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Environmentally Sustainable Intensive Care Unit

Mayur Patel[1], Darshana Rathod[2], Bhavik Shah[3]

[1] Mentor and Consultant, Department of Critical Care, Sir H. N. Reliance Foundation Hospital, Mumbai, India.
[2] Additional Director, Department of Critical Care, Sir H.N. Reliance Foundation Hospital, Mumbai, India.
[3] Head, Department of Critical Care, Ashoka Medicover Hospital, Nashik, India.

Corresponding Auhtor: Bhavik Shah

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ABSTRACT

Healthcare has made significant progress in the last century; however, its carbon footprint has negatively impacted the health of the planet. The intensive care unit (ICU) is called the 'carbon hotspot' of the hospital, as it contributes significantly towards the carbon footprint while delivering the care. We need to put in collaborative and continuous efforts from various stakeholders to make ICUs environmentally sustainable.

Keywords: Climate change, carbon footprint, green team, lifecycle assessment, material flow analysis.

INTRODUCTION

WHO's 2021 report on CLIMATE CHANGE AND HEALTH, mentions that climate change is the most severe and sustained threat to life on planet earth in the whole history of mankind[1]. Sustained threat of climate crisis is a catastrophe for humanity, due to disastrous and unrectifiable outcomes on human health. Impact of climate crisis on health includes direct injuries, death and illness and indirect effects such as infectious diseases and malnutrition leading to surging demands of healthcare[2]. WHO currently estimates that an additional 250,000 deaths will occur annually between 2030 and 2050 due to climate change[3].

Delivery of healthcare in ICU contributes majorly towards the carbon footprint and is called the 'carbon hotspot' within the hospital. The undesirable effects caused during delivery of healthcare arises because of consumption of energy, water, fossil fuels, metals and other substances required to manufacture, transport and use health care items (e.g., medicines, consumables and equipment), along with other waste management, pollution, food and building implications[4].

Desperate attempts from the ICU team with the support of management will be required for transitioning to deliver sustainable healthcare.

How do we quantify the effect?

The estimation of the impact that an activity, a service, or an item may have on the environment is defined as Carbon Footprint. This impact results from the direct or indirect production of greenhouse gas emissions. Carbon dioxide equivalents (CO_2e) are the units used to calculate, report and quantify the impact[4].

Carbon emissions are classified into three scopes: a) scope 1 - direct emissions (related to energy or fuel combustion) incurred at the facility, inclusive of anaesthetic gases, b) scope 2 - indirect emissions (associated with the purchase of electricity, cooling), and c) scope 3 - all other indirect emissions

associated with assets that are not within an organization's control or boundaries, which include water and waste, staff commuting, pharmaceuticals, equipment and food processing[5].

This carbon footprint can be comprehensively assessed by the methods of life cycle assessment (LCA).

An LCA examines the environmental footprint of a product or process throughout its entire life cycle (from raw material extraction to waste treatment), including material production or acquisition, use, recycling and disposal[6]. An LCA conducted in a United States hospital, showed that compared to acute care units, an ICU generates 1.3 times more solid waste (7.1 kg vs 5.5 kg) and 3.1 times more greenhouse gases [138 kg vs 45 kg CO_2e] per bed day, with major contribution to emissions coming from consumable goods, building energy consumption, capital equipment purchases, food services, and staff travel[7].

Material Flow Analysis (MFA) provides a quantitative understanding of consumables and waste flows that enter and leave a specific system[8]. On the basis of MFA, a Dutch study calculated the environmental impact per patient per day results in 17 kg of mass, 12 kg CO_2e, 300 Lit. of water usage and 4 m^2 of agricultural land occupation. Other interesting observation was identification of hotspots - non-sterile gloves, isolation gowns, bed liners, surgical masks, and syringes (including packaging) which cause significant impact to the environment requiring urgent attention[7].

How to improve environmental sustainability in ICU?

There are many steps which can be promoted to reduce the carbon footprint of ICU. The key interventions are avoiding, reduce, reuse, and recycle without compromising safe, and quality care, with simultaneous research into best practices and rethinking how ICUs can be more sustainable[9].

Avoid

All ICUs should have **'Resource Stewardship'** programme in their ICU, where the following tasks are chalked out:

a) effective and appropriate utilisation of ICU can be achieved by suitable triaging practices to prevent unnecessary admissions and readmissions to ICU[9].

b) follow goal-concordant care in accordance with the patient's goals and values to prevent unnecessary interventions and treatment[10].

c) follow hospital-based guidelines considering hospitals' local resources to optimise ICU supply with demand, thereby reducing costs and improve patient outcomes[11].

d) creating critical care outreach team will serve to avoid and reduce ICU admissions through timely detection and prompt treatment of deteriorating patients, and readmissions after ICU discharge[9].

Reduce

Reducing generation of waste at its origin will prevent the pollution of environment causing significant impact.

Clinical[12]:

a) Usage of proton pump inhibitors routinely in low risk patients should be reduced.
b) Thromboprophylaxis in ambulatory patients should be avoided
c) Reducing use of supplemental oxygen – this will prevent harmful gas emissions during the production of medical oxygen and disposable plastic masks and tubing
d) Costs will come down by curtailing routine blood tests and thereby reducing unnecessary transfusions
e) Unwarranted clinical variation in the use of MRI and CT scan causes significant emissions of CO_2[13]
f) f) Reduce the use of inhalational anaesthetics and hydrofluorocarbon-containing Metered Dose Inhalers[9].

Non-clinical[12]:

a) Reduce facility energy consumption for HVAC (heating, ventilation, and air conditioning)
b) Using natural light to decarbonize energy sources
c) Reduce paper consumption
d) Use of plastic should be minimized
e) Utilize telepresence to avoid unnecessary vehicular transport
f) The supply chain should be managed prudently to reduce unused medical waste
g) Sustainable Design: with sustainable materials for construction and furniture. They lower carbon emissions, energy consumption, and resource depletion.
h) Water Conservation: low-flow fixtures and greywater reuse systems
i) Carbon Offset: calculate and offset carbon emissions from ICU operations
j) Continuous Monitoring and Improvement: track energy usage, waste, and water consumption and regularly assess and implement new sustainability measures.

An interesting study from an Australian ICU showed that if 31.3% reduction in ABG tests could be achieved across all ICUs in Australia and New Zealand, savings could be made of up to A$33 million, 4400 litres of blood and 40 full-time equivalent staff[9].

Reuse

Reusing medical equipment's like stethoscopes, laryngoscope blades, laryngeal mask airways, pulse oximeters, blood pressure and calf compressor cuffs, and metal scissors reduces waste generation indirectly[7]. An environmental analysis has shown that selecting reusable gowns over disposable gowns reduced natural resource energy consumption (64%), greenhouse gas emissions (66%), blue water consumption (83%), and solid waste generation (84%)[14].

Recycle

Though recycling has limited impact, implementing a recycling program (for both medical and non-medical waste) considerably increases the percentage of recycled materials and is essential for both financial and environmental sustainability[15].

Steps to implement environmental sustainability in ICU

Environmental sustainability in ICU is a massive task which requires cultural and behavioural transformation of all the healthcare workers (HCWs) involved in the care of critical patients. It requires a collective effort from various stakeholders viz. HCWs, patients, managers, and policymakers. Sustainability program can be implemented in following ways:

1. Create Green Team

ICU HCWs are in a unique position to promote sustainability at all levels from clinical practice changes to influencing healthcare organisations, standards, and policies. Formal teams help to operationalise sustainability initiatives by providing legitimacy and permanency to the work, increasing awareness about individual actions, advocating changes at unit level and providing an interface between HCWs, the organisation, and experts[16].

2. Develop ICU specific sustainability toolkit

The ICU team should develop sustainability toolkit based on inputs from various stakeholders which can be implemented locally. Sustainability should be an integral part of intensive care practice, as it is motivating to understand how simple changes can be very effective on a scale[17].

3. Develop sustainable clinical practice

Care in ICU should be patient centred to meet health needs which is practical, accountable, economical and sustainable which doesn't impact the planetary health[9].

4. Sustainable value in quality improvement

ICU HCWs should learn, apply and embed sustainability into quality and safety activities of ICU.

5. Less is more

"Less is More" concept advocates a less aggressive approach in the care of critically

ill patient. The aim is to limit low-value or harmful care, including unnecessary screening, diagnostic and monitoring tests, diagnoses (overdiagnosis) and treatment (overtreatment). There is enough evidence that less intensive management is often superior to more intensive approaches to critical care delivery[2].

6. Education

To prepare the next generation of HCWs by imparting education about sustainable healthcare which will help in promoting and delivering sustainable healthcare. It can be done in following ways: a) raise awareness amongst the HCWs about the adverse effects of altered environment on health and protecting environment will protect human health, b) integrating sustainable healthcare education into medical curriculum, c) multidisciplinary learning – will require collaboration between healthcare workers, environmentalists, epidemiologists, government organisations, etc., and d) ethics - health care professionals need to include environmental care among their primary ethical obligation[18].

7. Inclusion in clinical trials.

Include environmental impact analyses, specifically carbon footprints, as endpoints in clinical trials for new intervention or therapeutics. This approach could help clinicians and policymakers understand the environmental effects of medical interventions and prioritize decarbonization strategies in healthcare[19].

CONCLUSION

ICUs are energy and resource-intensive enterprises within the hospital which affects the health of the planet negatively. It is the moral responsibility of the ICU team to promote sustainable environment within the ICU. The ICU professionals must have sufficient knowledge and skills as various tools are available to mitigate the carbon footprint of ICU. Collective efforts and engaging various stakeholders including manufacturers and health regulators will lead to environmentally sustainable ICUs which will produce better health outcomes for patients and the planet.

Declaration by Authors

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