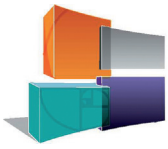
Anaesth Crit Care Pain Med xxx (2020) xxx–xxx



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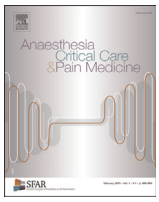

Editorial

Enhanced recovery programs and carbon footprint

Environmental protection forms one of the three pillars of sustainable development (social, economic, and environmental sustainability). Hospitals are responsible for a large share of the global carbon footprint. In turn, global warming has a major impact on health and so healthcare needs to be resilient and agile to meet new challenges. Recently, enhanced recovery programs (ERPs), comprising a set of perioperative components, have been adopted worldwide in several surgical specialties and are considered by many practitioners as a standard of care [1]. The proven and recognised benefits of ERPs include less overall morbidity, shorter hospital stay, better convalescence, improved team spirit, and the active involvement of patients in their care. All the benefits for the patients are secondary to reduced surgical stress. ERPs can offer the dual advantage of improving outcomes and reducing the carbon footprint of procedures by decreasing in-hospital consumption, number of visits, etc. At first sight, ERPs with less invasive care, no routine use of drains, and fast-track management should result in a lower carbon footprint. However, the unknown environmental impact of ERPs warrants evaluation, especially as ERPs are set to become daily practice worldwide.

Suggested hypotheses

A few papers have analysed the environmental impact of surgical care overall [2], or that of some individual components such as volatile anaesthetic agents [3], or minimally invasive surgery [4], but not the impact of the full ERP. Some ERP components probably have a lower carbon footprint, such as earlier feeding, eco-friendly anaesthetic practices using sevoflurane (rather than desflurane), avoiding tubes (indwelling urinary catheters, gastric tubes, surgical site drains), and earlier postoperative ambulation and discharge, and subsequently shorter hospital stays, fewer visits. Fewer postoperative complications as a result of ERP also mean a lower carbon footprint owing to less postoperative care.

Conversely, there are other ERP components that are associated with a higher or potentially higher carbon footprint, such as optimisation of chronic disease, prehabilitation, minimal access surgery [5] (laparoscopy, thoracoscopy) using single-use instruments, intraoperative goal-directed therapy with monitoring devices used in most cases, or robotics.

Beside the core program, the impact of some new perioperative measures (e.g. hypnosis using virtual reality headsets, music therapy with headphones, same-day admission, teleconsultation, arrival at the operating theatre on foot) has not been studied [6]. On the other hand, post-discharge monitoring using electronic devices or apps could add a significant carbon footprint.

Fig. 1 shows the possible carbon footprint of the main ERP components taken singly. This figure was constructed intuitively taking into account the direct and indirect carbon footprint according to the few published papers or the authors' own assessments, after consensus. To create this figure, we considered, for each component, energy-intensive medical equipment, materials packaging, landfill waste production, transport-associated greenhouse gas emissions (procurement, waste disposal, patient and caregiver travel), and the benefits of ERPs (better recovery, less postoperative care and shorter stay). The items cannot be dichotomous (good or bad for the carbon footprint).

Owing to the lack of dedicated studies, we do not yet know whether ERPs taken as a whole are environmentally virtuous or not.

What comes next?

Our purpose here is not to call into question the evidence-based and mandatory perioperative ERP components, but to suggest ways to improve their carbon footprint and that of ERPs as a whole. Besides the conventional greening strategies – improving recycling, using less water and energy and fewer single-use devices or equipment – we should seek ways to reduce the carbon footprint of each ERP component.

We need further specific studies to quantify the environmental impact of surgical care and its different pathways. ERPs have already shown the way and also offer an opportunity to further reduce the share of surgical care in the health care footprint. The next steps should be to model the carbon footprint of each pathway component, focusing on the worst components and then training users and building projects to reduce the environmental impact of these components while maintaining a high quality of care. When evaluating some components such as prehabilitation (with its multiple visits and devises) or minimal access surgery (with its specific instruments) or monitored goal directed therapy, or other accessory perioperative measures (using devises), the carbon footprint should be systematically included in future studies (whether comparative ones or simply observational ones) as an important outcome in addition to the classical ones (hospital stay, complications, or costs). This will allow clear policy decisions and effective actions. ERPs together with actions to reduce their environmental impact should meet goals #1 (better conditions of surgery patients), #2 (sustainable consumption and production patterns) and #3 (actions to combat climate change and its

https://doi.org/10.1016/j.accpm.2020.07.014

Please cite this article in press as: Slim K, et al. Enhanced recovery programs and carbon footprint. Anaesth Crit Care Pain Med (2020), https://doi.org/10.1016/j.accpm.2020.07.014

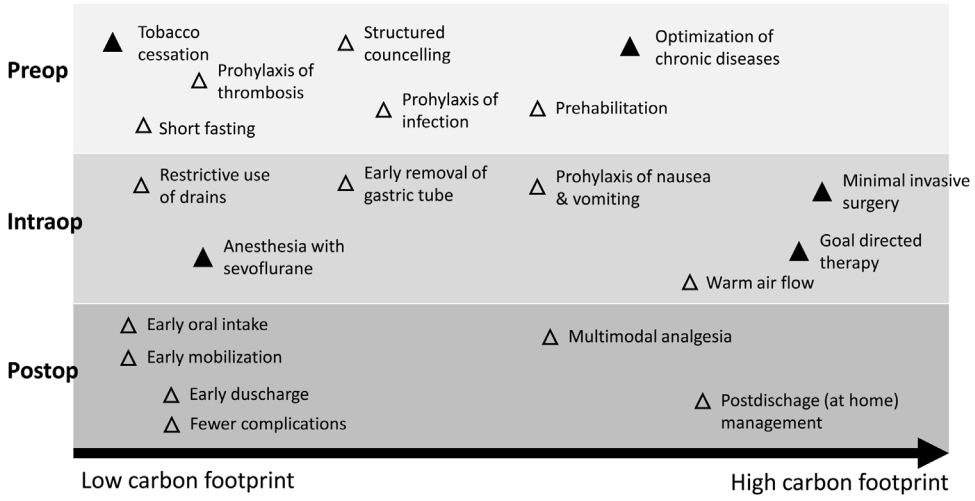

Fig. 1. Possible carbon footprint of the main single ERP components according to the few published papers or the authors' assessments, after consensus.
Preop = Preoperative period, Intraop = Intraoperative period, Postop = Postoperative period, ? = Component assessed by a clinical study, △ = Component not assessed by a clinical study.

impacts) of the UN project [7]. For ERPs, we should be thinking of both the individual benefits they provide and their societal benefits in terms of sustainable development. ERPs are well known for improving the functional conditions of patients (with better convalescence and earlier return to usual activities) and reducing health expenditure. ERPs thus already help support two pillars of sustainable development. We must now add the third pillar, which is environmental sustainability.

Finally, the main take home message is that, at present, we do not know whether ERPs taken as a whole are environmentally virtuous; some components are probably lowering the carbon footprint, but others are perhaps increasing it.

Conflicts of interest

KS: declare conflicts of interest with Sanofi, Merck, B-Braun, Baxter for the last 3 years. MS declares no conflict of interest. PA declares no conflict of interest.

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Please cite this article in press as: Slim K, et al. Enhanced recovery programs and carbon footprint. Anaesth Crit Care Pain Med (2020), https://doi.org/10.1016/j.accpm.2020.07.014