GREEN TEAM COMPETITION

CENTRE FOR SUSTAINABLE HEALTHCARE

2022 IMPACT REPORT

SWANSEA BAY

UNIVERSITY HEALTH BOARD

GIG CYMRU NHS WALES

Bwrdd Iechyd Prifysgol Bae Abertawe

Swansea Bay University Health Board

CENTRE *for* SUSTAINABLE HEALTHCARE

inspire • empower • transform

GREEN TEAM COMPETITION

POTENTIAL ANNUAL SAVINGS

£33,795

4,574,021 kgCO2e

CENTRE FOR SUSTAINABLE HEALTHCARE

CARBON SAVINGS EQUIVALENT TO

The same amount of carbon absorbed by 182,961 mature trees in one year

13,174,024 miles driven in average car

16,676 return trips between Swansea Bay and Edinburgh.

CENTRE FOR SUSTAINABLE HEALTHCARE

COMPETITION ENTRIES

INTRODUCTION

Climate change is having far reaching consequences for planetary health, including within the United Kingdom, and is accepted as one of the greatest threats to the health of global populations. In addition to climate change, the integrity of our environment, on which we depend, is threatened by pollution (air, plastic and chemical pollution), water scarcity, soil degradation, deforestation, and loss of biodiversity.

Whilst healthcare systems have a key part to play in maintaining health in the face of the threat of climate change, the delivery of healthcare is also undermining the health of our populations, by contributing to the problem. If healthcare were a country, it would be the 5th largest carbon emitter in the world[2].

However, climate change can also be viewed as 'the greatest global health opportunity'. The NHS was the first health service globally to commit to net zero carbon. In 2019, the Welsh Government declared a Climate Emergency supported by Members of the Senedd and have since set out an ambition for the public sector to be net zero by 2030. As the largest public sector organisation in Wales, the NHS has an important role to play in contributing towards this ambition. The NHS Wales Carbon Footprint 2018/19 was estimated to be 1,001,378 tCO2e which has informed the approach set out in the NHS Wales Decarbonisation Strategic Delivery Plan published on March 2021.

Clinicians have intimate knowledge of a vast range of medications, resources and equipment used for their daily practice to provide best, evidence-based care for their patients. Non-clinical teams are too essential to ensure that resources and patient care pathways are effective. The combined knowledge and understanding across of all aspects of care is vital when making the carefully nuanced decisions on how to maintain or improve clinical care whilst reducing environmental, social and financial cost.

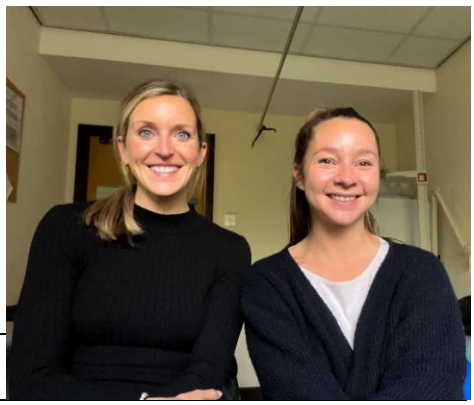
The Green Team Competition is a clinical leadership and engagement programme for NHS Trusts wishing to improve their sustainability practice. The Centre for Sustainable Healthcare (CSH) has worked directly with six teams across Swansea Bay University Health Board to develop, run and measure projects that add sustainable value within their service, by considering the 'triple bottom line' of reduced environmental harm, reduced financial waste, and adding social value.

$$\text{Sustainable Value} = \frac{\text{Outcomes for patients and populations}}{\text{Environmental + social + financial impacts (the 'triple bottom line')}}$$

Running the competition in an organisation also builds a community of clinical staff who are empowered, enthused, and equipped to further improve their services for the future, guided by the concepts of the triple bottom line and sustainable healthcare.

TEAM MEMBERS:

- Carys Howell (Clinical pharmacist and Respiratory Independent prescriber), Carys.Howell@wales.nhs.uk
- Rebecca Gillman (Medicines management pharmacy technician), Rebecca.Gillman@wales.nhs.uk



Background:

The NHS Wales decarbonisation strategic delivery plan (2021-2030) outlines methods in which to reduce the carbon footprint of NHS Wales. Pharmacy Teams across Acute Care, Primary Care and Community Pharmacy have a significant role to play as pharmaceuticals are the second highest contributing factor towards the NHS carbon footprint, and the largest contributor in General Practice with medicines accounting for 25% of emissions within the NHS.

It is estimated that Metered Dose Inhalers (MDIs) currently contribute 3.5% of the carbon footprint of the NHS[2]. MDIs contain a propellant hydrofluoroalkane (HFA) 134a which is a potent greenhouse gas; even when these inhalers are sent to landfill the HFA's can slowly leak out of the inhalers and contribute to global warming.

In contrast, dry powder inhalers (DPIs) and soft mist inhalers (SMIs), do not contain HFA propellants, and thus have a significantly lower carbon footprint than MDIs. Below is an example of a simple inhaler switch from a Fostair MDI to a Fostair Nexthaler (DPI), which is the exact same inhaler in terms of medicines included, but a different device.

Switch From	Switch To	Potential Carbon reduction	Approximate Cost implication	Comments
Fostair MDI® 100/6 200/6	Fostair NEXThaler® 100/6 200/6	86gCO_2e/puff 110gCO_2e/puff	Cost neutral	Ensure patient has sufficient inspiratory rate

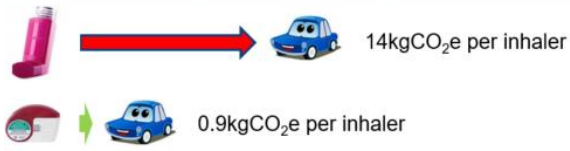
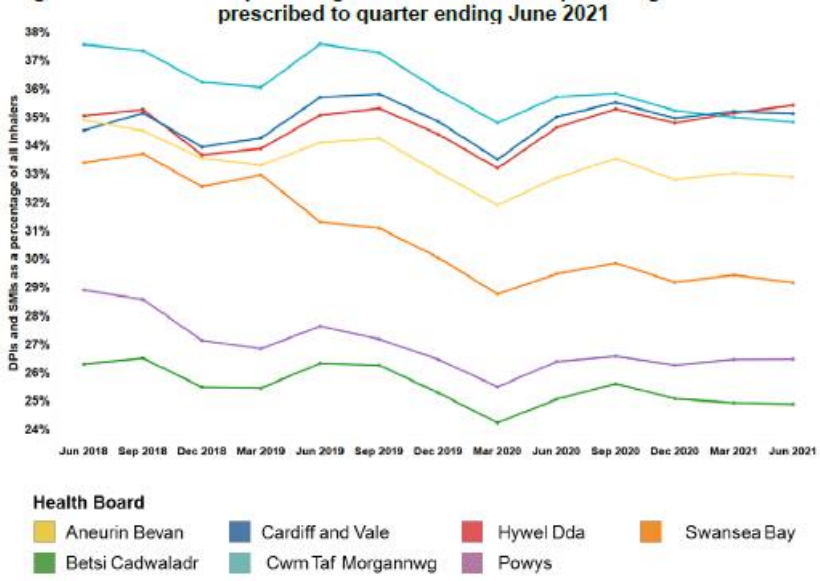


Figure A: Example of carbon footprint saving from switching an MDI to an equivalent DPI.

A new National Prescribing Indicator (NPI) for 2022-2023 has therefore been added which encourages a reduction in prescribing of MDI's in favour of DPI and SMI prescribing[5]. The graph below illustrates where Swansea Bay University Health board (SBUHB) currently sit within Wales when it comes to % of DPI and SMI prescribing.

Figure 16. Trend in the percentage of DPI and SMI as a percentage of all inhalers prescribed to quarter ending June 2021



As illustrated above, Swansea Bay University Health-board (SBUHB) has approximately 70% of inhaler prescriptions prescribed as MDIs resulting in some of the highest prescribing proportions within the country (3rd highest in Wales). In contrast, there are some countries in Europe (e.g. Sweden), where only 13% of their inhaler prescriptions are prescribed as MDIs. There is therefore a need to focus our attention on reducing the carbon impact of inhaler prescribing within our health-board. The ambitious goal set out by NHS Wales is to achieve an 80% prescribing rate of DPI and SMIs by 2025[8].

From a clinical perspective a UK observational study found high levels of short-acting beta-agonist (SABA) over-prescribing. An observational study conducted in East London reported that a quarter of patients with asthma were overprescribed their SABA inhalers (defined as 6 or more inhalers per year). Overuse of SABAs may suggest suboptimal asthma control[3] and is also associated with a high carbon footprint. There is therefore a clear need to improve our patient's asthma care in SBUHB, both from a clinical and environmental perspective. Wales, and SBUHB in particular, have a lot of work to do when it comes to prescribing inhalers more sustainably.

This project aims to focus on developing economical and environmentally sustainable ways on improving this care. Pharmacist-led decarbonisation focused asthma clinics have now been established as a pilot within one surgery in Swansea. This surgery has a population of 7581 patients, 526 of which are registered with asthma. Out of the 526 with asthma, 473 patients (90% of patients) have been highlighted as being overdue an asthma review (i.e. have not had an asthma review for over 12 months).

Specific Aims:

These clinics are aimed at improving asthma control and achieving the NPI target for an increase DPI and SMI prescribing. The clinics focus on those patients receiving >6 salbutamol inhalers/annum, as overuse may suggest suboptimal asthma control [3] and is associated with the largest carbon footprint.

- improve asthma care and disease control by providing and up-to-date face to face review (and up-titrating or down-titrating therapy where appropriate).
- increase the percentage of DPI's and SMI's prescribed vs MDI's in line with the new NPI for 2022-2023.
- promote prudent health-care by ensuring patients are empowered and involved in the decision making process for their treatment.
- reduce the carbon footprint of inhalers prescribed measured in g/CO_2 equivalent

Methods:

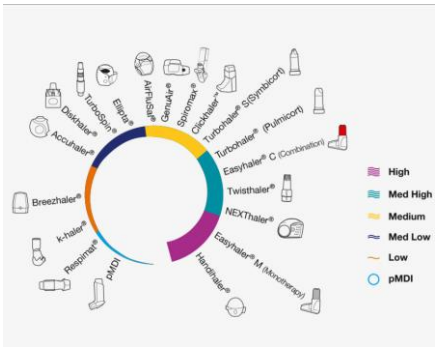
Face to face clinics were set up with a focus on patients receiving >6 salbutamol inhalers/annum. This involved liaising with the GP practice manager, nursing staff, administrative staff and the lead GPs to obtain permission for clinics to be held, and to organise a suitable clinical space and day of the week to see patients face to face. The administrative staff at the surgery assisted in ensuring there were prescriptions pads available for pharmacist independent prescriber use, and that the pharmacist was set up as a prescriber on the GP computer system (VISION).

Originally we set out to review both asthma and COPD patients, however we were asked by the surgery staff to focus on those patients with a diagnosis of asthma, as the practice nurse at the surgery was currently working her way through their cohort of COPD patients. Patients were identified by running a search on the GP VISION system for all salbutamol inhalers issued in the past 12 months. This data was then exported to and analysed using EXCEL database to filter off patients receiving >6 SABAs per year. A total of 333 patients were identified as receiving >6 salbutamol inhalers in the previous 12 months.

We then worked our way from the top of the list, focusing on those patients who had received the most SABA inhalers per year. Patient's clinical history was initially reviewed by the pharmacist and patients were booked in to clinic slots via telephone call with pharmacist/pharmacy technician. Clinical history involved checking the respiratory diagnosis, the current treatment, and the number of steroid courses issued in 12 months as all indicate poor disease control. Patients were sent an SMS reminder of their clinic appointment at the start of the week.

Asthma reviews were conducted utilising a pre-populated proforma (Appendix 1), which was created by the pharmacist independent prescriber (IP), with input from health-board respiratory nurses and pharmacy colleagues. This proforma included the novel addition of an inspiratory flow assessment utilising an In-check dial G16 device. This device allows for inspiratory flow to be measured, to ensure that the patient is able to safely use a DPI, which we know require a higher inspiratory flow than MDIs due to the lack of propellant within these devices. This device can also be used for correction in inhaler technique, by allowing the patient to practice how to 'breathe in/inhale' depending on the inhaler device chosen for them i.e. hard and deep for DPI's or slow and steady for MDI's.

Figure B: In-check dial G16 device



There was a focus on decarbonisation when changing inhaled therapy, utilising the All Wales adult asthma guidelines to guide management and therapy choice[1]

- Switch to DPI if possible (if patient has required inspiratory flow: generally between 30-90L/min).
- Switch to a lower carbon intensive MDI if a DPI was unsuitable (i.e. due to poor inspiratory flow or patient choice).
- Adjust dosage regimen to reduce inhaler burden e.g. 50mcg 2 puffs BD to 100mcg 1 puff BD, as this in itself will result in reductions in carbon footprint.
- Educate patient on inhaler carbon footprint and importance of inhaler recycling to community pharmacies to achieve long-term sustainability (leaflet by Greener Practice provided).
- Utilise MART (Maintenance and Reliever Therapy) regimes where appropriate, to reduce SABA use.

The pharmacist IP will make prescription changes needed without the need for GP input – allowing higher value interventions to be made, thus following the ethos of the 'Healthier Wales' document [7]. All patients will be counselled on how to use their new inhaler device by the pharmacy technician, thus ensuring compliance and improving asthma control through improved inhaler technique. Inhaler technique can also be re-iterated by incorporating the Right Breathe application on smart phones, which includes videos on correct inhaler technique.

Follow-up telephone consultations were arranged 6 weeks post intervention to ensure that the patients are managing well with their new inhaler, and to rule out any issues. These telephone consultations were conducted by the pharmacist and/or pharmacy technician.

Future plans/goals:
Future clinic plans also include the introduction of the pharmacy technician role to clinic. The aim is to utilise the pharmacy technician in the clinic set-up and the face to face appointment with the patient, with pharmacist IP input only needed for prescription changes or more complex queries.

This will be measured by capturing time taken with pharmacist versus time taken with technician (in minutes) over the space of 6 months. The technician will undergo competency assessment to conduct the asthma review and utilise the In-check dial device.

This additional clinic set up will allow for higher value interventions to be made and will improve economical sustainability, as the goal is for the time spent with the technician to increase, and time spent with the pharmacist IP to reduce. This will ultimately free up more pharmacy IP time to spend up-scaling this clinic set-up.

Measurement:

Additional outcome data captured via excel spreadsheet, including:

- Patient details
- Number of salbutamol inhalers issued/annum
- Number of oral steroid courses in 12 months
- Number of hospital admissions related to asthma in the past 12 months
- Royal colleague of physicians (RCP) 3 questions for asthma control
- Inspiratory flow measurement (measured in L/min)
- Original inhaler prescribed
- Newly prescribed inhaler
- Education provided around carbon impact of inhalers & inhaler recycling
- Time taken to conduct clinic (Pharmacist time and technician time)
- If a referral for spirometry was made

The above data collection then allowed us to record the following outcome data:

- % reduction in carbon footprint made during the clinic period (10 week-period)
- % patients educated on inhaler carbon footprint and recycling
- % increase in DPI inhalers vs MDI inhalers
- Number of patients referred for spirometry

Future data collection
The 10 week clinic period block was too short to measure long-term outcome data. However as the clinic progresses we hope to also capture the following:

- Increased number of patients with up-to date asthma review.
- A reduction in the number of salbutamol inhalers issued in 12 months per patient.
- A reduction in hospital admissions in 12 months per patient.
- Improved symptom control of asthma, recorded using the Royal College of Physicians (RCP) 3 asthma control questions
- Time pharmacist taken to conduct clinic versus technician – with the aim of increasing time spent with technician to promote more economical working.

***Patient outcomes**:*
The ten-week period for the project was too short to provide direct patient outcome data, however as the clinic progresses, we hope to measure the clinical impact through obtaining the following data: number of salbutamol inhalers used per year, number of hospital admissions, number of oral steroid courses needed per year, and improvement in patient symptoms through utilising the RCP 3 questions for asthma control.

Standards are met through utilising a pre-set asthma proforma in clinic, and through using the All Wales Adult Asthma guidelines when it comes to management and treatment choice

Population outcomes:
Population outcomes as a result of our project cannot be measured however we aimed to improve health-inequalities by

- promoting the All Wales asthma hub app to all patients with a mobile telephone. This smart app allows patients to monitor their own asthma symptoms, and thus become better educated on asthma control and when to seek advice.
- promoting healthier lifestyles during the clinic, e.g., we asked every patient regarding their smoking status, and signposted when needed to suitable services.
- Reminding all patients on the importance of vaccination in disease prevention, particularly as asthmatics are more vulnerable to flu and COVID-19.

Environmental sustainability:
Progress is measured by monitoring the reduction in gCO_2e over time, and the % increase in DPI/SMI versus MDI prescribing. This data is taken from MedOptomise (cloud based medicines optimisation tool), which incorporates emission factors from PrescQIPP, available via the PrescQIPP 295 bulletin[4]. and the data is updated every 3 hours, allowing us to provide the total carbon footprint savings in gCO_2e over the 10-week period, specifically for inhaler switches (MDIs switched to DPIs or MDI switches to lower carbon intensive MDIs). This data can also be expressed as a % carbon footprint saving during this time period, as well as an equivalence in terms of car journey (based on the average car emissions 100g/km).
We worked closely with the founder of MedOptomise to include carbon footprint data on the software. This software was originally designed to illustrate cost savings from medicine switches made by the medicines management team, however we have worked together to create a software that now enables the health-board to monitor it's carbon footprint savings (in gCO_2e) in real time.

Although we were unable to measure the potential carbon reductions from inhaler returns to pharmacies during this 10 week project, we educated 100% of our patients on the importance of inhaler recycling. At the beginning of the project period, 0 patients were aware of the safe disposal option for inhalers.

Economic sustainability:
There is an accepted cost impact on switching from MDIs to DPIs, as DPIs are generally more expensive inhaler devices.

The long-term goal of these clinics also includes more involvement of the pharmacy technician, meaning less pharmacist time spent on the clinic, which makes the clinic set-up more economically sustainable and allows higher value interventions to be made.

Social sustainability:
Patient feedback was obtained during clinics.

The long-term plan of these clinics to involve the pharmacy technician workforce will also lead to better job satisfaction, and development of the pharmacy technician role.

Results:

Patient outcomes:

Asthma reviews should be conducted annually, however 90% of the patients in the surgery had not had an asthma review for >1 year, likely due to the COVID-19 pandemic and lock-down measures. This clinic set-up has therefore helped with the pressures faced in the primary care sector, ensuring patients are seen in a timelier manner. During our 10-week period, we saw asthmatic patients who had not had a face to face review for a number of years, and consequently were uncontrolled and prescribed medications that are no longer recommended on the All Wales adult asthma guidelines.

The clinic set-up has made asthma reviews more patient centred. We utilise 'dummy' inhalers to show patients what options they have for their asthma treatment, thus making the clinic more prudent as patients are involved in the decision-making process behind their inhaler choice. This empowers patients to take control of their asthma again. Improving patient's knowledge on their asthma management will help reduce the need for GP contact time in the long-term, as patients will be better equipped with knowledge on how to look after themselves and what to do during an exacerbation.

As previously mentioned, the 10-week clinic period was too short to measure all patient outcomes. At the time of writing 9 patients have received a 6-week follow-up telephone consultation, and all 9 (100% of patients) were happy to continue with their new environmentally safer inhaler. All patients contacted felt that their symptoms had either improved or remained much the same, 0 patients reported worsening of symptoms. Patient quotes from the project period:

> *"I feel much better, I have gone from using my salbutamol 4 times every day to once a day, and I no longer wheeze when I talk!"* - MC (24 year old female)
>
> "*I usually hate coming to the GP surgery and tend to avoid these appointments. Thank you for taking the time to explain to me what my inhalers were for – I feel like I understand my asthma better"* - MV (59 year old female)
>
> *"Fantastic progress, thank you for your work. Looking forward to the end outcomes"- GP p*ractice manager

Out of a total of 29 patients seen in clinic over the 10 week period, only 3 patients had insufficient inspiratory flow to be switched to a DPI (10% of patients) when assessed using the in-check dial device. These patients were therefore offered a lower carbon MDI, and provided a spacer device to improve inhaler technique. This result proves that the majority of adults with asthma are able to safely use a DPI, and that the target of achieving 80% of inhaler prescriptions prescribed as DPI's by 2025 is achievable.

Number of patients referred for spirometry for accurate diagnoses: With the pressures that GP surgeries are under and the high demand for respiratory reviews post COVID-19 pandemic, these clinic appointments have ensured that patients have been seen with specialist input and have been given the opportunity to be referred for accurate diagnoses in a timely manner. At the end of the 10-week period, a total of four patients have been referred by the pharmacist IP for spirometry, to obtain accurate diagnosis and therefore ensure that they are managed appropriately.

Patients referred for secondary care opinion: As per the All Wales adult asthma guidelines, referral to secondary care should be considered if the patient displays any of the following: complex comorbidity, suspected occupational asthma, poor control following step 4 of asthma treatment, 2 or more steroid courses/year despite optimising therapy in primary care. During the clinic period the pharmacist IP identified one patient who was on step 5 asthma management and still experiencing uncontrolled asthma. This patient had not had an asthma review since 2015. Given the complex history and ongoing symptoms, this patient was referred to a secondary care asthma clinic for specialist input.

Environmental sustainability:

Please find below a screen grab from MedOptomise, which shows our reduction in gCO_2e and % carbon footprint reduction over the 10 week period as a result of interventions made to 29 patient's inhaler therapy.

IMPACT OF TEAMS WORK			
ORIGINAL INHALER CARBON	SWITCHED INHALER CARBON	CARBON SAVING	% REDUCTION
480,025	100,787	379,238	79.0%
FOOTPRINT (g CO2e)	FOOTPRINT (g CO2e)	g CO2e	IN CARBON FOOTPRINT

This saving of 379.2 kgCO2e is based on one inhaler switch for each of the 29 patients. Projected across a year, each patient will receive one inhaler per month on average, increasing our savings to **4,550.856 kgCO2e per year.** This is equivalent to 13,107.3 miles driven in an average car.

Projected savings across the HB.

Our savings equate to an average of 156.9 kgCO2e per patient. Swansea Bay UHB supports a population of 400,000 individuals, of which 7.2% (28,800 people) are registered with asthma (according to the primary care information portal). Assuming similar changes could be made to the full 7.2%, we anticipate savings of up to 4,518,720 kgCO2e per year. This data may be underestimated if patients with asthma haven't been coded correctly in the primary care database, or overestimated as it includes children, for which suitability to change inhalers requires different clinical considerations. However, of note, guidance has recently updated for patients over 6 years of age, who can now be prescribed DPIs. This saving is also a projection based on a small cohort of patients, and therefore may differ in actual practice. A large scale review on an individual patient basis would be required to determine true figures.

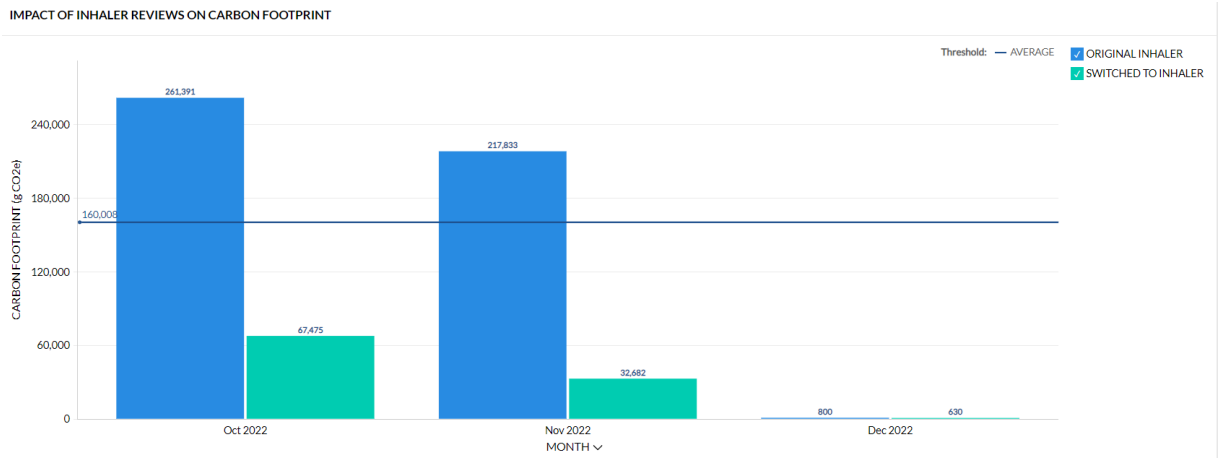


Figure C: Graph illustrating the reductions in carbon footprint from inhaler switches each month

The SPIRA decarbonisation dashboard[9] can be used to monitor carbon footprint reductions and % DPI increases at a health-board, cluster and GP practice level. Unfortunately, there is a 3 month lag with this data and therefore this data source could not be used to illustrate progress with this project, however it is a useful source for monitoring long-term progress and comparing our efforts against other HB's.

We predict that at least 80% of patients seen will now continue to return their used inhalers to pharmacies for incineration. This data was based on a questionnaire provided to patients at the end of the clinic session. We were unable to measure the carbon impact of increased inhaler returns during this project period, however there is currently an audit being undertaken in the Upper Valleys cluster in Swansea which involves measuring the impact of inhaler recycling.

Economic sustainability:
Although some inhaler changes made will be at an extra cost – the overall target of reducing carbon emissions was achieved as noted above.

This project has proven that clinics can be undertaken by pharmacist/technicians without the need for GP time, which in itself is more cost-effective and will free up GP time for more complex patients.

Having up-to-date asthma reviews also means that patients are better educated on their disease and have optimum treatment prescribed – this in turn will result in less SABA use, less exacerbations and hopefully less hospitalizations. All of which will help with economic sustainability.

Social sustainability:
Throughout the 10 week period we received very positive feedback from our patients, not only because they were being seen face to face, but also because they felt that their condition was explained to them thoroughly, and thus education around asthma and its management has improved. We acknowledge that this is likely due to having more contact time per patient consultation than when seeing a general practitioner. The clinic may lead to patients undertaken other sustainability behaviours, such as recycling inhalers.

> *"Since being to clinic I have taken my unused inhalers back to my pharmacy – I can't believe I didn't know to do this before. It's embarrassing how many I had lying around my house!"*
> - DE (29 year old female)

The clinic set up has potential to enhance job satisfaction for many.

> *"This project has made me more motivated to explore other roles that technicians can work towards. The role has been challenging, but it's exciting to see how we can get involved in patient care in the future"* - Rebecca Gillman (pharmacy technician):

Discussion:

The primary focus of reducing the carbon footprint of inhaler prescribing was achieved during this project period, and the results highlight that continued work in this area can lead to huge carbon footprint reductions for the health-board. There is also early indication that clinical outcomes for the patients reviewed have also improved. Saving will be underestimated as they do not account for reduced exacerbations and associated costs (e.g., admissions) and increased recycling.

Challenges: To ensure that these clinics are scalable across all GP practices in Swansea, nursing staff and pharmacy technicians will need training/education around the decarbonisation of inhalers, and utilising the In-check dial device for measuring inspiratory flow. This will unlikely be much of a barrier for nursing staff, but will require more competency assessments and training for the pharmacy technicians, who historically have not undertaken clinical roles.

In terms of health and safety, by incorporating the in-check dial device we ensured that patients would be able to safely use a DPI. We would not recommend blanket switching of inhalers to a DPI without utilising this assessment. We also ensured that all patients were given adequate inhaler technique counselling and are followed-up at 6 weeks to rule out any issues.

Logistically, we were fortunate that the surgery in which the project took place had sufficient clinical space to allow us to run these clinics face to face. However, we appreciate that this may not be the case in all GP surgeries. The administrative side of the clinic, which included being set up as a prescriber on the GP system and obtaining green prescription pads was time consuming, and is a factor that needs consideration for future clinic set ups.

Lastly, one of the factors that make these clinics economically sustainable was the use of a pharmacist IP, meaning no GP time was needed for prescribing. Again, this may not be achievable in all GP surgeries, where practice nurses or practice pharmacists are not IPs. There

is however scope for all practice nurses across SBUHB to include a decarbonisation focus during their asthma and COPD reviews, to help achieve the long-term goal of increasing the % of DPI prescribing.

Conclusions:

The success of this project was multifactorial. The drive and ambition to prescribe inhalers more sustainably had a huge impact on the outcome of the data and the success of the project, and was demonstrated by both the pharmacist IP and the pharmacy technician involved in the decarbonisation clinics.

In addition, support from the administrative staff at the surgery was paramount in helping with the initial setup of the clinic, and in ensuring that the pharmacist IP was able to utilise their qualification without the need for GP input. We would also like to acknowledge one of the GP leads, who supported our project and who was happy to deal with any complex or unwell patients identified during this project period. This provided reassurance and ensured that we considered the health and safety of our patients first.

Key learning when things didn't go well: As with all prudent prescribing, not all patients are as willing as others to switch their inhalers to more environmentally friendly devices. During this project period we were very fortunate that this only happened on one occasion. In these instances, if patients have been provided with all the evidence and benefits and still wish to not change device, we must appreciate and accept the patient's decision. Ultimately, this leads to an increase in trust between the clinician and the patient, and improves the prudent relationship.

What steps have been taken to ensure lasting change: By ensuring that patients are satisfied with their new inhaler at 6 weeks post intervention, and that their asthma remains controlled, we can be assured that the patients will not request to change back to their original device. We encouraged all of our patients to return their used inhalers to the pharmacy, which hopefully in the long-term will improve the % of inhalers recycled.

Does the organisation want to build on/expand the initiative: With utilising pharmacy technicians as part of the clinic set up, the clinics are scalable to roll out to other GP practices. Additionally, practice nurses can be educated on the additional decarbonisation step included within the asthma review, to ensure that these successes can be achieved across all GP practices in Swansea.

To conclude, the project has been successful in reducing the carbon footprint of inhaler prescribing. The success achieved in such a short time period highlights the huge opportunity that Swansea bay health-board has in reducing the carbon footprint of inhaler prescribing, and in achieving the ambitious goal of having 80% of inhaler prescriptions prescribed as DPI or SMIs by 2025.

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9. SPIRA - Decarbonisation Dashboard

Appendix 1: Asthma proforma utilised in clinic

Patient name: DOB: Allergies: Contact telephone:	
Royal college of physician 3 questions *(use the template available on VISION):*	
MRC questionnaire if patient also has a diagnosis of COPD *(use the template available on VISION):*	
Recent peak flow readings if available *(ask patient if they monitor peak flow at home and record recent readings)*	
What current therapy is the patient on *(regular inhalers and oral asthma therapy e.g. montelukast)*	
Is patient using inhalers as prescribed *(compliance check*)	
How many salbutamol inhalers in the past 12 months *(if patient unsure check GP prescribing system)*: *Use this opportunity to discuss switch from Ventolin to Salamol*	
How many oral steroid courses in the past 12 months *(check GP prescribing system/ discharge summaries from hospital/out of hours prescriptions)*: *Patients receiving 2 or more per year despite adherence with maintenance therapy should be referred to secondary care*	
Any hospital admissions because of asthma in the past year (Y/N):	
Any specific triggers for asthma *(e.g. pollen, pollution, exercise, fumes etc.)*	
Smoker Y/N (if Y how many/day) *Complete this as part of the health-check (apple) on VISION*	
Inspiratory flow check completed using in-check dial device *(record value in L/min)*	
Discuss decarbonisation – *ask patient re their awareness of inhaler impact on the environment. Offer patient leaflet on inhalers and the environment plus inhaler recycling.*	
Rule out other exacerbating factors: • Nasal symptoms • Reflux • Sleepiness / sleep apnoea	
Outcome of review (document on medoptomise) • Step-up in therapy • Step-down in therapy (if complete asthma control over a 3 month period) • Inhaler counselling • Smoking cessation advice/signposting • Decarbonisation (switch to lower GWP inhaler): • Personalised asthma action plan discussed (see below)	

Asthma action plan:

Personalised asthma action plan in place: asthma-action-plan-adult-2021.pdf

Peak flow advice:

Best peak flow should be ascertained when treatment is optimised and symptoms are stable. Best peak flow is more accurate than predicted peak flow.

Trigger points should be individualised but as a guide oral steroids are usually required when peak flow reaches ≤60% of best and emergency review is usually necessary when peak flow reaches ≤50% of best

https://awttc.nhs.wales/files/guidelines-and-pils/all-wales-adult-asthma-management-and-prescribing-guideline-pdf/

Asthmahub
Get your patients to download the AsthmaHub

TEAM MEMBERS:

- Katherine Burke, Neonatal Consultant
- Sharon Birch, Staff Nurse

on behalf of the Neonatal Team at Singleton Hospital

Background:

Family Integrated Care (FICare) is a model of neonatal care which promotes a culture of partnership between families and staff. This enables parents to become confident, knowledgeable and independent primary caregivers.

FICare is not a single entity or tangible, 'auditable' practice and there are many overlaps with the guiding principles of sustainable healthcare. FICare aims to prevent mortality and morbidity associated with needing neonatal care through involving parents-as-partners in care ('self-care' on a family level), giving parents more responsibility for the management of their infants health and care. It has 'lean' and prudent principles at its core, as it aims to minimise unnecessary medical intervention such as blood tests, valuing normal parental care within the NICU setting. It promotes many low carbon practices i.e. parental presence in the unit, reducing travel between home and hospital, breastfeeding, skin-to-skin to encourage thermal care.

We aimed to integrate principles of FiCare into our sustainability project by focussing on feeding. Feeding forms a huge part of the family journey through the neonatal unit and is an opportunity for bonding between parents and their baby. Infants born premature and/or with health complications often experience difficulties feeding and take time to achieve full oral feeding (weaning off supports such as nasogastric tube feeds). While breastfeeding is promoted for all infants, many will also require bottle feeding. It is common practice to use single use teats and bottles for these feeds, despite infants and families needing to transitioning to reusable, commercially available bottles on discharge.

Specific Aims:

1. To support families to provide their own feeding equipment (bottles and teats) as early as possible to reduce single use equipment in our infant feeding processes, as well as encouraging optimal feeding practices for infants.
2. To embed recycling and prudent waste management around feeding equipment into our two main clinical areas – NICU and special care

Methods:

We disseminated a staff questionnaire (online) to establish baseline attitudes to the sustainability impact of infant feeding practices across the neonatal unit.

1. Parents using own bottles / increasing use of reusable bottles

We developed and introduced parental written resources to the unit. We added to our pathways to inform parents about providing their own feeding equipment (bottles and teats). We emphasised patient benefits of this (detailed in results section). We provided written information to parents, 'rapid' staff education and embedded reminders in our daily safety huddles.

2. Recycling of feeding equipment

Previously, all feeding bottles were disposed of in clinical waste. If rinsed, these can be recycled as per our health board waste pathway. We have been establishing infrastructure for recycling plastic waste associated with feeding on the unit and raised awareness of what can be recycled to all staff.

Measurement:

Patient outcomes:

We will look at the number / percentage of infants who are receiving feeds via parent provided bottles / teats (as opposed to standard single use hospital issued feeding equipment). We completed an audit pre and post a 2 week intervention period. We have also reviewed literature on bottle feeding in premature infants to consider potential clinical benefits for infants**.**

Recycling of equipment will have no impact on patient care.

Environmental sustainability:

We are currently in the process of calculating the carbon footprint of a disposable bottle vs two commonly used brands of reusable feeding bottles commercially available to parents. This involves collating information on the raw materials and weights of the products and packaging as well as on transport from manufacturer to supplier. We will apply carbon emission factors for materials and transport provided by UK Governmant GHG conversion factor report. We will apply carbon emissions for waste disposal based on emissions factors in Rizan et al 2021[6]. The carbon associated with sterilisation of reusable bottles will also be considered. A total carbon footprint for each product per use will then be created.

We will measure the number and weight of bottles recycled to calculate the difference in emissions from clinical waste disposal and recycling using emissions factors from Rizan et al 2021[6].

Financial Sustainability:

As a department we will save money through a reduction in single use bottles needed / ordered and in a reduction of waste volume. This can be measured via our procurement documentation.

We have calculated savings of redirecting waste from clinical waste stream to recycling based on costs provided by our waste team.

Social sustainability:

Questionnaire examining staff knowledge and attitudes in regard to recycling and sustainability in the neonatal unit.

Results:

Patient outcomes:

The proportion of infants receiving oral feeds via a parent-provided bottle increased considerably, by 92% over a 2 week period.

Literature review of patient benefits:

Commercially available newborn teats are generally a slower flow rate than disposal teats. Slowing milk flow is a simple and effective intervention for promoting swallowing safety and oral feeding skill development for infants[1]. This is especially important for infants who commence oral feeding via bottle below the gestation age of 38 weeks, in which there is an increased risk and incidence of immature oral feeding skills and silent aspiration (foreign substance entering the lungs)[2]. Use of slow flow teats and parents own equipment aligns well with FiCare principles of parental involvement and in following a supportive infant led feeding approach, which can also improve

long-term feeding outcomes and reduce follow up care for feeding related difficulties such as reflux/vomiting, transitioning to full oral feeding or feeding aversion[3].

Environmental sustainability:

1. **Increasing use of reusable bottles**

We are still in the process of identifying the carbon footprint of one disposable bottle versus a reusable bottle. We anticipate the CO2e of a reusable bottle to be significantly lower than a single use item, as the CO2e reduces per use. Based on an increase in parents bringing in their own bottles, we anticipate this project will lead to significant CO2e savings in the NICU.

2. **Recycling of feeding equipment**

There is a potentially recyclable weight of 0.054kg/plastic per feed (ring, large feeding bottle, and syringes). With an assumption of 12 feeds per day and 10 infants in special care baby unit (SCBU) we would redirect 6.48kg of waste per day to recycling.

With 100% cot occupancy this equates to 2,365.2kg of plastic waste per year.

- CO2e if placed into clinical waste: 2.33 tonnes x 1074 = 2,502.4 kgCO2e
- CO2e if placed into recycling: 2.33 tonnes x 21.23 = 49.46 kgCO2e
- Saving: **2,452.96 kgCO2e per year.** This is equivalent to 7,065 miles driven in an average car.

Economic sustainability:

1. **Increasing use of reusable bottles**

Awaiting data. More time is required for our changes to be reflected in our procurement. We anticipate a financial saving as the purchasing of reusable bottles will be covered by parents. This is not an additional cost to families, as they would be required to purchase feeding equipment for home on discharge.

2. **Recycling of feeding equipment**

- Cost if waste placed into clinical waste: 2.33 tonnes x 504.04 = £1,174.4
- Cost if waste placed into recycling: 2.33 tonnes x 175 = £407.75
- Saving: **£766.65 per year**

Social sustainability:

Staff:

55 members of staff took part in a survey. 85% of staff in the neonatal unit feel anxious about the environmental impact of neonatal care. 100% of staff would be willing to be contribute to processes which mitigate the environmental impacts of providing neonatal care, even where these processes were more time consuming i.e. recycling sorting. These results demonstrate support for sustainable initiatives. We hope to decrease moral distress / burden for staff by them knowing the unit prioritises environmentally considerate practices.

Families:
Research on bottle feeding in NICU suggests that the top five concerns of parents in relation to feeding include how to regulate milk flow[4]. Parents express feelings of closeness and attachment to their infant when they have a role as a parent in making decisions about care, and when they provide for the infant (e.g. by holding and feeding them)[5]. Supporting parents to choose their own feeding equipment can support in addressing these concerns and encouraging parental autonomy and bonding. Linking bringing in their own feeding equipment with positive feeding outcome for their baby also support parental buy-in to the process of feeding.

Discussion:

Significant improvements in the number of infants feeding from parent-provided bottles were achieved through 2 interventions, namely – the provision of written information for parents and caregivers and 'rapid' staff education, embedded in the daily safety huddle – about the benefits of using parent-provided bottles from a patient, environmental, social and financial perspective.

There are potentially enormous environmental, financial and social benefits to the introduction of recycling in the NICU. This proof of concept work underplays the potential benefits as it only considered equipment associated with feeding in the special care area – the scope of plastic recycling is likely to be much greater than modelled here. Significant reductions in plastic waste result from the use of parent-provided bottles – reducing further the burden of single use plastic in our feeding pathways.

The consequences on staff morale were important – people felt good about the ability to support sustainability through the presence of recycling facilities on the ward. The staff survey has demonstrated how neonatal staff show concern for the environmental impacts of providing intensive care, and are keen to be involved in initiatives which have environmental, social and financial impacts – especially those which also improve patient care. Many expressed their dismay that recycling was not already embedded in our service as a standard of care. Parental perspectives on sustainable healthcare in the neonatal setting remain underexplored.

Conclusions:

The principles underpinning Family Integrated Care and Sustainable Healthcare are highly aligned.

The sustainable value of FICare remains a 'hidden benefit' of a family integrated approach and is worthy of celebration and further research and characterisation as NHS Wales moves towards a Net Zero Ambition in 2030.

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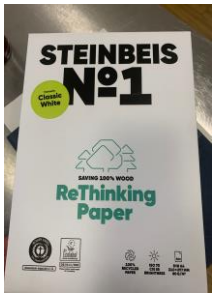
TEAM MEMBERS:

- Sarah Owens, Clinical Endoscopist
- Nicola Harvey, Unit Manager (Sister)
- Mark Hillier, Trainee Clinical Endoscopist
- Sandra John-Cox, Matron of Medicine
- Imran Rao, Service improvement lead for endoscopy



Background:

A report published by NHS Supply Chain (2020) revealed that by changing to recycled copier paper in 2019, the NHS has saved the equivalent of watching 85,503 hours of a plasma TV in energy, filling 161 Olympic size swimming pools with water, felling 20,000 trees, travelling 10 times around the world on an aeroplane in Co2. In our Endocopy units, we already use recycled paper, however believed there was room for us to reduce our printing and paper usage in the first place. Swansea Bay University Health Board has stated it wants to reduce its carbon footprint by around 3,000 tonnes and this small changes we can make to our paper usage can help towards this target.

There are 3 Endoscopy Units within the SBUHB, and each unit uses a significant amount of paper. Contrast is also used in the endoscopy unit for procedures that require x-ray input i.e. ERCP, Dilatation and Colonic Stenting. We have targeted both paper and contrast waste to improve our carbon footprint.

Specific Aims:

1. Reduce printing and paper use in the Endoscopy department by transitioning to electronic ways of working
2. To redirect Contrast waste from sharps (incineration) disposal to be recycled.

Methods:

1. Paper reduction project: We targeted 3 reasons for paper use within our Singleton unit.

a) **Patient information leaflets:** Post procedure the reporting endoscopist will request recovery nurses give patients advice leaflets on conditions they are at risk of such as haemorrhoids, diverticulosis and colitis. When our patients have had an endoscopy procedure there is often follow up advice to give. We have pre-printed advice sitting on the unit and this is given out on the clinician's request. But guidance changes all the time in healthcare. We run the risk of given our patients outdated and advice. A single sheet or two of paper is limiting and often will get shoved in a bag and eventually thrown out without the consumer really having the time to take it in absorb the information.

A single endoscopist working across 3 endoscopy sites would scope approximately 16 patients per week, where 10 would require follow up information in the method of a leaflet. Instead of printing this information, we proposed **g**iving the patient a link to a website, or copying and pasting a link onto the patients report (of which they receive a copy) using already established online leaflets[1].

b) Endoscopy reports: We print multiple reports of up to 10 pages following each procedure. We considered if all copies and all pages were necessary per procedure depending on who was receiving the report, and whether we could provide copies electronically. Team meetings were held to ensure patient follow up and care pathway would not be effected.

When we had reassurance from senior management that this was no longer required we were able to implement this change to roll out to our units.

- Patients notes: A meeting with the paperlite team revealed that there was no need to add a copy to patient notes as our electronic reporting system Endoscopy Management System (EMS) now uploads to the Welsh Clinical Portal (WCP).
- Endoscopy images – Not necessary as images available on WCP
- Histology – Encourage consultants to register for WCP alerts.
- Referring consultant – Encourage consultants to register for WCP alerts
- Patient – Encourage patients to register to patient knows best scheme to able to access reports and results.
- GP – Some practices are unable to access WCP. We are looking to trial digital alerts with a single practice or cluster.
- Our endoscopy reports can often be printed with errors in this instance we have confidential waste which requires disposal. This increases our waste output and further adding to the problem. The less reports we print the less the outcome of printing in errors.

c) **Patient questionnaires:** Currently out-patients are asked to complete a paper questionnaire post oesophagogastroduodenoscopy (OGD), flexible sigmoidoscopy and colonoscopy procedures to give feedback on their experience in the Endoscopy Service and to maintain standards. The questionnaire is 6 or 12 pieces of A4 paper (depending on single or double-siuded printing).

An audit was carried out, based at Singleton Endoscopy Unit, to obtain an average number of questionnaires that are completed per given time frame. We identified an average of 10, 6 page surveys are completed per week.

The Patient Experience Feedback team were involved ensuring they had capability to receive questionnaires in electronic form. The Patients in Singleton Endoscopy Unit can now complete their post procedure questionnaire on a tablet instead of paper. There are laptops in Morriston Endoscopy Unit and Neath and Port Talbot Endoscopy Unit that can be used for the purposes of the electronic questionnaire submission.

2. **Recycling of contrast:** Previously contrast waste from Endoscopy procedures was disposed of in sharps bins and incinerated. We have recently established a contrast recycling process by sending contrast back to supplier within recycling pots rather than waste in sharp bins.

Measurement:

Patient outcomes:
Patient outcomes were not measured.

Environmental sustainability:
An emissions factor for one A4 piece of recycled paper (0.003 kg CO2e) was provided by our paper supplier, Steinbeis. To calculate savings from ink, we used an emissions factor based on pounds spent from the Small World Consulting Database of 0.392 per pound spend, provided by CSH (this database is not publicly available). The CO2e for one piece of paper printed with double-sided ink is 0.0284 kgCO2e.

For patient questionnaires, we assumed that it takes patients 5 minutes for a patient to fill out questionnaire on an iPad to calculate the energy consumption of this, using the emissions factor for energy from the Government Database.

Economic sustainability:
Costs of our paper (2.4p) and ink (£78.07 / cartridge) were obtained via the HB procurement team and used to estimate potential financial savings.

Social sustainability:
The quantitative data was received from the Sister of Singleton Endoscopy Unit in the number of questionnaires completed per week on average.

Results:

Environmental sustainability

1) Paper reduction

a) Patient information leaflet

Across our 3 units we are funded for 38 patient lists per week, with an average of 5 patients per list (this includes a range of procedures). We estimate approximately 95 (50%) of patients require follow up advice. This is a reduction of 1-2 pieces of paper per patient, or 95-190 pieces of paper per day. We have taken an average of 142.5 pages per day to calculate our savings.

- Saving: 142.5 double sided pages per week = 4.047 kg CO2e

b) Endoscopy reports

We have used assumptions that 20 patients are seen per day in each unit. This is a total of 60 patients seen per day across our 3 units. Our service runs 5 days a week. This is a total of 15,600 patients seen per year.

We anticipate a reduction of 7-8 pages printed per endoscopy report, equivalent to 420-480 pages saved per day. We have taken an average of 450 pages per day to calculate our savings.

- Saving: 450 double sided pages printed per day = 12.78 kg CO2e
- Saving per week: 63.9 kg CO2e

c) Patient questionnaires

We will save 6 pieces of A4 double sided printing per questionnaire. Assuming 100% of patients are given a questionnaire, we will save 360 pieces of paper per day. Assuming it takes 5 minutes for each questionnaire to be completed, the energy consumption per use on iPad for filling out questionnaire is 0.000268 kWh, equating to 0.00007012 kgCO2e per questionnaire.

- 360 double sided pages printed = 10.224 kg CO2e
- 360 questionnaires completed on iPad = 0.25 kg CO2e
- Saving per day = 9.974 kg CO23
- Saving per week = 49.87 kg CO2e

Total reduction per week: 117.8 kg CO2e.

Projected across a year across the three units, we could save **6,126.48 kg CO2e per year** (2,042.16 kg CO2e per unit). This savings may vary dependant on single vs double sided printing. They may be underestimated as they do not include reduction in printing that can be made from waiting list initiative and weekends.

2) Recycling of contrast.

We estimate that 375 ml of contrast per week is being redirected from sharps waste disposal to recycling. This is a reduction of 19.5kg / year (0.0195 tonnes / year). This equates to a saving of **21 kg CO2e / year.**

Our project combined will save **6,147.48 kg CO2e per year**, equivalent to driving 17,705.9 miles in an average car.

Economic sustainability
Based on a reduction of 855 double sided pages printed per day, we anticipate savings of £2.11 per day. This is an annual saving of **£548 per year.** We will have a small additional saving of £10 from recycling of contrast.

Patient outcomes:
Patients attending Singleton Endoscopy Unit can ensure high standards of care for future patients needing an endoscopic procedure by completing the questionnaire and supporting the Endoscopy Service to audit and make improvements where needed.

We are also empowering patients to support own health with reliable evidence-based resources. Electronic information can be kept more regularly up to date, which is important as healthcare is constantly evolving with the latest research. By reducing paper we can potentially provide faster digital communication to deliver patient care, as patients can access websites that will provide them with further tools to assess and treat their condition quickly and at any time they wish without risk of losing the information.

Social sustainability:
Working on these projects is supporting change of workplace culture. We have made sustainable changes part of the 'normal' way of practice, e.g. by making contrast recycling on a ERCP list the normal way to dispose of this drug.

Information leaflets: Patient feedback was positive and very few patients were not candidates to receive digital links on their reports. With electronic information patients have long standing resource to support them with their gut health. They can share the knowledge and the link with friends and family and empower a culture from a reliable resource

Discussion:

Information leaflets
With so much information available on the internet, it can be confusing for patients to find accurate, reliable, and non-conflicting information. We often advice patients not to research and self-diagnose on the internet. By providing patients with an evidence-based link as a resource for them to educate themselves we can ensure they receive optimal up to date advice and prevent research on non-reputable websites. Patient leaflets are everywhere in the healthcare sector in both primary and tertiary care settings. We have seen a rise in QR codes to deliver information, but these methods take time to implement.

Implementing change can be difficult however supporting staff nurses liked the idea and could see benefits if all clinicians changed this one simple thing about their practice. The attractive element of this change is that it also provides a positive change in patient empowerment and education.

Questionnaires
We have successfully implemented electronic questionnaires in the Endoscopy Unit at Singleton Hospital. The resources are there for the same change to be implemented in Morriston and Neath and Port Talbot hospitals in the near future. When this takes place the laptops currently available at these sites will need the software installed so the patients can complete the questionnaire post procedure and staff trained in submitting the questionnaire to the Patient Feedback Team.

Reports
The issues we faced with removing the paper copy for referring clinicians and GP's were the fact that these paper notifications act as an alert to action review, putting care and/or treatment into action for the patient. Meetings with IT informatics showed us the options we had in place for alternative methodology. Consultants can receive alerts through WCP for histology and updates for patients in their care. We currently have all of our Singleton consultants receiving these alerts and two from our Morriston and Neath Port Talbot sites. We plan to present these findings in user groups and team meetings to encourage up take of the system so we can negate the referring consultant copy completely in future practice.

The GP copy is presenting more of a challenge as a number of GP's don't have access to WCP. We will further explore this area and look to trial a paperless alerts with a single GP practice or cluster

service to highlight best practices so we can roll this out in the future. This meeting with IT also gave us options for removing the patient copy. Patients routinely take a copy of their reports home. Patients that are registered to the patient knows best service can receive their results and reports digitally. This is slowly being rolled out across the health board. We plan to champion this service by making patients aware of the service and encouraging them to sign up where appropriate. This will remove the need to send mail from many services not just endoscopy. Allow appointments and patient advise to be sent digitally.

It became apparent that our paperlite projects required the implementation of technology to replace paper documentation. We must consider the reliability and confidentiality of the computer software we use as alternatives. We discussed developing more digital communication with our patients to reduce the paper we send out to them pre-procedure. Whilst text alerts, QR codes etc.. are plans for the future the technology available to us is not ready to replace this method of communication at this time. We have a lot of work to do and lot research and discussion need to take place before we can imbed these changes into our practice.

On reflection key learning points from this project were to persist with the initiative even when it didn't appear things were progressing. Colleagues are busy and we must allow them time to respond and adapt to change. Most of the conversations regarding this initiative were via e-mail and again due to busy workloads, staff issues etc. it was sometimes frustrating waiting for responses from colleagues.

Conclusions:

We have seen positive benefits across the triple bottom line from our paper reduction initiative. Future trials and projects could furthermore improve these figures. The reduction of paper in the NHS is something that all Departments should be looking at to reduce costs and carbon footprints. Any Departments that have paper post procedure care audits should be able to change to completing them on tablets and sending them directly to the relevant Departments.

Whilst this project has presented with its challenges, it has pushed us into a direction of positive change. The initiative has allowed us to communicate with other areas in the health board making them aware of our mission and desire to achieve change. We have gained many ideas and insights into our current projects and future projects we can undertake. It is hoped that eventually the majority of paper can be removed from the current systems in place within the Endoscopy Service.

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Appendices

- Iodine Recycling Video - YouTube
- Green Endoscopy Champions – Working towards a Sustainable Future - The British Society of Gastroenterology (bsg.org.uk)

4. REDUCING THE CARBON FOOTPRINT OF THE REHABILITATION ENGINEERING UNIT WORKSHOP (REU)

TEAM MEMBERS:
Jacob Redwood-Thomas and Benjamin Lee
Rehabilitation Engineers

Background:

Within REU, we provide three services, which include the Special Seating Service, Functional Electrical Stimulation (FES) and Pressure Ulcer Prevention and Intervention Service (PUPIS).

The Seating Service and FES cover Swansea Bay and Hywel Dda, whilst PUPIS cover these areas and part of Cwm Taf health board. As a department, we have in-house manufacturing facilities that can manufacture devices that provide a range of benefits such as postural support and pressure relief. Within the workshop, common materials used to manufacture devices include foam, metal, wood and plastic. Devices manufactured are highly bespoke and can rarely be classified for multi-patient use.

As a department we have implemented many strategies to reduce our carbon footprint, costs and improve patient care. Below are some of methods already implemented to reduce carbon emissions of the department:

- Visits in the community are grouped together so journeys are not for single patient visits
- Visits in the community are grouped together by post code when possible to save miles driven
- Virtual appointments scheduled where possible for reviews and fact finding etc. MDT meetings in particular
- Request images from service users to save journeys into the community to identify the problem and a follow up journey to resolve the problem
- FES service has frequently setup packs of refurbished devices for new patients to minimise new units being purchased or being disposed of
- Majority of old wheelchairs and accessories are returned to the Cardiff Posture and Mobility Centre for decontaminating to be reused
- Good engineering practises, always try to minimise waste when cutting from sheet materials
- When machining blocks of foam, we aim to fit as many parts in per block to reduce number of blocks used
- The use of black bag waste streams where appropriate to reduce number of orange bags going for incineration. This is outlined in our local Infection control so all staff know where best to direct waste

One of the barriers to reducing waste in our department is that the devices we develop are highly bespoke to the service user and are rarely re-issued to another service user. In addition, the materials we used are often ‘non-recyclable’ due to their plastic content, which makes it more difficult to recycle waste into its original state. Therefore, the process of repurposing waste material is more likely to be successful.

Specific Aims:

This project focussed on our materials aiming to

1) To reduce non-recyclable content by switching to use of more sustainable materials
2) To reduce waste to landfill by recycling materials

Methods:

We focussed on custom moulded seating systems manufacturing stream. We manufacture 37 of these devices on average per year. These devices are manufactured from a number of blocks of foam, cut down to size and assembled to form a moulded shape for a service user. These are then interfaced onto the wheelchair using metal fixings and plastic shells that enclose and protect the foam and prevent it from deforming during use.

We use an open cell foam for the majority of our custom moulded systems and occasionally a higher density closed cell foam if additional support is required. The plastic shell that holds the foam on the wheelchair is manufactured from ABS plastic.

We identified three possible methods of reducing the carbon footprint of this manufacturing stream.

- Switching to an eco-friendlier plastic that can be used instead of ABS plastic. We are aware that a similar service had implemented this switch. However, this switch requires testing and scoping to ensure the material properties of Polypropylene satisfy our requirements. before a decision can be made on this.
- Our supplier of white foam agreed to collecting the offcuts when they deliver new blocks of foam, for them to recycle into new products such as chipfoam or carpet underlay. We discussed returning offcuts of other materials with suppliers but unfortunately this has not been possible for out other materials.
- Third, we looked at sourcing materials closer to the department to save on CO2 emitted from delivering the materials (see discussion section).

Measurement:

Environmental sustainability:
Swansea Bay Health Board dispose of waste via an 'Energy from Waste' stream as opposed to landfill. We calculated the total weight of each material that we dispose of per year and applied tis to the emissions factor for Energy from Waste disposal from Rizan et al 2021[3].

We also calculated the CO2e emissions factor for changing our plastic material from ABS to Polypropylene. Polypropylene is less dense

Economic sustainability:
Cost of materials was obtained and compared.

Patient outcomes: We will test polypropylene o ensure it satisfies requirements for quality of our devices for patient care before implementing the change in material use.

Social sustainability: Not measured for this project however potential impacts discussed in results section.

Results:

Environmental Sustainability:

To manufacture 37 custom moulded seating systems, in the past 18 months, we have ordered 310.962kg of ABS. With a lower density, the total weight of Polypropylene would be 263.016kg

Material	Amount used*	Emissions Factor	CO2e
ABS plastic	310.962kg	3.76kgCO2e/kg	1169.217kgCO2
Polypropylene	263.016kg	3.10kgCO2e/kg	815.350kgCO2
		Saving	353.867kgCO2

*Polypropylene is a lower density than ABS, so a lower weight required.

The total CO2 emissions from sending the waste product to Energy from Waste plants is seen below:

Material	Amount disposed in tonnes	Emissions Factor for disposal (waste from energy)	CO2e
White foam	**0.2232**	172kgCO2e / tonne	**38.38 kgCO2e**
Evazote	0.1148		19.7 kgCO2e
ABS Plastic	0.11913		20.49 kgCO2e

Our suppliers of white foam agreed to collect the offcuts of white foam to recycle, so we saved 38.38kgCO2e per year. This saving only applies to one type of device that we manufacture and leaves scope to apply this to other devices we make. Unfortunately, returning the closed cell foam Evazote was not viable, as the department would need to cover the cost of a courier to send the waste back to the supplier. Similarly, the ABS offcuts would cost £25 to be collected and this would not be the same day as the delivery of new material and therefore increasing the number of journeys and CO2 emissions.

Combining the two changes, we have a total saving of **392.247kgCO2e**. This is equivalent to 1,129.7 miles driven in an average car.

Economic sustainability:

It is not possible to calculate the financial impact of switching from ABS to polypropylene subject to testing of the material to ensure it is durable and appropriate for our service users. Our current material, 6mm ABS, costs £157.41 per sheet. If we can switch to a 6mm Polypropylene at a cost of £115.20, we will save £42.21 per sheet. However, a 9mm Polypropylene may be more appropriate and at a cost of £168.30, this will be an increased cost of £10.89 per sheet.

Our white foam supplier has agreed to collect offcuts for free. There will be a small financial savings from reducing waste.

Social sustainability:

Although difficult to measure, this arrangement with the foam supplier is mutually beneficial as it allows them to reclaim usable material to use in production of new products with no additional resources invested.

Discussion:

During the competition phase we have been able to identify one material switch to reduce our CO2e, however this still requires testing to ensure use of polypropylene over ABS will not impact on the quality of our devices. Positively, we have also identified a foam supplier that is working towards producing foams containing plant-based polyols as an alternative to petrochemical-based ingredients[1]. This is something we will continue to explore in the future.

A barrier we encountered was a lack of recycling options for smaller scale operations such as ourselves. We were able to identify a company in the Netherlands that would take our foam offcuts and recycle these, but the minimum quantity was in the magnitude of shipping containers. We also encountered similar issues when considering other waste materials produced by the department such as textiles and scrap metal. Similarly, in these cases it was found not to be economically viable. Positively, there is additional research being carried out in to recycling closed cell foams[2].

Identifying local suppliers of the materials we use was attempted and found to be challenging, as often the cost of the material was much higher. For example, our current supplier of ABS is based near Brighton. We identified a supplier in Cardiff however switching suppliers would lead to a £90 increase in the price per sheet of ABS. The department has ordered a total of 30 sheets in the past 18 months, meaning a £2,700 increase in cost for the same material.

Conclusions:

Throughout the process, we have been able to identify two areas where we can save on CO2e emissions when manufacturing one type of device, albeit this device is one of the more labour and material intensive devices that we manufacture. Further CO2e savings can be achieved through sourcing more eco-friendly and sustainable versions of the materials we use. We will continue to explore options for this.

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5. THE GLOVES ARE OFF CAMPAIGN: REDUCING UNNECESSARY NON-STERILE GLOVE USE IN NICU/SCBU, GLOVES OFF TEAM

TEAM MEMBERS:

- Naomi Oxberry, Dietician and Medical Student at University of Swansea
- Amber O'Cliffe, Medical Student at University of Swansea

Background:

Between 2030 and 2050, climate change is expected to cause approximately 250,000 additional deaths per year, as a minimum[1]. In 2010, the NHS emitted 20 million tonnes of CO2 equivalent (MtCO@eq), making it the largest public sector contributor to climate change in Europe. This is equivalent to the entire carbon footprint of Croatia and exceeds the annual emissions from all passengers departing from Heathrow[2]. Although, exact figures vary, a common finding is that emissions related to procured goods are particularly high within the NHS [2]. This is particularly high during the COVID-19 pandemic; between Feb 2020 and Feb 2021, over 8.7 billion items of PPE were distributed to health and social care services in England, compared to approximately 2.43 billion items in 2019[3]. We would like to reduce the amount of PPE used, in line with NHS guidelines, to reduce our environmental impact.

Overuse of non-sterile gloves have been seen to increase transmission of pathogens, cross contamination**,** and a reduction in hand washing[4,5,6]. We hope to reduce the unnecessary use of non-sterile gloves and improvement in patients quality of care.

Specific Aims:

To reduce unnecessary non-sterile glove use within the NICU departments at Glangwilli General Hospital (GGH), Carmarthen and Singleton Hospital to;

- improve hand hygiene practices and reduce cross contamination stemming from the overuse of non-sterile gloves.
- Reduce the environmental impact (CO2e) of the NICU.

Methods:

This project was planned to take place in Singleton Hospital. However, due to additional clinical pressures in Singleton Hospital, we have initiated the project intervention at Glanwilli Hospital only. We have projected anticipated savings for Singleton Hospital in this report.

An initial audit using the validated glove audit tool[7] (Appendix 1) was carried out over 6 hours to obtain baseline data on how non-sterile gloves were used in the department. We then contacted procurement to find out how many units of non-sterile gloves were ordered to the department across the six months prior to our intervention.

Based off audit data and previous research, learning resources (an 8-minute training video (Appendix 4)) was developed to outline the problems with non-sterile gloves regarding infection and cross contamination, update members of staff on what the NHS guidelines are for glove use, outside of the COVID-19 pandemic and to share the results of our audit data. Two posters were

created on Canva (Appendix 5) summarising why this project was taking place for family and staff. The other poster was a checklist to remind staff on when non-sterile gloves are indicated. Once these resources were approved by GGH Infection Prevention and Control (IPC), these were then distributed.

We then repeated our audit for an additional 6 hours to calculate a percentage reduction in unnecessary glove use with the same audit tool at Glangwilli hospital.

Measurement:

Patient outcomes:
We hope to ensure infection rates are not impacted by this project and will measure positive blood culture rates before and after the intervention.

Staff outcomes:
Staff surveys were created covering a range of questions (Appendix 2) to gauge knowledge of correct glove use in the department before and after our intervention. We also presented participants with a list of clinical scenarios and asked them to select when they felt it was appropriate to wear non-sterile gloves. The percentage of incorrect answers before and after were measured to see if there was a change.

Environmental sustainability:
We obtained 6 months of glove procurement data from our procurement team. We are awaiting procurement data following our education intervention and expect to see a reduction in the number of gloves needing to be ordered. We will compare the procurement data with our audit data, and expect them to reflect a similar percentage reduction.

Audit data has been used to estimate potential savings while awaiting procurement data.

We will calculate the carbon saved using emission factor for a single glove taken from Rizan et al 2021[11] The carbon emissions of the gloves were estimated using a Life Cycle Analysis (LCA) and includes production, manufacturing, transport, and disposal of the gloves.

Economic sustainability:
We obtained the cost of gloves from our procurement department. We are awaiting our post intervention procurement data to look at cost savings of the project. There will additionally be a cost saving from reduced disposal of gloves.

Social sustainability:
Staff members were encouraged to given feedback across the whole study.

Results:

Patient outcomes:
We plan to measure infection rates via blood cultures. We anticipate a reduction in infections as our audit reflected there was less cross contamination before touching a patient or key site (see below).

Staff outcomes:

We had a significant improvement in correct glove use knowledge. Participants had to assess which answers out of multiple choice were appropriate to don gloves, to which there was one correct answer (taking blood samples). Before the intervention, 23.53% of people were 100% correct in identifying when it was appropriate to utilize non-sterile gloves. After staff watched our video 57.14% were 100% correct in identifying when to use non-sterile gloves. Therefore, our study has improved glove use understanding by 33.61%.

Environmental sustainability:
Audit:
In our initial audit gloves were used correctly 27.3% of the time. Following our intervention, gloves were used correctly 82.7% of the time. This is a 55.41% reduction in glove use. In addition, there were less instances of cross contamination, with the average number of items touched before the patient or a key site was 4.6 times whereas after the intervention it was 0.4 times.

Procurement:
Singleton NICU currently orders 60-90 boxes of nitrile gloves per month and each box contains approximately 100 gloves which equates to 9,000 gloves per month. We are still awaiting our post intervention procurement data to look at actual savings. Based on our audit data, we observed a 55.41% reduction in glove use. This equates to 4,986 less gloves being used per month.

The emissions factor for a singular non-sterile glove is 0.026 kgCO2e. Therefore, the theoretical carbon impact of our intervention is a reduction in 129.636 kgCO2e per month. Projected across a year, **1,555.6 kgCO3e** could be saved. This is equivalent to driving 4,480.4 miles in an average car.

Economic sustainability:
We were unable to obtain a cost per box of gloves. A cost of 0.06p per glove was assumed based on data from an NHS Trust (Northamptonshire Hospitals). A reduction in 9,000 gloves per month is equates to a saving of £540. Projected across a year we could save **£6,480.**

Both carbon and financial savings would be significantly increased if this project were to be scaled across the Health Board. This is one ward, estimated to have saved £6480. There are approximately 20 wards at Singleton.

Social sustainability:
A reduction in patient infections will also reduce risk of staff illness. A reduction in glove use could also be beneficial to staff members with dermatitis as case reports have linked contact dermatitis to nitrile rubber gloves [9,10] the same material as gloves used in the Health Board.

Discussion:

In summary, our survey data has shown that our intervention has caused an increase of staff correctly identifying when to use non-sterile gloves 100% of the time by 53.4%. Our post audit data has shown a reduction in glove use by 55.41%.

There were a few challenges to overcome during this process, mainly through communication and clearing infection control procedures. Initially, there was some confusion through process and procedures of completing an audit and therefore we did not register the audit at GGH audit office until quite late in the process, causing a decrease in time available to introduce our intervention and therefore obtain glove procurement data and blood culture results. We therefore changed our outcome measures for this report (survey data).

A risk managed throughout the whole process was ensuring our resources didn't lower staff use of non-sterile gloves when they indeed should be used. IPC were therefore a vital part of our team to ensure our resources were clear to staff. Ensuring that the new changes were in line with IPC guidance was another barrier to overcome as their team mentioned details our team hadn't considered including making sure all our depictions on our poster were bare below the elbow.

In addition, in meetings discussing this project our team were made aware of the complexities of risk assessing when a member of staff might encounter a bodily fluid in NICU, so some staff members opt to use gloves more often because of this. Therefore, it makes glove reduction harder than we initially

anticipated. However, this is less of a barrier in adult settings, such as an outpatient department, which indicates a potential for a larger reduction in inappropriate glove use.

When staff were completing our survey, we found we had to remove the multiple-choice answer "Giving an Injection" for question 5 "Which of the following activities requires glove use? (Select all that apply)". This was due to staff commenting that the wording was unclear when our team was there to clarify, so in the interest of members who answered when no members of the team were available to answer queries, we removed the question. In addition, one response indicated they had seen our intervention before it was released, however we were unable to verify due to the anonymity of the survey if it was a member of staff who may have seen our draft interventions. Therefore, we removed this datapoint.

Conclusion:

Reducing the number of unnecessary non-sterile glove use is an effective way to both improve patient safety, reduce cost and improve our environmental impact. We hope we can now have discussions with GGH as to whether we can roll this out across the hospital.

Special thanks to:
Matt Pickup, Madeline Shakeshaft, Rachel Morris, Karen Boyles, Catrin Johns, Tracey Gauci and the IPC team and Everyone in the neonatal team at GGH. We wouldn't have got very far without you.

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Appendices

Appendix 1. Glove use Audit, from Wilson et al (2015)

Clinical glove use audit

Commence observation when healthcare worker observed to be commencing a task/procedure and continue until the procedure is completed and gloves are removed or hands decontaminated

Ward:	Date:	Time start:
		Time stop:

1. Discipline			2. Location of task performed?	
HCA = healthcare assistant, AHP = Allied health professional e.g. physiotherapist, occupational therapist, pharmacist.	☐Senior nurse	☐Domestic		☐Clean utility
	☐Sister	☐Phlebotomist		☐Sluice
	☐Staff nurse	☐Porter		☐In bay/room
	☐Agency Nurse	☐AHP		☐Nurses station
	☐HCA	☐Junior doctor		☐Other
	☐Student	☐Senior doctor		☐Unknown

3. Sequence of items/objects touched in this episode of care with points of hand hygiene/glove use

Use to categorise the risk of cross-contamination in one or more of 'My 5 moments of hand hygiene' at end of the observation

Item	HH	G	Item	HH	G
1			7		
2			8		
3			9		
4			10		
5			11		
6			12		

4. If gloves used?

Location put on?		Location removed?	
	☐Clean utility		☐Clean utility
	☐Sluice		☐Sluice
	☐Inside bay/room		☐Inside bay/room
	☐Nurses station		☐Nurses station
	☐Other		☐Other
	☐Unknown		☐Unknown
Was this as close to the point of use as possible/practical?	☐Yes ☐No ☐U/K	*Was this as close to the point of use as possible/practical?*	☐Yes ☐No ☐U/K

5. Adequate hand hygiene after gloves removed? ☐Yes ☐No ☐U/K

According to local policy

Analysis

Procedure(s) performed during this care episode

	Procedure *Check with healthcare worker if cannot observe*	**Glove used?**	***Risk of contact with BBF?*** *Was/highly likely to be contact*	***Glove use appropriate*?***
1		☐Yes ☐No ☐U/K	☐Yes ☐No ☐U/K	☐Yes ☐No ☐U/K
2		☐Yes ☐No ☐U/K	☐Yes ☐No ☐U/K	☐Yes ☐No ☐U/K
3		☐Yes ☐No ☐U/K	☐Yes ☐No ☐U/K	☐Yes ☐No ☐U/K
4		☐Yes ☐No ☐U/K	☐Yes ☐No ☐U/K	☐Yes ☐No ☐U/K

** risk of contact with BBF, mucous membranes, hazardous substances (e.g. chemicals, cytotoxic drugs) or patient under isolation precaution.*

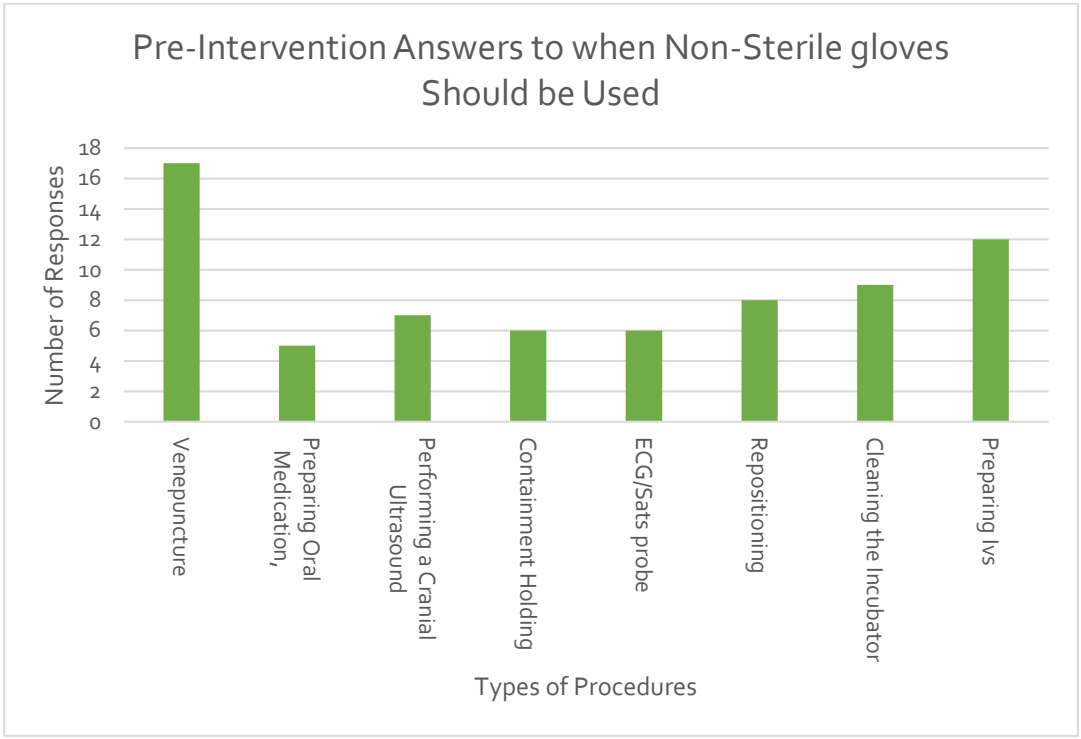
Was there a risk of cross contamination? ☐Yes ☐No ☐U/K	**If yes, which 'moments of hand hygiene'?**	
Assess from the list of items touched, time of glove use and hand hygiene and procedures undertaken. Indicate at which 'moment/s' the potential for cross contamination occurred.	1☐	*Before contact with patient zone*
	2☐	*Before contact with susceptible site^*
	3☐	*After contact with blood/body fluid*
	4☐	*After contact with patient zone*
	5☐	*After contact with healthcare zone*

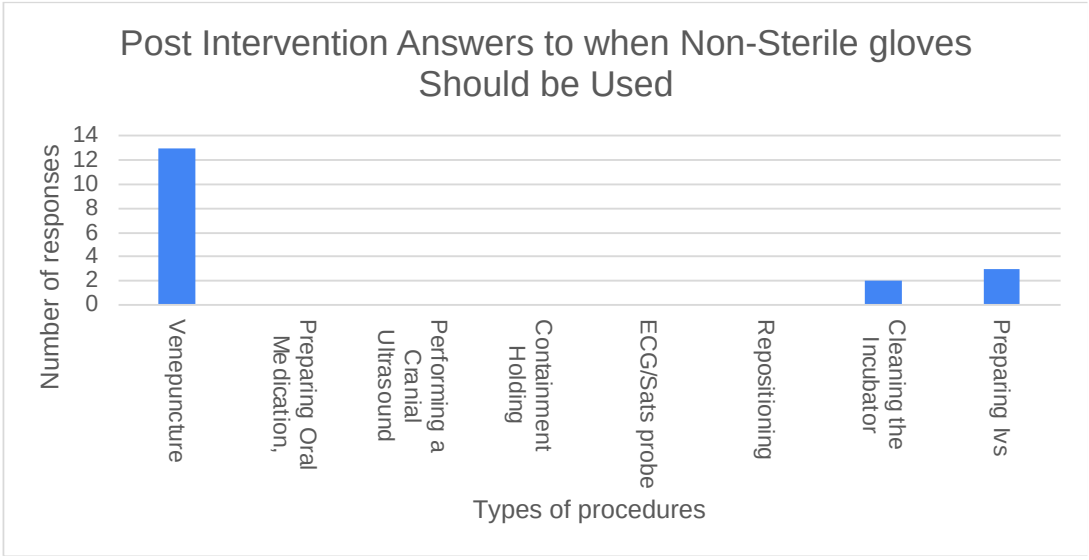
Comment

Appendix 2. Survey Questions:

1. What is your job title?
2. Have you seen the presentation for the Gloves off Campaign?
3. On a scale of 1-10, how confident are you in your knowledge of when gloves should and should not be worn?
4. Which of the following activities requires glove use? (select all that apply). Taking blood samples. Preparing oral medication, such as paracetamol liquid. Performing a cranial ultrasound. Containment holding. Changing ECG leads/Sats probs on baby. Repositioning baby in their incubator. Giving an injection. Cleaning the incubator. Preparing IVIs such as saline fluid
5. Glove use is more effective than hand washing at preventing infection. True or false
6. Who is protected when clinicians wear gloves? Patient, clinician, or both
7. On a personal level, what do you feel the advantages are in wearing non-sterile gloves?
8. On a personal level, what do you feel the disadvantages are in wearing non-sterile gloves?
9. Do you think it is useful to have reminders on when to use gloves?
10. Any additional thoughts on glove usage?

Appendix 3. Bar charts of answers from survey participants pre and post intervention:





Appendix 4. Training video on Non-sterile glove use

Final NICU Gloves Off Training Video (Glanwili) 1.mov
(Linked in the submission email also)

Appendix 5. Posters on GGH NICU/SCBU

Risk Assessment for Staff

Should I be wearing gloves for this?

Any Exposure to:

- Body fluids?
- Cytotoxic drugs/hormones or therapeutically active creams?
- Non-intact skin/mucous membranes/sterile sites?
- Sharps/Contaminated Devices?

Think Gloves

No Exposure, No Gloves

The Gloves Off Campaign

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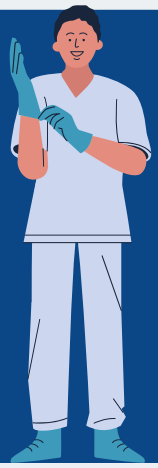
Are you Glove Aware?

Staff will be focusing on how they use gloves. We have noticed an increase in gloves worn when they are not needed, with 40-70% of glove usage has been highlighted as unnecessary in NICU units.

Why is this Change Happening?

Gloves should be worn to protect staff when they have contact with bodily fluids, not for routine duties.

Research shows that good hand hygiene protects both staff and patients by removing pathogens from their hands[1]. This is much safer for patients than routinely wearing gloves which can result in cross contamination and healthcare acquired infections[2,3]. We Will be promoting hand hygiene instead of wearing unnecessary gloves.



How Will this Affect me?

Staff might not wear gloves for certain tasks when they have done previously e.g. when giving IV medication or when bottle feeding a child.

The Gloves Off Campaign

Naomi Oxberry - 2001261@ swansea.ac.uk
Amber Cleife -970460@ swansea.ac.uk

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TEAM MEMBERS:

- Dr Elana Owen, Consultant Anaesthetist
- Dr Christine Range, Consultant Anaesthetist
- Gemma Hale, Operating Department Practitioner

Background:

Hospital operating theatres are highly specialised areas. They utilise powerful, high turnover ventilation systems, high level lighting and many electrical devices, which include anaesthetic machines with gas scavenging pumps and personal computers (PCs). Typically, an operating theatre consists of the theatre itself as well as an adjacent anaesthetic room used for the induction of anaesthesia (and smaller utility rooms beside). As a result, equipment such as PCs and anaesthetic machines are duplicated.

Planned (elective) operating usually takes place during daytime hours and during the working week only, while emergency operating occurs around the clock. Therefore, in our hospital with 20 operating theatres, the majority of these will not be used for most of the time (night and weekends).

Theatre ventilation systems involve powerful fans, achieving up to 500 air changes per hour in an operating theatre and thereby contributing to infection prevention. While we have not been able to find out energy consumption data of this equipment in our hospital, we know that it is significant, and furthermore they produce significant levels of noise (about 53dB at full power), which may be partially transmitted to adjacent hospital areas through walls and ceilings. This can represent a hidden source of patient and staff discomfort

Anaesthetic gas scavenging pumps and overhead radiators use large amounts of energy in anaesthetic practice[1]. Per theatre (with adjoining anaesthetic room) the anaesthetic gas scavenging pumps consumed 18.03 kWh per 24-hour day. We do not use overhead radiators in our hospital, but anaesthetic gas scavenging is an important part of workplace safety in that it minimises staff exposure to inhalational anaesthetics.

According to the Carbon Trust switching off a computer and monitor out of office hours could reduce its energy cost by over 75%[2]. In our setting the operating hours are longer, offering potential savings closer to 67%. Bearing in mind that there are approximately 100 computers in the operating theatres department, despite relatively low individual energy consumption the energy saving could be significant.

Our standard operating procedures did not include routine switching off of equipment at the end of the day. There have been energy saving initiatives in other hospitals, such as Operation TLC at Barts and the Royal London Hospitals resulting in significant financial savings and improved patient care[3]. We wanted to replicate this in similar fashion in our operating theatres department. By switching off electrical equipment and ventilation systems as well as lights in operating theatres outside of standard operating hours could result in significant energy savings.

Specific Aims:

To effect a behaviour change among staff, making the switching off of equipment at the end of the day second nature, increasing staff morale and resulting in carbon and financial savings.

Methods:

We compiled a list of electric devices that could be shut down routinely in elective operating theatres at the end of a working day. A member of our group took a snapshot audit of this equipment in all operating theatres during a night shift to give a baseline overview. We developed a theatres 'shutdown' list and poster (Appendix 1) with an eye-catching design, stating the Health Board's aim of carbon-neutrality and suggesting an easy "shutdown" list for elective operating theatres.

As we are members of the anaesthetics team it was important to get engagement from the surgical scrub staff who are responsible for roughly half of the devices on our "shutdown" list. Conversations were held with the senior management in theatres who have a surgical scrub background, and they expressed their support. When speaking to staff, it became apparent that to activate the routine self-check of the more sophisticated machines in the morning, the machine has to be switched off and back on again. So in this case our protocol of switching off the machine at the end of the day would not increase the overall workload for staff, but rather change the timing of a particular task.

Our posters were displayed within the operating theatres near the control panels for room ventilation and lights as well as in the anaesthetic rooms on the exit door. A clinical governance day was used to engage with staff and discuss with them about beneficial effects of following the new shutdown procedure.

When checking the anaesthetic gas scavenging we discovered a fault with the control panels, making it impossible to switch off scavenging pumps. The repairs were not completed by the time of writing of this report, so we are not able to measure this item on our shutdown list for the time being.

At time of writing, we are planning a repeat audit following a clinical governance day to review equipment use after our staff engagement. We also plan to integrate this review into our monthly audit cycle.

Measurement:

Patient outcomes:
We don't expect any direct benefits for patients. Potential harm could occur if staff forget to switch on equipment in the mornings, but checklists are already in place to help minimise this risk.

Population outcomes:
The reduction in energy use and energy expenditure for the health board will potentially benefit the wider population even though this may not be directly measurable.

Environmental sustainability:
Potential carbon savings were estimated by energy consumption of equipment, obtained from various Trust departments, namely medical electronics, IT and estates. We were successful in finding information on the energy consumption of the anaesthetic machines in standby modus. For the energy consumption of computer equipment, we have relied on information from the Carbon Trust. A group form Southampton has measured their energy consumption for anaesthetic gas scavenging and calculated the amount per theatre. We have not been able to find out the energy consumption of the theatre ventilation fan units nor the electric lights and have therefore excluded them from our calculations at this time.

Economic sustainability:
Our trust pays 28p per kWh of electricity, quoted by our Electrical and Biomedical Engineering Department.

Social sustainability:
We plan to assess staff satisfaction in unstructured conversation some time following the launch of the initiative.

Results:

Patient outcomes:
Checklists are already in place to help minimise risk to patients which will continue to be monitored and measured.

Environmental sustainability:
Our audit revealed that nearly 50% of equipment switched on in operating theatres that were not going to be used during the night. We have not been able to assess the effect of our theatre shutdown initiative yet following the clinical governance day and have therefore estimated the potential savings.

Equipment	Quantity of machines/ equipment	Additional time switched off per day	Power consumption per item	Potential saving per year	KG CO2e/year
computers	70	13 hours	200 Wh[5]	66,430 kWh	17,375
Anaesthetic machine	20	13 hours	210 Wh	19,929 kWh	5,212
Anaesthetic machine	16	13 hours	570 Wh	43,274 kWh	11,318
anaesthetic gas scavenging	17	13 hours	751 Wh[6]	60,579 kWh	15,844

We also anticipate that a 90% reduction in additional hours use would be realistic, which is a potential saving **44,774 kg CO2e per year**, equivalent to driving 128,957.6 miles in an average car.

Unfortunately, due to faulty control panels which require maintenance work it is not possible to turn off anaesthetic gas scavenging machines at present. Excluding this from our calculations, with 90% applicability, savings of up to 30,514 kg CO2e per year can be achieved.

Economic sustainability:
By switching off all the eligible anaesthetic machines and anaesthetic gas scavenging pumps rather than 0-50% as per baseline practice, the health board could save well over £26,000 per year.

This does not consider the potential savings from switching off computers, lights and theatre ventilation fans, because we lack the information needed to calculate.

Social sustainability:
We plan to assess staff satisfaction in unstructured conversation some time following the launch of the initiative. There may be an improvement to the immediate ward environments in the vicinity of the operating theatres through the noise reduction when the ventilation systems are shut down, although this is unlikely to be measurable.

Discussion:

Switching off equipment at the end of a working day is a natural thing to do. In a hospital environment however, there is always the possibility of unplanned requirements, such as having to set up a theatre not currently in use for emergency cases. In these time-critical events every minute counts, and the more elements there are to “setting up” the theatre, the longer it takes and the higher the risk of unintended omission. For that reason, there can be reluctance towards shutting down in the prescribed way. On the other hand, with 20 theatres available, the majority will never

be used out of hours, and good planning can enable staff to fully shut down most elective theatres at the end of a working day, while two or three theatres remain on standby.

There could also be concerns about patient and staff safety if important equipment was not switched on at the beginning of the working day. Computers and lighting do not carry such risk. A widely used routine checklist by the Association of Anaesthetists in Great Britain and Northern Ireland is carried out by every anaesthetist at the start of the day, in addition to the checks performed by the anaesthetic assistant before the first patient enters theatre. If any essential equipment has remained switched off, this will be noticed and rectified.

If the theatre ventilation system was not switched on, it would be unlikely to go unnoticed as the room temperature would increase due to the strong lighting and other electrical equipment running, causing staff discomfort. The absence of the usual background noise would probably be noted before any rise in temperature. Patient harm due to the absence of appropriate theatre ventilation would be impossible to detect as the main beneficial effect for patients relating to this is a reduction in wound infections, the causes of which are usually multi-factorial, and tracing things back to the theatres environment whether or not there was adequate ventilation would be impossible.

Computers in the operating theatres and anaesthetic rooms are shared equipment and normally automatically login on booting. There are occasions when the automatic login does not happen and staff have difficulty remembering login details, in particular the generic ID. This potential obstacle to switching off computers was eliminated by GH by attaching labels to each computer in the theatres department stating their individual login IDs. The passwords required for login are generally known and should not be displayed for obvious reasons.

The timescale of ten weeks for this project was not sufficient to gather all the relevant information from the various departments about the respective energy consumption of the different parts of equipment used in the operating theatres. As a consequence we had to use data from the internet in the interim period to be able to estimate the savings made through this project.

Conclusions:

Switching off electrical equipment at the end of a working day has a positive psychological effect for staff in that it signals the conclusion of a day's task. It gives a good feeling through the knowledge of doing something right. This in itself can raise the morale, which is highly relevant in clinical workplaces.

Saving energy is part of an attempt to live and work in a sustainable fashion with future generations in mind. Although our hospital owns a solar farm it cannot cover all its electricity needs all the time, particularly not at night since it has no energy storage facilities.

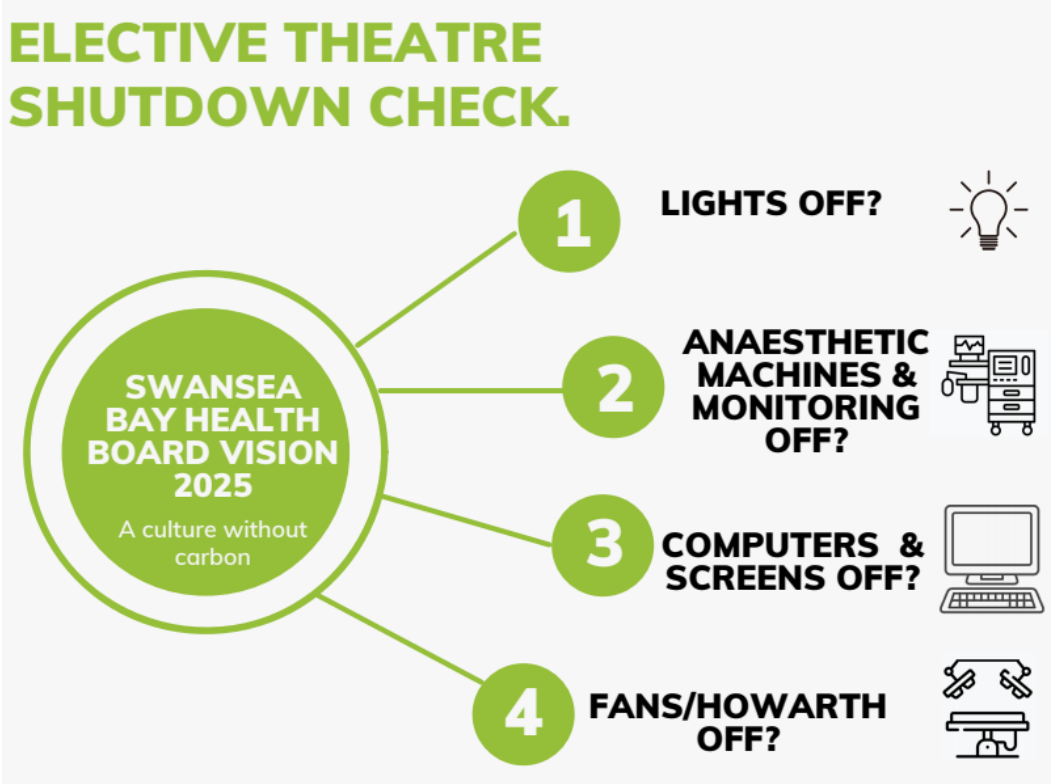
The financial aspect of energy saving has become particularly relevant in recent months with the increases in the cost of electricity.

This initiative has beneficial effects in all of these aspects, and we hope that with time the actions prompted by our posters will be second nature to all staff in the operating theatres so much that they will be applied in other areas.

References:

1. Pierce et al. (Health Estate 2014 Mar;68(3):58-62)
2. CTV007_OfficeBasedCompanies-2021-update.pdf (windows.net) accessed 6/12/22
3. Barts links energy saving to patient care and saves £105,000 in first year | Guardian sustainable business | The Guardian accessed 6/12/22
4. https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022
5. Source for energy consumption of a computer: How much power does a computer use? And how much CO2 does that represent? – Energuide (accessed 17/1/23)
6. Source for energy consumption of anaesthetic gas scavenging machine: Pierce et al. Reducing theatre energy consumption. (Health Estate 2014 Mar;68(3):58-62)

Appendix 1: Poster used for publicity of the Elective Theatre Shutdown Check:



AWARDS

WINNERS: Pharmacy Team

HIGHLY COMMENDED: Two teams were selected: The Anaesthetics Team and The Neonatal Intensive Care Unit Team

Congratulations to the WINNING team, the Pharmacy team. Their project targets a massive carbon hotspots in the NHS, with inhalers alone contributing 3% of emissions. Decarbonisation clinics are a great example of sustainable quality improvement in practice, bringing benefits for the environment and patient together. We at CSH are looking forward to hearing updates from the team in regards to their ambitious longer term aims to scale up the clinics across the Health Board.

ACKNOWLEDGEMENTS

CSH would like to thank the teams for all their enthusiasm, dedicated work & creativity in devising and completing their projects.

Thank you to Hayley Beharrell, Sustainability Planning Manager, Swansea Bay University Health Board for partnering with us for one of the first Green Team Competitions in Wales.

Thank you to Emma Smith, Quality Improvement Information Manager, Swansea Bay University Health Board for your involvement in the competition and interest in bringing QI and sustainability together.

Thank you to our judges for your time and keen interest in the projects.

- Lisa Wise, Head of Health and Social Care Climate Emergency National Programme, Welsh Government
- Hazel Powel, Deputy Director of nursing and patient experience, Swansea Bay University Health Board
- Nuala Hampson, Lead Facilitator, Education Programmes, Centre for Sustainable Healthcare

Thank you to Rosie Hillson, Carbon Modelling Assistant, The Centre for Sustainable Healthcare, for her careful and highly skilled work in carbon footprinting. Rosie supported the teams in carrying out their own carbon footprinting and equipped teams with the knowledge and tools to carry out future calculations for projects in the future. Carbon calculations are essential to 'triple bottom line' integrated project reporting and make plain the true cost and impacts of services to allow better, safer and more responsible decisions to be made in healthcare organisations.

POTENTIAL ANNUAL SAVINGS

The following table provides detail on the **annual** savings available from the 2022 Green Team Competition projects when projects are fully implemented and embedded.

Project	Financial Outcomes	Environmental (CO2e) Outcomes	Social Outcomes	Clinical Outcomes
Incorporating decarbonisation into pharmacist-led asthma clinics	Data not available	4,550.86 kgCO2e (GP practice) 4,518,720 kgCO2e (HB wide)	• Increased awareness of impact of inhalers • Improved asthma control will reduce burden on healthcare services and may reduce waiting times for other patients • Reduced medication prescriptions save staff time • Increased job satisfaction	• Improved patient inhaler technique which may in turn reduce number of salbutamol inhalers used per year, number of hospital admissions, number of oral steroid courses needed per year, and improve patient symptoms
Greener feeding practices in the NICU	£766.65	2,453 kgCO2e	• 100% of staff willing to be contribute to processes which mitigate the environmental impacts of providing neonatal care. • For families, bringing in own bottles contributes to autonomy and role as a parent in the NICU, which is supportive of attachment and bonding.	• 92% increase in parents bringing in own bottles. Commercially available newborn teats generally slower flow rate, promoting safe swallowing and oral feeding skill development. • Aligns with FiCare principles of parental involvement and infant led feeding approach, which can also improve long-term feeding difficulties.
Paper lite and contrast recycling in Endoscopy	1 unit: £192.60 3 units: £548	1 unit: 2,042.16 kgCO2e 3 units: 6,126.48 kg CO2e	• Supporting sustainable workplace culture • Positive patient feedback for digital forms of information	• Patient empowerment to manage own health with updated evidence-based resources.
Reducing the Carbon Footprint of the Rehabilitation Engineering Unit	Data not available subject to testing of material.	392.25 kgCO2e	No negative social outcomes	No impact on patient care
The Gloves are Off Campaign in NICU/SCBU	£6,480	1,555.6 kgCO2e	• Increased knowledge and correct use of gloves by staff. • Reduced patient infections may reduce staff illness • Reduced rates of contact dermatitis for staff	• Improve hand hygiene and reduce cross contamination and infection rates
Elective theatres shutdown check	£26,000	44,774 kgCO2e	• improvement to immediate ward environments in the vicinity of the operating theatres through the noise reduction when the ventilation systems are shut down.	No impact on patient care
Total Savings	**£33,794.65**	**4,574,021.3 kgCO2e**		