Policy Brief

PB

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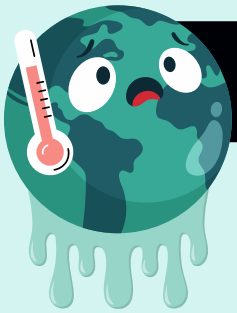
How Does the Health System Impact Our World?:

Health, Economic,and Environmental Impacts of IntravenousVersus Oral Paracetamol for Surgeries

Highlight

- The pharmaceutical industry is a significant emitter of carbon emissions, which accelerates climate change and directly affects human health and health systems.
- The safety and efficacy profiles of intravenous (IV) and oral paracetamol for patients undergoing surgeries are comparable.
- Switching from IV to oral paracetamol, unless contraindicated, can offer significant economic and environmental benefits.



Carbon Emissions from the Health Sector is Accelerating Climate Change

Global carbon dioxide (CO_2) emissions, which are responsible for climate change, is on the rise, reaching over 37.8 billion tons in 2023[1,2]. **Worryingly, the health systems are responsible for approximately 10% of the total emissions[3].**

A significant proportion of this emission comes from pharmaceuticals

- Raw material extraction
- Waste disposal[4]
- Research and development (R&D)
- Use in hospitals
- Production process
- Supply chain

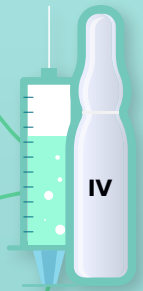
To ensure a sustainable future, health systems should aim to deliver care in a way that optimises health, economic, and environmental outcomes.

One of the most prescribed medications is **paracetamol (acetaminophen),** accounting for around

6% **of all pharmaceutical sales globally[5].**

Comparison of IV and Oral Paracetamol in Surgical Settings

- Ease of administration[6]
- Perceived faster onset[6]



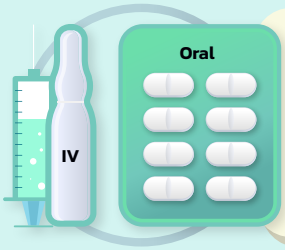
- May be contraindicated during emergency surgeries[7]
- Offers superior economic and environmental outcomes[8,9]
- Comparable safety and analgesic efficacy[7]

Health Benefits from IV and Oral Paracetamol are Comparable

Evidence on safety and efficacy profiles comes from two systematic reviews and trial sequence analyses, which included a combined of 20 clinical trials[6,7]. Below are key points:

1 No significant differences were observed in opioid consumption during the first 24 hours, time to first analgesic request or rescue dosage, patient satisfaction, time to discharge from the recovery unit and the hospital, nausea or vomiting, pruritus, sedation, and plasma paracetamol concentration[6].

2 Evidence on pain relief after surgery of paracetamol at 0–2 hours, 2–6 hours, 6–24 hours, and >24 hours remains inconclusive[7]. No significant difference in efficacy nor any evidence to suggest the increased bioavailability of IV enhances efficacy outcomes[6]. Although individual studies reported higher plasma levels and faster onset with IV paracetamol, they did not appear to have a significant effect on overall pain relief and adverse events[10–12].



Both studies concluded that **there were no significant differences in safety and efficacy profiles between IV and oral paracetamol and recommended switching to oral route (when not contraindicated) due to potential financial savings[6,7].**

Oral Paracetamol is Significantly Less Costly to Health Systems and the Environment

Evidence on the carbon emissions, financial cost, and potential savings from switching from IV to oral paracetamol come from a multicenter modelling study covering Australia, the UK, and US[8], and an implementation study from Changi Hospital, Singapore[9], as presented in Table 1.

Table 1: Carbon Emissions and Cost per Country (per a single 1 g dose of paracetamol)

Setting	Carbon emission ($g CO_2e$)		Unit cost (USD)		Carbon and cost savings from switching to oral paracetamol**
	IV*	Oral	IV	Oral	
US[8]	310 - 628	38 - 151	26.48	0.05 - 2.38	**Carbon:** 88.6% of total estimated emissions in the study year **Cost:** up to 93% of the total direct costs in all three countries
UK[8]			0.66	0.01 - 0.39	
Australia[8]			1.23	0.01 - 0.16	
Changi Hospital, Singapore[9]	310 - 628	38	NA	NA	**Carbon:** 48.4% (from 194,300 to 100,300 gCO_2e per 1000 cases) **Cost:** 76.4% per 1000 cases (USD 1346 to $317)
Thailand[13]	NA	NA	2.76	0.013/500 mg	NA

*Dependent on type of packaging and administration supplies; glass vials have higher carbon emission than plastic vials

**Estimated CO_2e savings were calculated assuming 100% of IV doses given to eligible patients could be replaced with an oral tablet alternative.

gCO_2e: grams of carbon dioxide equivalent; mg: milligram; NA: not available

The studies[8,9] reveal that switching from IV to oral can lead to significant carbon and financial savings for each country. As Thai data on carbon emissions and prevalence of unnecessary IV use were not available, we were unable to estimate the potential savings. Nonetheless, considering almost 99.06% difference in the unit cost of IV and oral paracetamol[13], the potential economic gains from switching to oral paracetamol in Thailand remains very high.

Recommendations

Our findings highlight that using IV instead of oral paracetamol during surgeries, unless contraindicated, does not provide additional health benefit, is more expensive, and contributes to worsening climate change. Thus, this practice contributes to low-value care. To increase economic and environmental efficiency, we recommend the following:

For physicians and nurses: When not contraindicated, we advocate switching from IV to oral (tablet or liquid) paracetamol dosage form for surgeries. This will likely result in co-benefits, including carbon and financial savings in Thailand.

For researchers: Further detailed studies in Thailand on the following areas would strengthen the evidence base: (i) carbon emissions from IV and oral paracetamol using life cycle assessment (LCA) methodology, (ii) prevalence of IV use during surgeries that could be replaced with oral paracetamol, and (iii) economic analysis on potential financial savings from switching to oral forms.

For data custodians and policymakers: Providing the researchers access to data on drug use by procedure would allow future studies to assess the health, economic, and environmental impacts of pharmaceuticals – enabling the identification and elimination of low-value care in Thailand.

Limitations

Besides the unit cost of paracetamol, data on Thailand-specific carbon emissions and the prevalence of unnecessary IV use are currently unavailable. Therefore, our recommendations are based on unanimous findings from other settings.

Authors

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