and rural settings. It will in some cases over and in others underestimate the distance travelled.

Table 4: GHG emissions factors of different modes of transport

Mode of transport	Unit	GHG emissions factor (CO2e/unit)
Walk	miles	0
Cycle	miles	0
Car (average size, national fuel mix)	miles	0.346
Motorbike (average size)	miles	0.233
Taxi	passenger.mile	0.353
Local bus, London	passenger.mile	0.155
Local bus, not London	passenger.mile	0.236
Coach	passenger.mile	0.054
National rail	passenger.mile	0.069
Lightrail	passenger.mile	0.052
London Underground	passenger.mile	0.052

If the mode of transport is unknown, the carbon calculator makes assumptions about transport modality based on information from the *National Travel Survey (NTS0308) 'Average number of trips by trip length and main mode: England'*[8]. The NTS provides information on the proportion each mode of transport is used when travelling certain distances. Based on this information aggregate carbon emissions factors for different distances can be calculated – see table4 below. These aggregate carbon emissions factors are incorporated in the spreadsheet and automatically pulled into the calculation where required.

Table 5: Aggregated GHG emissions factors

Distance travelled (miles)	Aggregate GHG emissions factor (kgCO2e/mile)
<1	0.065
1 - 1.99	0.220
2 - 4.99	0.304
5 - 9.99	0.309
10 - 24.99	0.303
25 - 49.99	0.284
50- 99.99	0.300
>= 100	0.300

Step 5: Calculate the GHG emissions savings

Following the data entry, the carbon calculator will automatically calculate the GHG emissions for patient travel. The calculations are based on the equation below. If your sample size is only a fraction of the patient group you are looking at, the carbon calculator allows you to enter the proportion it represents and calculates the emissions savings for the whole patient group.

GHG emissions savings = distance travelled (return journey) x GHG emissions factor (kgCO2e)

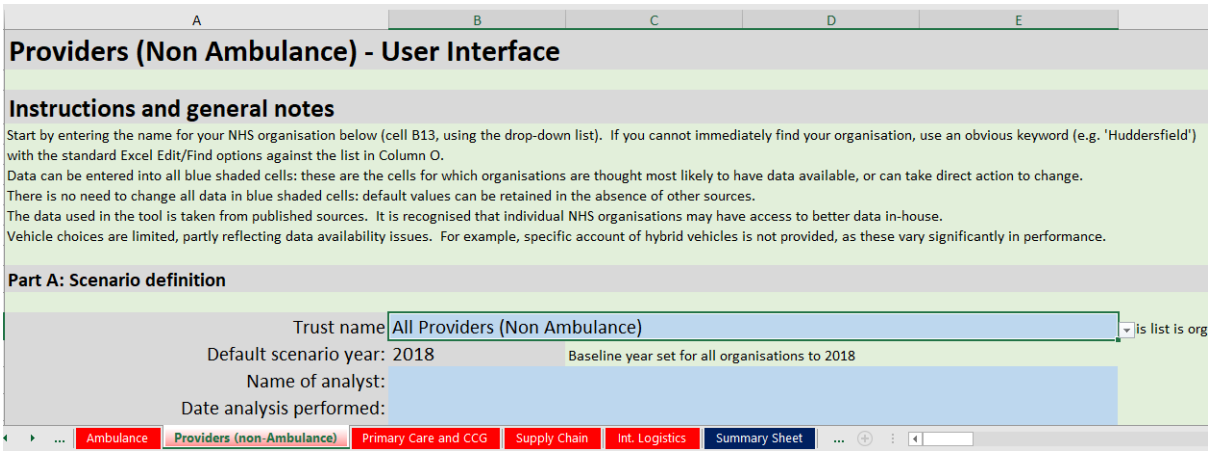
Method 3

Method 3 uses the Greener NHS Team's *Health Outcomes of Travel Tool (HOTT)*[9], which estimates patient and visitor travel, staff commuting, business travel and freight transport related GHG emissions. It also measures healthcare related travel and transport's local impact on air pollution, noise pollution and road traffic accidents, which are translated into Quality Adjusted Life Years (QALYs) and health damage costs. In its current format, the tool can be used by NHS Provider Trusts, Ambulance Trusts and Clinical Commissioning Groups, but not individual GP practices.

This guide describes how HOTT can be utilized by health professionals or estates and sustainability managers working at an NHS Provider Trust to estimate the impact of switching from in-person to remote consultations on **patient travel related** GHG emissions[g] and air pollution, which is measured in amount of nitrogen oxides (NO_x) and particulate matter ($PM_{2.5}$).

The tool is an excel spreadsheet which has a data entry tab for each organisation type (Figure 2). At the top of each data entry worksheet is a dropdown box where you can choose your own organisation. The tool is pre-populated with data from each NHS organisation. In the case of NHS Provider Trusts, it contains data on the average distance patients travel to your Trust.

Figure 2: Screenshot of HOTT's data entry sheet for Provider NHS Trusts



[g] For the purpose of the guide, we will not look at visitor travel, staff commuting, business travel or freight transport.

Information on mode of patient travel is based on the National Travel Survey. The vehicle mix for diesel, petrol and electric is taken from the Department for Transport projections.

The advantage of this tool is its ability to estimate patient travel's impact on local air pollution. HOTT is less specific when used for patient groups of individual clinical pathways or clinical departments. It is based on a Trust-specific average distance travelled. Though transport modality can be adjusted to local settings, it is more difficult to adjust the tool for specific patient groups only.

Step 2: Identify the resources you will measure

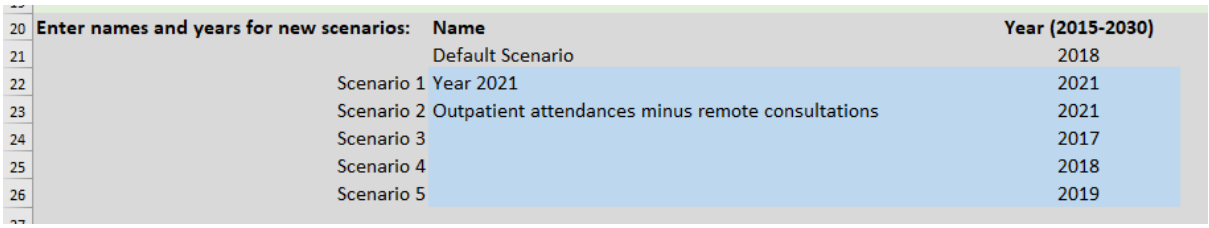
To use HOTT to estimate the GHG emissions savings associated with a switch from in-person outpatient appointments to remote consultations, you only need to collect information on the number of outpatient appointments which have been switched to remote consultations.

Step 3: Collect and enter the data

The tabs for all the data entry worksheets are red. On the data entry worksheets, all cells in blue can be altered.

HOTT has created a default scenario based on the existing data of NHS organisations from the year 2018. To estimate the GHG emissions and air pollution impact of switching to remote consultations, you need to 'create' two new scenarios, which are named at the top of the worksheet. For scenario 1 select the current year in the column 'Year (2015 -2030)'. For scenario 2, select also the current year. This allows data to be changed under scenario2 (Figure 3). In our case, it would mean entering the new (reduced) number of in-person outpatient appointments in row 82 of scenario 2 (reduced in-person OPAs = number of in-person OPAs in scenario 1 minus the number of OPAs which have been switched to remote consultations).

Figure 3: Screenshot of data entry sheet – naming of new scenario



20	**Enter names and years for new scenarios:**	**Name**	**Year (2015-2030)**
21		Default Scenario	2018
22	Scenario 1	Year 2021	2021
23	Scenario 2	Outpatient attendances minus remote consultations	2021
24	Scenario 3		2017
25	Scenario 4		2018
26	Scenario 5		2019

Step 4: Attribute a GHG emissions factor

The GHG emissions factors are attributed automatically.

Step 5: Calculate the GHG, NO_x and $PM_{2.5}$ emissions savings

HOTT automatically calculates the amount of GHG emissions in tonnes of CO_2e (row 199), tonnes of NO_x emissions (row 223) and tonnes of $PM_{2.5}$emissions (row 230)of scenario 1 and scenario 2.

To calculate the GHG, NO_x and $PM_{2.5}$ emissions savings, calculate:

GHG emissions savings = GHG emissions scenario 1– GHG emissions scenario 2 (tCO2e)

Nitrogen oxide emission savings (t NOx) = t NOx scenario 1 – t NOx scenario 2

Particulate matter emissions savings (t PM2.5) = t PM2.5 scenario 1 – t PM2.5 scenario 2

Section 2: Calculating the 'rest' of the carbon footprint of in-person outpatient/GP appointments vs remote consultations

Switching from in-person outpatient or GP appointments to remote consultations not only saves GHG emissions associated with patient travel, but also emissions embedded in all the resources used during the appointment. However, digital technology used for remote consultations does generate some GHG emissions.

Step 1: Define the goal and scope

Before calculating and comparing the carbon footprint of in-person vs remote consultations, you need to be clear if you would like to look at appointments within one clinical pathway, within one clinical department or the whole hospital.

Step 2: Identify the resources you will measure

Consultants/GPs are likely to conduct their remote consultations from consultation rooms in their hospital or GP surgeries. Therefore, it is unlikely that there will be considerable GHG emissions savings associated with energy use for heating, electricity use and staff commuting.

Overhead functions are also likely to be similar. For both in-person and remotely conducted appointments, patients will need to be invited to an appointment and booked in.

However, there are likely to be changes in the use of other resources, mainly medical and non-medical supplies, electricity use by medical equipment, water and waste disposal. These can be identified by creating an inventory that lists all the resources required for a GP or the specific outpatient appointment you are investigating. Keep in mind that outpatient and GP appointments can differ widely in their resource use, depending, if and what type of investigations and laboratory services the appointment includes.

In contrast, for remote consultations, consultant/GP and patients need a computer, smartphone or phone which uses energy, servers and networks and are responsible for emissions generated during their manufacture and disposal. Create a second inventory, listing the resources used for remote consultations.

At this stage, it is important to identify the GHG emissions factors you will need to convert resource use into CO_2e. The emissions factors will determine which metric you will have to use for measuring the resources. For example, you are unlikely to have emissions factors available for individual medications or medical equipment by weight. However, there is an emissions factor for pharmaceuticals and for medical equipment per £ spend. You therefore will measure the overall expenditure on medication and medical equipment.

A list of the most commonly needed healthcare emissions factors is provided in Appendix 1. For additional emissions factors, the database published and annually updated by the UK Government Department of Business, Energy & Industrial Strategy (BEIS) is a good source of information.

Tables 6a and 6b list the types of resources to consider and the metrics to use.

Table 6a: Inventory for in-person outpatient and GP appointments

Resource/ Item		Unit	Amount	EF*
Medical supplies	PPE	Item		
	Medical & Surgical Equipment	£		
	Dental & Optical Equipment	£		
	Diagnostic Imaging & Radiotherapy Equipment & Services	£		
	Laboratory Equipment & Services	£		
	Pharmaceuticals Blood Products & Medical Gases	£		
	Pharmaceuticals excl. Blood Products and Medical Gases	£		
	Inhalers	Item		
	Dressings	£		
	Patients Appliances	£		
	Chemicals & Reagents	£		
	Anaesthetic Gases	litre		
	Other, specify ….			
Non-medical supplies	Staff Clothing	£		
	Office Equipment Telecomms Computers & Stationery	£		
	Other, specify …			
Other resources	Water use	m^3		
	Waste disposal	tonnes		
	Electricity use of medical equipment	kWh		
	Laptop use	hour		

* EF = emissions factor

Table 6b: Inventory for remote consultations

Resource/Item		Unit	Amount	EF
Other resources	Laptop use consultant	hour		
	Smartphone use consultant	hour		
	Laptop use patient	hour		
	Smartphone use patient	hour		

* EF = emissions factor

Step 3: Measure the resource utilisation (collect the data)

Once an inventory has been drawn up, the activity data can be collected. Data on commonly used resources, e.g. energy, water use and waste disposal, can normally be obtained from the head of estates at your hospital or the practice manager at your GP surgery. For expenditure data for medical supplies you might consult the nurses in your department or the procurement department of your hospital.

Step 4: Attribute a GHG emissions factor

Once you have collected all the data, GHG emissions factors can be attributed. Depending on the availability of data, you might have to revise the emissions factors you have identified in Step 2.

Step 5: Calculate the carbon footprint

Following the collection of activity data and the identification of suitable emission factors, the two can be multiplied together to provide an estimate of the carbon footprint. The results for each resource should be added together to provide the overall carbon footprint of the outpatient or GP appointment; this is illustrated in Tables 7a and 7b.

Table 7a: Summary -Carbon footprint calculation of face-to-face OPA/GPA

Resource/ Item	Unit	Amount	x EF	= kgCO2e
Medical supplies				
Non-medical supplies				
Other resources				
Overall carbon footprint (kgCO2e)			=	

Table 7b: Summary -Carbon footprint calculation of remote consultations

Resource/ Item	Unit	Amount	x EF	= kgCO2e
Laptop/smartphone use consultant				
Laptop/smartphone use patient				
Overall carbon footprint (kgCO2e)				=

To calculate the GHG emissions savings associated with switching from in-person to remote consultations:

GHG emissions savings = carbon footprint in-person consultation – carbon footprint remote+ GHG emissions savings of avoided patient travel

Appendix 1: Some useful GHG emissions factors

Medical Supplies

GHG emissions factors for NHS financial spend on:

- Pharmaceuticals: 0.155 $kgCO_2e$ / £
- Pharmaceuticals Blood Products & Medical Gases: 0.43 kgCO2e / £
- Medical equipment (e-class procurement): 0.3 $kgCO_2e$ / £
- Medical instruments/equipment (NHS Trusts): 0.41 kgCO2e/£
- Diagnostic imaging & radiotherapy equipment & services: 0.3 $kgCO_2e$ / £
- Dental & optical equipment: 0.3 $kgCO_2e$ / £
- Laboratory equipment & services: 0.3 $kgCO_2e$ / £
- Dressings: 1.54 $kgCO_2e$ / £
- Chemical & Reagents: 0.76 $kgCO_2e$ / £
- Patients appliances: 1.54 $kgCO_2e$ / £
- Staff clothing: 0.29 $kgCO_2e$ / £
- Patients clothing & footwear: 0.29 $kgCO_2e$ / £
- Bedding linen & textiles: 0.32 $kgCO_2e$ / £

Source: *Carbon factors Greener NHS Team2020-21*

PPE

- Single glove: 0.026 kgCO2e / item
- Cup fit FFP respirator: 0.125 kgCO2e/item; duckbill FFP respirator 0.076 kgCO2e / item
- Type IIR surgical mask: 0.02 kgCO2e, type II surgical mask: 0.013 kgCO2e / item
- Face shield: 0.231 kgCO2e / item
- Apron: 0.065 kgCO2e / item
- Single-use gown: 0.905 kgCO2e / item

Source: *Rizan C, Reed M, Bhutta M. Environmental impact of Personal Protective Equipment supplied to health and social care services in England in the first six months of the COVID-19 pandemic. Journal of Society of Medicine. 2021.* https://doi.org/10.1177/01410768211001583

Anaesthetic gases

GHG emissions factors per litre of:

- Desflurane: 3,7211 $kgCO_2e$ / litre
- Isoflurane: 762.96 $kgCO_2e$ / litre

- Sevoflurane: 197.86 $kgCO_2e$ / litre
- Nitrous oxide: 0.559 $kgCO_2e$ / litre
- Nitrous oxide with oxygen 50/50 split: 0.278 $kgCO_2e$ / litre

Source: *Carbon factors Greener NHS Team 2020-21*

Metered dose inhalers

GHG emissions factors per inhaler:

- Large volume inhaler, e.g. Ventolin: 24 $kgCO_2e$ / inhaler
- Small volume inhaler, e.g. Salamol: 10 $kgCO_2e$ / inhaler

Source: *Wilkinson AJK et al. Costs of switching to low global warming potential inhalers. An economic and carbon footprint analysis of NHS prescription data in England. BMJ Open Access. Sep 2019. https://bmjopen.bmj.com/content/bmjopen/9/10/e028763.full.pdf*

Non-medical supplies

GHG emissions factors for NHS financial spend on:

- Office equipment, telecommunications, computers & stationery: 0.53 $kgCO_2e$ / £
- Information and communication technologies: 0.19 kgCO2e
- Furniture fittings: 0.48 $kgCO_2e$ / £
- Provisions: 0.97 $kgCO_2e$ / £
- Hotel services, equipment, materials & services: 0.49 $kgCO_2e$ / £
- Building & engineering products & services: 0.49 $kgCO_2e$ / £
- Gardening & farming: 2.68 $kgCO_2e$ / £
- Hardware crockery: 0.58 $kgCO_2e$ / £
- Recreational equipment & souvenirs: 0.28 $kgCO_2e$ / £
- Staff & patient consulting services & expenses: 0.31 $kgCO_2e$ / £
- Food and catering: 0.64 kgCO2e/£

Source: *Carbon factors Greener NHS Team 2020-21*

Other Resources

- Electricity use (UK): 0.2913 $kgCO_2e$/kWh
- Water use: 0.3666 $kgCO_2e$ / m3

Source: *Government emission conversion factors for greenhouse gas company reporting 2021, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005677/conversion-factors-2021-full-set-advanced-users.xlsm (accessed Jul 2021)*

Laptops and smartphones:

- Laptop use (incl. server & network use, embodied emissions of laptop): 0.067 kgCO2e / hour
- Smartphone use (incl. server & network use, embodied emissions of smartphone): 0.058 kgCO2e / hour

Mike Berners-Lee 'How bad are bananas?' Profile Books.

Waste disposal:

- Recycling reusable instruments: 21 kgcO2e / tonne
- Recycling reusable surgical linens: 21 kgCO2e / tonne
- Recycling batteries: 65 kgCO2e / tonne
- Low temperature incineration with energy for waste - dry mixed recycling, domestic waste: 172 kgCO2e / tonne
- Low temperature incineration with energy for waste – non-infectious offensive waste: 249 kgCO2e
- Autoclave decontamination plus Low temperature incineration with energy for waste – infectious waste: 569 kgCO2e / tonne
- High temperature incineration – clinical waste, medicinal contaminated sharps, anatomical waste, medicinal waste 1074 kgCO2e/tonne

Rizan C, Bhutta M, Reed M, Lillywhite R. The carbon footprint of waste streams in a UK hospital. Journal of Cleaner Production 286 (2021) 125446.
https://www.sciencedirect.com/science/article/abs/pii/S0959652620354925

Appendix 2: Travel Survey Template

The following travel survey template has been developed in partnership with six representatives of the Public and Patient Involvement in Research (PPIRes) group of the Norfolk and Suffolk Primary and Community Care Research Office.

The survey's sole purpose is to collect the patient travel data required for using the carbon calculator described in Method 2 of the guide. If you would like to collect patient travel information to optimize your organisation's travel planning, this survey is unlikely to be sufficient. You might want to add additional questions.

The travel survey is written for hospitals and General practices (please delete as applicable). Add your hospital/General practice letterhead, the name of your hospital/General practice where required and instructions on how to return the survey.

Insert hospital letterhead

Travel Survey

Purpose of the Survey

The NHS has recognized the climate emergency and its impact on health and is committed to reducing its carbon footprint to net zero by 2045 while maintaining its high-quality patient-centered care[10]. This commitment will only be achievable if we understand how services improve clinical outcomes and impact the environment.

In-person appointments and remote consultations are both essential in delivering healthcare. Many NHS staff have been involved in finding out how the recent switch from in-person appointments to remote consultations has affected patients, staff, the quality of care and the environment. The survey below will help our [hospital/General practice name] to better understand the environmental impact of patient travel.

How your data will be used

The data collected will be anonymized and only used by [insert hospital/General Practice name] to calculate the carbon footprint of patient travel.

We would be very grateful if you could fill in the survey below. This should only take a couple of minutes to complete.

Survey Questions

1. Please enter your home postcode
2. What type of transport would you have used to travel to the hospital if your appointment had been in person?

Please tick just **one** option. If you would have used more than one type of transport, please select the one which was used for the majority of the journey.

- Walk ☐
- Cycle ☐
- Car ☐
- Motorbike ☐
- Taxi ☐
- Local bus (London) ☐
- Local bus (not London) ☐
- Coach ☐
- National rail ☐
- Light rail ☐
- London Underground ☐
- Other, specify…. ☐

3. If the hospital appointment would have been in person would you have been accompanied by another person?

   Yes ☐

   No ☐

4. Please estimate how much per person your return journey to the hospital would have cost **you.**

   Public transport (£)

   If you would have travelled by car or motorbike, please estimate the cost of parking (£)

Thank you for taking the time to complete this survey. Please return the survey to [*Hospital to insert instructions how to return survey*].

Appendix 3: Pull-out instructions for patient travel

Aim

These pull-out instructions are all you need to calculate the greenhouse gas (GHG) emissions savings of avoided patient travel due to switching from in-person outpatient appointment (OPA) or GP appointments (GPA) to remote consultations.

Choose a method

Choose one of the three different methods of calculating the carbon footprint of patient travel. For more information, go to the relevant page in the guide.

Method	Advantages	Disadvantages	Data you'll need
Method 1 (page 6)	Quickest method	Dependent on national averages, less accurate, does not include air pollution impact.	No. of OP/GP appointments which have been conducted remotely.
Method 2 (page 7)	Most accurate method. Specific to your own situation. Can be tailored to specific patient groups.	Requires some data input.	Distance the patients would have travelled if they had attended the OP/GP appointment in person, or the patients' home postcodes and/or the mode of transport.
Method 3 (page 12)	Fairly quick, estimates the impact on GHG emissions and local air pollution.	Less accurate than method 2. Unable to tailor to specific groups, not suitable for individual GP practices.	No. of OP/GP appointments which have been conducted remotely.

Calculate the greenhouse gas (GHG) emissions savings

Method	Emissions factors (EF) for return trip to OPA/GPA	Calculation of GHG emissions savings
Method 1 (page 6)	OPA: 5.8 kgCO2e GPA: 1.12 kgCO2e	No. of OP/GP remote consultations x EF = GHG emissions savings of avoided patient travel
Method 2 (page 7)	Carbon calculator is pre-populated with EFs	Enter the postcode data/distance travelled and mode of transport (if mode is known) into the carbon calculator Follow the instructions on the 'How to' tab of the carbon calculator The calculator will calculate the GHG emissions savings
Method 3 (page 12)	HOTT is pre-populated with EFs	Choose your own organisation from the drop-down box at the top of the worksheet 'Provider (Non-Ambulance)'. 'Create' two new scenarios, for **scenario 1** select the current year in the column 'Year (2015 -2030)'. For **scenario 2,** select also the current year. Enter the new (reduced) number of in-person outpatient attendances in row 82 of scenario 2. Calculate: GHG emissions savings (row 199) = GHG emissions scenario 1 (tCO2e) – GHG emissions scenario 2 (tCO2e) NOx emission savings (row 223) = t NOx scenario 1 – t NOx scenario 2 $PM_{2.5}$emissions savings (row 230) = t $PM_{2.5}$ scenario 1 – t $PM_{2.5}$ scenario 2

References

[1] Climate Change Act 2008. https://www.legislation.gov.uk/ukpga/2008/27/contents

[2] NHS (2019). NHS Long-term plan. https://www.longtermplan.nhs.uk/wp-content/uploads/2019/08/nhs-long-term-plan-version-1.2.pdf

[3] NHS (2019). NHS Long-term plan. https://www.longtermplan.nhs.uk/wp-content/uploads/2019/08/nhs-long-term-plan-version-1.2.pdf

[4] SDU (2015). Carbon Hotspots update for the health and care sector in England.

[5] SDU (2018). Reducing the use of natural resources in health and social care.

[6] SDU (2015). Sustainable Care Pathways Guidance – Patients Travel Module – October 2015

[7] National Travel Survey (NTS 0308) 'Average number of trips by trip length and main mode: England.' https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/905950/nts0308.ods

[8] National Travel Survey (NTS 0308) 'Average number of trips by trip length and main mode: England.' https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/905950/nts0308.ods

[9] SDU (2019). Health Outcomes of Travel Tool. https://networks.sustainablehealthcare.org.uk/networks/sustainable-healthcare/health-outcomes-travel-tool

[10] Greener NHS, https://www.england.nhs.uk/greenernhs/

Remote Consultations:

Do they reduce Greenhouse Gas Emissions?

Your Guide to Calculating the Answer

Published by the Centre for Sustainable Healthcare

The Centre for Sustainable Healthcare
t: +44 (0) 1865 51581
e: info@sustainablehealthcare.org.uk
www.sustainablehealthcare.org.uk
@SusHealthcare

CENTRE *for* SUSTAINABLE HEALTHCARE
inspire • empower • transform

The Centre for Sustainable Healthcare is registered as a company limited by guarantee in England & Wales No. 7450026 and as a charity No 1143189. Registered address 8 King Edward Street, Oxford OX1 4HL.