



## SUSQI PROJECT REPORT: IV to oral paracetamol switch

### Reducing the CO<sub>2</sub>e of Orthopaedic Surgery

**Start date of Project: 20th May 2024**

**Date of Report: 16th August 2024**

#### Team Members:

- Laura Vale - Senior Operating Department Practitioner, [laura.vale@hhft.nhs.uk](mailto:laura.vale@hhft.nhs.uk)
- Krithea Baker - Recovery Nurse Practitioner, [krithea.baker@hhft.nhs.uk](mailto:krithea.baker@hhft.nhs.uk)
- Dr Jaco DeBeurs - Specialist Doctor Anaesthetics, [jaco.debeurs@hhft.nhs.uk](mailto:jaco.debeurs@hhft.nhs.uk)
- With special thanks to Oliver Grassby (CT2 Anaesthetics), Jessica Lynch (CT1 Anaesthetics), Alhan Al-Sammak (Speciality Doctor) & Ellie Watson.

#### Background:

Paracetamol is routinely given in our trust to patients intraoperatively via the intravenous (IV) route in a plastic bottle. This is not only waste and cost intensive but also poses hazards associated with IV drug administration. This includes iatrogenic hypotension which is most notable in the critically ill which may require additional vasopressor support (Maxwell et al., 2019). NICE guidelines recommend giving paracetamol orally as the first line route of administration (National Institute for Health and Care Excellence, 2024). Considering efficacy, research suggests no significant differences in post operative pain scores when given IV or oral paracetamol (Fenlon et al., 2013; Mallama et al., 2021). We therefore plan to switch to preoperative oral paracetamol where possible.

#### Methods:

At the start of the project, we engaged the clinical lead for anaesthetics who supported the project and assisted in the development of an educational survey (See appendix) to communicate our aims, assess prescribing habits and educate clinicians on the motivation to switch to oral preparation of paracetamol. An infographic detailing the project was then created and displayed in all anaesthetic rooms (see appendix). Pharmacy were involved in order to add the new preparation to our ordering stock lists. Reusable jugs and cups were obtained from kitchen supplies and distributed to anaesthetic rooms. The cup used for water was to follow the patient to recovery to save on washing at the end of the shift. It was decided the best way to do this was to label the cup using a drywipe marker. Feedback was collected via a QR code on the infographic and from the survey. Use was audited through monitoring paracetamol use over a four week period.

#### Measurement:

##### *Patient outcomes:*

NICE (2024) recommends the oral route as the first line route of administration for paracetamol and therefore this change follows recommended patient guidelines. Furthermore, this change avoids any risk of iatrogenic hypotension associated with administering paracetamol intravenously



(Maxwell et al., 2019). Feedback was collected via both an educational survey and QR feedback form.

*Environmental sustainability:*

Given the complexities of calculating the carbon footprint of pharmaceutical products, we have taken data from a recently published life cycle assessment of both oral and IV paracetamol preparations (Davies et al., 2024). This data accounted for production, formulation, packaging, sterilisation (IV only) and distribution to a UK port and disposal (Davies et al, 2024). Their calculations also included administration items such as giving sets which we have excluded for the purposes of this project. This is due to the requirement for a giving set for all patients undergoing anaesthesia in our trust regardless of administration route of paracetamol. This data has been to project annual carbon savings based on our audit on usage.

*Economic sustainability:*

Financial costs of both the oral and IV preparations of paracetamol were obtained from our pharmacy purchasing departments. The projected number of patients receiving oral paracetamol annually was projected from a 4 week audit post-implementation.

*Social sustainability:*

Feedback and comments on theatre staff and clinician outcomes were welcomed via a QR code for feedback and via comments from the educational survey distributed prior to implementation. Additional considerations are that the intravenous preparation of paracetamol is bulky, with a box of 10 bottles weighing 1.43kg. In comparison, 100 tablets or fifty 1g doses of oral paracetamol weigh only 88g in a significantly smaller box. We expect that this will reduce the burden on pharmacy and theatre staff and porters in manual handling and also reduce space required in store rooms. This should also reduce ordering time as one box of oral preparation holds 5 times as many doses as IV, meaning we should have to order less frequently.

**Results:**

*Patient outcomes:*

Our educational survey found that 58.3% respondents have delayed giving IV paracetamol or given vasopressors to prevent iatrogenic hypotension secondary to IV paracetamol administration. This shows potential for reducing the need to administer additional drugs to manage this hypotension and also for preventing inadvertent harm to patients. However, there were also some patient related concerns voiced around bioavailability of oral paracetamol when compared with IV despite the evidence for efficacy based on post operative pain scores. There were also some concerns around reduced gastric absorption in anxious patients, highlighting the importance of patient selection.



*Environmental sustainability:*

<b>Table 4: Carbon Footprint of Oral vs IV Paracetamol</b>		
	<b>Per 1g Paracetamol (kgCO<sub>2</sub>e)</b>	<b>Actual savings based on 1473 patients receiving oral paracetamol (kgCO<sub>2</sub>e)</b>
<b>Oral</b>	0.038	<b>440.43</b>
<b>IV</b>	0.337	

The anticipated carbon savings from our relatively small hospital seem minimal, indeed uptake has not been as high as we would have hoped. At our Winchester site alone, 7320 bottles of IV paracetamol were ordered between FY 2023-2024. Davies et al. (2024) calculated that 45% of UK elective surgical cases were eligible for oral preparation. Using this data, we could have expected 3294 patients to receive oral paracetamol annually, generating a maximum potential saving of 984.9kgCO<sub>2</sub>e. To appreciate the potential of this UK wide, Davies et al. (2024) calculated that if every patient eligible for oral perioperative paracetamol received it, UK savings could be 932.3 tCO<sub>2</sub>e annually. The majority of emissions were attributable to the packaging and materials as opposed to the drug preparation itself (Davies et al., 2024), the carbon emission attributable to pharmaceuticals were 36.5g versus 40.5g for oral and IV respectively whilst the packaging and disposal accounted for 0.1g and 197.4g for oral and IV respectively, showing a marked difference.

*Economic sustainability:*

<b>Table 7: Financial Evaluation of Oral vs Intravenous Paracetamol</b>		
<b>Cost/1g Oral Preparation</b>	<b>Cost/1g Intravenous Preparation</b>	<b>Projected Annual Saving Based on 1473 patients receiving oral paracetamol</b>
£0.019	£0.60	<b>£855.80</b>

The oral preparation per 1g paracetamol in our trust is 32 times cheaper than the IV alternative. Projected annual savings based on our actual usage during the project time are modest, however, if all eligible patients received the oral preparation based on 45% of elective patients (Davies et al 2024), savings would increase to £1913.81 per year.

*Social sustainability:*

Our educational survey found that 75% respondents said they would be somewhat likely or very likely to adopt oral paracetamol in their clinical practice. There were also lots of comments and suggestions around the logistics of the administration of oral paracetamol, for example if this could be done by the admitting nurse on the ward. This had been anecdotally attempted previously with poor results which led us to trial this given before induction. Some respondents welcomed the



availability of oral preparation of paracetamol and suggested having other drugs available orally too.

#### 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.

Patient and staff safety remains of paramount importance, and we must address the potential exposure to risk when implementing new processes. We have addressed issues and concerns around infection control and exposure to anaesthetic gases through developing processes to mitigate risk and seeking advice from specialist practitioners. Seeking approval from divisional governance has also helped us to consider any potential areas for harm so that we could mitigate these.

Going forward, we aim to ensure that these initiatives become embedded into daily practice, through review and audit of our processes. The aspects of our project that are yet to be implemented will be prioritised, and data collection ongoing to measure the impacts across the triple bottom line and improve sustainable value in our department.

#### Conclusions:

There was true value in devising an educational survey prior to implementing this project. It's benefits were multifaceted as we were able to promote and educate the benefits whilst also gathering data on prescribing habits and willingness to change. Uptake was not as high as we expected. Reduced uptake and hesitance to give oral paracetamol due to perceived risk of aspiration may explain the slow adoption. Forgetting to give it prior to induction may also have been a contributing factor, and may require further education and promotion to achieve the maximum savings. Although not commented on in the feedback, it was noticed that the anaesthetic practitioners were required to be fully engaged as they were responsible for ensuring cups and water were available, and this in turn provided a visual cue for the anaesthetist to remember to give the paracetamol orally. Going forward, we intend to continue with education and engagement, and also consider rolling this out to other medications that could be given in the same way, for example ibuprofen and ondansetron.



## References

- Davies, J. F., McAlister, S., Eckelman, M. J., McGain, F., Seglenieks, R., Gutman, E. N., Groome, J., Palipane, N., Latoff, K., Nielsen, D., Sherman, J. D., & TRA2SH, GASP, and WAAREN collaborators (2024). Environmental and financial impacts of perioperative paracetamol use: a multicentre international life-cycle analysis. *British journal of anaesthesia*, S0007-0912(23)00725-0. Advance online publication. <https://doi.org/10.1016/j.bja.2023.11.053>
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## Appendices

### Appendix 1: Link to Educational Survey Paracetamol

[Switch from IV to Oral Paracetamol \(google.com\)](#)

### Appendix 2: Paracetamol switch Infographic

