

Sowing the Seeds of Change: An Experience From Intensive Care Green Teams

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Abstract

Introduction

Our health care systems are huge contributors to the climate crisis. Several medical societies have recommended implementing green teams to increase practical sustainability projects and awareness.

Action and Aim

Both in Amsterdam University Medical Centre (AUMC) and University Hospital Antwerp (UZA) green teams were started by physicians and nurses. During the meetings ideas were shared and translated into projects.

Results

In both centres several projects were initiated; bedside sustainable skin products for children, increased duration of iv-line use, decrease of pharmaceutical spilling and ICU-based waste sorting. Ideas were difficult to implement due to lack of hospital structures and lack of unit specific data. Other experts increasingly participated in the teams.

Lessons learned

Green teams are based on managing sustainability practices from a clinical perspective, although there are plenty of ideas, prioritizing and feasibility can be challenging. Also time and people are scarce and behavioural change in your own unit is difficult. It can be useful to identify several key members for a green team to improve efficiency and efficacy. The focus for sustainable medical societies should be to stimulate the step from practical to evidence-based recommendations by supporting and publishing practical research.

Introduction

Our health care systems are huge contributors to the climate crisis. The buildings, the energy, the drugs and anaesthetic gases but also things such as traffic to and from the hospitals, the use of paper and general waste, cause a substantial CO₂ footprint (1). The generation of hospital waste is a huge problem in every ward, but even more visible at the (Paediatric) Intensive Care Unit (PICU). Not only the central lines and tubes themselves but also the packaging and sterile sets contribute to the total burden. In some reports the daily waste generated in an Intensive Care Unit (ICU) per patient is grossly equivalent to the yearly average waste per patient (2, 3). With the recent COVID pandemic, the visible amount increased adding isolation gowns, masks and gloves. From the departments of ICU and anaesthesia plans were initiated to act on the increasing burden of plastic. From the paediatric specialties awareness is raised on the specific impact the climate crisis has on their vulnerable population (4).

When considering a strategy to decrease the CO₂ footprint of healthcare, the 5Rs give some guidance. These stand for: Refuse, Reduce, Reuse, Recycle and Repair. However in a clinical setting, applying these tools may remain vague. Practical input from the wards is needed for implementation of changes, guided by research to prioritize the right projects. More and more journals and medical societies make recommendations on the implementation of green teams (5-7). Green teams are groups of collaborators who (mostly) voluntarily come together and focus on detecting

and addressing sustainability challenges in the company's daily activities, implementing sustainability initiatives in a bottom-up instead of top-down manner (8). In an ideal world the green team consists of members from several disciplines. In this paper we describe the experience of several ICU and PICU green teams.

Action

In Amsterdam University Medical Centre (AUMC) we started a PICU green team in 2020. In the Antwerp University Hospital (UZA) in 2023, a green team was started in PICU-ICU. In AUMC the green team was led by 2 physicians combined with 2 nurses all of whom participated enthusiastically due to personal interest. In AUMC, with time the hospital pharmacy staff members became involved as well. At the same time other green teams emerged in the hospital and sustainability research and policies were created hospital wide. In the UZA the green team consists of 3 physicians, 5-6 nurses from 5 different intensive care units and on invitation the sustainability officer participates in meetings. Throughout the years environmental staff, facility managers and quality officers have been increasingly engaged in the teams.

Aim

In every green team we aimed to improve sustainability practices on the wards. During the meetings particularly nurses came up

TABLE 1: Potential green team members and their role, adapted from De Waele JJ et al., Environmental sustainability in intensive care: the path forward. An ESICM Green Paper. Intensive Care Med. 2024 Nov;50(11):1729-1739 (5).

Principle green team member	Description of role
Nurses and physicians	Provide bedside practices, initiation and principle management of green team
Sustainability officer (if present in hospital)	Provides expertise on local sustainability practices and coordinates efforts across departments
Facility managers	Responsible for the maintenance and operation of physical spaces, paramount for implementing change in energy and water usage
Infection prevention	Ensures that sustainable practices meet health and safety standards and identifies opportunities to reduce disposable use without compromising patient safety
Extra members for specific projects or advice	Description of role
Dietitians	Fundamental for sustainable sourcing of patient meals and reducing food waste
Environmental staff services	Fundamental for waste management and information on daily waste streams
Laboratory specialists and technicians	Fundamental for projects concerning optimizing the strategy for sampling and processing
IT specialists	Fundamental when optimizing energy efficiency of electronic systems and advocating for digital over paper use
Pharmacists	Fundamental for understanding medication sourcing, optimal use and disposal
Procurement officers or supply chain managers	Influence the purchasing of sustainable products and engage with suppliers who prioritize sustainability
Quality officers	Ensure that sustainable practices meet quality standards and guarantee incorporation in local protocols
Biomedical engineers	Help with the maintenance, proper disposal and replacement of medical equipment with more energy-efficient options
Financial officers	Analyse the (positive) financial impact of sustainability initiatives and help in obtaining funds and/or relocate resources for green projects
Legal advisor	Ensures that all sustainability initiatives comply with relevant regulations and laws
Communication specialists	Assist in promoting initiatives internally and externally and engage with the community and stakeholders
Patient advocates, former patients or family members	Ensure that patient perspective are included in sustainability efforts, as they are significant stakeholders in healthcare systems

with ideas, often related to sustainable product use, waste management, and spilling of medications, diapers and food. The first meetings were usually related to generating ideas, followed by prioritization and discussions on feasibility. Usually 1-2 projects/year were chosen and timelines were made.

Results

In the 3 years at AUMC we changed the bedside skincare products from a standard to a sustainable brand and reduced volumes and packaging for the products in the whole children's hospital. Although the aim was to also change the diaper brand and introduce diaper recycle systems, this was too difficult to implement due to regional recycling possibilities. We did, however, choose a more sustainable variant of the diaper, including paper packaging instead of plastic. Particularly costs and partnership in waste management posed challenges for definite change. After this we looked at the duration of iv-line use and extended the days for obligatory change from 3 to 7 days. We also collected the waste of medications for several days and analysed which medications were most often discarded. In further analysis and discussions with nurses and doctors, inefficient prescription practices for continuous medications, such as vasopressors appeared to be a contributing factor to the spilling. By discussing and changing these things, increasing consciousness led to several awareness teaching sessions on other wards. In the past years in the UZA we looked at the collection of recyclable plastic waste and discussed the guidelines and practical bedside approach for waste separation with the nurses and sustainability

officer. The waste sorting guideline was redesigned for ICU, at the same time increasing the number of plastic waste bins per unit. We aimed to look at electricity use within the units. Although general hospital data is available, no detailed data per unit could be generated. The general electricity usage data was believed insufficient to come up with specific recommendations. New projects will be aimed at food waste and teaming up with infection prevention for isolation guidelines and introducing more sustainable practices.

Lessons learned

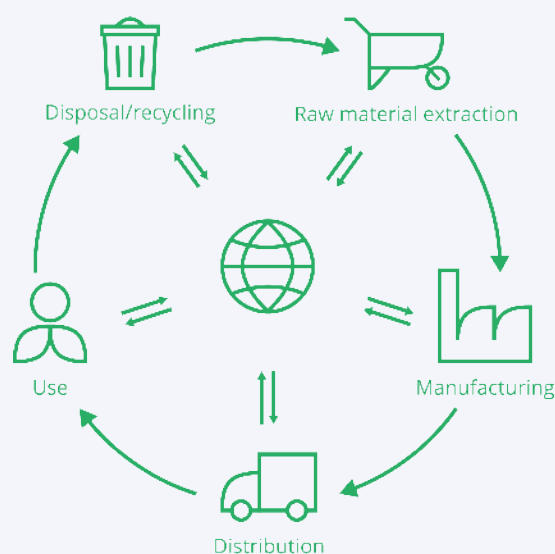
Although many journals and medical societies advocate for more sustainable health services, evidence for sustainable actions in hospitals is only slowly starting to appear. A green team can be a way to start sustainable practices in the meantime. As green teams implement sustainability practices from within their own units, projects can be thought through more carefully and practically by the team members participating. Team members should come from different backgrounds (Table 1), particularly cleaners, infection prevention experts and sustainability officers should not be overlooked when starting a green team. For well-integrated plans, several other experts can be alternately asked for advice. Due to the bottom-up system, the so-called low-hanging fruit: seemingly small, practical ideas with a possible big impact, are identified early. Starting off with this type of projects, for example reduction of paper prints in an outpatient department or the prolonged use (in days) of iv-lines, additionally lead to visibility

and positivity because they are relatively easy changes that can also reduce (bedside) work load (7, 9). The real power of the green team comes from its practical, experienced and multidisciplinary members that warrant efficacy and efficiency by thinking plans through from different perspectives.

The challenge lies in prioritizing and feasibility. After the initial focus on low-hanging fruit, successfully identifying the right projects can benefit from research. Within the medical sustainability sector, technical universities have participated to synergistically identify useful methods. Life cycle analysis (LCA) is one of the more often used calculations in which the environmental impact is broken down into a life cycle. This means the impact is calculated for the raw material, the production, the use and the post-use phases (see Figure 1). In Amsterdam an LCA was done for the use of single use or washable operation caps (10). Taking into account the washing, detergent, transport and all other details, it showed that the final footprint kg CO₂ equivalent per use of washable caps is lower. The more often the washable caps are used, the lower the footprint. Another tool recently used is circular material flow analysis (MFA), which focuses on a quantitative understanding of all the goods and waste flows that enter and leave the system or in this case the hospital unit. It can be used to manage resources and waste flows leading to actual decisions. From the adult ICU in Rotterdam, the Netherlands, a comprehensive analysis identified 5 carbon footprint hotspots: non-sterile gloves, isolation gowns, bed liners, surgical masks and syringes (including their packaging) (11). The focus for sustainable medical societies should be to stimulate the step from practical to evidence-based recommendations by supporting and publishing practical research.

Although setting up a green team sounds inspiring and easy, the reality is that perseverance and timing are the keys to success. In our experience, green team members participate in their spare- and often sparse non-clinical time. With staff shortages, this means most meetings take place after or before shifts and depend on goodwill. Staff shortages are a significant hurdle for implementation and success of sustainability projects (12). Even if there is enough staff and time investment is facilitated, the step from green team towards the rest of the unit is equally challenging. Somewhere between the lack of sustainable instructions for healthcare workers and the lack of motivation, the green team stands to fill the gap towards their own colleagues. The green team members are not trained to change behaviour and many meetings have been about how to positively influence the whole staff. In the Netherlands

FIGURE 1: Life cycle analysis (source Life Cycle Assessment (LCA) explained - PRÉ Sustainability)



competitions, such as the paracetamol challenge were introduced, where changing from intravenous to oral paracetamol prescriptions can significantly reduce CO₂ production and costs (13). In our experience, it takes the right time and the right people to positively introduce new sustainability projects within each department's own culture.

Conclusion

Once you are convinced that our current ways of delivering healthcare can be more sustainable, it's too easy to say, "just do it". The tools presented in this paper to persevere and make changes are 1] find the right people from all over the hospital and make an inspiring team, 2] the chain of implementation in healthcare is long and complex it needs practical multidisciplinary observations from the working floor and lastly 3] use and add to the growing amount of evidence on effective sustainability projects.

REFERENCES

- Hagenaars N, Jacobs S, Merkus K. De inhaalrace naar de duurzame zorg. Amsterdam, the Netherlands: Gupta Strategists; 2022 [cited 2026 March 6]. Available from: <https://gupta-strategists.nl/onderzoek/de-inhaalrace-naar-duurzame-zorg>.
- Corbin L, Hoff H, Smith A, Owens C, Weisinger K, Philipsborn R. A 24-Hour Waste Audit of the Neuro ICU during the COVID-19 Pandemic and Opportunities for Diversion. *J Clim Chang Health*. 2022;8.
- Kubicki MA, McGain F, O'Shea CJ, Bates S. Auditing an intensive care unit recycling program. *Crit Care Resusc*. 2015;17(2):135-40.
- Ahdoot S, Baum CR, Cataletto MB, Hogan P, Wu CB, Bernstein A, et al. Climate Change and Children's Health: Building a Healthy Future for Every Child. *Pediatrics*. 2024;153(3).
- De Waele JJ, Hunfeld N, Baid H, Ferrer R, Iliopoulou K, Ioan AM, et al. Environmental sustainability in intensive care: the path forward. An ESICM Green Paper. *Intensive Care Med*. 2024;50(11):1729-39.
- Bein T, McGain F. Climate responsibilities in intensive care medicine-let's go green! An introduction to a new series in Intensive Care Medicine. *Intensive Care Med*. 2023;49(1):62-4.
- Yun YM, Kirby C, Bob N, Calabria C, Hernandez A, Cook B, et al. Promoting Sustainability Practices in the Outpatient Pediatric Setting. *Yale J Biol Med*. 2023;96(2):261-5.
- Suárez-Cantor A, Janeth Urrego Garzón A, Carolina Silva Soche A. 20-4DYV Green teams in intensive care units: alliances for life and planet. *BMJ Open Quality*. 2024;13(Suppl 3).
- Lucchini A, Giani M, Rezoagli E, Favata G, Andreani A, Spada M, et al. Impact of a 'Catheter Bundle' on Infection Rates and Economic Costs in the Intensive Care Unit: A Retrospective Cohort Study. *Nurs Rep*. 2024;14(3):1948-60.
- Cohen ES, Djufri S, Bons S, Knoppert MR, Hehenkamp WJK, Kouwenberg L, et al. Environmental Impact Assessment of Reusable and Disposable Surgical Head Covers. *JAMA Surg*. 2023;158(11):1216-7.
- Hunfeld N, Diehl JC, Timmermann M, van Exter P, Bouwens J, Browne-Wilkinson S, et al. Circular material flow in the intensive care unit-environmental effects and identification of hotspots. *Intensive Care Med*. 2023;49(1):65-74.
- Gonzalez-Pizarro P, Brazzi L, Koch S, Trinks A, Muret J, Sperna Weiland N, et al. European Society of Anaesthesiology and Intensive Care consensus document on sustainability: 4 scopes to achieve a more sustainable practice. *Eur J Anaesthesiol*. 2024;41(4):260-77.
- Van inhuus naar tablet: de paracetamol challenge is een echte win-win-win. The Netherlands: Green Deal Duurzame Zorg 2024 [cited 2026 March 6]. Available from: <https://www.greendealduurzamezorg.nl/service/nieuws/van-inhuus-naar-tablet-paracetamol-challenge/>.