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ORIGINAL RESEARCH

Calculating and reducing the environmental impact of hybrid endovascular surgery

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Plain English Summary

Why we undertook the work: Healthcare creates lots of greenhouse gases and surgery plays a big role in this. Surgical cases require a lot of disposable single-use equipment, anaesthetic gases and high-energy systems like ventilation, lighting and temperature control. This study measured the carbon footprint of common arterial vascular surgeries and explored ways to reduce their environmental impact.

What we did: At one vascular surgery centre we studied four types of vascular surgery procedures: simple endovascular (keyhole) aneurysm repair (EVAR); complex EVAR (involving custom-made devices and extra branches for arteries to the internal organs); percutaneous (keyhole) lower limb procedures for circulation like angioplasty and stents; and hybrid lower limb revascularisation involving a combination of open surgery and keyhole procedures. For each operation we recorded in real time the devices, disposable items and waste produced. We then estimated the carbon emissions associated with each item by considering its full journey from producing the raw materials and manufacturing the product through to packaging and transport and finally disposal. This approach, known as a life-cycle assessment, looks at the environmental impact of a product from when it is made to when it is thrown away.

What we found: The amount of carbon emissions varied depending on the type of procedure. Complex EVAR had the highest average carbon emissions since it uses more resources and is more complicated. This was about the same as driving 418 miles in a petrol-driven car. We also saw that more people in the operating theatre resulted in a greater number of single-use wearable items such as hats and gowns being used, adding to the waste produced. Ways to reduce the emissions could include using more keyhole techniques, reusable surgical fabrics, ecofriendly packaging and more efficient imaging methods.

What this means: This study is the first to look at the carbon footprint of common arterial vascular surgeries and identifies where changes could be made to make these procedures more environmentally friendly. As this study is an early exploratory investigation, further research involving multiple hospitals and a wider range of procedures is needed to confirm these findings and to see whether these changes really make surgery more environmentally friendly.

Abstract

Background: The healthcare sector is a substantial contributor to global greenhouse gas emissions, with surgical services accounting for a significant proportion. This is driven by the extensive use of single-use consumables, volatile anaesthetic agents and energy-intensive infrastructure including ventilation, lighting and climate control systems. This study quantified the carbon footprint of commonly performed arterial vascular procedures and identified modifiable drivers to reduce their environmental impact.

Methods: A prospective observational study was carried out at a single vascular surgery centre, focusing on four procedure types: simple endovascular aneurysm repair (EVAR); complex EVAR; percutaneous lower limb revascularisation; and hybrid lower limb revascularisation. Real-time data were collected to capture devices, consumables and waste associated with each intervention. A life-cycle assessment approach was used to estimate carbon emissions across the product pathway including raw material extraction, manufacturing, packaging, transportation and disposal.

Results: A total of 24 procedures were analysed (6 simple EVAR, 8 complex EVAR, 5 percutaneous lower limb revascularisations and 5 hybrid lower limb revascularisations). Carbon emissions varied significantly between procedure types (Kruskal–Wallis test, H=11.53,

p<0.05), with complex EVAR associated with the highest median emissions, reflecting greater resource intensity and procedural complexity. Median emissions for complex EVAR were equivalent to driving approximately 418 miles in a standard petrol vehicle. A strong positive correlation was seen between the number of theatre personnel and the volume of single-use wearable items (Spearman's ρ=0.878, p<0.001), suggesting staffing levels contribute meaningfully to procedural waste. Opportunities to reduce emissions were identified, including use of percutaneous techniques, reusable surgical textiles, sustainable packaging strategies and imaging optimisation.

Conclusion: This pilot study represents the first observational quantification of the carbon footprint associated with common arterial vascular procedures and identifies targets for sustainability interventions within vascular surgery. Given the procedural heterogeneity and single-centre design, further multicentre studies with larger sample sizes and standardised methodologies are required to better quantify emissions and evaluate the effectiveness of sustainability interventions.

Key words: CO_2 emissions, hybrid vascular surgery, environmental impact

Introduction

Background

Climate change refers to long-term shifts in global temperatures and weather patterns, driven predominantly over the past two centuries by human activity, particularly the combustion of fossil fuels. The release of greenhouse gases such as carbon dioxide (CO_2) and methane (CH_4) traps heat within the atmosphere, raising global temperatures,[1] which is known as global warming. This represents one of the prime manifestations of climate change, alongside air pollution, increase in prevalence of human diseases, food insecurity and other socioeconomic impacts. Climate change has escalated into a global emergency, affecting ecosystems, economies and public health worldwide.

The Paris Agreement, signed in 2016, aimed to limit the global mean temperature rise to below 2°C and to achieve net negative emissions by 2100. However, current projections suggest that, even with immediate action, global temperatures are expected to continue rising by an additional 0.2–0.5°C over the next decade, potentially reaching a 1°C increase by the end of the 21st century. The World Health Organization (WHO) has projected that climate change will cause 250,000 additional deaths between 2030 and 2050, with the burden of climate change not being distributed equally. Vulnerable communities face disproportionate health risks due to limited access to well-resourced healthcare and food security systems.[2] This highlights the critical need for stronger and more unified global mitigation efforts to effectively combat climate change.[3]

Climate change and healthcare

The increasing contribution of healthcare systems[4] to the global climate emergency is now widely recognised. The global health sector was estimated to generate 2.6 billion metric tonnes of carbon dioxide equivalent (CO_2e) in 2011, and in 2014 the global health climate footprint accounted for approximately 4.4% of total global emissions, equivalent to the greenhouse gas emissions from 514 coal-fired power plants.[5]

The increase in greenhouse gas emissions and the resulting intensification of the climate crisis presents both direct and indirect risks to public health. These risks include injury, illness from changes to vector ecology, air pollution and natural disasters (Figure 1). This creates a cycle in which worsening climate-related health outcomes increase healthcare demand, further amplifying healthcare-related emissions. As this cycle continues the burden on healthcare systems grows, making it increasingly challenging to mitigate both climate-related health issues and the environmental impact of healthcare systems.[4]

Recognising the environmental responsibility, the NHS set an aim to become the world's first net zero national health service. The plan outlines two key targets: achieving net zero for the NHS Carbon Footprint by 2040 (covering emissions under direct control) and net zero for the NHS Carbon Footprint Plus by 2045, which includes emissions from the supply chain, patient and staff travel, and commissioned services.[6]

Surgery and sustainability

Within healthcare, surgical care has been identified as a significant contributor to the global climate emergency due to the extensive use of energy, medical devices and consumables and generation of waste. The energy performance of the surgical suite at John Radcliffe Hospital was shown to be 12.61 GJ/m^2 compared with 2.14 GJ/m^2 for the building as a whole, demonstrating the increased energy intensity of operating theatres.[7] A systematic review which aimed to determine the reported carbon footprints of surgical operations in hospitals worldwide identified medical devices and consumables to be the greatest contributor to their carbon footprints (Figure 2), most likely due to their increased requirement in surgery to ensure sterility and efficiency.

Figure 1 Impacts of climate change on human health.[4]

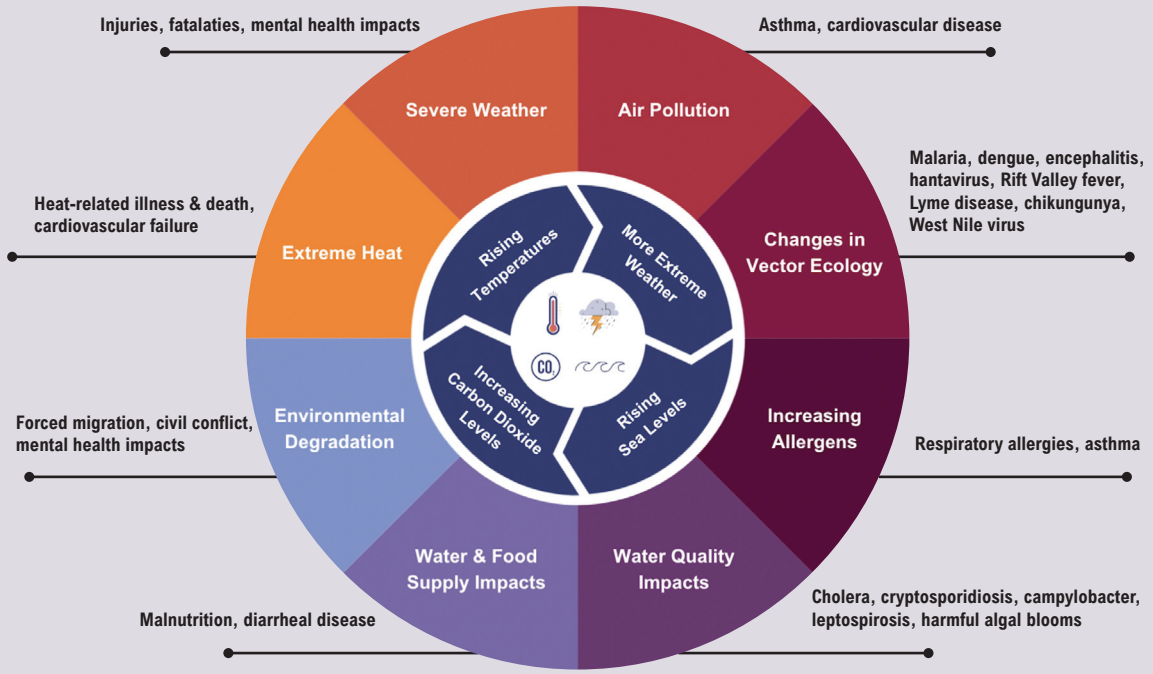
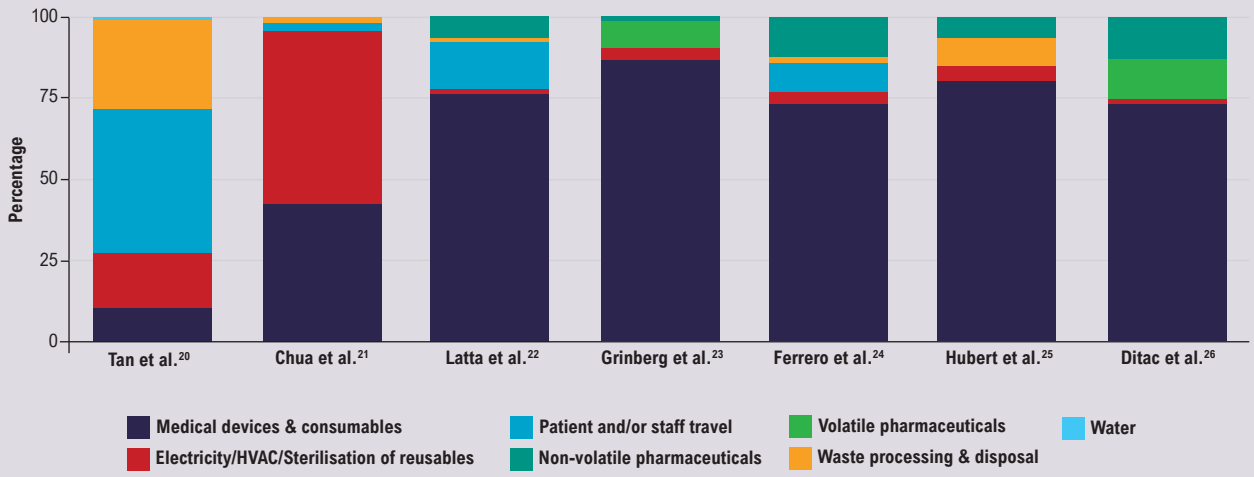


Figure 2 Carbon hotspots across a range of surgical procedures. HVAC, heating, ventilation and air conditioning.[8]



Carbon footprint contribution deriving from transportation of these medical devices and consumables makes up only a small proportion of the total carbon footprint, therefore attempts at reducing the carbon footprint should be focused on other areas. The material production and manufacture of medical devices and consumables was the greatest contributor of their emissions and highlights an area in which more sustainable alternatives could be used, such as through the substitution of single-use items with reusable types. An essential detail which emerges from systematic reviews conducted to determine the reported carbon footprint of surgical operations is that there are no specific guidelines for calculating the carbon footprint of surgical operations, causing diverse results between studies. Standardisation of methods will provide better quality data in order to guide more sustainable surgical practice.[8]

Vascular surgery and sustainability

Vascular surgery is a unique surgical specialty in that open surgery,

endovascular interventions and hybrid techniques are all used in the management of life- and limb-threatening conditions. Endovascular surgery has evolved rapidly over the last 50 years as evidence of reduced periprocedural morbidity and mortality compared with open surgery emerged.[9] Hybrid techniques incorporating elements of both open and endovascular surgery are now common. These procedures have become the standard of care for many patients with life- and limb-threatening ischaemia, and guidelines from major clinical bodies such as the National Institute for Health and Care Excellence (NICE) and the European Society for Vascular Surgery (ESVS) increasingly recommend endovascular interventions as the preferred approach for treating abdominal aortic aneurysms.[10,11]

Endovascular surgical techniques call for specialised equipment such as guidewires, angiographic catheters, balloons and stents, all of which are composed of complex synthetic materials such as polytetrafluoroethylene (PTFE), teflon, stainless steel and nitinol, which increase their cost and environmental impact (polyethylene is more affordable and more environmentally friendly than PTFE, yet PTFE is still more commonly used[12]).[13] The packaging associated with these devices is also extensive. One study on packaging materials associated with equipment used in endovascular aneurysm repair (EVAR), a common vascular surgical procedure, found that typical equipment packaging contained between four and seven elements to hold one device, such as cardboard or plastic inserts, foam and sterility packaging. Some of these packaging items lack the universal recyclable symbol, causing uncertainty of their disposable methods even though the majority of materials were classed as recyclable when discussed with company representatives. The shift towards minimally invasive procedures has led to greater reliance on these disposable devices in vascular surgery, and a formal framework to mitigate the environmental impact of vascular surgery is needed.[14]

A few studies have quantified the carbon footprint of vascular procedures, Gu *et al*[15] showed that the median amount of carbon produced over 59 vascular procedures was 15.2 kg CO_2e, roughly equivalent to driving a car for 108 km.[16] Many vascular and endovascular procedures are difficult to fully standardise and therefore few studies have attempted to assess arterial interventions. Notably, a recent study by Sénémaud *et al*[17] evaluated the carbon footprint associated with a single EVAR, estimating it to generate a median of 108 kg of CO_2e and identifying consumables to be one of the most emissive factors. More specific evidence on the environmental impact of vascular surgery remains limited and, as endovascular techniques continue to grow, their collective environmental impact will likely increase, highlighting the need for robust data in order to develop effective tools to reduce their environmental impact.

Aims and objectives

The primary aim of this study was to describe the environmental impact of commonly performed arterial vascular procedures. With a particular focus on carbon emissions generated through the use of disposable medical devices and consumables and waste management, the study sought to address a critical gap in the existing literature.

The secondary aim was to assess the potential for carbon footprint reduction through changes in clinical practice, such as the adoption of reusable surgical textiles and reusable instrument sets. By assessing the environmental implications of such changes, this study aims to provide practical recommendations for transitioning towards more sustainable surgical practices.

The specific objectives guiding the study to achieve these aims are:

1. To systematically identify and document the equipment used in common arterial vascular procedures and to analyse the associated waste disposal practices, including the classification and management of different waste streams.
2. To calculate the carbon footprint of commonly performed arterial vascular procedures by integrating observational data with life-cycle methodology, published manufacturer-derived data, online sources and published emission factors.
3. To estimate the potential environmental cost savings associated with change in clinical practice, with a particular focus on substitution of single-use surgical textiles with reusable textiles.

Methods

Study design

In this observational exploratory pilot study, prospective data collection methods were employed to assess the environmental impact of commonly performed vascular surgical procedures. A life-cycle assessment (LCA) was used to estimate the carbon footprint associated with disposable medical devices and equipment used.

The LCA focused on per-procedure resource use rather than top-down economic input-output modelling, allowing attribution of emissions to specific items and waste streams used during individual cases. An LCA is a standardised approach used to evaluate the environmental impact of a product or process across its entire life-cycle, from raw material extraction and manufacturing, use, their associated packaging and disposal practices, measured in kilograms of CO_2 equivalent (kg CO_2e). In this context, it enables the identification of carbon intensive components and supports evidence-based changes to more sustainable clinical practice.[18] This study primarily employed a bottom-up, process-based LCA using per-procedure resource use data collected in real time. Where item-specific life-cycle data were unavailable, top-down published emission factors were applied for material production, transport and waste processing.

This study was conducted with local audit approval (project no. 16785).

Procedure selection

Four procedures were selected as follows:

1. Standard endovascular aneurysm repair (EVAR), which is

defined as any EVAR procedure using a standard infrarenal device (stent graft) following the manufacturer's instructions, without the use of any adjunctive procedures.
2. Complex endovascular aneurysm repair (complex EVAR), defined as any EVAR procedure that includes fenestrated, branched, customised or internal iliac branch devices.
3. Percutaneous lower limb intervention, referring to a range of minimally invasive procedures performed to manage peripheral arterial disease, particularly in cases of chronic limb-threatening ischaemia. The procedures aim to revascularise occluded or stenotic arteries (ie, percutaneous transluminal angioplasty (PTA) and stenting).
4. Hybrid lower limb revascularisation, a combined approach which integrates both open and endovascular techniques to revascularise in patients with complex peripheral arterial disease (eg, common femoral endarterectomy alongside endovascular treatment of the iliac, superficial femoral or tibial arteries).

The four selected procedures are among the most commonly performed vascular procedures in the UK, with approximately 43,000 vascular surgery procedures being carried out in England each year and more than 28,000 of those cases relating to aortic aneurysm repair and lower limb revascularisation. There has been an increase in endovascular procedures in recent years as techniques such as EVAR have been established,[19] with lower patient mortality and morbidity,[20] increasing the patient population eligible for treatment.

These procedures are widely recognised and recommended for treatment for different manifestations of arterial disease and chronic limb-threatening ischaemia by various guidelines such as the NICE, the ESVS and the Trans-Atlantic Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II).[10,20,21]

As such, they are being increasingly favoured over purely open strategies and will remain highly relevant in clinical practice. As these procedures become more common, and the complexity of interventions achievable with endovascular and hybrid techniques increases, the collective carbon footprint will also increase, making it essential to understand and reduce environmental impacts through developing sustainable practices.

Four operative groups were included in this study as described above, with consecutive cases being recorded where a data collector was available. There were no specific exclusion criteria, although the hybrid peripheral revascularisation group referred specifically to the hybrid nature of the revascularisation, rather than a purely endovascular procedure combined with adjunctive minor amputation.

Data collection

Data collection was performed by a single operator (YS) over a two-month period, during which 28 cases were selected and observed. A case was observed from the time the patient entered the operating room from the anaesthetic room, until the patient exited for the recovery ward. Data regarding the following were recorded: personal protective equipment (such as gloves and masks), surgical fabrics (such as drapes and gowns), implantable and single-use devices and consumables, all packaging materials associated with devices and consumables, waste produced from the procedure, and data on reusable items. A database of all medical devices, disposables, reusable items, packaging and waste of observed cases was constructed.

Data regarding devices such as catheters, guidewires, stent grafts and consumables, such as gloves and gowns, included the product type, the total weight of the item and the weight of the corresponding packaging, the quantity used, the manufacturing location of the item and the main material composition of the product and its packaging. Data regarding devices and consumables that had been opened but not used would also be recorded. The category 'miscellaneous disposables' included individual single-use items not captured within predefined device categories including syringes, labels, caps, connectors and other small ancillary materials used during routine procedural workflow. The waste produced from each procedure was categorised as recycling – which itself comprised white recycling bag waste and hard plastic and paper kept aside separately for recycling – and clinical waste, which was then weighed. Methods of waste management such as incineration and recycling were also recorded. Data regarding reusable items and laundry recorded the quantity, category (eg, reusable scrub gowns, reusable instrument sets/kits) and weight, referring to sterile instrument sets assembled and packaged locally within the hospital sterile services department, containing reusable procedural instruments prepared for specific vascular interventions. These sets did not include disposable consumables and were recorded separately from single-use items (Table 1).

All weights were recorded using a DIGI® DS-502 weighing scale (maximum capacity 6 kg) to the nearest gram, with no individual item exceeding this limit, and the database for data collection was constructed on Microsoft Excel™. Data on manufacturing location and material composition of disposable medical equipment were gathered by examining the labelling and manufacturing details printed on the product packaging where available, but when such details were not clearly specified, data were gathered through online searches including manufacturing websites, product brochures and other publicly available online sources. The data on identifying waste streams and their associated carbon emissions with their respective disposal methods were obtained through direct correspondence with the trust waste manager of Guy's and St Thomas' NHS Foundation Trust. All the data were collected through direct observation in the hybrid theatre at St Thomas' Hospital, and all appropriate cases during the time period were to be observed, accepting limitations around time commitments for a single data observer.

Table 1 Data capture categories.

Category	Variable	Description	Examples	Data collected
Waste – recycling	White recycling bag	White recycling bag containing the packaging of equipment used during the procedure	White recycling waste bag	Weight (g), method of disposal
Waste – recycling	Hard paper	Hard paper packaging	Packaging from stent/grafts	Weight (g), method of disposal
Waste – recycling	Hard plastic	Hard plastic packaging from stent/grafts	Packaging from stent/grafts	Weight (g), method of disposal
Waste – clinical waste	Clinical waste bag	Orange bags containing infectious or potentially infectious waste	Orange clinical waste bag	Weight (g), method of disposal
Disposables	Kits	Pre-packed kits containing disposable items used during the procedure	St Thomas' Hybrid Angiopack	Weight (g), quantity (n), material composition, manufacturing location
Disposables	Access	Equipment used to gain vascular access for percutaneous devices	Brite Tip Sheath 4F introducer 11 cm 0.035"	Weight (g), quantity (n), material composition, manufacturing location
Disposables	Sheaths	Equipment used to maintain vascular access	Terumo peripheral guiding sheath 8F 90cm straight	Weight (g), quantity (n), material composition, manufacturing location
Disposables	Catheters	Angiographic catheters for injection of contrast media	Cordis BER II 4F 100 cm catheter	Weight (g), quantity (n), material composition, manufacturing location
Disposables	Balloon catheters	Catheters used to dilate vessels during angioplasty procedures	Charger OTW PTA balloon 5F 3×40 mm 135 cm	Weight (g), quantity (n), material composition, manufacturing location
Disposables	Guidewires	Wires used to aid in percutaneous navigation of stents/grafts	Lunderquist extra stiff guidewire 300 cm 0.035"	Weight (g), quantity (n), material composition, manufacturing location
Disposables	Grafts/stents	Mesh or fabric devices used to reinforce vessels	GORE Excluder AAA EP 16x27x14 mm 15Fr 0.035"	Weight (g), quantity (n), material composition, manufacturing location
Disposables	Drapes/covers	Sterile barriers used to maintain an aseptic field	3M ioban 2 56 x 60 cm antimicrobial incise drape	Weight (g), quantity (n), material composition, manufacturing location
Disposables	Gauze/dressings	Materials applied to clean and cover surgical wounds	3M Tegaderm film 15 x 20 cm	Weight (g), quantity (n), material composition, manufacturing location
Disposables	Closure devices	Devices used to achieve haemostasis at vascular access sites	Prostyle Perclose suture system	Weight (g), quantity (n), material composition, manufacturing location
Disposables	Instruments	Manual tools used during procedure	Disposable mosquito clip	Weight (g), quantity (n), material composition, manufacturing location
Disposables	Catheterisation	Equipment used when catheterisation patient	Foley catheter ch 12 4 mm x 10 mL	Weight (g), quantity (n), material composition, manufacturing location.
Disposables	Suture/clips	Materials used to close wounds and incisions	Ethicon Ligaclip large	Weight (g), quantity (n), material composition, manufacturing location
Disposables	Wearables	Materials worn by staff to maintain aseptic field	Disposable blue gloves	Weight (g), quantity (n), material composition, manufacturing location
Disposables	Misc.	All other items which were used throughout the procedure	Baxter heparin solution in NaCl 500 mL	Weight (g), quantity (n), material composition, manufacturing location
Reusables	Instrument sets	Preassembled instrument sets	Vascular fine access set	Quantity (n)
Reusables	Reusable scrub caps	Personal reusable scrub caps		Quantity (n)
Reusables	Laundry	Surgical scrub gowns		Weight (g), quantity (n)

Data analysis and LCA calculations

Categorical data, such as quantity of disposables were presented as numbers and percentages, and continuous data such as the total carbon footprint per type of procedure were described using inclusive median and interquartile range (IQR). Planned statistical analyses included non-parametric comparisons between procedure groups (Kruksall–Wallis tests) and correlation analyses (Spearman's rank correlation). The clinical-to-recycling waste ratio was calculated for each case by dividing the weight of clinical waste by the weight of the recyclable waste produced. The total carbon footprint for each case was quantified using Formula 1 (see Appendix 1 online at www.jvsgbi.com).

The CO_2e associated with disposable items was estimated using a process-based LCA approach, combining measured item weights with emission factors to account for raw material production, manufacturing, packaging, transport, and end-of-life waste processing, allowing the contribution of each stage to the total carbon footprint to be understood, meaning that carbon saving

strategies can easily be applied to stages which contribute the most. The LCA calculator used for this study is shown in Formula 2 (see Appendix 1 online at www.jvsgbi.com).

The CO_2e from raw material processing of disposables was quantified by identifying the main material components and using respective emission factors obtained from online sources, discussed in (see Appendix 2 online at www.jvsgbi.com). Transport CO_2e was calculated by identifying the manufacturing location, and then using a publicly available online sea shipping route calculator[22] to obtain the distance to St Thomas' Hospital, London, in kilometres, covering both sea and road distances. Subsequently, the emission factors for shipping through general sea and road freight obtained from the greenhouse gas reporting conversion factors 2024 spreadsheet from the Department for Energy Security and Net Zero were used to calculate the CO_2e.[23] The contribution of CO_2e from end-of-life treatment was obtained by using emission factors provided by the trust waste manager of Guy's and St Thomas' NHS Foundation Trust, with the emission factors for waste processing differing between recycling and clinical waste with 359 kg CO_2e produced for processing one tonne of clinical waste compared with 21 kg CO_2e /tonne for recycling processes (Guy's and St Thomas' NHS Foundation Trust Waste Management Team).

In the absence of published item-specific life-cycle data for manufacturing and packaging stages, a simplified mass-based emission factor of 0.001 kg CO_2e per gram (equivalent to 1 kg CO_2e per kg of material) was applied. This value was selected as a screening-level approximation and applied consistently across all items to enable comparative analysis between procedures within this exploratory pilot study. Mass-based proxy emission factors were used where item-specific data were unavailable, consistent with ISO 14040 guidance permitting the use of representative secondary data within life-cycle inventory analysis provided assumptions and limitations are transparently reported. Published LCAs of plastics manufacturing report supply chain emission intensities typically within the order of approximately 1–5 kg CO_2e per kg of material, placing the selected value within the lower range of empirically reported estimates for polymer manufacturing.[24]

More granular proportional attribution using material-specific emission factors (eg, DEFRA conversion factors for plastics, paper, and cardboard packaging) was not undertaken in this pilot analysis in order to maintain methodological consistency across heterogeneous devices and packaging types. Introducing variable material-specific factors without complete component standardisation may have introduced additional uncertainty and reduced comparability between procedures. However, incorporation of such approaches represents an important refinement for future work.

Maintaining a uniform modelling approach across all procedures ensured internal consistency of emission estimates, allowing relative differences between procedure types to be interpreted with greater confidence within this exploratory pilot framework.

The CO_2e from laundry is relevant due to the use of reusable surgical gowns. However, it should be noted that centre-specific emission factors were not obtainable, so instead emission factors deriving from a LCA of items commonly reprocessed by a large hospital laundry service were used.[25]

In each case the 'St Thomas' Hybrid Angio Pack' refers to a pre-packaged set of disposable items consisting of 44 individual items including drapes, hypodermic needles, disposable plastic kidney dishes, galley pots, etc. The above carbon emissions calculator formula has been applied to these items, resulting in a total CO_2e per 'St Thomas' Hybrid Angio Pack' of 46.1 kg CO_2e (see Appendix 3 online at www.jvsgbi.com). This has then been included as a single item for subsequent descriptive statistics.

For each case, pre-filled bags of heparinised saline solution (heparin sodium 1000 units/500 mL infusion Viaflex bags) were utilised.[26] The CO_2e calculations for this were generated based on the above LCA calculator, by taking the heparin additive into account for the carbon emissions deriving from raw material processing, which is not synthetic but extracted from animal-based materials (porcine intestinal mucosa).[26] To estimate the carbon emissions, published data were used which indicated that the rearing of a single pig produces approximately 670 kg CO_2e, and each pig yields approximately 65,000 IU of heparin,[27] therefore the carbon emissions deriving from a 1000 IU dose was able to be calculated by substituting the following variable into Formula 3 (see Appendix 1 online at www.jvsgbi.com).

Assumptions

Several assumptions were made during the data analysis process, due to lack of data being publicly available and to ensure consistency. Medical devices and equipment are made of several individual components, using a variety of materials. The use of patents and trademarks by manufacturers limits the data available in the public domain, and therefore material composition was limited to the two most predominant materials, estimated using publicly available online resources and through the use of open-source AI.

The use of a simplified mass-based emission factor for manufacturing and packaging and attribution based on dominant material compositions represents a screening- level approximation. Incorporation of material-specific emission factors and full component inventories may refine absolute emission estimates but is unlikely to substantially alter relative comparisons between procedure groups.

For CO_2e relating to transport, once the manufacturing location was identified (once again estimates had to be made when specific details were not available, such as if a country of manufacture was provided, the capital city of that country was used as the manufacturing location), it was entered into an online shipping route calculator, using St Thomas' Hospital as the destination in order to calculate the total distance by road and sea shipping, with sea shipping routes that use the London Gateway Port as the point of

entry into the UK for consistency across data. It was assumed that container ships with an average TEU and diesel HGV trucks which where average laden were used for sea and road transport.

Centre-specific emission factors for the sterilisation of reusable instrument kits were not able to be obtained and therefore were excluded from the total carbon footprint. However, the contribution of sterilisation of single-use items has previously been estimated at <1%.[28] Similarly, for the purposes of this study, anaesthetic components of care, which have been well described in the existing literature,[29] were excluded as were staff and patient travel, hospital infrastructure and out of theatre patient care components. These elements have all been previously studied[30] and fall outside the remit of this study, given the time limitations. There is unlikely to be significant variation in these elements for this study compared with the previously published data.

Table 2 Summary of disposable items used by procedure type.

Disposables	Simple EVAR (n=6) Median (IQR)	Complex EVAR (n=8) Median (IQR)	Percutaneous LL (n=5) Median (IQR)	Hybrid LL (n=5) Median (IQR)
Sets	2 (0)	2 (0)	1 (0)	2 (0)
Access	5.5 (2.75–6)	6.5 (5–10)	3 (0)	3 (2–5)
Sheaths	0.5 (0–1)	1 (0.5–1.5)	0 (0)	0 (0)
Catheters	5.5 (4.25–6)	6 (5–6.5)	3 (3–3)	2 (0)
Balloon catheters	1.5 (1–2.75)	2.5 (1–3.75)	3 (2–4)	2 (0)
Guidewires	3.5 (2.25–4)	9 (6.5–11)	4 (2–5)	4 (2–6)
Grafts/stents	2.5 (1–4)	9 (7.25–9.5)	1 (0–1)	2 (2–3)
Drapes/covers	1 (0.25–1.75)	0 (0–1)	1 (1–2)	3 (1–3)
Swabs, gauze, dressings	3.5 (3–4.75)	2.5 (1.75–5)	4 (3–4)	6 (0)
Closure	4 (4–4.75)	4 (2.75–4.25)	1 (1–1)	0 (0)
Instruments	0.5 (0–1)	0 (0–1.25)	6 (1–9)	6 (5–9)
Catheterisation	4 (0)	4 (0)	0 (0)	4 (0)
Suture clip	0 (0)	0 (0)	0 (0)	9 (6–11)
Wearables	18 (16.2–25)	31.5 (17–34)	20 (16–21)	25 (23–28)
Miscellaneous	8.5 (7.25–11.25)	13 (12–15.25)	11 (10–11)	19 (17–22)
TOTAL	**60.5 (53.5–66)**	**91 (75.5–103.75)**	**52 (52–59)**	**99 (84–105)**

EVAR, endovascular aneurysm repair; LL, lower limb.

Results

A total of 28 cases were observed, with the previously mentioned data analysis methodologies only being applied to 24 of them. The flowchart in Figure 3 illustrates the process. These consisted of simple EVAR (n=6), complex EVAR (n=8), percutaneous lower limb revascularisation (n=5) and hybrid lower limb revascularisation (n=5).

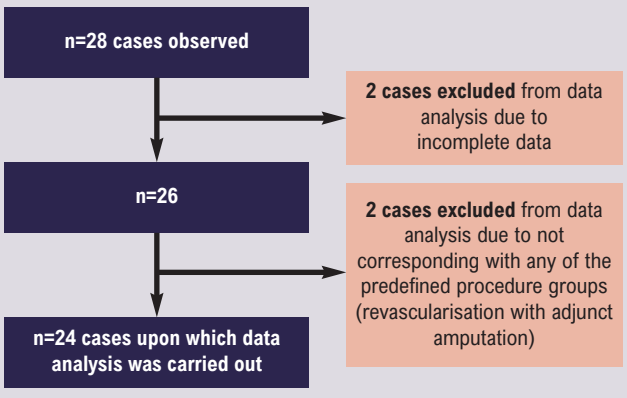
Disposable item analysis

For each of the procedure types studied the number of disposable items used is shown in Table 2, giving the median (IQR) number of items for each procedure type due to the small sample sizes and non-normal distributions observed across procedure groups.

The data showed variation between cases and groups, with the complexity of the case having a direct correlation with the number of disposables. The median (IQR) number of disposable items used per procedure was 70.5 (58.5–97). When stratified by procedure type, hybrid lower limb revascularisation procedures showed the highest number of disposables used (99 (84–105)), followed by complex EVAR procedures (91 (75.5–103.75)), simple EVAR (60.5 (53.5–66)) and percutaneous lower limb interventions (52 (52–59)).

More personnel were present during complex procedures, which correlated with a greater number of wearable disposable items used during the case (Figure 4). Spearman's rank correlation coefficient was selected as a non-parametric method to assess the association between these two variables. The analysis confirmed a strong positive correlation between the two variables (Spearman's $\rho=0.878$, $p<0.001$). These findings are consistent with expectations, as each theatre personnel requires disposable items to maintain sterility, and the significance of the observed relationship emphasises the impact that personnel numbers may have on the overall carbon footprint.

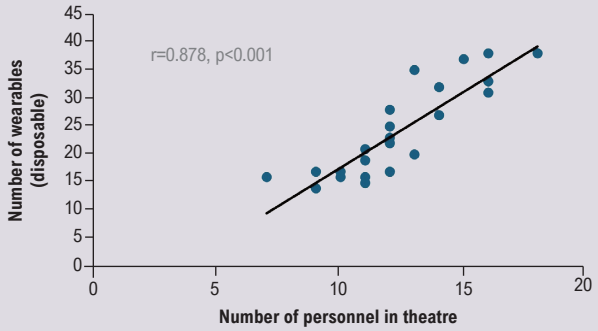
Figure 3 Study flowchart.



Waste generation analysis

The median waste generated per case also varied between procedure types. The weight of waste is given to the nearest gram.

Figure 4 Correlation between number of personnel and disposable wearable items. Scatter graph with line of best fit illustrating the relationship between the number of personnel in the theatre (x-axis) and the number of wearables (disposable) (y-axis). Spearman's rank correlation coeffecient ρ=0.878, p<0.001.



Separate analysis of recyclable waste and clinical waste is given in Figures 5 and 6.

Differences in both clinical waste and recyclable waste were noted across groups with the complex EVAR and hybrid lower limb revascularisation groups again representing the greater waste generation.

A Kruskal–Wallis test was performed to determine if there were statistically significant differences in the clinical-to-recycling waste ratios across procedure types. This statistical test was selected as it is a non-parametric method for comparing continuous non-normally distributed data across multiple independent groups. The analysis showed a significant difference between groups (H=18.09, p=0.00042), indicating that the proportion of clinical waste to recycled waste differed between procedure types. The median clinical-to-recycling waste ratios varied between procedure types (Table 3), suggesting that hybrid and percutaneous lower limb procedures tended to generate proportionally greater amounts of clinical waste relative to recycling waste.

LCA results

LCA of carbon emissions of disposable items was conducted for each case. The full data tables are given in Appendix 3 (online at www.jvsgbi.com). Similar to the disposable items and waste analysis, the complex EVAR (median (IQR) 110.59 (100.77–121.87) kg CO_2e) and hybrid lower limb revascularisation groups (median (IQR) 86.59 (70.56–94.70) kg CO_2e) were the procedure groups generating the most carbon waste, and the complex EVAR group generated significantly greater CO_2e than the hybrid lower limb revascularisation group (Figure 7).

Another Kruskal–Wallis analysis demonstrated a significant difference in carbon emissions across the four procedure groups (H=11.53, p=0.0092), indicating that the environmental impact varied depending on the procedure type. It is likely that this relates to the greater complexity of the implantable devices used across

Figure 5 Recycling waste generated by procedure type. Box and whisker plot of recycling waste produced per procedure type in grams. Values shown are median (IQR). Simple EVAR: 3192.5 (2950.75–3455.25) g; complex EVAR: 8612 (5103.5–9366.5) g; percutaneous lower limb procedures: 2561 (2430–2585) g; hybrid lower limb procedures: 2838 (2050–3057) g. EVAR, endovascular aneurysm repair; LL, lower limb.

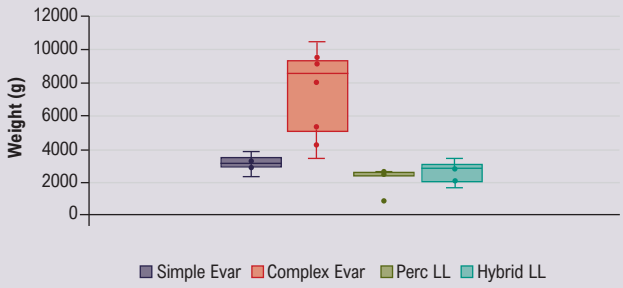


Figure 6 Clinical waste generated by procedure type. Box and whisker plot of clinical waste produced per procedure type in grams. Values shown are median (IQR). Simple EVAR: 6047.5 (5637.5–6494.25) g; complex EVAR: 7323 (5682.5–8293) g; percutaneous lower limb procedures: 5881 (5143–6604) g; hybrid lower limb procedures: 7380 (6038–8703) g. EVAR, endovascular aneurysm repair; LL, lower limb.

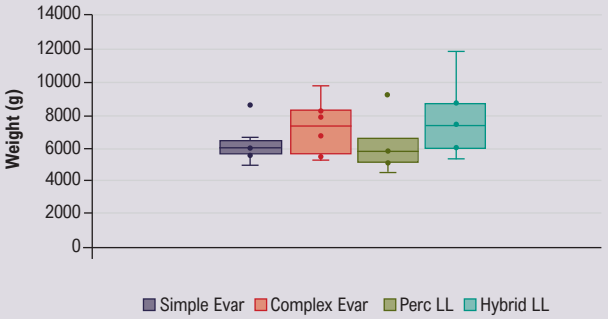
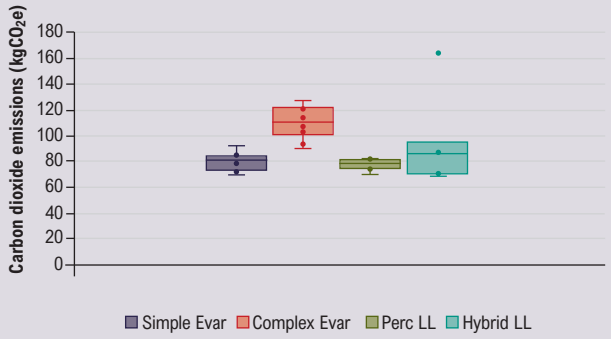


Table 3 Clinical-to-recycling waste ratios

Procedure type	Median clinical-to-recycling ratio	IQR
Simple EVAR	1.94	(1.74–2.34)
Complex EVAR	0.97	(0.83–1.12)
Percutaneous lower limb	2.50	(2.28–3.82)
Hybrid lower limb	2.95	(2.60–3.23)

EVAR, endovascular aneurysm repair

Figure 7 Carbon dioxide emissions by procedure type. Box and whisker plot of carbon emissions produced per procedure type ($kgCO_2e$). Values shown are median (IQR). Simple EVAR: 80.83 (73.70–84.04); complex EVAR: 110.59 (100.77–121.87); percutaneous lower limb procedures: 78.20 (74.69–81.21); hybrid lower limb procedures: 86.59 (70.56–94.70). EVAR, endovascular aneurysm repair.



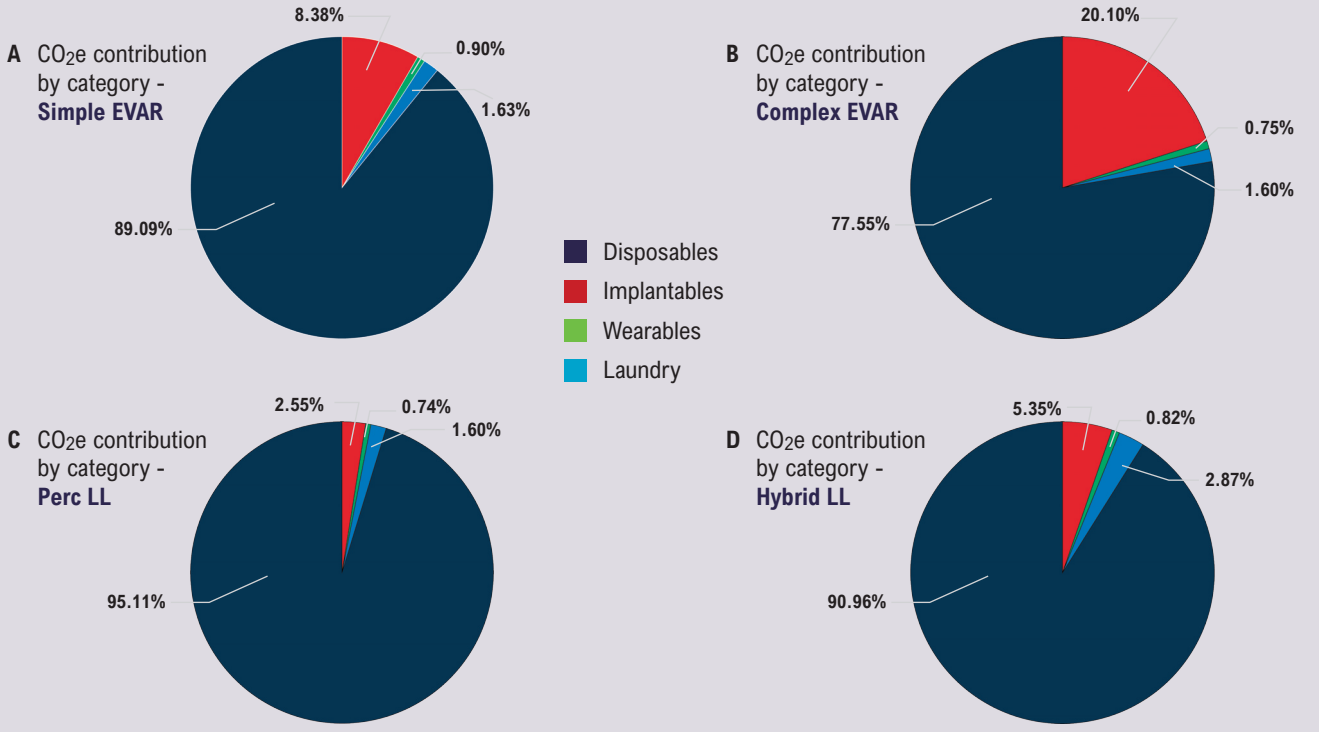
groups, with complex EVAR cases requiring custom-made stent grafts and other specialised equipment, often involving more complex manufacturing processes and potentially greater shipping distances, although this subgroup analysis was beyond the scope of the current project.

The emission factor for laundry processing was obtained from published results from an LCA which aimed to estimate the environmental impact of linen items reprocessed by a large hospital laundry unit and was 0.508 kg CO_2e per kg of laundry.[25]

In order to investigate the contributors to CO_2e generation, all emission-generating components which were used in the LCA calculations were further categorised into four categories: single-use disposables (sheaths, guidewires, catheters, balloon catheters, swabs/gauze/dressings, instruments, kits, drapes/covers, access and closure devices, equipment used when catheterising patients, suture/clips), implantable devices (stent/grafts), wearables (hats, masks, gloves, gowns) and laundry.

Analysis of CO_2e contributions by components across the four procedure types revealed that single-use disposables were the predominant source of emissions in all cases, accounting for 77.55–95.11% of total procedure-related CO_2e (Figure 8). The proportion attributable to disposables was highest in percutaneous lower limb interventions (95.11%) and lowest in complex EVAR cases (77.55%), in which a greater reliance on stents and grafts resulted in a higher relative contribution from implantables (20.10%). Implantables contributed minimally in simple EVAR (8.38%), hybrid lower limb (5.35%) and percutaneous lower limb (2.55%) procedures. Wearables and laundry represented minor emission sources overall, each contributing minimally across all procedure types. These findings indicate that disposables and

Figure 8 Contributors to CO_2e on LCA by procedure type. Pie charts illustrating the contribution to total procedural CO_2e by procedure type (%). (A) Simple EVAR: n=479.69 $kgCO_2e$; (B) complex EVAR: n=880.55 $kgCO_2e$; (C) percutaneous lower limb (LL) procedures: n=386.36 $kgCO_2e$; (D) hybrid lower limb procedures: n=484.81 $kgCO_2e$. EVAR, endovascular aneurysm repair; LCA, life-cycle assessment.



implantable devices are the primary contributors to procedural carbon emissions, and targeted carbon-saving strategies should prioritise these domains to optimise sustainability in vascular surgical practice.

Discussion

This exploratory study aimed to estimate the carbon footprint associated with four common arterial endovascular surgical procedures. Through understanding the main procedural components to the environmental impact from surgery, it may be possible to reduce emissions through targeted system change. The main findings are that procedural carbon emissions varied by procedure type, with higher emissions observed in more complex endovascular and hybrid procedures, and that disposable medical devices and consumables accounted for the largest proportion of total emissions across all procedure types. Given the pilot nature of this study, these findings should be interpreted as descriptive. The study was designed to provide baseline data that may inform future sustainability research within vascular surgery.

The carbon emission data obtained from this study are likely to underestimate the actual carbon emissions for the procedures, as certain contributing factors were not included in the analysis such as energy use of the theatre as a whole, carbon emissions from anaesthesia and transport of staff and patients, based on existing literature and the pragmatic constraints of a pilot design. Operating theatres and hybrid suites vary widely in size, ventilation requirements, imaging capabilities and procedural duration is likely to differ between simple and complex interventions as well as between operators. These factors may meaningfully influence energy consumption and could vary by procedure type. Incorporating direct measurement or estimation of theatre energy use represents an important area for future research.

The total carbon footprint of a procedure would comprise all the emission-generating components, such as anaesthesia, for which there is also published literature. The anaesthetic team at Guy's and St Thomas' NHS Foundation Trust have moved away from inhaled volatile gas-based anaesthesia to total intravenous anaesthetic techniques, known to confer reduced carbon emissions.[29] This is standard practice across all vascular anaesthetists and all procedure types, and therefore would have been unlikely to impact the results discussed in this study focusing on vascular surgery.

The study highlights differences in environmental impacts with each different procedure type. In particular, the clinical waste generation and total carbon emissions generated through complex hybrid lower limb revascularisations were high, and significantly greater than for percutaneous lower limb revascularisations. This is expected, given the hybrid nature of the intervention involving open common femoral surgery in addition to the endovascular components of the procedure.

Interestingly, although the complex EVAR group was the greatest contributor to overall carbon emissions, the clinical waste generation was low and emissions seemed to relate largely to graft manufacture and transport. Recyclable waste was high in this group, reflecting the large number of disposable and implantable items which are packaged in paper and plastic-based materials.

The findings of this study align with and expand upon previous work quantifying the environmental impact of surgical procedures. The study supports the findings of Rizan *et al*[31] who identified single-use consumables and textiles as major contributors to surgical emissions. In particular, the high carbon emissions generated in complex endovascular and hybrid revascularisation procedures in this analysis reflect the intensive use of disposable equipment. While prior research has focused on general surgery, orthopaedics or anaesthetic-related emissions, this study adds to a growing body of evidence highlighting the high carbon intensity of device-heavy specialties such as vascular surgery. The waste generated per procedure observed here are consistent with ranges reported in studies of comparable surgical complexity such as arthroscopic procedures,[32] and the carbon emissions generated and quantity of disposables are consistent with ranges reported from a previous study quantifying the carbon footprint of EVAR procedures.[17]

The data were collected through real-time observation of procedures, which allowed for a highly accurate documentation of devices and consumables used and waste produced. The direct observation allowed for the identification of different categories of waste like recycling and clinical waste and, by distinguishing between different waste streams, this study provides a greater understanding of their individual contributions to total carbon emissions. The prospective nature of the study meant that all data were documented accurately from the moment the patient entered the operating theatre to the moment of exit, including data on items which may not be listed on procedure logs or in inventory records, improving the accuracy of the dataset.

The use of a single observer for data collection allowed for a greater understanding of procedural practices. The nuances between theatre staff in their practices when setting up for procedures and waste management was able to be observed, ensuring that a standardised method was consistently applied when collecting data.

To the team's knowledge, this is also the first study to explore the environmental impact of different vascular and endovascular arterial procedures and therefore generates new knowledge which may equip clinical teams with information necessary to consider systematic change towards greener vascular practice.

In capturing 'real world' complex cases rather than those more standardised and easily protocolised cases (eg, endovenous ablation), the study results are relevant and valid in relation to the varied and complex vascular cases which require operative intervention, providing information on which decisions can be made to reduce environmental impact.

Despite the strengths of this study, several limitations must be acknowledged when interpreting the findings. The heterogeneity within the dataset was a primary challenge. Variability arising from

differences in procedure type and complexity and also the surgical practices of individual surgeons resulted in a wide variety in the quantity of consumables, which limits the generalisability of the findings. A larger dataset incorporating a broader range of procedures would be necessary to draw more statistically robust conclusions.

The study was conducted in a single centre, introducing further limitations due to variability in surgical practices across vascular units, waste management and procurement choices of equipment between trusts in the UK. A multicentre study would therefore be required to validate the findings and to ensure the results have a broader applicability across different geographic sites. The relatively small sample size also limits the conclusions which may be drawn from the results. The limited number of cases reduces statistical power to detect meaningful differences in CO_2e.

Operator experience, procedural complexity and case duration are likely to influence resource utilisation and emissions; however, the sample size was insufficient to permit stratified analysis by operator type or experience. Future studies with larger cohorts may allow exploration of whether emissions vary systematically according to operator factors or procedural efficiency.

Manufacturers were not directly consulted regarding device transport pathways and shipment modes were estimated using standard assumptions. Variability in transport logistics, including potential use of air freight, may influence absolute emission estimates and represent an area for refinement in future analyses through industry collaboration.

Although having a single observer ensured a consistent approach to data collection, it also introduces the potential for bias. The presence of one observer may have influenced the behaviour of theatre staff, and the subjective judgement of the single observer may have caused data to be incorrectly categorised or recorded.

Opportunities to reduce environmental impact

Several opportunities to reduce the environmental impact of vascular surgical practice have been identified through this study and in the wider literature. A key intervention applicable across all procedure types is the transition from disposable to reusable surgical fabrics. Adoption of reusable textiles represents a simplified practical change, requiring minimal alteration to clinical workflows or staff training. A 2018 study by Vozzola *et al*[33] showed that the use of reusable isolation gowns over disposable isolation gowns resulted in a 30% reduction in greenhouse gas emissions (kg CO_2e). This reduction was largely attributed to decreased clinical waste generation and the elimination of repeated manufacturing processes associated with single-use gowns. The study also noted that reusable gowns could offer additional environmental benefits such as lower water and energy usage when processed through modern industrial-scale laundering systems, which often incorporate wastewater treatment facilities to reduce the environmental impact of water output from the cleaning process.

A more comprehensive follow-up study by the same group in 2020 focused specifically on surgical gowns and reported an even greater reduction in carbon emissions, up to 66% (kg CO_2e), when using reusable gowns compared with disposables.[34] This larger reduction compared with the 30% seen in the earlier isolation gown study is primarily attributable to differences in the type of gown assessed and the inclusion of more detailed life-cycle components in the analysis. Unlike the previous study, which focused on isolation gowns with limited packaging and fewer handling steps, the 2020 study evaluated surgical gowns which typically require more robust manufacturing, sterility controls and packaging. The analysis accounted for all stages from raw material extraction through to end-of-life disposal and included emissions from packaging production, the full energy demands of repeated laundering cycles and the role of wastewater treatment plants used in modern laundry systems. By incorporating these additional factors, particularly transport, industrial-scale cleaning infrastructure and textile processing, the study offered a more accurate estimation of the emissions associated with each gown type, thereby highlighting the substantial carbon savings achievable through reusable systems.

The findings from both studies reinforce the role of textile-related choices as a key area of opportunity for carbon emission reduction within surgical care. Although the exact scale of savings may vary depending on gown type, laundering system and hospital infrastructure, the consistent finding across multiple analyses is that reusable gowns lead to substantial and repeatable reductions in carbon emissions. At St Thomas' Hospital reusable surgical gowns are already standard practice, representing a strong commitment to sustainable procurement. However, further environmental gains could be achieved by optimising elements of the laundering system, particularly through investment in more efficient wastewater treatment infrastructure to reduce the footprint of repeated washes. Additionally, while life cycle models often assume a defined reuse limit, typically 75 uses per gown, based on manufacturers' advice, in practice, gowns at St Thomas' are washed and reused indefinitely until failure, which may in fact amplify the carbon savings beyond those reported in the literature. This study did not assess infection risk or barrier performance associated with reusable surgical textiles, and conclusions regarding clinical safety cannot be drawn. The results reinforce the potential of reusable surgical textiles as a practical and impactful intervention to reduce the carbon footprint of routine surgical care.

The paradigm shift towards prioritising percutaneous lower limb revascularisation over hybrid lower limb procedures highlights a key clinical strategy in reducing the carbon footprint of vascular procedures. Full percutaneous techniques such as interventions at the common femoral artery have been shown to be increasingly effective, with low rates of periprocedural complications and mortality and better patency.[35] By minimising the need for open surgical exposure, percutaneous approaches can decrease operative time, reduce consumable use and lower waste generation, all contributing to a lower procedural carbon footprint. However, it is essential that environmental consideration does not

override clinical judgement. Decisions regarding revascularisation strategy should remain grounded in patient selection, anatomical suitability, risk stratification and multidisciplinary team discussion to ensure optimal clinical outcomes. Sustainability consideration may complement – but should not replace – established decision-making frameworks.

Packaging waste also represents a significant contributor to the total carbon footprint of surgical procedures, with medical consumables and devices being packaged in multiple layers to ensure sterility and prevent damage to fragile components. The widespread use of virgin plastics and complex composite materials – which are often trademarked and patented – reduce the recycling opportunities. Switching to biodegradable or recycled plastics offers a sustainable solution to this problem, but collaboration between healthcare institutes and industry partners is needed to encourage greener packaging practices and is a complex and time-consuming process.

A further opportunity identified for reducing procedural carbon emissions relates to imaging modality choices during vascular interventions. Digital subtraction angiography is commonly used in vascular procedures for its enhanced imaging quality; however, recent research has shown that this technique contributes significantly more to procedural carbon emissions compared with standard fluoroscopic imaging runs.[36] Considering minimising the number of digital subtraction angiograms and using fluoroscopy where possible could potentially contribute to overall reduced CO_2e per procedure without compromising patient safety, in addition to reducing procedural radiation exposure.

Conclusion

This exploratory study aimed to estimate the carbon footprint associated with four vascular surgical procedures, demonstrating that emissions vary by procedure type and are largely driven by disposable medical devices and consumables.

The findings from this study represent a small pilot single-centre investigation, but at the time of writing it is the first study to describe the environmental impacts of arterial vascular procedures commonly performed for life- and limb-threatening pathologies. The procedures represent a common subset of procedures used in clinical practice due to their minimally invasive nature and favourable patient outcomes, but their dependence on disposable devices and consumables presents a difficult environmental challenge.[19]

To address this environmental challenge, a multifaceted approach will be required, involving reduced reliance on disposables through increasing use of reusable textiles and instruments where possible, implementing better waste management protocols and collaborating with industry partners to promote the development of more sustainable devices and packaging.

Despite the limited scope of this study, the results highlight the significant carbon footprint generated by endovascular and hybrid techniques. These findings provide us with essential baseline data to build upon for future efforts aimed at reducing the environmental impact of vascular surgery, and future work is required to validate and consolidate the findings through larger multicentre studies with more comprehensive data collection.

KEY MESSAGES

- Hybrid and endovascular arterial procedures generate a substantial carbon footprint.
- Carbon emissions varied significantly by procedure type, and disposable medical devices accounted for the largest share of total emissions across all procedure types.
- The study identified practical and implantable sustainability interventions such as switching to reusable surgical textiles, use of percutaneous techniques and imaging optimisation to meaningfully reduce emissions.

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Appendix 1 Formulas

Formula 1.

$$CO_2e_{Total} = \sum(CO_2e_{per\ disposable\ item}) + CO_2e_{laundry}$$

Where:

$CO_2e_{Total} = Total\ carbon\ emissions\ per\ case$ Total carbon emissions per case

$\sum(CO_2e_{per\ disposable\ item}) = Sum\ of\ carbon\ emissions\ from\ disposable\ items$

$CO_2e_{laundry} = Carbon\ emissions\ from\ laundry\ processing$

Formula 2.

$$CO_2e_{item} = CO_2e_{material} + CO_2e_{manufacture} + CO_2e_{transport} + CO_2e_{packaing} + CO_2e_{end-of-life\ treatment}$$

Where:

$CO_2e_{item} = Total\ carbon\ dioxide\ equivalent\ per\ single\ disposable\ item$

$CO_2e_{material} = Carbon\ dioxide\ equivalent\ from\ raw\ material\ processing$

$CO_2e_{manufacture} = Carbon\ dioxide\ equivalent\ from\ product\ manufacture$

$CO_2e_{transport}$
$= Carbon\ dioxide\ equivalent\ from\ transport\ of\ product\ from\ manufacturor$

$CO_2e_{packaing} = Carbon\ dioxide\ equivalent\ from\ packaging\ materials$

$CO_2e_{end-of-life\ treatment}$
$= Carbon\ dioxide\ equivalent\ from\ waste\ management\ methods$

Formula 3.

$$CO_2e_{material} = \left(\frac{670kg\ CO_2e}{65{,}000IU}\right) \times 1000$$

Where:

$CO_2e_{material}$
$= Carbon\ dioxide\ equivalent\ from\ raw\ material\ processing\ of\ Baxter\ heparin$

Appendix 2 Raw material emission factors

Material	CO2e per g	Source
Polyethylene	0.0018	open AI
PTFE	0.01444	https://www.climatiq.io/data
nylon	0.01066	https://www.climatiq.io/data
pebax	0.005	open AI
hdpe	0.002506	https://www.climatiq.io/dataatiq
braided nylon	0.01166	open AI
silicone	0.00016	open AI
polyurethane	0.0027	https://www.mecanocaucho.com/download/catalog/Sylomer_Environmental_Product_Declaration.pdf
PET	0.0031	https://www.inference.org.uk/sustainable/LCA/elcd/external_docs/petb_31116f00-fabd-11da-974d-0800200c9a66.pdf
duralyn	0.01066	open AI
woven polyester	0.0257	https://www.climatiq.io/datatiq
barrier	0.00275	open AI
cotton	0.0009	https://www.sciencedirect.com/science/article/pii/S266691612500026X
soft parrafin	0.0029	open AI
polycarbonate	0.005936	https://www.climatiq.io/data
polypropylyne	0.0018	https://www.inference.org.uk/sustainable/LCA/elcd/external_docs/pp_31116f04-fabd-11da-974d-0800200c9a66.pdf
pvc	0.00249	https://www.climatiq.io/data
titanium	0.00143	https://www.ipcc-nggip.iges.or.jp/efdb/find_ef.php?ipcc_code=2.B.6&ipcc_level=2
latex	0.00013	https://apps.carboncloud.com/climatehub/product-reports/id/13365715946#:~:text=%E2%80%9DLatex%20natural%E2%80%9D%20currently%20has%20a,match%20the%20latest%20climate%20science.
nitrile	0.0035	open AI
tungsten	0.0055	open AI
s steel	0.00216	https://www.climatiq.io/data
nitinol	0.0225	open AI
nickel	0.0175	open AI
cobalt	0.0282	open AI
cocr	0.0275	open AI
viscose	0.01	open AI
bovine pericardium	0.0175	open AI
cellulose	0.0033	https://apps.carboncloud.com/climatehub/product-reports/id/1267952392638#:~:text=%E2%80%9DCellulose%20film%E2%80%9D%20currently%20has%20a,of%203.30%20kg%20CO%E2%82%82e%2Fkg.

Appendix 2 Raw material emission factors continued

Poliglecaprone 25	0.006	open AI
Polyglactin 910	0.007	open AI
abs plastic	0.0031	https://bage-plastics.com/sustainable-recycled-granules-by-bage-plastics-with-excellent-carbon-footprint/
aluminum	0.0041	https://www.climatiq.io/data
sponge	0.005	open AI
wood based fibre	0.001	open AI
heparin	10.3kg of co2 per 1000IU	https://pmc.ncbi.nlm.nih.gov/articles/PMC10851001/

Appendix 3 Raw data tables

St Thomas Hybrid Angiopack

ST Thomas Hybrid Angiopack	Gross weight (g)	Packaging (g)	NET WEIGHT (g)	Material	Location	DistanceSEA	DistanceRO	Disposal	Material CO2	Product CO2	Transport CO	Packaging C	Disposal CO	Disposal CO	TOTAL CO2
1x Needle 19Gx7cm Single Wall	1	0	1	S steel	China	24860	70	Alternative, recyclin	0.00216	0.001	0.00040757	0	0.000359	0	0.00392657
3x Syringe 10ml L/S	18	0	18	Polypropylen	China	24860	70	Alternative, recyclin	0.0324	0.018	0.00733634	0	0.006462	0	0.06419834
2x Clamps Towel 70mm	44	0	44	S steel	China	24860	70	Alternative, recyclin	0.09504	0.044	0.01793328	0	0.015796	0	0.17276928
2x Gallipot 120ml	23	0	23	Polypropylen	Egypt	6210	240	Alternative, recyclin	0.0414	0.023	0.00284113	0	0.008257	0	0.07549813
1x Cover set Poly with Caution Label	2	1	1	Polypropylen	Worcester	0	220	Alternative, recyclin	0.0018	0.001	2.147E-05	0.001	0.000359	0.000021	0.00420147
1x Bowl Sponge 500ml	15	0	15	Polypropylen	Egypt	6210	240	Alternative, recyclin	0.027	0.015	0.00185291	0	0.005385	0	0.04923791
1x Solution Guidewire Bowl	12	0	12	Polypropylen	Egypt	6210	240	Alternative, recyclin	0.0216	0.012	0.00148233	0	0.004308	0	0.03939033
2x Cover Trolley 140x210cm Blue	151	0	151	Polyester	Egypt	6210	240	Alternative, recyclin	3.8807	0.151	0.01865262	0	0.054209	0	4.10456162
2x Bowl Kidney Emesis 700ml	54	0	54	Polypropylen	Egypt	6210	240	Alternative, recyclin	0.0972	0.054	0.00667047	0	0.019386	0	0.17725647
2x OR Towel Blue	44	0	44	cotton	Worcester	0	220	Alternative, recyclin	0.0396	0.044	0.00094469	0	0.015796	0	0.10034069
2x Drape Adhesive Edge 75x90cm 3ply	290	0	290	Polyester	Worcester	0	220	Alternative, recyclin	7.453	0.29	0.00622637	0	0.10411	0	7.85333637
1x Protection Station Plus	45	15	30	Polypropylen	Worcester	0	220	Alternative, recyclin	0.054	0.03	0.00064411	0.015	0.01077	0.000315	0.11072911
1x Drape Angio Femoral 200x300cm 2Fen 14cm	423	0	423	Polyester	Worcester	0	220	Alternative, recyclin	10.8711	0.423	0.00908191	0	0.151857	0	11.4550389
1x Needle BD Drawing Up	1	0	1	S steel	China	24860	70	Alternative, recyclin	0.00216	0.001	0.00040757	0	0.000359	0	0.00392657
1x Bag Open Poly 51x76cm	38	0	38	Polypropylen	Worcester	0	220	Alternative, recyclin	0.0684	0.038	0.00081587	0	0.013642	0	0.12085787
4x Syringe 20ml L/S	56	0	56	Polypropylen	China	24860	70	Alternative, recyclin	0.1008	0.056	0.02282418	0	0.020104	0	0.19972818
1x Forceps Artery Mosquito Curved	34	0	34	S steel	China	24860	70	Alternative, recyclin	0.07344	0.034	0.01385754	0	0.012206	0	0.13350354
1x Cover Fluoro Medium Blue	1	0	1	Polypropylen	Worcester	0	220	Alternative, recyclin	0.0018	0.001	2.147E-05	0	0.000359	0	0.00318047
1x Label Set New Colours	2	0	2	Polypropylen	Worcester	0	220	Alternative, recyclin	0.0036	0.002	4.294E-05	0	0.000718	0	0.00636094
1x Bowl Denture Cup 250ml	11	0	11	Polypropylen	Egypt	6210	240	Alternative, recyclin	0.0198	0.011	0.0013588	0	0.003949	0	0.0361078
1x Needle Containment Device	31	0	31	Polypropylen	Worcester	0	220	Alternative, recyclin	0.0558	0.031	0.00066558	0	0.011129	0	0.09859458
1x Cover 102x102cm	205		205	Polyester	Worcester	0	220	Alternative, recyclin	5.2685	0.205	0.0044014	0	0.073595	0	5.5514964
1x Steriwrap 130x150cm	279	16	263	Polyester	Worcester	0	220	Alternative, recyclin	6.7591	0.263	0.00564667	0.016	0.094417	0.000336	7.13849967
2x Swab Gauze 7.5x10cm XR 32ply 5 Pack	58	2	56	cotton	Hubei, China	26640	960	Alternative, recyclin	0.0504	0.056	0.02929501	0.002	0.020104	0.000042	0.15784101
2x UK 26ml Tinted Chloraprep	142	14	128	Polypropylen	Madrid, Spain	1910	670	Alternative, recyclin	0.2304	0.128	0.01231051	0.014	0.045952	0.000294	0.43095651
2x Drape Adhesive Edge 175x175cm 3ply	277	0	277	Polyester	Worcester	0	220	Alternative, recyclin	7.1189	0.277	0.00594726	0	0.099443	0	7.50129026
1x Scalpel No.11 Retractable	6	0	6	S steel	China	24860	70	Alternative, recyclin	0.01296	0.006	0.00244545	0	0.002154	0	0.02355945
1x Eclipse Needle 21Gx1.5"	2	0	2	S steel	China	24860	70	Alternative, recyclin	0.00432	0.002	0.00081515	0	0.000718	0	0.00785315
1x P.I.L ChloraPrep Tint	12	0	12	Polypropylen	Worcester	0	220	Alternative, recyclin	0.0216	0.012	0.00025764	0	0.004308	0	0.03816564
1x Stopcock 3 Way ON 360º	3	0	3	Polypropylen	China	24860	70	Alternative, recyclin	0.0054	0.003	0.00122272	0	0.001077	0	0.01069972
Packaging		422										0.422		0.008862	0.430862
Total		2696													46.103969
	2280														

Case 1 : Simple EVAR

Items	Quantity	Material Manufacture	Product Manufacture	Transport CO2e	Packaging CO2e	Disposal CO2e clinical	Disposal CO2e Recycling	CO2e per item	TOTAL CO2e
GORE Excluder AAA EP 26mm x 14.5 x 12 16Fr 61 cm 0.035"	1	2.7705	0.15	0.04925735	0.3	0.05385	0.0063	3.3299073	3.3299073
GORE Excluder AAA EP 16x27x14 mm 15Fr 0.035"	1	2.75203	0.149	0.04892897	0.3	0.053491	0.0063	3.30975	3.30975
GORE Excluder AAA extender 15Fr 69cm 0.035"	1	2.75203	0.149	0.04892897	0.3	0.053491	0.0063	3.30975	3.30975
Surgical Scrub gloves	6	0.00078	0.006	0.00062748	0.004	0.002154	0.000084	0.0136455	0.0818729
Disposable surgical cap	9	0.0072	0.004	7.8074E-06	0	0.001436	0	0.0126438	0.1137943
Disposable Blue Gowns	4	0.0846	0.047	0.01915601	0	0.016873	0	0.167629	0.670516
Disosable Blue Gloves	10	0.0245	0.007	0.00285302	0	0.002513	0	0.036866	0.3686602
Dispoasable masks	6	0.0072	0.004	0.0016303	0	0.001436	0	0.0142663	0.0855978
St Thomas Hybrid Angiopack	1							46.103	46.103
Prosys 400ml Urine Meter	1	0.72708	0.292	0.00122537	0.015	0.104828	0.000315	1.1404484	1.1404484
National Catheterisation Pack Opt 1	1							0.208	0.208
Instillagel 11ml	1	0.0432	0.024	0.00087739	0.003	0.008616	0.000063	0.0797564	0.0797564
Sterile Saline Pods 20ml x 2	1	0.0846	0.047	0.01915601	0	0.016873	0	0.167629	0.167629
Foley Catheter ch 12 4mmx10ml	1	0.00512	0.032	0.01192037	0.004	0.011488	0.000084	0.0646124	0.0646124
Cordis PIG 5F 65cm	2	0.02424	0.003	0.0006845	0.02	0.001077	0.00042	0.0494215	0.098843
Prostyle Perclose suture system	6	0.150735	0.039	0.01993843	0.073	0.014001	0.001533	0.2982074	1.7892446
Terumo 2.5ml syringe	1	0.009	0.005	0.00203787	0.002	0.001795	0.000042	0.0198749	0.0198749
Lunderquist extra stiff guidewire 260cm 0.035"	2	0.4814	0.058	0.00450401	0.022	0.020822	0.000462	0.587188	1.174376
Glidewire advantage angled guidewire 180cm 0.035"	1	0.24548	0.017	0.00771526	0.018	0.006103	0.000378	0.2946763	0.2946763
Brite Tip Sheath 5F introducer 11cm 0.035"	2	0.142	0.008	0.001641	0.022	0.002872	0.000462	0.176975	0.35395
Brite Tip Sheath 10F introducer 11cm 0.035"	1	0.1775	0.01	0.00205125	0.022	0.00359	0.000462	0.2156033	0.2156033
Flexi-feel US probe cover w/ gel	1	0.0972	0.054	0.02200903	0.007	0.019386	0.000147	0.199742	0.199742
Angioflex Catheter Extension 225cm	1	0.11952	0.048	4.6844E-05	0.011	0.017232	0.000231	0.1960298	0.1960298
Scrub Gauze XRD 30x30cm 12ply looped tied 5	1	0.0099	0.011	0.00575438	0.004	0.003949	0.000084	0.0346874	0.0346874
BD 30ml luer-lock syringe	1	0.045	0.025	0.0024044	0.002	0.008975	0.000042	0.0834214	0.0834214
Easi-Mask surgical skin marker ruler label	1	0.018	0.01	0.00017567	0.005	0.00359	0.000105	0.0368707	0.0368707
Tegaderm film 15x20cm	2	0.0108	0.006	0.00019592	0.006	0.002154	0.000126	0.0252759	0.0505518
GORE DrySeal Flex introducer system 16F 33cm	2	0.95944	0.268	0.08800646	0.01	0.096212	0.00021	1.4218685	2.8437369
Cordis PIG 5F 100cm 0.035"	3	0.03232	0.004	0.00091267	0.02	0.001436	0.00042	0.0590887	0.177266
Cordis BER II 4F 65cm	2	0.0404	0.005	0.00114084	0.02	0.001795	0.00042	0.0687558	0.1375117
Encore 26 Inflation Device	1	0.52643	0.122	0.00323061	0.083	0.043798	0.001743	0.7802016	0.7802016
Baxter heparin solution in NaCl 500ml	1	10.3	0.56	0.14044424	0.007	0.20104	0.000147	11.208631	11.208631
GORE molding + occlusion balloon catheter 10-37mm 10Fr	1	0.5395	0.065	0.02134485	0.217	0.023335	0.004557	0.8707369	0.8707369
Cordis MK2 5F 80cm 0.035"	1	0.0404	0.005	0.00114084	0.02	0.001795	0.00042	0.0687558	0.0687558
Aptus Tour Guide steerable sheaths 7F 55cm	1	1.680525	0.165	0.03384568	0.43	0.059235	0.00903	2.3776357	2.3776357
Glidewire advantage angled guidewire 260cm 0.035"	1	0.34656	0.024	0.01089214	0.018	0.008616	0.000378	0.4084461	0.4084461
BS 6F impulse PIG catheter 125cm 0.038"	1	0.0641	0.01	0.00228168	0.026	0.00359	0.000546	0.1065177	0.1065177
GORE Excluder AAA EP 61cm 12Fr 0.035"	2	2.71509	0.147	0.0482722	0.3	0.052773	0.0063	3.2694352	6.5388704
Charger OTW PTA balloon 7F 12x40mm 135cm	1	0.172	0.025	0.00931279	0.125	0.008975	0.002625	0.3429128	0.3429128
Lunderquist extra stiff guidewire 300cm 0.035"	1	0.5063	0.061	0.00473697	0.024	0.021899	0.000504	0.61844	0.61844
Elis Surgical Drape 70x70	1	0.1035	0.115	4.4892E-05	0.01	0.041285	0.00021	0.2700399	0.2700399
TORK coloured long-lasting cleaning cloth	3	0.009	0.009	0.00017092	0	0.003231	0	0.0214019	0.0642058
Clinell Wipes	7	0.0124	0.004	0.0016303	0	0.001436	0	0.0194663	0.1362641
Laundry								1.7826	1.7826
	95								92.313938

Case 2 : Left Femoral Embolectomy Hybrid

Items	Quantity	Material Manufacture	Product Manufacture	Transport CO2e	Packaging CO2e	Disposal CO2e clinical	Disposal CO2e Recycling	CO2e per Item	TOTAL CO2e
St Thomas Hybrid Angiopack	2							46.103	92.206
Flexi-feel US probe cover w/ gel	1	0.0972	0.054	0.022009	0.007	0.019386	0.000147	0.199742	0.199742
Brite Tip Sheath 4F introducer 11cm 0.035"	1	0.142	0.008	0.001641	0.022	0.002872	0.000462	0.176975	0.176975
S-MAK MM mini access kit 4F	1	0.1245	0.015	0.006922	0.005	0.005385	0.000105	0.156912	0.156912
Smith & Nephew paraffin gauze dressing	1	0.0418	0.022	0.0089666	0.01	0.007898	0.00021	0.0908746	0.0908746
Unisurge bandage velbond 15cm	1	0.0198	0.022	0.0115088	0.01	0.007898	0.00021	0.0714168	0.0714168
Roclalle Healthcare stockinette 20cm	1	0.58	0.058	0.0255959	0.025	0.020822	0.000525	0.7099429	0.7099429
Ethicon Suture Vicryl Plus 2-0	3	0.021	0.003	0.000462	0.002	0.001077	0.000042	0.027581	0.0827429
Batrick suture clamp tags 0.9"x0.75" pink	1	0.00064	0.004	0.0004762	0.003	0.001436	0.000063	0.0096152	0.0096152
Sharps safety station purple surgical	1	0.40917	0.069	0.0018181	0.004	0.024771	0.000084	0.5088431	0.5088431
Roclalle bandage crepe 15cmx4.5m	1	0.0684	0.076	0.0335395	0.01	0.027284	0.00021	0.2154335	0.2154335
Medtronic DLP suction rube 11F shaft with 9F tip	1	0.03984	0.016	0.0004237	0.005	0.005744	0.000105	0.0671127	0.0671127
Skintact ESU tip cleaner	1	0.01	0.002	0.0008151	0.002	0.000718	0.000042	0.0155751	0.0155751
Pennine CT-4037 3m, 6mm F/F/M suction tube	1	0.27141	0.109	0.0444256	0.007	0.039131	0.000147	0.4711136	0.4711136
Unisurge Scrub Gauze XRD 10x7.5cm 12ply looped tied 5	7	0.0036	0.004	0.0020925	0.002	0.001436	0.000042	0.0131705	0.0921935
3M loban 2 56x60cm antimicrobial incsie drape	1	0.0112	0.07	0.0094588	0.024	0.02513	0.000504	0.1402928	0.1402928
Blade 10	2	0.00216	0.001	0.0004076	0.001	0.000359	0.000021	0.0049476	0.0098951
Covidien surgipro 3-0 60mm suture	3	0.0036	0.002	5.856E-06	0.002	0.000718	0.000042	0.0083659	0.0250976
Conmed diathermy electrosurgical handpiece	1	0.2628	0.073	0.0113974	0.028	0.026207	0.000588	0.4019924	0.4019924
Baxter heparin solution in NaCl 500ml	4	10.3	0.56	0.1404442	0.007	0.20104	0.000147	11.208631	44.834525
Radifocus Guidewire angled 260cm 0.035"	2	0.0656	0.016	0.0086576	0.014	0.005744	0.000294	0.1102956	0.2205912
Cordis BER II 4F 100cm catheter	1	0.06464	0.008	0.0018253	0.02	0.002872	0.00042	0.0977573	0.0977573
Cordis RIM 4F 65cm 0.035"	1	0.02424	0.003	0.0006845	0.02	0.001077	0.00042	0.0494215	0.0494215
Brite Tip Sheath 5F introducer 11cm 0.035"	1	0.142	0.008	0.001641	0.022	0.002872	0.000462	0.176975	0.176975
Cook Medical fixed core wire guide 145cm 0.035	2	0.7279	0.058	0.0123499	0.022	0.020822	0.000462	0.8415339	1.6830677
Brite Tip Sheath 7F introducer 11cm 0.035"	1	0.142	0.008	0.001641	0.022	0.002872	0.000462	0.176975	0.176975
Prostyle Perclose suture system	1	0.150735	0.039	0.0199384	0.073	0.014001	0.001533	0.2982074	0.2982074
Adhesive Drape 75x90cm 365 Healthcare	2	0.153	0.085	0.0001659	0.045	0.030515	0.000945	0.3146259	0.6292518
Halyard 2 tape strips	2	0.0486	0.027	0.0120771	0.008	0.009693	0.000168	0.1055381	0.2110762
Glidewire advantage angled guidewire 260cm 0.035"	1	0.34656	0.024	0.0108921	0.018	0.008616	0.000378	0.4084461	0.4084461
Cook Medical Flexor introducer set 8F 30cm 0.038"	1	0.16315	0.013	0.0027681	0.017	0.004667	0.000357	0.2009421	0.2009421
Torque valve/device	1	0.00996	0.004	0.0016303	0.002	0.001436	0.000042	0.0190683	0.0190683
Abbott Hi-Torque Command ES guidewire 300cm 0.014	1	0.5146	0.062	0.031697	0.021	0.022258	0.000441	0.651996	0.651996
Indigo system lightning bolt 7 penumbra aspiration cathet	1	1.87456	0.232	0.1186081	0.342	0.083288	0.007182	2.6576381	2.6576381
Merit Medical PIG 5F 100cm 0.035"	1	0.1212	0.015	0.006922	0.021	0.005385	0.000441	0.169948	0.169948
Encore 26 inflation device	2	0.52643	0.122	0.0032306	0.083	0.043798	0.001743	0.7802016	1.5604032
Charger OTW PTA balloon 6F 7.0x100mm 75cm	2	0.28208	0.041	0.015273	0.109	0.014719	0.002289	0.464361	0.9287219
Blade 11P	1	0.00216	0.001	0.0004076	0.001	0.000359	0.000021	0.0049476	0.0049476
Tufftex embolectomy catheter EMB 3	1	0.44903	0.083	0.0109337	0.027	0.029797	0.000567	0.6003277	0.6003277
Tuftex embolectomy catheter EMB 4	1	0.46526	0.086	0.0113289	0.026	0.030874	0.000546	0.6200089	0.6200089
Disposable intraoperative probe 8MHz	1	0.258955	0.067	0.0015693	0.383	0.024053	0.008043	0.7426203	0.7426203
Disposable mosquitor clip	1	0.0648	0.03	0.0122272	0.008	0.01077	0.000168	0.1259652	0.1259652
Eclipse needle 0.6mmx25mm 23G	2	0.00648	0.003	0.0012227	0.001	0.001077	0.000021	0.0128007	0.0256014
Clinell wipes	4	0.0124	0.004	0.0016303	0	0.001436	0	0.0194663	0.0778652
National Cath opt 1	1							0.208	0.208
Prosys 400ml urine meter	1	0.72708	0.292	0.0012254	0.015	0.104828	0.000315	1.1404484	1.1404484
Instillagel 11ml	1	0.0432	0.024	0.0008774	0.003	0.008616	0.000063	0.0797564	0.0797564
Sterile Saline pods 20mlx2	1	0.0846	0.047	0.019156	0	0.016873	0	0.167629	0.167629
Foley Catheter ch 12 4mmx10ml	1	0.00512	0.032	0.0119204	0.004	0.011488	0.000084	0.0646124	0.0646124
Zilver Flex 35 vascular self expanding stent 10x40mm	1	1.98	0.088	0.0023303	0.195	0.031592	0.004095	2.3010173	2.3010173
GORE Excluder AAA EP 8mmx10cm 8F	1	2.67815	0.145	0.0476154	0.3	0.052055	0.0063	3.2291204	3.2291204
Surgical scrub gloves	6	0.00078	0.006	0.0006275	0.004	0.002154	0.000084	0.0136455	0.0818729
Disposable surgical cap	9	0.0072	0.004	7.807E-06	0	0.001436	0	0.0126438	0.1137943
Disposable Blue Gowns	2	0.0846	0.047	0.019156	0	0.016873	0	0.167629	0.335258
Disosable Blue Gloves	16	0.0245	0.007	0.002853	0	0.002513	0	0.036866	0.5898564
Dispoasable masks	5	0.0072	0.004	0.0016303	0	0.001436	0	0.0142663	0.0713315
Laundry								2.665984	2.665984
	109								**163.8728**

Case 3 : FEVAR

Items	Quantity	Material Manufacture	Product Manufacture	Transport CO2e	Packaging CO2e	Disposal CO2e clinical	Disposal CO2e Recycling	CO2e per item	TOTAL CO2e
Terumo relay pro thoracic stent graft 34-30mm 209mm	1	2.3136	0.096	0.05194575	0.21	0.034464	0.00441	2.7104197	2.7104197
Terumo TREO abdominal stent graft system custom	1	6.4347	0.267	0.14447411	0.227	0.095853	0.004767	7.1737941	7.1737941
BeFlared FEVAR 8/10mmx27mmx120cm	2	1.6776	0.08	0.00620371	0.06	0.02872	0.00126	1.8537837	3.7075674
GORE excluder aortic extender 36mmx4.5cm	1	2.43804	0.132	0.04334647	0.3	0.047388	0.0063	2.9670745	2.9670745
BeFlared FEVAR stent 6/8mmx27mmx120cm	2	1.6776	0.08	0.00620371	0.06	0.02872	0.00126	1.8537837	3.7075674
BeGraft peripheral stent system 8mmx27mmx120cm	1	1.6776	0.08	0.00620371	0.06	0.02872	0.00126	1.8537837	1.8537837
Terumo abdominal stent graft system 15-20mm, 120mm	1	2.2413	0.093	0.05032244	0.21	0.033387	0.00441	2.6324194	2.6324194
Terumo abdominal stent graft system 15x141mm	1	6.266	0.26	0.1406864	0.183	0.09334	0.003843	6.9468694	6.9468694
Surgical scrub gloves	4	0.00078	0.006	0.00062748	0.004	0.002154	0.000084	0.0136455	0.0545819
Disposable Blue cap	7	0.0072	0.004	7.8074E-06	0	0.001436	0	0.0126438	0.0885067
Disposable mask	4	0.0072	0.004	0.0016303	0	0.001436	0	0.0142663	0.0570652
Prosys 400ml Urine Meter	1	0.72708	0.292	0.00122537	0.015	0.104828	0.000315	1.1404484	1.1404484
National Catheter pack opt 1	1							0.208	0.208
Instillagel 11ml	1	0.0432	0.024	0.00087739	0.003	0.008616	0.000063	0.0797564	0.0797564
Foley Catheter ch 12 4mmx10ml	1	0.00512	0.032	0.01192037	0.004	0.011488	0.000084	0.0646124	0.0646124
Sterile Saline pods 20ml x 2	1	0.0846	0.047	0.01915601	0	0.016873	0	0.167629	0.167629
St Thomas Angiopack	1							46.103	46.103
Terumo 15x20cm	2	0.0108	0.006	0.00019592	0.006	0.002154	0.000126	0.0252759	0.0505518
Brite Tip Sheath 10F introducer 11cm 0.035"	2	0.1775	0.01	0.00205125	0.022	0.00359	0.000462	0.2156033	0.4312065
Brite Tip Sheath 5F introducer 11cm 0.035"	2	0.142	0.008	0.001641	0.022	0.002872	0.000462	0.176975	0.35395
Prostyle Perclose suture system	4	0.150735	0.039	0.01993843	0.073	0.014001	0.001533	0.2982074	1.1928297
Angioflex Catheter Extension 225cm	1	0.11952	0.048	4.6844E-05	0.011	0.017232	0.000231	0.1960298	0.1960298
GORE DrySeal Flex introducer system 16F 33cm	2	0.95944	0.268	0.08800646	0.01	0.096212	0.00021	1.4218685	2.8437369
Lunderquist extra stiff guidewire 300cm 0.035"	1	0.5063	0.061	0.00473697	0.024	0.021899	0.000504	0.61844	0.61844
Rosen curved wire guide 260cm 0.035"	2	0.166	0.02	0.00425857	0.028	0.00718	0.000588	0.2260266	0.4520531
Radifocus Guidewire angled 180cm 0.035"	1	0.0697	0.017	0.00919873	0.014	0.006103	0.000294	0.1162957	0.1162957
Ultimum EV hemostasis introducer 10F 12cm	2	0.189	0.105	0.0311362	0.328	0.037695	0.006888	0.6977192	1.3954384
Cordis BER II 4F 65cm	1	0.0404	0.005	0.00114084	0.02	0.001795	0.00042	0.0687558	0.0687558
Cordis PIG 5F 100cm 0.035"	1	0.03232	0.004	0.00091267	0.02	0.001436	0.00042	0.0590887	0.0590887
Cordis C2 5F 65cm 0.038"	1	0.02424	0.003	0.0006845	0.02	0.001077	0.00042	0.0494215	0.0494215
BD 30ml luer-lock syringe	1	0.045	0.025	0.0024044	0.002	0.008975	0.000042	0.0834214	0.0834214
Aptus Tour Guide steerable sheaths 7F 55cm	1	1.680525	0.165	0.03384568	0.43	0.059235	0.00903	2.3776357	2.3776357
GORE DrySeal Flex introducer system 18F 33cm	1	0.97734	0.273	0.08964837	0.01	0.098007	0.00021	1.4482054	1.4482054
Cordis BER II 4F 100cm catheter	1	0.06464	0.008	0.00182534	0.02	0.002872	0.00042	0.0977573	0.0977573
Encore 26 inflation device	1	0.52643	0.122	0.00323061	0.083	0.043798	0.001743	0.7802016	0.7802016
GORE molding + occlusion balloon 10-37mm 10Fr 90cm	1	0.5395	0.065	0.02134485	0.217	0.023335	0.004557	0.8707369	0.8707369
Merit Medical heart span steerable sheath introducer 8.5F	1	2.7307	0.329	0.1518236	0.048	0.118111	0.001008	3.3786426	3.3786426
Baxter heparin in solution 500ml	2	10.3	0.56	0.14044424	0.007	0.20104	0.000147	11.208631	22.417262
Heli-fx endo anchor system + guide wire	1	2.2358	0.14	0.00370726	0.72	0.05026	0.01512	3.1648873	3.1648873
Flexor Check-Flo introducer set 8F 90cm 0.038"	1	1.31775	0.105	0.02235749	0.005	0.037695	0.000105	1.4879075	1.4879075
Cordis powerflex pro PTA balloon 8mmx2cm 5F	1	0.33542	0.062	0.01271777	0.103	0.022258	0.002163	0.5375588	0.5375588
Merit Medical PIG 5F 100cm catheter 0.035	1	0.1212	0.015	0.00692205	0.021	0.005385	0.000441	0.169948	0.169948
3M Tegaderm + pad 5cmx7cm	2	0.0072	0.004	0.00013062	0.005	0.001436	0.000105	0.0178716	0.0357432
Ethicon Suture Vicryl Rapide 4-0	2	0.021	0.003	0.00046197	0.002	0.001077	0.000042	0.027581	0.0551619
Clinell wipes	7	0.0124	0.004	0.0016303	0	0.001436	0	0.0194663	0.1362641
Laundry								2.278383	2.278383
	77								**126.81061**

Case 4 : TEVAR + left subclavian branch

Items	Quantity	Material Manufacture	Product Manufacture	Transport CO2e	Packaging CO2e	Disposal CO2e clinical	Disposal CO2e Recycling	CO2e per item	TOTAL CO2e
3M Tegaderm + pad 5cmx7cm	2	0.0072	0.004	0.0001306	0.005	0.001436	0.000105	0.0178716	0.0357432
3M Tegaderm film 15x20cm	2	0.0108	0.006	0.0001959	0.006	0.002154	0.000126	0.0252759	0.0505518
Baxter heparin in NaCl 500ml	2	10.3	0.56	0.1404442	0.007	0.20104	0.000147	11.208631	22.417262
BD 30ml luer-lock syringe	1	0.045	0.025	0.0024044	0.002	0.008975	0.000042	0.0834214	0.0834214
Brite Tip Sheath 10F introducer 11cm 0.035"	1	0.1775	0.01	0.0020513	0.022	0.00359	0.000462	0.2156033	0.2156033
Brite Tip Sheath 4F introducer 11cm 0.035"	1	0.142	0.008	0.001641	0.022	0.002872	0.000462	0.176975	0.176975
Brite Tip Sheath 5F introducer 11cm 0.035"	1	0.142	0.008	0.001641	0.022	0.002872	0.000462	0.176975	0.176975
BS Jagwire angle tip 0.035" x 450cm	1	0.6225	0.075	0.0171126	0.035	0.026925	0.000735	0.7772726	0.7772726
Clinell wipes	8	0.0124	0.004	0.0016303	0	0.001436	0	0.0194663	0.1557304
Cordis BER II 4F 65cm	1	0.0404	0.005	0.0011408	0.02	0.001795	0.00042	0.0687558	0.0687558
Cordis C2 5F 65cm 0.038"	2	0.02424	0.003	0.0006845	0.02	0.001077	0.00042	0.0494215	0.098843
Cordis PIG 5F 100cm 0.035"	1	0.03232	0.004	0.0009127	0.02	0.001436	0.00042	0.0590887	0.0590887
Cordis powerflex pro PTA dilation cath 12mmx2cm 7F	1	0.34624	0.064	0.013128	0.103	0.022976	0.002163	0.551507	0.551507
Easi-mark surgical pen+ ruler	1	0.018	0.01	0.0001757	0.005	0.00359	0.000105	0.0368707	0.0368707
Encore 26 inflation device	1	0.52643	0.122	0.0032306	0.083	0.043798	0.001743	0.7802016	0.7802016
Ethicon Suture Vicryl Rapide 4-0	3	0.021	0.003	0.000462	0.002	0.001077	0.000042	0.027581	0.0827429
Flexi-feel US probe cover w/ gel	1	0.0972	0.054	0.022009	0.007	0.019386	0.000147	0.199742	0.199742
Flexor Check flo introducer set 10F 80cm 0.038	1	1.31775	0.105	0.0223575	0.005	0.037695	0.000105	1.4879075	1.4879075
Foley Catheter ch 12 4mmx10ml	1	0.00512	0.032	0.0119204	0.004	0.011488	0.000084	0.0646124	0.0646124
Glidewire advantage angled guidewire 180cm 0.035"	1	0.24548	0.017	0.0077153	0.018	0.006103	0.000378	0.2946763	0.2946763
Glidewire advantage angled guidewire 260cm 0.035"	1	0.34656	0.024	0.0108921	0.018	0.008616	0.000378	0.4084461	0.4084461
Instillagel 11ml	1	0.0432	0.024	0.0008774	0.003	0.008616	0.000063	0.0797564	0.0797564
Lunderquist extra stiff guidewire 300cm 0.035"	1	0.5063	0.061	0.004737	0.024	0.021899	0.000504	0.61844	0.61844
National Cath opt 1	1							0.208	0.208
Prostyle Perclose suture system	3	0.150735	0.039	0.0199384	0.073	0.014001	0.001533	0.2982074	0.8946223
Prosys 400ml Urine Meter	1	0.72708	0.292	0.0012254	0.015	0.104828	0.000315	1.1404484	1.1404484
St Thomas angiopack	1							46.103	46.103
Sterile Saline pods 20ml x 2	1	0.0846	0.047	0.019156	0	0.016873	0	0.167629	0.167629
Unisurge Scrub Gauze XRD 30x30cm 12ply looped tied 5	1	0.0099	0.011	0.0057544	0.004	0.003949	0.000084	0.0346874	0.0346874
Disposable Blue Gowns	2	0.0846	0.047	0.019156	0	0.016873	0	0.167629	0.335258
Disposable masks	4	0.0072	0.004	0.0016303	0	0.001436	0	0.0142663	0.0570652
Disposable surgical cap	7	0.0072	0.004	7.807E-06	0	0.001436	0	0.0126438	0.0885067
GORE DrySeal Flex introducer system 24F 33cm	1	1.05968	0.296	0.0972012	0.01	0.106264	0.00021	1.5693552	1.5693552
GORE TAG thoracic branch endoprosth 40mmx15cm12m	1	2.82591	0.153	0.0502425	0.15	0.054927	0.00315	3.2372295	3.2372295
GORE TAG thoracic branch endoprosth 40mmx15cm12m	1	2.82591	0.153	0.0502425	0.15	0.054927	0.00315	3.2372295	3.2372295
GORE viabahn endoprosthesis 11mmx5cm 10F radiopaq	1	1.0209	0.123	0.040391	0.07	0.044157	0.00147	1.299918	1.299918
GORE viabahn VBX balloon EP 11mmx59mm 135cm 0.03	1	1.079	0.13	0.0426897	0.07	0.04667	0.00147	1.3698297	1.3698297
Surgical Scrub gloves	4	0.00078	0.006	0.0006275	0.004	0.002154	0.000084	0.0136455	0.0545819
Laundry								1.728216	1.728216
	66								90.446702

Case 5 : Common femoral endarterectomy + iliac stent hybrid

Items	Quantity	Material Manufacture	Product Manufacture	Transport CO2e	Packaging CO2e	Disposal CO2e clinical	Disposal CO2e Recycling	CO2e per Item	TOTAL CO2e
Zilver Flex 35 vascular self expanding stent 10x40mm	2	1.98	0.088	0.0023303	0.195	0.031592	0.004095	2.3010173	4.6020346
Surgical scrub gloves	5	0.00078	0.006	0.0006275	0.004	0.002154	0.000084	0.0136455	0.0682274
Disposable surgical cap	5	0.0072	0.004	7.807E-06	0	0.001436	0	0.0126438	0.063219
Disposable Blue Gowns	2	0.0846	0.047	0.019156	0	0.016873	0	0.167629	0.335258
Dispoasable masks	5	0.0072	0.004	0.0016303	0	0.001436	0	0.0142663	0.0713315
ST Thomas Angiopack	1							46.103	46.103
Ethicon Suture Vicryl Plus 2-0	1	0.021	0.003	0.000462	0.002	0.001077	0.000042	0.027581	0.027581
Ethicon Suture Monocryl 3-0	2	0.018	0.003	0.000462	0.002	0.001077	0.000042	0.024581	0.0491619
Ethicon Suture prolene 5-0	1	0.0054	0.003	0.000462	0.002	0.001077	0.000042	0.011981	0.011981
Blade 11	1	0.00216	0.001	0.0004076	0.001	0.000359	0.000021	0.0049476	0.0049476
Blade 10	2	0.00216	0.001	0.0004076	0.001	0.000359	0.000021	0.0049476	0.0098951
Conmed diathermy electrosurgical handpiece	1	0.2628	0.073	0.0113974	0.028	0.026207	0.000588	0.4019924	0.4019924
Skintact ESU tip cleaner	1	0.01	0.002	0.0008151	0.002	0.000718	0.000042	0.0155751	0.0155751
Unisurge Scrub Gauze XRD 10x7.5cm 12ply looped tied 5	4	0.0036	0.004	0.0020925	0.002	0.001436	0.000042	0.0131705	0.052682
Unisurge Scrub Gauze XRD 30x30cm 12ply looped tied 5	1	0.0099	0.011	0.0057544	0.004	0.003949	0.000084	0.0346874	0.0346874
NRFit syringe 20ml	1	0.0306	0.017	0.0069288	0.003	0.006103	0.000063	0.0636948	0.0636948
Safety hypodermic needle 21G	3	0.00648	0.003	0.0012227	0.001	0.001077	0.000021	0.0128007	0.0384022
Tube suction bubble clear non-conductive	1	0.35856	0.144	0.0029512	0.178	0.051696	0.003738	0.7389452	0.7389452
Yan kauer suction tip 18F 6mm	1	0.0249	0.01	0.0003611	0.005	0.00359	0.000105	0.0439561	0.0439561
Baxter heparin in NaCl 500ml	1	10.3	0.56	0.1404442	0.007	0.20104	0.000147	11.208631	11.208631
3M Ioban 2 56x60cm antimicrobial incise drape	1	0.0112	0.07	0.0094588	0.024	0.02513	0.000504	0.1402928	0.1402928
Brite Tip Sheath 4F introducer 11cm 0.035"	1	0.142	0.008	0.001641	0.022	0.002872	0.000462	0.176975	0.176975
Batrik vascular silicone ties	5	0.0008	0.005	0.0005952	0.004	0.001795	0.000084	0.0122742	0.0613711
Detex 5-Xray detectable peidgets in holder	1	0.0072	0.008	0.0002889	0.007	0.002872	0.000147	0.0255079	0.0255079
Rocialle healthcare 500ml bowl single wrap	1	0.0306	0.017	0.0076322	0.005	0.006103	0.000105	0.0664402	0.0664402
Xenosure biologic patch 1cmx10cm	1	0.2975	0.017	0.0022394	0.015	0.006103	0.000315	0.3381574	0.3381574
Ethicon Suture Prolene 7-0	2	0.0054	0.003	0.000462	0.002	0.001077	0.000042	0.011981	0.0239619
Ethicon Suture prolene 5-0	1	0.0054	0.003	0.000462	0.002	0.001077	0.000042	0.011981	0.011981
Cordis BER II 5F 65cm	1	0.03232	0.004	0.0009127	0.021	0.001436	0.000441	0.0601097	0.0601097
Encore 26 inflation device	1	0.52643	0.122	0.0032306	0.083	0.043798	0.001743	0.7802016	0.7802016
Cordis PIG 4F 65cm	1	0.03232	0.004	0.0009127	0.02	0.001436	0.00042	0.0590887	0.0590887
Brite Tip Sheath 6F introducer 11cm 0.035"	1	0.142	0.008	0.001641	0.022	0.002872	0.000462	0.176975	0.176975
Charger OTW PTA balloon 6F 7.0x100mm 75cm	1	0.28208	0.041	0.015273	0.109	0.014719	0.002289	0.464361	0.464361
Ethicon Suture Prolene 6-0	4	0.0054	0.003	0.000462	0.002	0.001077	0.000042	0.011981	0.0479239
Disposable mosquito clip	1	0.0648	0.03	0.0122272	0.008	0.01077	0.000168	0.1259652	0.1259652
Clinell wipes	6	0.0124	0.004	0.0016303	0	0.001436	0	0.0194663	0.1167978
Laundry								2.467356	2.467356
	70								69.08867

Case 6 : TEVAR Repair – Endovascular placement of stent

Items	Quantity	Material Manufacture	Product Manufacture	Transport CO2e	Packaging CO2e	Disposal CO2e clinical	Disposal CO2e Recycling	CO2e per item	TOTAL CO2e
St Thomas Angiopack	1							46.103	46.103
Tourguide steerable sheath 7F 55cm	1	1.680525	0.165	0.03384568	0.43	0.059235	0.00903	2.3776357	2.3776357
Tempo PIG 5F 100cm catheter	2	0.03232	0.004	0.00091267	0.02	0.001436	0.00042	0.0590887	0.1181773
Encore 26 inflation device	1	0.52643	0.122	0.00323061	0.083	0.043798	0.001743	0.7802016	0.7802016
Image intensifier cover 65cm	1	0.0396	0.022	0.00896664	0.013	0.007898	0.000273	0.0917376	0.0917376
Brite tip sheath 10F introducer	1	0.1775	0.01	0.00205125	0.022	0.00359	0.000462	0.2156033	0.2156033
Cordis BER II 4F 65cm catheter	1	0.0404	0.005	0.00114084	0.02	0.001795	0.00042	0.0687558	0.0687558
Cordis COB-2 5F 100cm catheter	1	0.03232	0.004	0.00091267	0.02	0.001436	0.00042	0.0590887	0.0590887
Cordis C2 5F 65cm catheter	1	0.02424	0.003	0.0006845	0.02	0.001077	0.00042	0.0494215	0.0494215
MPA2(1) 4F 80cm catheter	1	0.04848	0.006	0.00136901	0.02	0.002154	0.00042	0.078423	0.078423
Unisurge Scrub Gauze XRD 30x30cm 12ply looped tied 5	1	0.0099	0.011	0.00575438	0.004	0.003949	0.000084	0.0346874	0.0346874
High pressure connection tubing for pump runs	1	0.07221	0.029	0.01181966	0.005	0.010411	0.000105	0.1285457	0.1285457
BD 30ml luer-lock syringe	1	0.045	0.025	0.0024044	0.002	0.008975	0.000042	0.0834214	0.0834214
Perclose Prostyle	2	0.150735	0.039	0.01993843	0.073	0.014001	0.001533	0.2982074	0.5964149
Avanti Sheath introducer 11cm 0.038 5F	1	3.99375	0.225	0.04615321	0.025	0.080775	0.000525	4.3712032	4.3712032
Standard J-Tip 3mm guidewire 145cm 0.038	1	0.332	0.04	0.02044967	0.025	0.01436	0.000525	0.4323347	0.4323347
Steri strip dressing 12mmx100mm	1	0.0342	0.019	0.00062043	0.015	0.006821	0.000315	0.0759564	0.0759564
Surgical skin marker pen + ruler	1	0.018	0.01	0.00017567	0.005	0.00359	0.000105	0.0368707	0.0368707
Tegaderm film 15cmx20cm	1	0.0108	0.006	0.00019592	0.006	0.002154	0.000126	0.0252759	0.0252759
Radifocus Guidewire angled 180cm 0.035"	1	0.0697	0.017	0.00919873	0.014	0.006103	0.000294	0.1162957	0.1162957
Ultrasound probe cover + gel	1	0.0972	0.054	0.02200903	0.007	0.019386	0.000147	0.199742	0.199742
Angioseal 6F	1	0.057975	0.015	0.0018716	0.055	0.005385	0.001155	0.1363866	0.1363866
Clinell wipes	4	0.0124	0.004	0.0016303	0	0.001436	0	0.0194663	0.0778652
Baxter heparin solution in NaCl 500ml	1	10.3	0.56	0.14044424	0.007	0.20104	0.000147	11.208631	11.208631
BeFlared stent - FEVAR stent	1	1.6776	0.08	0.00620371	0.06	0.02872	0.00126	1.8537837	1.8537837
Surgical scrub gloves	4	0.00078	0.006	0.00062748	0.004	0.002154	0.000084	0.0136455	0.0545819
Disposable surgical cap	11	0.0072	0.004	7.8074E-06	0	0.001436	0	0.0126438	0.1390819
Disposable Blue Gowns	4	0.0846	0.047	0.01915601	0	0.016873	0	0.167629	0.670516
Disosable Blue Gloves	4	0.0245	0.007	0.00285302	0	0.002513	0	0.036866	0.1474641
Dispoasable masks	4	0.0072	0.004	0.0016303	0	0.001436	0	0.0142663	0.0570652
Laundry								1.401064	1.401064
	30								71.789232

Case 7 : FEVAR

Items	Quantity	Material Manufacture	Product Manufacture	Transport CO2e	Packaging CO2e	Disposal CO2e clinical	Disposal CO2e Recycling	CO2e per item	TOTAL CO2e
Cook Medical custom endovascular graft	2	3.6218	0.26	0.0553614	0.183	0.09334	0.003843	4.2173444	8.4346888
BeFlared FEVAR 22mm 7.5F	1	1.6776	0.08	0.0062037	0.06	0.02872	0.00126	1.8537837	1.8537837
BeFlared FEVAR 27mm 7F	3	1.6776	0.08	0.0062037	0.06	0.02872	0.00126	1.8537837	5.5613511
Zenith endovascular graft spiral Z iliac leg 20x13x90mm	2	2.53526	0.182	0.038753	0.85	0.065338	0.01785	3.689201	7.378402
Surgical scrub gloves	6	0.00078	0.006	0.0006275	0.004	0.002154	0.000084	0.0136455	0.0818729
Disposable surgical cap	13	0.0072	0.004	7.807E-06	0	0.001436	0	0.0126438	0.1643695
Disposable Blue Gowns	1	0.0846	0.047	0.019156	0	0.016873	0	0.167629	0.167629
Disosable Blue Gloves	12	0.0245	0.007	0.002853	0	0.002513	0	0.036866	0.4423923
Dispoasable masks	6	0.0072	0.004	0.0016303	0	0.001436	0	0.0142663	0.0855978
St Thomas anglopack	1							46.103	46.103
Brite Tip Sheath 5F introducer 11cm 0.035"	4	0.142	0.008	0.001641	0.022	0.002872	0.000462	0.176975	0.7079
Brite Tip Sheath 10F introducer 11cm 0.035"	3	0.1775	0.01	0.0020513	0.022	0.00359	0.000462	0.2156033	0.6468098
Cordis BER II 4F 65cm	3	0.0404	0.005	0.0011408	0.02	0.001795	0.00042	0.0687558	0.2062675
Cordis C2 5F 65cm 0.038"	1	0.02424	0.003	0.0006845	0.02	0.001077	0.00042	0.0494215	0.0494215
Corids MPA2(1) 4F 80cm	1	0.04848	0.006	0.001369	0.02	0.002154	0.00042	0.078423	0.078423
Cordis PIG 5F 100cm 0.035"	1	0.03232	0.004	0.0009127	0.02	0.001436	0.00042	0.0590887	0.0590887
Rosen curved wire guide 260cm 0.035"	4	0.166	0.02	0.0042586	0.028	0.00718	0.000588	0.2260266	0.9041063
Lunderquist extra stiff guidewire 260cm 0.035"	2	0.4814	0.058	0.004504	0.022	0.020822	0.000462	0.587188	1.174376
Radifocus Guidewire angled 180cm 0.035"	1	0.0697	0.017	0.0091987	0.014	0.006103	0.000294	0.1162957	0.1162957
Fixed core guide wire 145cm 3mm	1	0.7279	0.058	0.0123499	0.022	0.020822	0.000462	0.8415339	0.8415339
Prostyle Perclose suture system	4	0.150735	0.039	0.0199384	0.073	0.014001	0.001533	0.2982074	1.1928297
3M Steri strip dressing 12mmx100mm	1	0.0342	0.019	0.0006204	0.015	0.006821	0.000315	0.0759564	0.0759564
Easi-mark surgical pen+ ruler	1	0.018	0.01	0.0001757	0.005	0.00359	0.000105	0.0368707	0.0368707
Medtronic sentrant introducer sheath 20F	1	0.550588	0.236	0.0062494	0.346	0.084724	0.007266	1.2308274	1.2308274
Unisurge Scrub Gauze XRD 30x30cm 12ply looped tied 5	2	0.0099	0.011	0.0057544	0.004	0.003949	0.000084	0.0346874	0.0693748
Angioflex Catheter Extension 225cm	1	0.11952	0.048	4.684E-05	0.011	0.017232	0.000231	0.1960298	0.1960298
BD 30ml luer-lock syringe	1	0.045	0.025	0.0024044	0.002	0.008975	0.000042	0.0834214	0.0834214
3M Tegaderm film 15x20cm	2	0.0108	0.006	0.0001959	0.006	0.002154	0.000126	0.0252759	0.0505518
Baxter heparin solution in NaCl 500ml	2	10.3	0.56	0.1404442	0.007	0.20104	0.000147	11.208631	22.417262
National catheterisation pack opt 1	1							0.208	0.208
Instillagel 11ml	1	0.0432	0.024	0.0008774	0.003	0.008616	0.000063	0.0797564	0.0797564
Prosys 400m urine meter	1	0.72708	0.292	0.0012254	0.015	0.104828	0.000315	1.1404484	1.1404484
Foley Catheter ch 12 4mmx10ml	1	0.00512	0.032	0.0119204	0.004	0.011488	0.000084	0.0646124	0.0646124
20ml sterile saline pods	1	0.0846	0.047	0.019156	0	0.016873	0	0.167629	0.167629
Encore 26 inflation device	1	0.52643	0.122	0.0032306	0.083	0.043798	0.001743	0.7802016	0.7802016
MM Impress renal bifurcation 5F 65cm	1	0.01458	0.006	0.0027688	0.025	0.002154	0.000525	0.0510278	0.0510278
Cook Medica Flexor introducer set 7F 30cm 0.038"	3	0.16315	0.013	0.0027681	0.017	0.004667	0.000357	0.2009421	0.6028262
Charger OTW PTA balloon 5x40mm 75cm	1	0.19952	0.029	0.0108028	0.116	0.010411	0.002436	0.3681698	0.3681698
Aptus Tour Guide steerable sheaths 7F 55cm	1	1.680525	0.165	0.0338457	0.43	0.059235	0.00903	2.3776357	2.3776357
5F quick-cross support catheter 90cm 0.035	1	0.37976	0.047	0.0180655	0.033	0.016873	0.000693	0.4953915	0.4953915
Cordis MHK2 5F 80cm cathether	1	0.0404	0.005	0.0011408	0.02	0.001795	0.00042	0.0687558	0.0687558
Cordis BER II 5F 65cm	1	0.03232	0.004	0.0009127	0.021	0.001436	0.000441	0.0601097	0.0601097
Cordis powerflex pro PTA balloon 12mmx2cm 7F	1	0.34624	0.064	0.013128	0.103	0.022976	0.002163	0.551507	0.551507
Amplatz extra stiff wire guide 260cm 0.035	1	0.2905	0.035	0.0074525	0.015	0.012565	0.000315	0.3608325	0.3608325
Glidewire advantage angled guidewire 180cm 0.035"	1	0.24548	0.017	0.0077153	0.018	0.006103	0.000378	0.2946763	0.2946763
Glidewire advantage angled guidewire 260cm 0.035"	1	0.34656	0.024	0.0108921	0.018	0.008616	0.000378	0.4084461	0.4084461
Angioseal system 6F	1	0.057975	0.015	0.0018716	0.055	0.005385	0.001155	0.1363866	0.1363866
Coda LP balloon catheter 9F 120cm	1	0.59856	0.087	0.0185248	0.175	0.031233	0.003675	0.9139928	0.9139928
Flexor Check-Flo introducer 20F 80cm	1	1.3805	0.11	0.0234221	0.005	0.03949	0.000105	1.5585171	1.5585171
Unisurge Scrub Gauze XRD 10x7.5cm 12ply looped tied 5	5	0.0036	0.004	0.0020925	0.002	0.001436	0.000042	0.0131705	0.0658525
Blade 10	1	0.00216	0.001	0.0004076	0.001	0.000359	0.000021	0.0049476	0.0049476
Safety hypodermic needle 21G	3	0.00648	0.003	0.0012227	0.001	0.001077	0.000021	0.0128007	0.0384022
Disposable mosquito clip	1	0.0648	0.03	0.0122272	0.008	0.01077	0.000168	0.1259652	0.1259652
Clinell wipes	8	0.0124	0.004	0.0016303	0	0.001436	0	0.0194663	0.1557304
Laundry								2.353564	2.353564
	123								113.84382

Case 8 : Left Superficial Femoral Artery Recanalisation

Items	Quantity	Material Manufacture	Product Manufacture	Transport CO2e	Packaging CO2e	Disposal CO2e clinical	Disposal CO2e Recycling	CO2e per item	TOTAL CO2e
St Thomas Angiopack	1							46.103	46.103
Cordis BER II 4F 65cm catheter	1	0.0404	0.005	0.0011408	0.02	0.001795	0.00042	0.0687558	0.0687558
S-MAK MM mini access kit 4F	1	0.1245	0.015	0.006922	0.005	0.005385	0.000105	0.156912	0.156912
Brite Tip Sheath 4F introducer 11cm 0.035"	1	0.142	0.008	0.001641	0.022	0.002872	0.000462	0.176975	0.176975
Radifocus Guidewire angled 180cm 0.035"	2	0.0697	0.017	0.0091987	0.014	0.006103	0.000294	0.1162957	0.2325915
Molnlycke Barrier split sheet w/ perineal cover 200x260cm	1	0.69025	0.251	0.0179189	0.035	0.090109	0.000735	1.0850129	1.0850129
3M Tegaderm film 15x20cm	3	0.0108	0.006	0.0001959	0.006	0.002154	0.000126	0.0252759	0.0758278
Barrier foot cover	1	0.0234	0.013	0.0052985	0.007	0.004667	0.000147	0.0535125	0.0535125
Brite Tip Sheath 7F introducer 11cm 0.035"	1	0.142	0.008	0.001641	0.022	0.002872	0.000462	0.176975	0.176975
Emboshield NAV embolic protection system	1	1.8584	0.23	0.1175856	0.212	0.08257	0.004452	2.5050076	2.5050076
Jetstream XC OTW atherectomy catheter 7F 135cm	1	0.538923	0.231	0.006117	0.196	0.082929	0.004116	1.059085	1.059085
Emboshield bare wire workhorse filter delivery wire	1	0.1743	0.021	0.0107361	0.025	0.007539	0.000525	0.2391001	0.2391001
Encore 26 inflation device	1	0.52643	0.122	0.0032306	0.083	0.043798	0.001743	0.7802016	0.7802016
Ranger OTW PTA balloon catheter 5mmx150mm 150cm	1	0.2408	0.035	0.0011771	0.115	0.012565	0.002415	0.4069571	0.4069571
Ranger OTW PTA balloon catheter 6mmx200mm 150cm	1	0.2408	0.035	0.0011771	0.115	0.012565	0.002415	0.4069571	0.4069571
Starclose system 6F	1	0.374905	0.097	0.0025686	0.08	0.034823	0.00168	0.5909766	0.5909766
Baxter herpain solution 500ml	2	10.3	0.56	0.1404442	0.007	0.20104	0.000147	11.208631	22.417262
CXI support catheter 150cm 2.6F 0.018	1	0.39592	0.049	0.0104335	0.015	0.017591	0.000315	0.4882595	0.4882595
Workhorse Command 18ST guidewire 300cm 0.018 10cr	1	0.415	0.05	0.0255621	0.026	0.01795	0.000546	0.5350581	0.5350581
Terumo 2.5ml syringe	1	0.009	0.005	0.0020379	0.002	0.001795	0.000042	0.0198749	0.0198749
BD 10ml luer-lock syringe	2	0.009	0.005	0.0020379	0.002	0.001795	0.000042	0.0198749	0.0397497
Abbott HI-Torque Command ES guidewire 300cm 0.014	1	0.5146	0.062	0.031697	0.021	0.022258	0.000441	0.651996	0.651996
Coyote OTW PTA balloon 2x120mm 150cm	1	0.29584	0.043	0.0011387	0.107	0.015437	0.002247	0.4646627	0.4646627
Unisurge Scrub Gauze XRD 30x30cm 12ply looped tied 5	1	0.0099	0.011	0.0057544	0.004	0.003949	0.000084	0.0346874	0.0346874
Unisurge Scrub Gauze XRD 10x7.5cm 12ply looped tied 5	2	0.0036	0.004	0.0020925	0.002	0.001436	0.000042	0.0131705	0.026341
21G needle	4	0.00648	0.003	0.0012227	0.001	0.001077	0.000021	0.0128007	0.0512029
Blade 10	1	0.00216	0.001	0.0004076	0.001	0.000359	0.000021	0.0049476	0.0049476
Disposable mosquito clip	1	0.0648	0.03	0.0122272	0.008	0.01077	0.000168	0.1259652	0.1259652
Clinell wipes	6	0.0124	0.004	0.0016303	0	0.001436	0	0.0194663	0.1167978
Surgical scrub gloves	3	0.00078	0.006	0.0006275	0.004	0.002154	0.000084	0.0136455	0.0409364
Disposable surgical cap	7	0.0072	0.004	7.807E-06	0	0.001436	0	0.0126438	0.0885067
Disposable Blue Gowns	1	0.0846	0.047	0.019156	0	0.016873	0	0.167629	0.167629
Disosable Blue Gloves	2	0.0245	0.007	0.002853	0	0.002513	0	0.036866	0.073732
Dispoasable masks	3	0.0072	0.004	0.0016303	0	0.001436	0	0.0142663	0.0427989
Laundry								2.086864	2.086864
	59								81.59512

Case 9 : Simple EVAR

Items	Quantity	Material Manufacture	Product Manufacture	Transport CO2e	Packaging CO2e	Disposal CO2e clinical	Disposal CO2e Recycling	CO2e per item	TOTAL CO2e
St Thomas angiopack	1							46.103	46.103
Brite Tip Sheath 10F introducer 11cm 0.035"	2	0.1775	0.01	0.00205125	0.022	0.00359	0.000462	0.2156033	0.4312065
Brite Tip Sheath 5F introducer 11cm 0.035"	2	0.142	0.008	0.001641	0.022	0.002872	0.000462	0.176975	0.35395
Angioflex Catheteter extension 225cm	1	0.11952	0.048	4.6844E-05	0.011	0.017232	0.000231	0.1960298	0.1960298
Cordis BER II 4F 64cm catheter	1	0.0404	0.005	0.00114084	0.02	0.001795	0.00042	0.0687558	0.0687558
Cordis PIG 5F 100cm 0.035"	2	0.03232	0.004	0.00091267	0.02	0.001436	0.00042	0.0590887	0.1181773
Radifocus Guidewire angled 180cm 0.035"	2	0.0697	0.017	0.00919873	0.014	0.006103	0.000294	0.1162957	0.2325915
Lunderquist extra stiff guidewire 260cm 0.035"	2	0.4814	0.058	0.00450401	0.022	0.020822	0.000462	0.587188	1.174376
National Catheterisation Opt 1	1							0.208	0.208
Prosys 400ml urine meter	1	0.72708	0.292	0.00122537	0.015	0.104828	0.000315	1.1404484	1.1404484
Foley Catheter ch 12 4mmx10ml	1	0.00512	0.032	0.01192037	0.004	0.011488	0.000084	0.0646124	0.0646124
Instillagel 11ml	1	0.0432	0.024	0.00087739	0.003	0.008616	0.000063	0.0797564	0.0797564
Sterile Saline pods 20ml x 2	1	0.0846	0.047	0.01915601	0	0.016873	0	0.167629	0.167629
3M Tegaderm film 15x20cm	2	0.0108	0.006	0.00019592	0.006	0.002154	0.000126	0.0252759	0.0505518
Prostyle Perclose suture system	4	0.150735	0.039	0.01993843	0.073	0.014001	0.001533	0.2982074	1.1928297
Flexi-feel US probe cover w/ gel	1	0.0972	0.054	0.02200903	0.007	0.019386	0.000147	0.199742	0.199742
GORE DrySeal Flex introducer system 12F 33cm	1	1.01672	0.284	0.09326058	0.01	0.101956	0.00021	1.5061466	1.5061466
GORE DrySeal Flex introducer system 18F 33cm	1	0.97734	0.273	0.08964837	0.01	0.098007	0.00021	1.4482054	1.4482054
Merit Medical PIG 5F 100cm 0.035"	1	0.1212	0.015	0.00692205	0.021	0.005385	0.000441	0.169948	0.169948
Baxter heparin solution in NaCl 500ml	1	10.3	0.56	0.14044424	0.007	0.20104	0.000147	11.208631	11.208631
Coda LP balloon catheter 9F 120cm	1	0.59856	0.087	0.01852478	0.175	0.031233	0.003675	0.9139928	0.9139928
Unisurge Scrub Gauze XRD 10x7.5cm 12ply looped tied 5	2	0.0036	0.004	0.0020925	0.002	0.001436	0.000042	0.0131705	0.026341
Unisurge Scrub Gauze XRD 30x30cm 12ply looped tied 5	1	0.0099	0.011	0.00575438	0.004	0.003949	0.000084	0.0346874	0.0346874
Safety hypodermic needle 21G	1	0.00648	0.003	0.00122272	0.001	0.001077	0.000021	0.0128007	0.0128007
Blade 10	1	0.00216	0.001	0.00040757	0.001	0.000359	0.000021	0.0049476	0.0049476
Disposable mosquito clip	1	0.0648	0.03	0.01222724	0.008	0.01077	0.000168	0.1259652	0.1259652
Surgical marker and ruler	1	0.018	0.01	0.00017567	0.005	0.00359	0.000105	0.0368707	0.0368707
Clinell wipes	5	0.0124	0.004	0.0016303	0	0.001436	0	0.0194663	0.0973315
Disposable masks	4	0.0072	0.004	0.0016303	0	0.001436	0	0.0142663	0.0570652
GORE excluder AAA EP 32x14.5x14 18F	1	2.7705	0.15	0.04925735	0.3	0.05385	0.0063	3.3299073	3.3299073
GORE excluder AAA endoprosthesis 16x14.5x14 12F	1	2.75203	0.149	0.04892897	0.3	0.053491	0.0063	3.30975	3.30975
GORE excluder AAA endoprosthesis 16x14.5x7 12F	1	2.56733	0.139	0.04564514	0.3	0.049901	0.0063	3.1081761	3.1081761
GORE excluder AAA endoprosthesis 16x23x12 14F	1	2.67815	0.145	0.04761544	0.3	0.052055	0.0063	3.2291204	3.2291204
Surgical scrub gloves	4	0.00078	0.006	0.00062748	0.004	0.002154	0.000084	0.0136455	0.0545819
Disposable surgical cap	7	0.0072	0.004	7.8074E-06	0	0.001436	0	0.0126438	0.0885067
Disposable Blue Gowns	2	0.0846	0.047	0.01915601	0	0.016873	0	0.167629	0.335258
Laundry								1.362456	1.362456
	63								82.242346

Case 10 : BEVAR

Items	Quantity	Material Manufacture	Product Manufacture	Transport CO2e	Packaging CO2e	Disposal CO2e clinical	Disposal CO2e Recycling	CO2e per item	TOTAL CO2e
Stent Graft system 15mmx19mmx90cm limb	1	2.9952	0.234	0.0689325	0.872	0.084006	0.018312	4.2724505	4.2724505
Stent Graft system 15mmx19mmx105cm limb	1	3.3408	0.261	0.0768863	0.873	0.093699	0.018333	4.6637183	4.6637183
beGraft peripheral plus stent system 7x57x120cm	1	1.6776	0.08	0.0062037	0.06	0.02872	0.00126	1.8537837	1.8537837
Viabahn balloon expandable endoprosthesis GORE	1	1.0209	0.123	0.040391	0.07	0.044157	0.00147	1.299918	1.299918
beGraft peripheral plus stent system 8x57x170	1	1.6776	0.08	0.0062037	0.06	0.02872	0.00126	1.8537837	1.8537837
Zilver flex self expanding stent 7x20x125 Cook medical	1	1.62	0.072	0.0019066	0.208	0.025848	0.004368	1.9321226	1.9321226
Zilver flex self expanding stent 7x30x125 Cook medical	1	1.9125	0.085	0.0022508	0.21	0.030515	0.00441	2.2446758	2.2446758
Surgical Scrub gloves	6	0.00078	0.006	0.0006275	0.004	0.002154	0.000084	0.0136455	0.0818729
Disposable surgical cap	11	0.0072	0.004	7.807E-06	0	0.001436	0	0.0126438	0.1390819
Disposable Blue Gowns	3	0.0846	0.047	0.019156	0	0.016873	0	0.167629	0.502887
Disosable Blue Gloves	6	0.0245	0.007	0.002853	0	0.002513	0	0.036866	0.2211961
Dispoasable masks	6	0.0072	0.004	0.0016303	0	0.001436	0	0.0142663	0.0855978
St Thomas angiopack	1							46.103	46.103
E-xpand stent graft balloon catheter 100cm 12F	2	0.36464	0.053	0.00411	0.135	0.019027	0.002835	0.578612	1.1572239
GORE DrySeal Flex introducer system 18F 33cm	3	0.97734	0.273	0.0896484	0.01	0.098007	0.00021	1.4482054	4.3446161
Cordis BER II 4F 100cm catheter	1	0.06464	0.008	0.0018253	0.02	0.002872	0.00042	0.0977573	0.0977573
Cordis PIG 5F 100cm 0.035"	2	0.03232	0.004	0.0009127	0.02	0.001436	0.00042	0.0590887	0.1181773
Cordis BER II 4F 65cm catheter	1	0.0404	0.005	0.0011408	0.02	0.001795	0.00042	0.0687558	0.0687558
Cordis C2 5F 65cm 0.038"	1	0.02424	0.003	0.0006845	0.02	0.001077	0.00042	0.0494215	0.0494215
Encore 26 inflation device	1	0.52643	0.122	0.0032306	0.083	0.043798	0.001743	0.7802016	0.7802016
Foley Catheter ch 12 4mmx10ml	1	0.00512	0.032	0.0119204	0.004	0.011488	0.000084	0.0646124	0.0646124
Unisurge Scrub Gauze XRD 30x30cm 12ply looped tied 5	1	0.0099	0.011	0.0057544	0.004	0.003949	0.000084	0.0346874	0.0346874
Glidewire advantage angled guidewire 180cm 0.035"	1	0.24548	0.017	0.0077153	0.018	0.006103	0.000378	0.2946763	0.2946763
Glidewire advantage angled guidewire 260cm 0.035"	1	0.34656	0.024	0.0108921	0.018	0.008616	0.000378	0.4084461	0.4084461
National cath opt 1	1							0.208	0.208
Baxter heparin in 500ml	2	10.3	0.56	0.1404442	0.007	0.20104	0.000147	11.208631	22.417262
Heli-fx endo anchor system guidewire 62cm 0.035	1	2.2358	0.14	0.0037073	0.72	0.05026	0.01512	3.1648873	3.1648873
Abbott HI-Torque Command ES guidewire 300cm 0.014	1	0.5146	0.062	0.031697	0.021	0.022258	0.000441	0.651996	0.651996
High pressure connection tubing for pump runs	1	0.07221	0.029	0.0118197	0.005	0.010411	0.000105	0.1285457	0.1285457
Sterile saline pods x2	1	0.0846	0.047	0.019156	0	0.016873	0	0.167629	0.167629
Instillagel 11ml	1	0.0432	0.024	0.0008774	0.003	0.008616	0.000063	0.0797564	0.0797564
Lunderquist extra stiff wire 300cm 0.035	1	0.5063	0.061	0.004737	0.024	0.021899	0.000504	0.61844	0.61844
Lunderquist extra stiff wire 260cm 0.035	1	0.4814	0.058	0.004504	0.022	0.020822	0.000462	0.587188	0.587188
Perclose prostyle	1	0.150735	0.039	0.0199384	0.073	0.014001	0.001533	0.2982074	0.2982074
Progreat microcatheter 2.7F 150cm	1	0.361	0.025	0.011346	0.015	0.008975	0.000315	0.421636	0.421636
Prosys 400ml urine meter	1	0.72708	0.292	0.0012254	0.015	0.104828	0.000315	1.1404484	1.1404484
Rosen curved wire guide 260cm 0.035"	5	0.166	0.02	0.0042586	0.028	0.00718	0.000588	0.2260266	1.1301328
Terumo peripheral guiding sheath 8F 90cm straight	1	0.0747	0.009	0.0048699	0.021	0.003231	0.000441	0.1132419	0.1132419
Brite Tip Sheath 5F introducer 11cm 0.035"	1	0.142	0.008	0.001641	0.022	0.002872	0.000462	0.176975	0.176975
Brite Tip Sheath 10F introducer 11cm 0.035"	2	0.1775	0.01	0.0020513	0.022	0.00359	0.000462	0.2156033	0.4312065
GORE DrySeal Flex introducer system 24F 33cm	1	1.05968	0.296	0.0972012	0.01	0.106264	0.00021	1.5693552	1.5693552
Easi-mark surgical pen+ ruler	1	0.018	0.01	0.0001757	0.005	0.00359	0.000105	0.0368707	0.0368707
TORK coloured long-lasting cleaning cloth	2	0.009	0.009	0.0001709	0	0.003231	0	0.0214019	0.0428038
Clinell Wipes	7	0.0124	0.004	0.0016303	0	0.001436	0	0.0194663	0.1362641
Laundry								1.13792	1.13792
	88								107.33143

Case 11 : BEVAR

Items	Quantity	Material Manufacture	Product Manufacture	Transport CO2e	Packaging CO2e	Disposal CO2e clinical	Disposal CO2e Recycling	CO2e per item	TOTAL CO2e
St Thomas Angiopack	1							46.103	46.103
Terumo peripheral guiding sheath 8F 90cm straight	1	0.0747	0.009	0.004869914	0.021	0.003231	0.000441	0.11324191	0.11324191
Baxter heparin solution in NaCl 500ml	2	10.3	0.56	0.14044424	0.007	0.20104	0.000147	11.2086312	22.4172624
National Catheterisation pack opt 1	1							0.208	0.208
Prosys 400ml urine meter	1	0.72708	0.292	0.00122537	0.015	0.104828	0.000315	1.14044837	1.14044837
Foley Catheter ch 12 4mmx10ml	1	0.00512	0.032	0.011920369	0.004	0.011488	0.000084	0.06461237	0.06461237
Instillagel 11ml	1	0.0432	0.024	0.000877386	0.003	0.008616	0.000063	0.07975639	0.07975639
Sterile Saline pods 20ml x 2	1	0.0846	0.047	0.019156008	0	0.016873	0	0.16762901	0.16762901
Cordis C2 5F 65cm 0.038"	1	0.02424	0.003	0.000684504	0.02	0.001077	0.00042	0.0494215	0.0494215
Cordis PIG 5F 100cm 0.035"	2	0.03232	0.004	0.00091267	0.02	0.001436	0.00042	0.05908867	0.11817734
Cordis BER II 4F 65cm	1	0.0404	0.005	0.00114084	0.02	0.001795	0.00042	0.06875584	0.06875584
Cordis BER II 4F 100cm	1	0.06464	0.008	0.001825344	0.02	0.002872	0.00042	0.09775734	0.09775734
Angioflex catheter extension 225cm	1	0.11952	0.048	4.68442E-05	0.011	0.017232	0.000231	0.19602984	0.19602984
Flexi-feel US probe cover w/ gel	1	0.0972	0.054	0.022009031	0.007	0.019386	0.000147	0.19974203	0.19974203
BD 30ml luer-lock syringe	1	0.045	0.025	0.002404396	0.002	0.008975	0.000042	0.0834214	0.0834214
Lunderquist extra stiff guidewire 260cm 0.035"	1	0.4814	0.058	0.004504006	0.022	0.020822	0.000462	0.58718801	0.58718801
Lunderquist extra stiff guidewire 300cm 0.035"	1	0.5063	0.061	0.004736972	0.024	0.021899	0.000504	0.61843997	0.61843997
Brite Tip Sheath 10F introducer 11cm 0.035"	2	0.1775	0.01	0.002051254	0.022	0.00359	0.000462	0.21560325	0.43120651
Brite Tip Sheath 5F introducer 11cm 0.035"	1	0.142	0.008	0.001641003	0.022	0.002872	0.000462	0.176975	0.176975
Rosen curved wire guide 260cm	3	0.166	0.02	0.00425857	0.028	0.00718	0.000588	0.22602657	0.67807971
Glidewire advantage angled guidewire 260cm	2	0.34656	0.024	0.010892137	0.018	0.008616	0.000378	0.40844614	0.81689227
Glidewire advantage angled 5cm 180cm	1	0.24548	0.017	0.007715264	0.018	0.006103	0.000378	0.29467626	0.29467626
15x20cm Tegaderm	1	0.0108	0.006	0.000195924	0.006	0.002154	0.000126	0.02527592	0.02527592
30x30 gauze 5 pack	1	0.0099	0.011	0.005754376	0.004	0.003949	0.000084	0.03468738	0.03468738
Encore 26 inflation device	1	0.52643	0.122	0.003230609	0.083	0.043798	0.001743	0.78020161	0.78020161
GORE dryseal sheath 18F 33cm	2	0.97734	0.273	0.089648373	0.01	0.098007	0.00021	1.44820537	2.89641075
Perclose prostyle	2	0.150735	0.039	0.019938432	0.073	0.014001	0.001533	0.29820743	0.59641486
High pressure connection tubing for pump runs	1	0.07221	0.029	0.011819665	0.005	0.010411	0.000105	0.12854566	0.12854566
Hi-Torque command ST 300cm guidewire	1	0.5146	0.062	0.031696994	0.021	0.022258	0.000441	0.65199599	0.65199599
Surgical pen + ruler	1	0.018	0.01	0.000175666	0.005	0.00359	0.000105	0.03687067	0.03687067
Clinell Wipes	11	0.0124	0.004	0.001630299	0	0.001436	0	0.0194663	0.21412928
Stent Graft system 15mmx19mmx90cm limb	1	2.9952	0.234	0.068932506	0.872	0.084006	0.018312	4.27245051	4.27245051
Stent Graft system 15mmx19mmx105cm limb	1	3.3408	0.261	0.076886257	0.873	0.093699	0.018333	4.66371826	4.66371826
GORE viabahn VBX balloon EP 8x39mm 135cm 0.035"	2	1.0375	0.125	0.04104779	0.07	0.044875	0.00147	1.31989279	2.63978558
GORE Viabahn VBX balloon EP 9x79mm 135cm 0.035"	1	1.0209	0.123	0.040391025	0.07	0.044157	0.00147	1.29991803	1.29991803
Surgical Scrub gloves	4	0.00078	0.006	0.000627481	0.004	0.002154	0.000084	0.01364548	0.05458192
Disposable surgical cap	5	0.0072	0.004	7.80736E-06	0	0.001436	0	0.01264381	0.06321904
Dispoasable masks	4	0.0072	0.004	0.001630299	0	0.001436	0	0.0142663	0.05706519
Disosable Blue Gloves	4	0.0245	0.007	0.002853022	0	0.002513	0	0.03686602	0.14746409
Laundry								1.00584	1.00584
	67								94.2792882

Case 12 : EVAR extension to iliac stent

Items	Quantity	Material Manufacture	Product Manufacture	Transport CO2e	Packaging CO2e	Disposal CO2e clinical	Disposal CO2e Recycling	CO2e per item	TOTAL CO2e
St Thomas Angiopack	1							46.103	46.103
Tempo PIG 5F 100cm catheter	2	0.03232	0.004	0.00091267	0.02	0.001436	0.00042	0.0590887	0.1181773
Cordis BER II 4F 65cm catheter	1	0.0404	0.005	0.00114084	0.02	0.001795	0.00042	0.0687558	0.0687558
Cordis C2 5F 65cm catheter	1	0.02424	0.003	0.0006845	0.02	0.001077	0.00042	0.0494215	0.0494215
High pressure connection tubing for pump runs	1	0.07221	0.029	0.01181966	0.005	0.010411	0.000105	0.1285457	0.1285457
lunderquist extra stiff guidewire 260cm	2	0.4814	0.058	0.00450401	0.022	0.020822	0.000462	0.587188	1.174376
Encore 26 inflation device	1	0.52643	0.122	0.00323061	0.083	0.043798	0.001743	0.7802016	0.7802016
Angioflex 225cm catheter extension	1	0.11952	0.048	4.6844E-05	0.011	0.017232	0.000231	0.1960298	0.1960298
US probe cover	1	0.0972	0.054	0.02200903	0.007	0.019386	0.000147	0.199742	0.199742
Brite tip sheath 5F introducer	2	0.142	0.008	0.001641	0.022	0.002872	0.000462	0.176975	0.35395
Tegaderm film 15x20cm	1	0.0108	0.006	0.00019592	0.006	0.002154	0.000126	0.0252759	0.0252759
Perclose Prostyle suture closure system	2	0.150735	0.039	0.01993843	0.073	0.014001	0.001533	0.2982074	0.5964149
Terumo 2.5ml syringe	1	0.009	0.005	0.00203787	0.002	0.001795	0.000042	0.0198749	0.0198749
Glidewire Advantage 0.035" 180cm	1	0.24548	0.017	0.00771526	0.018	0.006103	0.000378	0.2946763	0.2946763
Tourguide steerable sheath 7F 55cm	1	1.680525	0.165	0.03384568	0.43	0.059235	0.00903	2.3776357	2.3776357
Baxter heparin solution in NaCl 500ml	1	10.3	0.56	0.14044424	0.007	0.20104	0.000147	11.208631	11.208631
Radifocus Guidewire angled 180cm 0.035"	1	0.0697	0.017	0.00919873	0.014	0.006103	0.000294	0.1162957	0.1162957
Disposable mosquito clip	1	0.0648	0.03	0.01222724	0.008	0.01077	0.000168	0.1259652	0.1259652
30x30cm swab gauze 5 pack	1	0.0099	0.011	0.00575438	0.004	0.003949	0.000084	0.0346874	0.0346874
10x7.5cm swab gauze 5 pack	2	0.0036	0.004	0.0020925	0.002	0.001436	0.000042	0.0131705	0.026341
National cath opt 1	1							0.208	0.208
Foley cath	1	0.00512	0.032	0.01192037	0.004	0.011488	0.000084	0.0646124	0.0646124
Prosys 400ml urine meter	1	0.72708	0.292	0.00122537	0.015	0.104828	0.000315	1.1404484	1.1404484
Instillagel 11ml	1	0.0432	0.024	0.00087739	0.003	0.008616	0.000063	0.0797564	0.0797564
Saline pods 20ml	1	0.0846	0.047	0.01915601	0	0.016873	0	0.167629	0.167629
Clinell Wipes	6	0.0124	0.004	0.0016303	0	0.001436	0	0.0194663	0.1167978
BeFlared stent - FEVAR stent	1	1.6776	0.08	0.00620371	0.06	0.02872	0.00126	1.8537837	1.8537837
Surgical Scrub gloves	4	0.00078	0.006	0.00062748	0.004	0.002154	0.000084	0.0136455	0.0545819
Disposable surgical cap	7	0.0072	0.004	7.8074E-06	0	0.001436	0	0.0126438	0.0885067
Disposable Blue Gowns	1	0.0846	0.047	0.01915601	0	0.016873	0	0.167629	0.167629
Dispoasable masks	4	0.0072	0.004	0.0016303	0	0.001436	0	0.0142663	0.0570652
Laundry								1.27762	1.27762
	53								69.274428