SUSQI PROJECT REPORT

Project Title: Green Team Competition - OPAT service at Hampshire Hospitals Foundation Trust (HHFT) in the Net Zero NHS

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Team Members: J Mazurek[1*], J Cunningham[2], R Johnson[2], S Munro[3], C Mendes[4], A Okubuike[4], N Parker[5], U Onyendoro[5], J Nops[5], F Creese[5], B Rogers[5], C Thomas[5]

[1]Foundation Year 2 Doctor, Hampshire Hospitals Foundation Trust (HHFT)
[2]Clinical Lead for OPAT plus /Infection Consultant, HHFT
[2]Operations Manager for OPAT plus, HHFT
[3]Cellular Pathology Operational Manager, HHFT
[4]OPAT plus Sister, HHFT
[4]OPAT plus Band 6, HHFT
[4]OPAT plus/antimicrobial pharmacist, HHFT
[4]OPAT plus/antimicrobial pharmacist, HHFT
[5]Clinical Services Matron Community Nursing Teams, HHFT
[5]Team Matron Winchester Community Team, HHFT
[5]Infection Consultant, HHFT
[5]Infection Consultant, HHFT

Background:

Outpatient parenteral antibiotic therapy (OPAT) is a service that allows patients to receive antimicrobial therapy on an outpatient basis (6, 10, 11). It is a safe and validated model of care, whereby IV medication can be administered intravenously at home by the district nurse or patient sometimes by using special elastomeric pumps. Allow the drug repertoire to be expanded to regimens that are not only administered once a day as they enable 24 hour infusion of antibiotics. Whenever appropriate patients with complex infections are supported on oral regimes (4, 7).

At its core OPAT is designed with sustainability principles at heart. Patient-centeredness decreased risk of healthcare related infection and a more cost-effective utilisation of hospital resources(10). Furthermore, evidence suggests OPAT services contribute to reducing a patient's length of stay in hospital, promotes early discharges, reduces the risk of hospital-acquired infection and improves patient experiences of care (7, 8).

Its social and economic benefits have been explored more broadly and are well evidenced in the literature (5, 9, 10). Environmental impact of medical treatments and interventions is an emerging area of focus for healthcare providers. Hampshire Hospitals Foundation Trust and NHS as a larger organisation have taken a Net Zero strategy which aims to significantly reduce carbon emissions produced through healthcare

delivery (12). We believe OPAT is helping fulfil those aspirations by embedding gold standard, environmentally friendly alternatives of evidence-based practice into HHFT's DNA.

This competition allows us to think about our visibility and accessibility as a service within the trust and ways engagement can be improved going forward. Currently, OPAT is open to any eligible patient across HHFT at BNHH and RHCH sites. Eligibility criteria are clearly defined within best practice guidelines (8). Following formal referral, each patient has an ID/Micro Consultant and OPAT nurse specialist review. This is done in conjunction with the patient in the context of their wider social setting. At present, just over 50% of OPAT referrals received in the trust come from the orthopaedic department. This means a proportion of eligible patients suitable for the service are not being referred.

Specific Aims:

The primary aim of the report is to evaluate the OPAT service across the triple bottom line – social, environmental, and financial. Triple bottom line as a business framework has been previously called aspirational and naïve for tasking to achieve success in all three domains. Hopefully, this report will demonstrate that OPAT defeats those odds, and we will be able to support our sustainability claims by estimating the carbon emissions we produce.

Secondly, we are hoping to increase engagement and visibility of the OPAT service to the clinical teams across HHFT to encourage appropriate referrals from a wider variety of treating teams. Within this we are keen to promote direct and indirect sustainability benefits of OPAT care including emission savings, reduced hospital stays and reduction in healthcare associated infection. The aim is to observe an increase in the number and diversity of submitted referrals for OPAT review in the 10 week competition period.

Methods and Measurement:

Aim 1 Method

Using data from existing and previous OPAT patients between December 2022 and August 2023 we have estimated the average carbon footprint of different treatment pathways available under the OPAT umbrella. This allowed us to compare relative carbon emission savings created through the work of the OPAT plus team.

Data gets recorded by OPAT staff and outlines type of infection, mode of delivery of treatment, duration of therapy, step down to oral treatment as well as relevant safety information such as allergies etc. Lists of consumables, drugs used – provided by OPAT nurses and pharmacists. Calculations are made based on averages of costs for patients during and before the competition period rather than exact spendings. Carbon emissions calculations were obtained using externally calculated published emissions factors were possible and for the rest calculated using the bottom-up approach guided by a Carbon Modelling Assistant. Estimated carbon savings were made based on subtraction of OPAT service emissions across all treatment pathway options from emissions produced by inpatient admission for the number of bed days saved by work of the OPAT service(see Appendices for spreadsheets with carbon emission calculation for the service). Average annual saving projections were calculated based on data from the review period between December 2022 to August 2023. Financial data for OPAT expenditures for 22/23 financial year as well as cost of Level 1 inpatient bed for a day was provided by the Operational manager for Microbiology from numbers utilised for the business case. We collected anonymised quotes from staff and patients regarding their opinions on the service and its effect on their experience of healthcare and overall quality of life.

Anonymised data from the OPAT Staff Satisfaction Survey was used to support the arguments on wider social impacts of OPAT intervention.

Aim 2 Method

Calculated the average number of referrals made via ePurple referral before and during the 10-week competition period based on data collected between December 2022 and August 2023. It should be noted that where possible patients are switched to an oral antibiotic regimen as there is increasing evidence to support IVOST (IV to oral switch) in some complex infections. In these instances intravenous therapy is avoided (as are the associated risks and consumables) but patients are still closely monitored via out-patient clinics. These are not captured via the e-purple process so any data underestimates numbers of bed days saved.

We have also tried to access trends in traffic on the OPAT+ Intranet webpage in the same periods to quantify increase in visibility.

Results Aim 1:

Patient outcomes:

The patient has always been the top priority of any health professional's agenda. Reduction in duration of hospital stay could be discussed in context of numerous impacts including environmental, financial, and wider social effects, but importantly results in an improved patient experience of healthcare. 735 bed days have been saved by those patients on IV formulations alone, between December 2022 and August 2023. This would equate to 980 days annually on average with OPAT working at its current capacity. Those numbers exclude a proportion of patients on IVOST (V-Oral Antibiotic Switch Therapy) which further increases the numbers with OPAT working at its current capacity. Those numbers excludes a proportion of patients on IVOST (V-Oral Antibiotic Switch Therapy) which further increases the numbers

Often considered purely in monetary terms, these days represent days of life with their loved ones at home that the patients get back. Feedback from previous OPAT patients has been overwhelmingly positive, highlighting ability to get back to daily routines, sleeping in their own beds, feeling more in control of the treatments they receive as key determining factors. Increased accessibility and satisfaction with treatment options has also been reported to increase compliance. Patients have particularly highlighted the empathy, kindness and professionalism of the OPAT clinical team members.

Patient reported health related quality of life in context of the OPAT plus experience hasn't been evaluated in large high-quality studies in the UK. It would be helpful to gather information locally via validated qualitative tests to reflect experiences of patients treated in HHFT to plan relevant service quality improvement measures.

Patient quotes:

'Really excellent and thorough care. [The team] Listened to our questions, clear expression of what's happening next and a clear plan'

'They [OPAT team] made me feel important and gave me confidence in my treatment(...)'

'[Doctor] has a great manner and credibleness that ensures I listened to advice and concentrated on recovery (…)'

Population outcomes:

Impact on wider population

OPAT has been endorsed by the Department of Health as a key antimicrobial prescribing decision within the Antimicrobial Stewardship Initiative for Secondary Care called 'Start Smart – Then Focus'(13). It is presented as one of five strategies outlined in this guidance published by the UK Health Security Agency in order to increase awareness and educate health practitioners and the general public alike about antimicrobial resistance (AMR). AMS ensures prudent, effective, and safe use of antimicrobials in order to minimise unintended consequences such as *Clostridioides difficile* associated disease (CDAD), methicillin resistant

Staphylococcus aureus (MRSA) infection or drug-related toxicity, as well as optimise health outcomes(11). Within the OPAT programme itself, antimicrobial stewardship principles are similarly important as on the wards. Limiting unnecessarily prolonged IV therapy, promoting early switches from IV to oral treatment and, if possible, simplification of antimicrobials to the narrowest spectrum possible is encouraged (11).

Education: *'Scientia potentia est'*

OPAT clinical staff have dedicated 3,300 minutes to patient education in the review period (Dec 22-Aug 23). It translates to about 7 days of working full time solely dedicated to training. Education is pivotal to ensure delivery of a safe and effective delivery of care in the outpatient environment. Interestingly, education does empower patients to be better attuned with their own health and aware of their therapeutic goals and targets(). I would consider this an important avenue of potential research in the future. The phrase 'Knowledge is power' is so frequently used and for a reason. In the context of inpatient care provision, to patients' disadvantage, this area can often be neglected due to increasing pressures, staffing shortages and bed crises. I feel this is a unique point of differentiation for OPAT, which further supports its environmental credentials. Society with improved health literacy can directly impact carbon emissions by reducing unnecessary presentations in A&E, primary care and outpatients, reduced staff and patient mileage, reduced bed days, fewer pharmaceuticals prescribed, and less intensive procedures.

Environmental sustainability:

Tangible environmental impact of implementing OPAT as a strategy towards Net Zero NHS was perhaps the most under researched area of this report. This competition allowed to draw attention to the fantastic contribution of this team towards a more sustainable future. In contrast, financial and social incentives of running this service have been discussed in the aforementioned sections of this report.

As part of the evaluation of the triple bottom line, the carbon emissions produced via the work of the OPAT plus service in HHFT were compared to 'standard' practice involving inpatient admission for intravenous antibiotic therapy to the different OPAT Pathways offered. Annual average projected emission savings of 25,139 kgCO2e could be produced with OPAT operating at current capacity. This is equivalent to driving 74,244 miles in an average car.

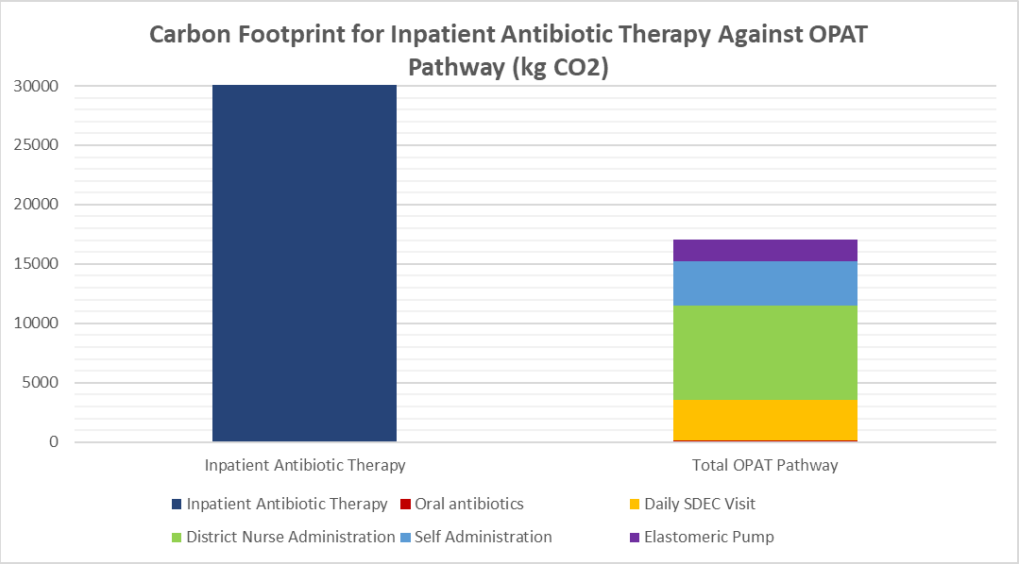


Figure 1. Carbon Footprint(kgCO2e) of IP antibiotic therapy vs OPAT pathway.

Medications contribute to a quarter of the NHS carbon emissions. 59.2% of patients were switched to an oral antibiotic regime at some point of their treatment under OPAT which further contributes to this

observed reduction in carbon emissions. An average cost of 1 unit of oral antibiotics is 0.14 kgCO2e, a fraction of the 17.5kgCO2e for an average unit of IV medication.

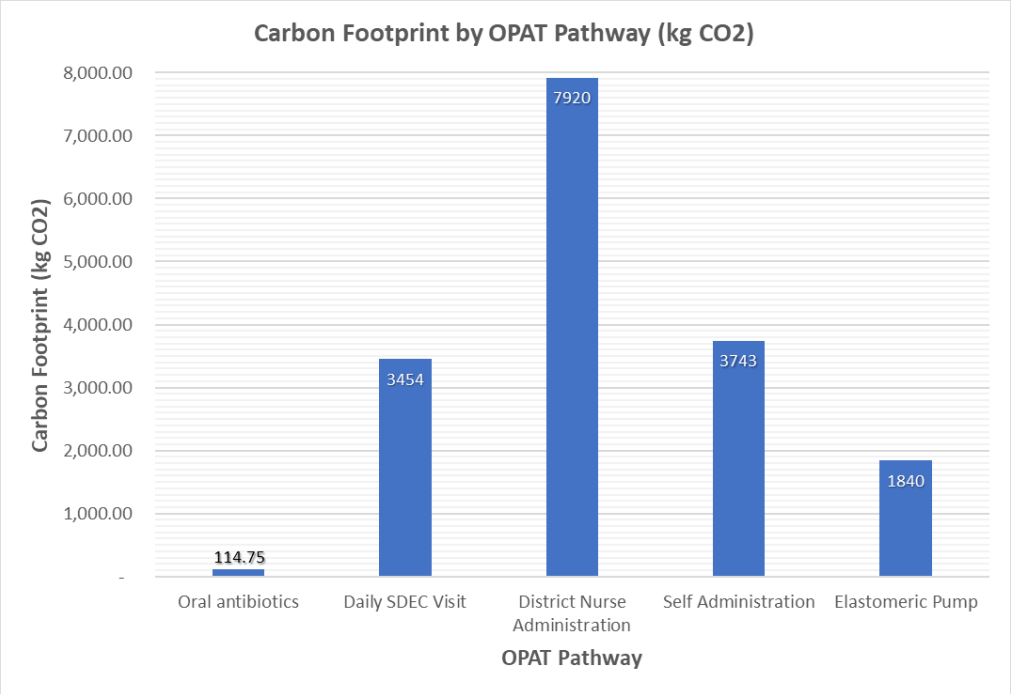


Figure 2. Carbon emissions by OPAT pathway (kgCO2e)

Economic sustainability:
OPAT expenditure (including staffing cost) for the financial year 2022/2023 was £135,611.
Cost of inpatient hospital Level 1 bed was £256.38/day
Across the period under review December 2022 – August 2023 number of bed days saved was 735. This can be extrapolated to 980 bed days per annum at current operational capacity.
Cost of delivering care in inpatient setting without OPAT on average per annum: £251,252.4
Cost of the day beds saved by OPAT during this review period: £251,252

Estimated monetary savings because of OPAT at HHFT: **£115,641**

Social sustainability:

Delivering a more sustainable and effective service doesn't just change patient's lives. It affects staff who are building the future of the low emission NHS. Working with a team of like minded, driven professionals to build a gold standard service solution to a worsening bed crisis can improve perceived job satisfaction. OPAT staff have volunteered statements describing their experiences working within the services.
Staff quotes:

'I have experience in orthopaedics nursing, and sometimes, patients remain in hospitals for a long period of time, getting treatments, so It's a pleasure to be able to step in and facilitate their discharge once they have been declared medically fit for discharge, most OPAT patients gets discharged and go back to their jobs, book a holiday etc, all these things happen whilst they are still getting their treatments. In conclusion, the OPAT service doesn't just treat the patient's infections, we also personalise the patient's care to allow them to go on 'living their lives' as safe as possible, and I'm so glad to be a part of it'

A staff satisfaction survey carried out as part of Green Team Competition revealed only a third of responding staff were concerned about the impact of their job on the environment. Nevertheless, 100% of the staff have reported increased job satisfaction knowing that their work is helping deliver sustainable care. This further highlights that sustainability is often a bonus but may not be a significant motivating factor for working within the service.Unsurprisingly, all respondents felt very satisfied by being able to contribute to improved patient flow and reduction in inpatient bed pressures.

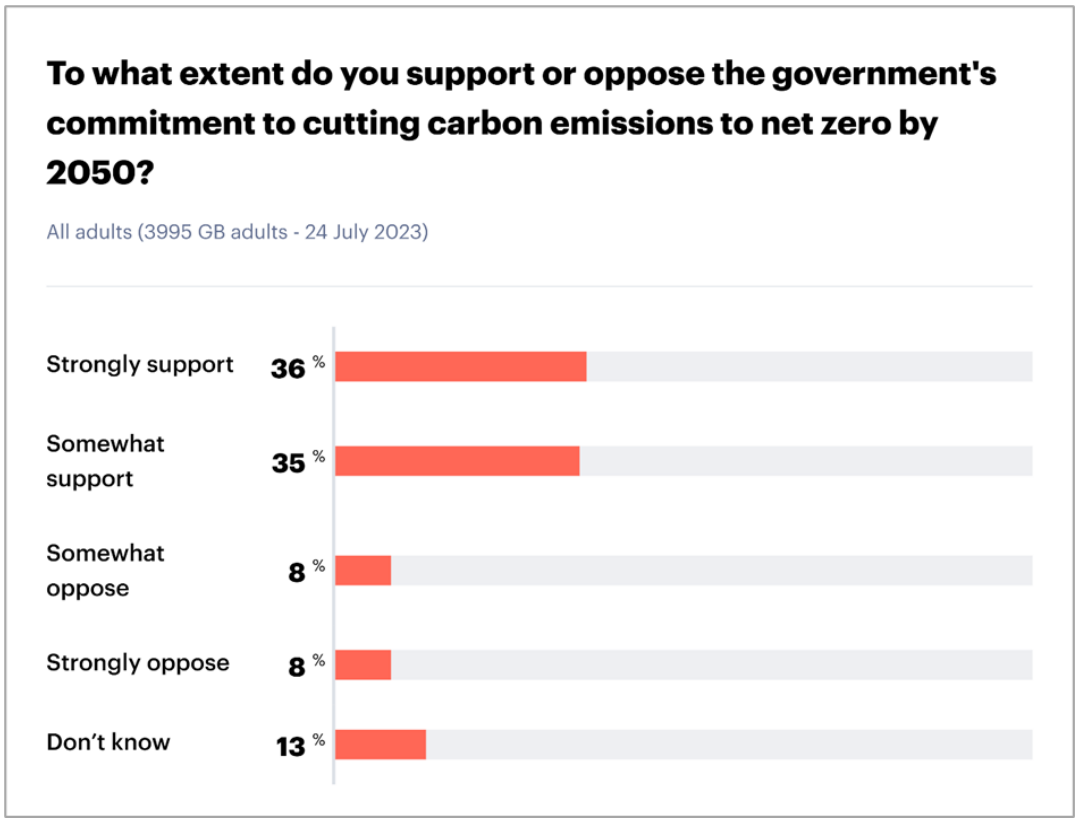
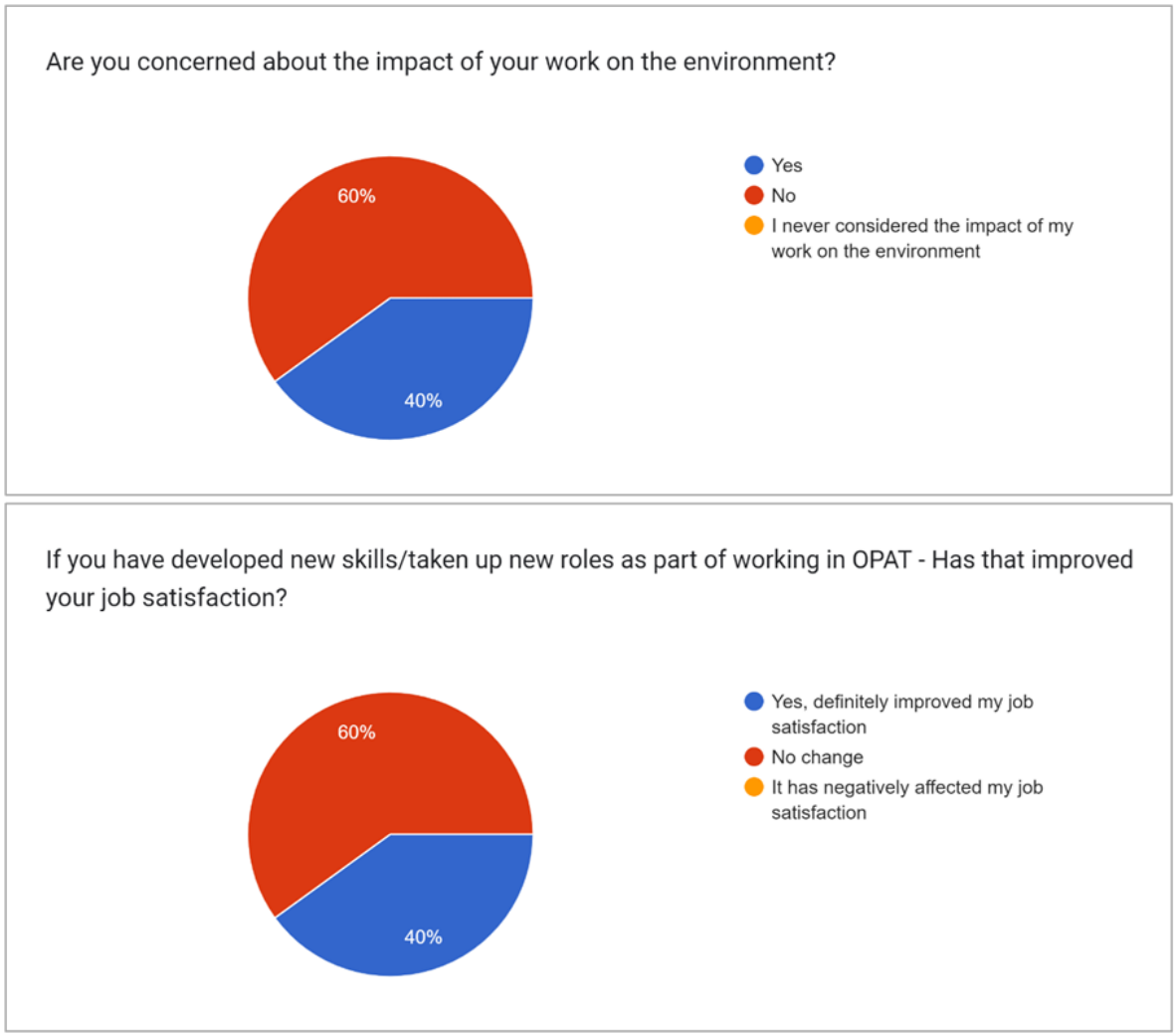


Figure 3. YouGov.co.uk website survey results highlighting public support for Net Zero by 2050

Interestingly, a YouGov website survey conducted in July 2023 on almost 4000 adults in the UK has found that 9 out of 10 people felt supportive of the idea of committing to a Net Zero NHS. This highlights a wider societal need for improved sustainability credentials within healthcare provision.

Figure 4. Responses from 4 questions of OPAT staff satisfaction survey of 5 staff members.



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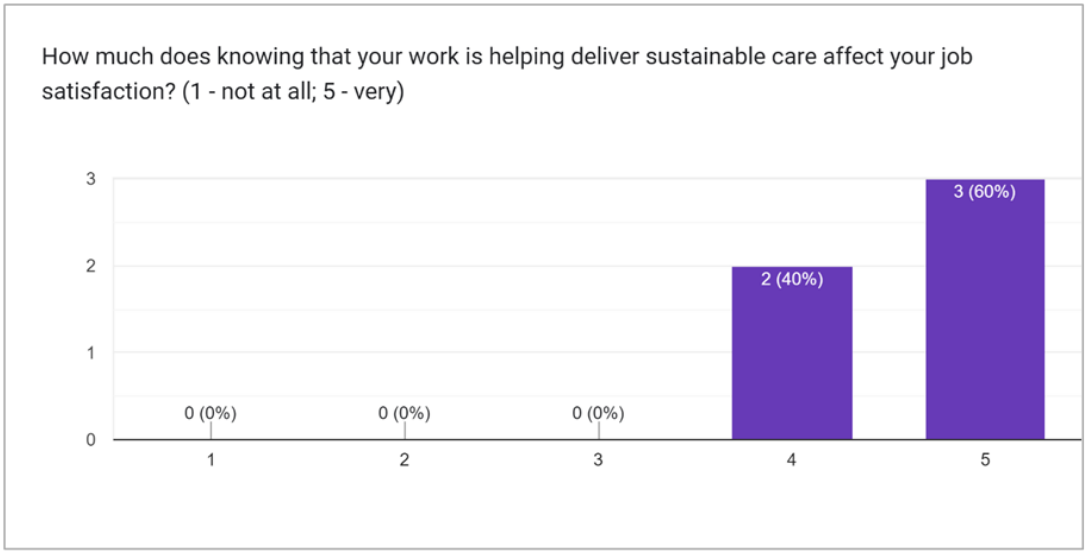

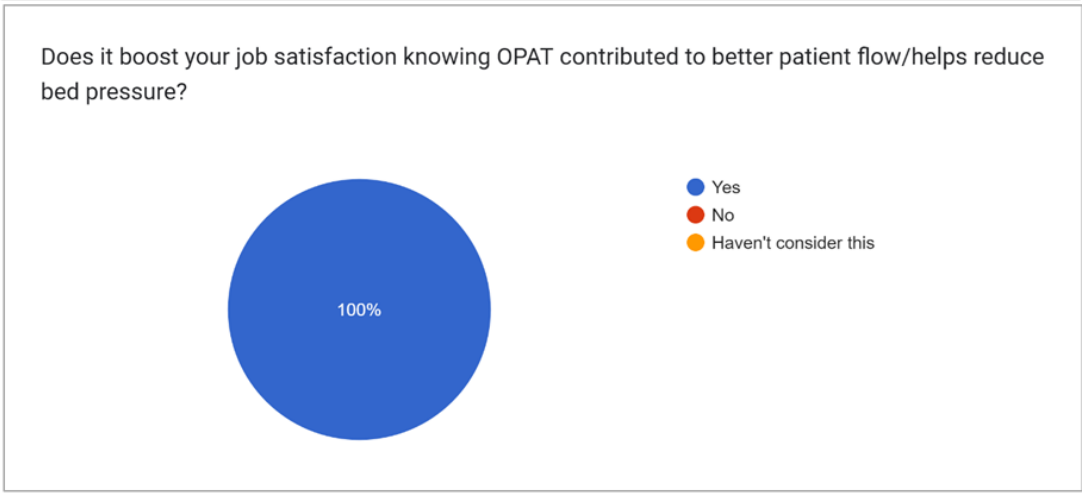

Results for Aim 2:

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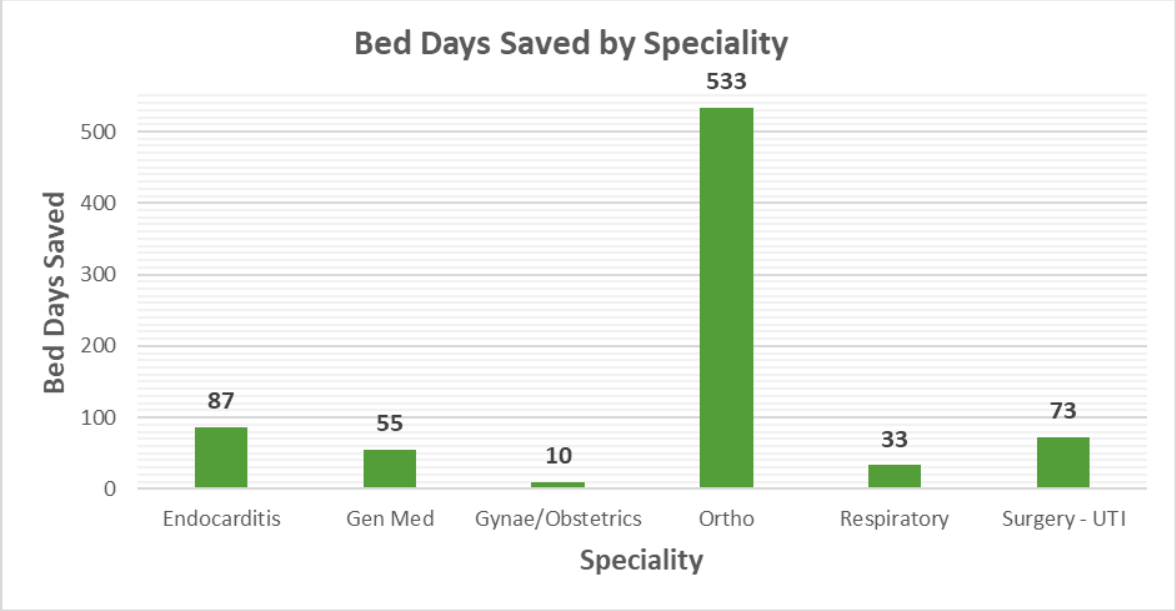
Results: OPAT visibility and engagement

Clinical and non-clinical staff working within OPAT have been heavily involved in promoting the service amongst the wider medical clinical teams to increase visibility and engagement with the service. Currently, over 50% of referrals come from the orthopaedic department and those patients contribute to most bed day savings. This isn't surprising given that bone and joint infections often require weeks of antibiotic treatment and positive outcomes in that patient cohort are well evidenced. Nevertheless, with a broadening arsenal of medication used in OPAT therapy treatment of other types of infections becomes increasingly possible.

Figure 5. Bed day savings generated by OPAT split by specialty.



We have taken actions to ensure other departments in the hospital are aware of the option to treat patients under OPAT. At the HHFT matrons meeting, we raised the profile of the types of patients who are eligible for outpatient antimicrobial care and further clarified the referral pathway. Currently OPAT runs as a 9-5 service during standard working days, but this opportunity allowed us to discuss collaborative solutions for weekend cover. During the competition period we have promoted OPAT digitally on the trust social media. Unfortunately, we were unable to obtain statistics for the engagement this has generated within this 10 week period, this remains an area of future improvement and development to maintain long lasting effects following the competition period.

To increase visibility physically in the RHCH site the OPAT nurses have put up posters across the hospital and the same actions will be taken in BNHH site in September 2023. Furthermore, the OPAT plus team has been given access to the Lyford ward clinic room area, which has become a space for education and care provision including PICC line care/insertion, blood test monitoring etc. Having a designated area for the above means better recognition of the service locally and improved approachability. Finally, in September our nursing team will be starting regular OPAT plus 'ward rounds' to identify suitable patients and increase awareness and interest in the service.

Discussion:

Going forward, environmental statistics calculated as part of this project could be included on the page. This would ensure sustainability messaging is promoted and people become increasingly educated about the impact of 'standard' hospital care on the environment.

During 'OPAT+' discussions with the Virtual Ward Team, creation of an EPR format of documentation was raised to audit and trace statistics about patient referrals and treatment plans more reliably. At present referrals can be done by ePurple referral and/or supported by bleep for patients needing IV therapy. However, a significant portion of referrals are made during MDTs and ward referrals so a portion of patients on the OPAT plus pathways might be missed in the current documentation format. While current spreadsheets used for monitoring patient statistics are safe and should capture the majority, an improved EPR format would allow for more accurate estimation of workload and by extension environmental and financial savings produced. This also has the potential to enhance the data collection required by the virtual ward team. Embracing new technological improvements would further expand OPAT's environmental credentials.

Limitations:

1. **Environmental data calculations**

Calculations of emissions for consumables, drugs and pumps do not account for waste and its disposal method.

2. **Referral tracking and documentation**

Calculation and patient numbers might not be completely reflective of the entire cohort due to oversights on patients referred directly through consultant to consultant referral in MDT setting and this has two fold effects. As a result our observed impact of intervention on volume of referrals could be inaccurately portrayed. Secondly, emissions statistics could also be affected by excluding some of the OPAT+ patients not included in the spreadsheet.

3. **Timeframe of competition**

Competition period was quite short in real terms, which in turn affects the ability to produce a meaningful change in number of patients under OPAT care as well as number and variety of referrals. The outcome of this goal should be considered and estimated on a more long-term basis (per annum etc).

4. **Service capacity**

We are limited in OPAT to safely deliver care for 8-10 patients on IV antimicrobial therapy at any given time– it is effectively working at its full capacity at time of this competition. This presents a barrier to expand until there are means to increase the capacity of the service itself.

5. **Risks and implications of increasing OPAT treatment complexity**

Good AMS practices extend to OPAT. The potential use of agents with a broader antimicrobial spectrum than may be necessary due to the logistics of once daily versus multiple daily dosing regimens, or the unnecessary prolongation of intravenous therapy when oral antibiotics would be suitable. Even for patients established on oral therapy, OPAT's role extends to monitoring toxicity of certain agents (Linezolid etc). This involves ongoing planning and coordination from team members and with rising complexity of the patient case mix.

6. **Pharmaceutical responsible for 25% of emissions within the NHS in England**

Given that medications contribute to a significant portion of carbon emissions, considerations for sustainability of long-term solutions should be carefully considered. Sometimes antimicrobials used in the community may be more expensive than those used for inpatients. Elastomeric drugs on average cost more per unit than standard IV medications or oral drugs. Crucially, elastomeric pumps are currently not suitable for recycling and contribute to the burden of domestic waste load.

7. Transport - The 'Zero' Fleet

Patients may need to attend outpatient appointments as part of their treatment with OPAT- at times daily. Similarly, district nurses must travel to deliver treatment in patients' homes. We have to start considering transport solutions that will help us reach sustainability goals. There are significant differences in emissions produced by a journey in a car, taxi, bus and train etc. According to NHS England 9.5 billion miles of road travel relates to patients, visitors, staff and suppliers to the NHS. In a Net Zero NHS we should consider solutions leading towards a 'Zero' Transport Fleet for patients, relatives and staff alike.

8. Comparing environmental impact of different OPAT pathways

OPAT pathways' carbon footprints can't be compared directly with each other to decide which is the lowest carbon option. We can only demonstrate carbon savings achieved by switching to OPAT pathways in general. Different methodologies were used to calculate each pathway(daily OP visit, nurse in community, Baxter elastomeric pump or oral medication), so it would be hard to make direct comparisons to decide which is the lowest carbon service. In order to do this, or we would need to undertake a full bottom-up carbon footprint of each service in the future.

Conclusions:

In this report OPAT was evaluated across the triple bottom line, proving to produce significant financial and environmental savings as well as having an overall positive wider social impact. Through careful examination of data gathered by the OPAT plus team between December 2023 and August 2023, it is reasonable to conclude parenteral antibiotic therapy facilitated in the community by district nurses, outpatient appointments or at the patients own home are all more sustainable options of care provision when compared to inpatient therapy in hospital. These savings have been depicted on a longer-term scale by extrapolating the current level of activity across a period of a year, further supporting ongoing savings generated by OPAT's work. By analysing the environmental data we have been able to accurately carbon footprint the OPAT service using top down and bottom up approaches, resulting in delivery of the most anticipated figures in this report.

Financial and social impacts have been equally impressive as the environmental outcomes. We have clearly demonstrated tangible monetary savings to the trust because of the work of OPAT. These are potentiated by the undeniable effects on improving patients' quality of life, improved patient flow and staff satisfaction. By listening to opinions of wider staff and patients alike we can be reassured that the hard work, kindness, and empathy involved in running a service like this does not go unnoticed. Locally gathered small scale qualitative data and literature review support claims of OPAT as a preferable option of care for patients and staff who are happy to facilitate allowing their patients to 'claim back their lives'. However, further validated perceived quality of life questionnaires and regular audit cycles of those outcomes could be introduced to explore this area in the future.

Secondly, we aimed to improve engagement and visibility of the OPAT plus service within HHFT to diversify the populations of patients referred. This outcome is difficult to assess in a short period of time over the course of the 10 weeks of the competition. We haven't been able to demonstrate any results to support that claim, but we have taken multiple actions that we can hope will bring long term effects in the future. This project has allowed us to shine a spotlight on this incredible service and encourage more people to use it. In an era where healthcare professionals find themselves increasingly overstretched and time poor, some existing, well proven solutions become forgotten or underutilised. The Green Team project has pushed OPAT to begin spreading its ethos and now, thanks to the calculations undertaken as part of the competition, is able to use its evident environmental credentials to more keen ears.

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Appendices

Figure 1. Calculations of IV drug costs in £ and kgCO2e

IV drug costs		
Name	*Cost (£)*	*Carbon emissions (kgCO2e)*
Ertapenem 1g injection	34.000	4.341
Teicoplanin 400mg vial	7.300	
Teicoplanin 200mg vial	3.700	
Daptomycin 350mg vial	28.000	
Daptomycin 500mg vial	35.000	
Ceftriaxone 2g vial	1.200	
Flucloxacillin 12g elastomeric pump	91.000	
Flucloxacillin 8g elastomeric pump	86.000	
Piperacillin/tazobactam 13.5g	100.000	
Piperacillin/tazobactam 18g	129.000	

average cost of 1 dose of IV drug	51.520	17.517

average cost elastomeric drugs	88.500	30.090

Figure 2. Calculations of IV Consumables costs in £ and kgCO2e

Consumables for IV Self Admin			
Name	Cost in kgCO2e	Number of units used for admin	*total kgCO2e*
sharps bin		1.000	
saline flush	0.792	3.000	*2.376*
10ml syringe	0.059	2.000	*0.118*
blunt fill needle	0.022	2.000	*0.044*

blunt fill needle with filter	0.022	1.000	*0.022*
iv giving set		1.000	-
10ml 0.9% NaCl ampoule	0.010	2.000	*0.020*
50ml 0.9% NaCl	0.027	1.000	*0.027*
100ml 0.9% NaCl	0.073	1.000	*0.073*
alcohol wipe	0.021	4.000	*0.083*
gloves 1 pair	0.052	1.000	*0.052*
picc line extension	0.046	1.000	*0.046*

total kgCO2e per day	*2.861*

Figure 3. Calculations of kgCO2e of items used for district nurse administration of IV medication

Consumables for District Nurse Admin			
Name	Cost in kgCO2e	number of units used for admin	*Total kgCO2e*
sharps bin		1.000	
saline flush	0.792	3.000	*2.376*
10ml syringe	0.059	2.000	*0.118*
blunt fill needle	0.022	2.000	*0.044*
blunt fill needle with filter	0.022	1.000	*0.022*
iv giving set		1.000	-
10ml 0.9% NaCl ampoule	0.010	2.000	*0.020*
50ml 0.9% NaCl	0.027	1.000	*0.027*

100ml 0.9% NaCl	0.073	1.000	*0.073*
alcohol wipe	0.021	4.000	*0.083*
gloves 1 pair	0.052	1.000	*0.052*
picc line extension	0.046	1.000	*0.046*

total kgCo2 per day	*2.861*

Figure 4. Calculations for costs of oral antibiotics in £ and kgCO2e

Oral antibiotics		
Name	Cost in £	Cost in kgCO2
Doxycycline 100mg caps	0.070	0.024
Rifampicin 300mg caps	1.580	0.537
Ciprofloxacin 750mg tab	0.450	0.153
Fluconazole 200mg caps	0.120	0.041
Levofloxacin 500mg tab	0.600	0.204
Amoxicillin 500mg cap	0.020	0.007
co-trimoxazole 480mg tab	0.080	0.027
clindamycin 150mg cap	0.060	0.020
Linezolid 600mg	0.600	0.204
average cost/unit	0.398	0.135

Figure 5. Emissions factor figures used for calculations

Emission factors	per	kgCO2e
Pharmaceuticals	£	0.128
Medical and surgical equipment	£	0.465
Hampshire NHS Trust pharmaceutical factor	£	0.340

Consumables (bottom-up method)	per	kgCO2e
10ml syringe	item	0.059
5ml syringe	item	0.033
20ml syringe	item	0.064
Cannula	item	0.046
Needle	item	0.022
Single use gown	item	0.905
Face shield	item	0.231
Cup fit FFP respirator	item	0.125
Duck bill FFP respirator	item	0.076
Single use apron	item	0.065
Pair of single use gloves (non sterile)	item	0.052
Type IIR surgical mask	item	0.020
Sterile gloves	item	0.789
Sterile gloves (non latex)	item	0.800
1 single Clinell wipe	item	0.021
Pharmaceticals (bottom up)	**£ per item**	**kgCO2e**
10ml 0.9%NaCl ampoule	0.080	0.027
50ml 0.9% NaCl bag	0.210	0.071
100ml 0.9% NaCl bag	0.570	0.194
prefilled saline flush 10mL	6.200	2.108

Figure 6. Cost of Consumables for Elastomeric Pump administration of IV medications in kgCO2e

Consumables for Elastomeric Pump			
Name	Cost	number of units used for admin	*Total kgCO2e*
saline flush	0.792	3.000	*2.376*
alcohol swab	0.021	4.000	*0.0825*
gloves	0.052	1.000	*0.052*
picc line extension	0.046	1.000	*0.0461*

Total kgCO2e per day	***2.557***

Figure 7. Bottom-up approach to Elastomeric pump CO2e emissions estimation

Pump	e of material	ight of the ump (g)	ight of np (kg)	eight of ump (t)	Carbon issions for naterial kgCO2e)	Carbon issions for lisposal gCO2e)	bon emissions bag (kgCO2e)
hat material is np made out of?							
Material 1	PET and olyethylene	150	0.15	.00015	0.6028	0.1611	0.76
Sub-total		**150**	**0.15**	**.00015**			**0.7639**
Transport	**Location**	**istance ravelled**	**Unit**	**Mode of ansport**	**ight of bag packaging tonnes)**	**Carbon nissions factor**	**bon emissions bag (kgCO2e)**
							0
untry of origin - UK harbour	ifornia port - elgium port	5,600.87	km	tainer ship	0.00015	0.01977	0.04626438
bour - Location retailer in UK	lgium port - istribution tre (+ return to port)	325	km	HGV	0.00015	0.22978	0.011201775
	lgium port - ixstowe port	233.5	km	tainer ship	0.00015	0.01977	0.000692444
ation of retailer - tions of Hospital	xstowe port - hospital	246	km	Van	0.00015	0.57514	**0.0212**
Sub-total							**0.0794**
Total per bag							**0.8433**

Carbon emissions factor

Material	Unit of measurement	EF (kgCO2e/unit)
Paper	tonne	919.4
PET	tonne	4,018.48
HDPE	tonne	3,255.98
HGV all rigids average laden	tonne.km	0.26386
Clinical waste	tonne	1074
Waste to energy	tonne	172

Activity	Unit of measurement	Emission Factor (EF) (kgCO2e/unit)
Container ship	tonne.km	0.01977
HGV all rigid average laden	tonne.km	0.22978
Van	tonne.km	0.57514