



SUSQI PROJECT REPORT: Pulse Lavage

Reducing the CO₂e of Orthopaedic Surgery

Start date of Project: 20th May 2024

Date of Report: 16th August 2024

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Background:

The pulse lavage is a device used in orthopaedic surgery to provide a washout process which is required when performing joint replacement surgery. The washout process aims to allow the surgeon a clear view of the site, remove debris and prepare the bone surface to allow a clean cancellous bone bed. This is so the cement can penetrate the bone for a more lasting fix and reduce contamination and potential infection rate. (NICE: Joint replacement. 2022). The pulse lavage is a device that is recommended for use in all total joint arthroplasty operations in the UK (Chan & Mutimer, 2024). The device currently used in orthopaedic surgery at our trust is fully disposable after each operation which includes 8xAA batteries. Figures obtained from procurement show our trust used approximately 972 pulse lavage last year. This calculates 1.39 tonnes of waste which is sent for incineration as well as 7,776 AA batteries which are sent for recycling. We aim to find an alternative device that uses an alternative power supply and a reduced amount of waste material. By eliminating the need for the AA batteries to power the device as well as a reduction in raw material we aim to reduce the carbon footprint of the orthopaedic washout process.

Methods:

The first step of this project was to engage all stakeholders that would need to have involvement and this included, surgeons, scrub team, procurement and management. The pulse lavage project was presented at governance and given agreement to proceed. The rep from the company of the device we wanted to trial (DeSoutter) was then introduced to the scrub team and a trial period of 4 weeks was agreed at both the Basingstoke and Winchester site. DeSoutter provides a compatible Ecopulse (P31) which can be used with a Stryker drill which is the drill manufacturer predominantly used within our trust. On the Winchester site they have some DePuy drills which require an adaptor for them to work with the Ecopulse P31. The trial of the alternative device started at Basingstoke first due to the compatibility of the type of surgical drill (Stryker) they use. The Winchester trial began 2 weeks later once the adaptor for the drills they used (DePuy) had arrived. Each time a device was used the surgeon was asked to complete a feedback form (Appendix 1) which was



collected for both sites. While the trials were taking place conversations with procurement and waste management took place to gather information on costs.

Measurement:

Patient outcomes:

We anticipate no change to patient outcomes or experience and so this was not measured.

Environmental sustainability:

The GHG emission figures were obtained from a previous study (Chan M, Mutimer J, January 13, 2024) which calculated the hard plastic, battery, tubing and inner/outer packaging carbon emissions for the pulse lavage. The Ecopulse device has a carbon-neutral certification (see appendix) in which a Co2e calculation is published for a cradle-to-grave analysis. Unfortunately, this figure couldn't be used because it would have been very difficult to replicate for the Interpulse device as it was carried out by an external company and was very detailed. The decision to use this figure from (Chan & Mutimer, 2024) was made because the devices were very similar in components and weight and then only the transport information required adapting. The transportation carbon emissions for the devices were calculated by obtaining manufacturing and distribution locations from both the manufacturers and then estimating the total miles and mode of transport used.

Economic sustainability:

Data was obtained from the trust procurement on the usage of the pulse lavage from last year (2023) and our current purchasing agreement. The pricing obtained from DeSoutter for the Ecopulse along with the data from procurement was used to calculate the estimated annual cost implication of switching to the Ecopulse. The costing is based on the assumption that there would be 100% implementation of the Ecopulse across both our Winchester and Basingstoke sites.

Social sustainability:

The alternative pulse lavage has noticeably less materials and does not include the battery pack. The batteries are currently recycled in our trust and therefore need segregation from other waste. Switching to the alternative pulse lavage means staff no longer have to take time to segregate the battery waste as well as the smaller device saving space in storage. These things can have a positive effect on staff by giving them a sense of "doing good" for the environment by reducing waste and improving the working environment.

Results:

Patient outcomes:

The pulse lavage, hip arthroplasty positioning aids and spinal pack arms of the project did not anticipate any impact upon, and therefore did not measure patient outcomes directly. We will however remain vigilant of follow up and welcome any feedback regarding these projects.



Environmental sustainability:

Pulse lavage

Table 1: Carbon footprint of Pulse Lavage - Original V's Alternative	kgCO₂e	kgCO₂e/year (based on 972 devices used)	Savings/year (kg/CO₂e)
Interpulse (Original -Stryker)	4.56	4,432.32	
Ecopulse (Alternative - DeSoutter)	1.69	1,642.68	2,789.64

The Ecopulse is a carbon-neutral certified device meaning the company carbon offsets its emissions, further improving its environmental impact. Table 1 shows each device's estimated carbon footprint and potential carbon savings, if the switch was implemented. The table shows a significant carbon saving from switching away from the battery-powered pulse lavage.

As mentioned previously the Ecopulse uses the existing power tool to provide the power source for the pulse lavage. This eliminates the need for the 8x AA batteries that are required to power the interpulse and is where the main carbon saving comes from. The reduction in the raw materials from the handpiece and the company being UK-based resulting in less travel-related emission, also contributes to the carbon savings when switching to the Ecopulse. The interpulse is currently used for 100% of cases across our trust so assuming we had all compatible drills and full compliance from all surgeons in the trust the annual carbon saving would be 2,789.64 kgCO₂e which is the equivalent of driving 8238 miles in a car. For the purpose of this project it is estimated the two orthopaedic theatres will use 700 devices per year and this would result in an estimated carbon saving of 2,009kgCO₂e. This is equivalent to driving 5933 miles in a car.

Economic sustainability:

Pulse Lavage:

Table 4: Financial evaluation of Pulse Lavage. Original V's alternative	£/Per device	£/year (Based on 972 devices per year)	Saving Implications
Interpulse (Stryker)	£19.98	£19,420.56	
Ecopulse (DeSoutter)	£27.80	£27,021.60	-£7,601.04

The table above shows costs for the whole trust. Unfortunately, introducing the ecopulse would result in a cost implication for the trust. The cost agreement that the trust has with Stryker enables them to offer the Interpulse at a significantly lower price. Despite conversation between the DeSoutter Rep and the trust's procurement they were unable to offer a competitive price. In addition to the figures above the financial savings made by the reduction in waste would be an

estimated £195.95 per year. For the purpose of this project when applying the costing above to the two orthopaedic theatres there would be an estimated cost implication of -£5,474 a year.

Social sustainability:

Qualitative data of the trial was collected via feedback forms that the surgeons were required to complete upon use of the Ecopulse device (See appendix). The feedback forms showed comments on the noise reduction from the Ecopulse which will improve the working environment for the staff in theatre.

Discussion:

Our aim for this project was to implement a 'green surgery' within the 2 orthopaedic theatres and to achieve this we wanted to implement as many carbon reducing initiatives as possible. The limited time frame of this project was one of our barriers to completing all our projects. It became evident that to enable change to happen in a complex environment like the operating theatres it can involve many stakeholders. It is important that these stakeholders are engaged early on in the project as some of the processes of engagement can be lengthy.

Financial implication became a barrier for one of the projects causing it to not be completed regardless of the significant carbon savings the project projected. We hope that with promotion and exposure of the wider sustainability agenda, we can highlight and utilise the savings from other projects in order to allow for investment in those projects that need it.

Conclusions:

Conducting this project has shown the Ecopulse pulse lavage device demonstrates a significant carbon reduction compared to the traditional battery powered devices currently used. This has been achieved by the company DeSoutter, considering its innovative technology manufacturing process and location while ensuring it achieves a carbon neutral device. Unfortunately the mass production of the current device through overseas manufacturing enables them to offer the device at a low price. This resulted in the project predicting a cost implication for the trust and unfortunately means the swap to the Ecopulse device is unlikely to happen in this trust at present. Considering the significant carbon savings achievable this is a project that would benefit from being revisited in the future to assess the available technology on the market and its costing evaluation.

When planning implementing this project into a trust, consideration should be taken regarding compatibility of the device with the currently used power tools. DeSoutter offer compatible devices for their own DeSotter manufactured drills (P30) and Stryker manufactured drills (P31). They also offer an adaptor for the P30 device which enables it to be used with Syenthis (DePuy) drills. This adaptor comes with an additional cost of Approx £1000 per drill. This has the potential to significantly increase the cost implication of implementing this project. This was something that had to be considered during this project as the majority of drills in our trust are Stryker we do have 8 Synthes drills on our Winchester site.

Surgeons reported mixed feedback regarding the pulse lavage during the trial period across trust. Some surgeons reported the device was adequate for the task while some surgeons reported the device was not powerful enough to complete the task. There was positive feedback regarding the



sustainability of the device with surgeons agreeing they would support the use of the device based on this.

References

- Chan M, Mutimer J (January 13, 2024) Reducing Carbon Footprint of Disposable Pulse Lavage Systems in Total Hip and Knee Arthroplasty. *Cureus* 16(1): e52195. doi:10.7759/cureus.52195
- Department for Business, Energy & Industrial Strategy (2022). Greenhouse gas reporting: Conversion factors 2022. Retrieved from: [Greenhouse gas reporting: conversion factors 2022 - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022)
- National Institute for Health and Clinical Excellence. (2020). Joint replacement (primary): hip, knee and shoulder. Retrieved from: [Recommendations | Joint replacement \(primary\): hip, knee and shoulder | Guidance | NICE](https://www.nice.org.uk/guidance/NG157/evidence/joint-replacement-primary-hip-knee-and-shoulder).
- National Institute for Health and Clinical Excellence. (2022). Joint replacement (primary): hip, knee and shoulder [H] Evidence review for wound lavage. <https://www.nice.org.uk/guidance/ng157/evidence/h-wound-lavage-pdf-8771013045>



Appendices

Appendix 1: Ecopulse feedback form



Field Trial Evaluation



Hospital	
Name	
Position	
Date	
What system do you currently use?	
How many do you currently use?	
Procedures carried out today	

Performance of Equipment

	Excellent	Good	Average	Poor	Bad
Pulse rate	5	4	3	2	1
Control of pulse rate	5	4	3	2	1
Removal/changing of nozzles	5	4	3	2	1
Range of nozzles	5	4	3	2	1
Noise Level	5	4	3	2	1
Reliability during the Trial	5	4	3	2	1
General ease of use	5	4	3	2	1

Based on the Eco Pulse® performance would you support the purchase of this product?

Yes/No

“ Did you know?... For every 100 pump kits that you replace with a De Souther Medical Eco Pulse®, you prevent 800 AA batteries going to landfill and up to 62% less waste (63kg) ”

Based on the Eco Pulse® environmental benefits would you support the purchase of this product?

Yes/No


Please tell us more about your experience using the equipment today

Thank you for your time.

Signature


For office use only:			
Reviewed by:	Date:	Comments:	






**CARBON
NEUTRALITY
CERTIFICATE**

Awarded to
**De Soutter Medical Limited for the
P30 & P31 Eco Pulse Lavage System**
Issue Date: 20 May 2022



Carbon
Neutral
Product

Carbon Footprint Assessment
Scope: Product – EcoPulse
Assessment boundary: Cradle to Grave
Emissions Total: 2.96 kg CO₂e
Assessment undertaken/assured by: Carbon Footprint Ltd



John Buckley
Managing Director, Carbon Footprint Ltd
www.carbonfootprint.com

Carbon Offsetting
Amount offset: 60 tCO₂e
Project name: Reducing emissions from deforestation and degradation in Brazil
Project Reference: VCS 981
Project Standard: Verified Carbon Standard (VCS)