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SUSTAINABILITY IN SURGERY

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Position Statement

ASSA believes that:

1. Climate change is one of the biggest global threats to healthcare in the 21st century, and changes need to be made immediately to reduce greenhouse gas emissions, particularly in the healthcare sector and surgical field.
2. Healthcare systems are responsible for maintaining environmental health to deliver holistic care to patients.
3. A top-down approach needs to be implemented in the medical community to promote sustainability and achieve a decreased carbon footprint.
4. There are many current initiatives and groups to promote sustainability in surgery in Australia. However, a collaborative and consultative approach must be undertaken to overcome logistical challenges and ethical issues.

Policy Points

ASSA calls on:

1. The Australian and New Zealand Federal, State, and Territory Governments to:
 - a. Discard medical waste safely and efficiently to minimise environmental damage;
 - b. Foster relationships with international health institutions to review and update health policies to be more environmentally friendly;
 - c. Review and alter medical equipment supply chains to adopt sustainable multi-use equipment;
 - d. Facilitate research to measure the carbon outputs of hospitals in detail and implement plans and processes to reduce carbon emissions;
 - e. Empower and support professional bodies to help create and drive policy changes to increase sustainability;
 - f. Provide tax and monetary incentives for hospitals to implement sustainable practices and renewable energy sources;
 - g. Mandate a sustainable and realistic emissions target for the public healthcare sector to meet on a federal, state and local level.
 - h. Implement a monitoring scheme to ensure continual progress is made towards a carbon-neutral footprint.
2. The Royal Australasian College of Surgery (RACS) to:

- a. Require all surgical trainees to complete a sustainability course during their training, covering but not limited to environmentally sustainable practices, waste reduction, and responsible resource use in surgical settings;
 - b. Emphasise sustainability in surgical education and training by ensuring that tangible sustainable practices are integrated into surgical curricula;
 - c. Encourage the development of sustainable surgical purchasing policies for all surgically active hospitals, championing the reduction of single-use plastics and products with a high carbon footprint and actively promoting environmentally friendly alternatives;
 - d. Promote the reduction of the carbon footprint of surgical practice by establishing a carbon offsetting program;
 - e. Work with hospitals and surgical departments to establish and maintain an active recycling program for surgical materials, including single-use devices;
 - f. Advocate for the promotion and use of telemedicine, where appropriate, to reduce carbon emissions associated with in-person consultations and teaching and training resources;
 - g. Work with government agencies to develop policies and initiatives that promote sustainability in surgical practice, including:
 - i. Funding for research into sustainable surgical practices;
 - ii. Tax incentives for hospitals and surgical practices that adopt environmentally sustainable practices;
 - iii. Legislation that regulates the use of products that have a high carbon footprint in surgical settings.
 - h. Work collaboratively with other organisations to promote sustainability in surgical practice and ensure that all stakeholders know the importance of environmental stewardship in healthcare.
3. Health systems and institutions to:
- a. Invest in research to measure the environmental impact of surgical practice whilst developing technologies and techniques to mitigate said impact;
 - b. Promote collaboration between non-government organisations, national health systems, and policymakers.
 - c. Review and change hospital policies to foster practices leading to a carbon-neutral state;
 - d. Encourage greater participation in the global reduction of carbon emissions;
 - e. Implement sustainable hardware and equipment, such as LED lights, HVAC setback systems, and renewable energy sources, to reduce unnecessary energy expenditure and emissions;
 - f. Provide operating rooms with reusable and recyclable equipment;
 - g. Encourage the use of alternative forms of anaesthesia to reduce the use of high global warming potential anaesthetic gases.
4. Medical schools to:
- a. Implement sustainable medical practice into medical training
 - i. Reuse surgical and medical garments and equipment when teaching clinical skills
 - ii. Utilise renewable sources of energy to power buildings

- iii. Implement the use of LED lighting and HVAC setback systems where possible in university settings
 - b. Provide training and resources on reusing and recycling medical equipment
 - c. Encourage students to research the environmental impact of surgical practice
 - d. Encourage discussion around the implementation of sustainable medical practice and the challenges it faces
 - e. Implement both face to face and online teaching as vectors to cover teaching about climate change and the health field's impact on it
- 5. Medical schools to:
 - a. Implement sustainable practices in medical training by:
 - i. Reusing surgical and medical garments and equipment when teaching clinical skills;
 - ii. Utilising renewable sources of energy to power buildings.
 - b. Provide training and resources on reusing and recycling;
 - c. Implement climate change into medical curricula.
- 6. Medical student societies to:
 - a. Lead and promote student-led initiatives that increase climate change awareness and the contribution of healthcare to it;
 - b. Collaborate with various health groups, including the DEA and RACS, to engender a sustainable outlook towards healthcare within students.
- 7. Medical Students to:
 - a. Consider the impact of surgical energy use and waste production on the global issue of climate change in surgical practices;
 - b. Appreciate the surgical practices undertaken by surgical teams to minimise environmental harm and seek opportunities to implement successful strategies in future medical practice;
 - c. Participate in events run by student bodies and universities that address the issue of sustainability in surgery;
 - d. Advocate for sustainable surgical practice through student bodies like the ASSA and the IFMSA.

Background

Introduction

The 2022 Lancet report states, "Climate change is the biggest global health threat of the 21st century." As such, the rising environmental cost of emissions from hospital settings has led to a global call for "health systems to lead decarbonisation", which can subsequently reduce hospitalisations caused by climate change (1). The past seven years are the warmest in history, and the related increase in both frequency and intensity of extreme weather events is a cause for concern (1). With no reduction in carbon emissions in sight, the driving factor for climate change, progress to meet the Paris Agreement threshold of under 1.5°C is unlikely. Therefore, action on climate change is a matter of necessity and urgency (1).

In Australia, the healthcare sector contributes up to 7% of the nation's carbon footprint, with 44% attributed to private and public hospitals (2). As surgery is associated with significant

production of medical waste, carbon emissions, and high energy expenditure, it is a major accelerator of climate change in the healthcare sector. As a result, ASSA maintains that critical actions must be enacted to reduce carbon emissions and promote effective and sustainable healthcare practices.

Environmental Impact of Surgery

Medical Wastage

In Australia, operating rooms account for 20-33% of the 655,000 tonnes of medical waste generated annually (3). The significant surgical contribution to medical waste is primarily due to the reliance on many single-use items, such as disposable gloves, surgical masks, gowns, drapes, and sharps. Moreover, current waste disposal practices are resource-intensive and harmfully impact the environment. In addition to general waste, surgery generates a large proportion of toxic waste products. Improper disposal of infectious, hazardous, or radioactive waste can contaminate the environment, possibly spreading infectious diseases, air pollution or radiation.

Energy Expenditure & Carbon Emissions

The healthcare sector is energy-intensive, accounting for 7% of the country's total energy consumption (8). Compared to other hospital facilities, the energy expenditure of surgical departments is to the order of three to six times greater. (3,4). Energy use by healthcare also contributes to carbon emissions as hospitals utilise fossil fuels to generate electricity. In addition to greenhouse gases, health facilities also produce harmful pollutants such as particulate matter, sulphur dioxide, and nitrogen oxides. Surgical procedures often utilise energy-intensive equipment, such as surgical lights, anaesthesia machines, sterilisation machines, and medical imaging systems. Additionally, operating rooms require precise temperature and humidity control to maintain a sterile environment and ensure patient comfort, therefore utilising large amounts of heating, ventilation, and air conditioning. Furthermore, extensive infrastructure is required to support surgical procedures, increasing the hospital's total energy use.

Water Consumption

Water consumption of health facilities is another unsustainable practice, with the sector accounting for 7% of the country's total water consumption (2). As water used for medical procedures often contains hazardous chemicals, improper treatment before discharge can contaminate natural water bodies and harm the ecosystem. In addition to the environmental impact of wastewater, the high water consumption of healthcare facilities can also contribute to water scarcity in areas with limited water resources.

Surgery contributes to a large amount of hospital water consumption, primarily due to the need to prevent and control contamination. Surgical instruments and equipment must undergo thorough sterilisation processes to prevent infections. Water is often used for pre-cleaning, rinsing, and steam sterilisation in autoclaves, processes that require large volumes of water. Surgical environments must also be regularly cleaned to ensure hygiene and infection control. Although it is common practice for healthcare professionals to perform hand hygiene procedures constantly, surgeons and operating room staff must scrub their hands and arms with water and antiseptic solutions before entering a surgical environment. Multiple scrubbing cycles throughout the day can result in substantial water consumption. Lastly, similar to energy use, the heating, ventilation, and air conditioning used in surgery require much water.

The Need for Sustainability

As outlined, the healthcare industry has a social responsibility to reduce its environmental impact. Healthcare systems provide essential services critical to the health and wellbeing of individuals and communities, including environmental health. Therefore, the health sector should not be exempt from the pressure other industries face to become more environmentally

friendly (9,10). Furthermore, there is a direct correlation between environmental sustainability and public health. For example, poor air quality can cause respiratory and cardiovascular diseases, water contamination may spread waterborne diseases, and some chemical waste is teratogenic (11-15).

Promoting sustainable healthcare can help improve public health by reducing environmental risks and creating a cycle of decreased demand for healthcare, leading to fewer resources used in the healthcare industry (16). Evidence for such a relationship already exists, with nations such as France and Cyprus demonstrating a markedly higher life expectancy with comparatively lower per capita healthcare sector greenhouse emissions. Finally, there are economic benefits to implementing sustainable practices such as energy-efficient lighting, heating, and cooling systems (17,18). For example, energy-efficient lighting can reduce electricity costs, while reducing water usage can lead to lower water bills (17,18). Additionally, adopting sustainable practices such as reducing waste, promoting recycling and using renewable energy sources can improve resource management and reduce costs associated with waste disposal and energy consumption (17,18).

Sustainable Solutions

Emission Reduction

To reduce carbon emissions, Australia may follow a model demonstrated by the United Kingdom's National Health Service, which reduced emissions by 11% (19). The preliminary step in addressing these issues is to identify carbon hotspots whereby large amounts of environmental waste are produced through a systematic process termed "carbon accounting" (19). Furthermore, accounting for plastic pollution and other non-carbon wastes can provide a greater holistic representation of produced wastage, which can serve as the cornerstone to instigating targeted changes in particular regions with high carbon footprints. Against the backdrop of these proposed changes, the Royal Australasian College of Surgeons (RACS) emphasised the medical community's need to promote awareness and advocate for emission reductions on a specifically surgical background (20). Through increasing recognition and advocacy, organisations like the colleges are well positioned to garner interest and foster engagement among health professionals with climate change and delivering sustainable healthcare (19).

Education & Awareness

As integral constituents of the frontline medical staff, surgeons and other healthcare professionals reflect the attitudes and actions of the medical community as a whole (1,19,20). Through the promotion of sustainable clinical practices, healthcare professionals can establish a working environment where carbon emissions and environmental wastage can be curtailed in a hospital setting. Additionally, doctors can serve as essential role models for aspiring medical students, allowing future generations to adopt a carbon-neutral model of healthcare gradually. Relating to this, a survey conducted involving doctors, nurses and medical students assessed their attitudes towards climate change and subsequent engagement with sustainability. It revealed a noteworthy awareness of climate issues and their impact on healthcare but a deficit in knowledge and support to address them. These results suggest that a sustainable clinical environment can be constructed through education and support for healthcare workers, compounded by their awareness and willingness to address the issues of excessive environmental waste production in surgical practices. Finally, the survey highlights the need for cohesiveness within the healthcare system, which would allow hospitals, doctors and colleges to proceed with a united climate policy to address the issues of sustainability in clinical practice (21).

As such, medical students may be empowered by thorough climate change education. Unfortunately, only 15% of 2817 surveyed medical schools incorporate climate change into their curricula (22). As the International Federation of Medical Students' Association (IFMSA)

highlights, the discrepancy between the deteriorating climate situation and its lack of inclusion within numerous medical curricula is detrimental to promoting engagement between healthcare professionals and sustainable care (22). Conversely, engaging students with learning activities increases awareness of current climate issues (23). However, time and resource constraints have proved to be challenging barriers to overcome in this setting, and the difficulty of completing a medical degree may force these issues into the background (24). Online teaching has been explored as an alternative, but engagement with content still proves to be an issue (23,24).

To circumnavigate these issues, student-led bodies like IFMSA have proved crucial in providing a medium for student advocacy and research in these fields (22). Through conferences and sustainability workshops addressing the issue of climate change in a healthcare setting, these student-run initiatives empower colleagues with the educational tools required to research and advocate for sustainable medical practice (22). The following recommendations have been proposed to medical students on how to contribute to sustainable care:

1. Consider viewing the surgery remotely rather than scrubbing in;
2. If assisting but lacking confidence, consider not participating to reduce the use of resources;
3. If assisting, adequately research the procedure to improve the efficiency of the operation and minimise energy expenditure of surgical equipment and facilities.

Whilst these proposals on a reduced scale may not be effective mechanisms for reducing the carbon footprints of hospitals but are pivotal in instigating a fundamental paradigm shift towards how future surgical professionals will approach sustainable practices.

Current Initiatives & Challenges in Promoting Sustainability in Surgery

Australia has several ongoing initiatives focused on promoting sustainability in the surgical sector. One of these initiatives is RACS' Environmental Sustainability in Surgical Practice Working Group (ESSPWP) (25, 26). The ESSPWP actively works to reduce the environmental impact of surgical practices by promoting the principles of the five Rs: refuse, reduce, reuse, recycle, and recover, via webinars and forums directed at RACS fellows. In addition, the most recent ESSPWP position paper outlines key strategies to reduce the significant carbon footprint of healthcare in Australia, such as reducing the use of anaesthetic gases where possible and developing 'recovery systems' where not possible to prevent the gases entering the atmosphere and contributing to the operating theatre's carbon footprint (27).

Another important initiative is the RACS Professional Skills Curriculum, which guides the development of professional skills in surgical trainees and Specialist International Medical Graduates (SIMGs) towards the behaviour expected of RACS fellows. Sustainability is one of the key themes of this curriculum, emphasising the importance of sustainable surgical practices and environmental stewardship (28).

Additionally, Doctors for the Environment Australia (DEA) is an organisation of medical professionals that advocates for a sustainable healthcare system and addresses the environmental impacts of healthcare. DEA aims to promote sustainable practices in healthcare, including in surgical settings (29). Finally, the Royal College of Surgeons of Edinburgh (RCSEd) has a sustainability champion and a trainee committee that promote sustainability in surgery and encourages the adoption of sustainable practices by surgeons (30).

However, implementing sustainable surgical practices faces several challenges and ethical issues, such as:

- Insufficient knowledge: Many professionals and institutions may need more knowledge and skills to implement sustainable practices effectively (31).
- Lack of motivation: Implementing more sustainable surgical operating practices requires significant effort. The use of heavy incentives may be explored to drive the adoption of new sustainable practices on both an individual and institutional level (31).
- High costs: Implementing sustainable practices in surgical care also requires significant financial investment. As such, a financial barrier may exist to already struggling institutions (32).
- Limited sustainable resource options: Surgical care requires a significant amount of resources, including medical supplies, equipment, and energy. However, the options for sustainable resources are currently limited (33).

In addition to these challenges, the implementation of sustainable practices in surgical care raises several ethical issues, including:

- Environmental impact: Surgical care can have a significant environmental impact from its use of medical supplies, equipment, and energy. Healthcare professionals must minimise this impact and reduce the negative consequences on the environment and future generations (34,35).
- Patient safety: Implementing sustainable practices in surgical care should not compromise patient safety. Healthcare professionals must ensure that sustainable practices minimise any negative impact on patient care (35).
- Ethical Resource Allocation: Implementing sustainable practices in surgical care requires the fair and just allocation of resources without discrimination against any particular group or individual (34,36).

Opportunities To Promote Sustainability in Surgery

The Intergovernmental Panel on Climate Change (IPCC) has proposed two complementary strategies to tackle climate change: mitigation and adaptation (36). These strategies are incorporated into the new initiative of climate-smart surgery that maintains quality patient care by adapting to the ongoing effects of climate change and incorporating methods to reduce greenhouse gas emissions (37). Decisions made in the operating room, from the type of anaesthesia and instrument preferences to the light bulbs used, significantly affect the environmental impact of a healthcare facility. Three proposed changes to increase sustainability are changing surgical supply chains, and wasting anaesthetic gases and energy. Regarding the surgical supply chain, recycling has been proposed as a possible initiative to reduce surgical waste; however, it is important to note that the process requires energy and thus has a marginal overall effect in reducing emissions (38). Opting for reusable instruments and minimising the use of unnecessary and single-use items was seen to reduce greenhouse gas emissions by nearly 50% (39). There is also a cost benefit to hospitals, as it was found in Australia that a hospital with six operating rooms would spend approximately \$10,000 per annum more for single-use laryngoscope blades alone (40). In a study of a neurosurgical department in the United States, there is an approximately \$2.9 million annual loss in the cost of unused supplies (41). Unnecessary and wasteful uses of equipment are harmful to the environment, and steps need to be taken from an administrative level to fix these issues.

In the United States, an estimated 51% of emissions associated with surgical care are attributable to waste anaesthetic gases (42). Despite being released in small amounts, anaesthetic gases, particularly desflurane and nitrous oxide, have significantly higher global warming potentials than carbon dioxide due to their ability to trap heat over time (43). For example, one hour of desflurane use is equivalent to driving a car 378–764 kilometres (44).

As for nitrous oxide, in addition to being a potent greenhouse gas, it also contributes to the depletion of the stratospheric ozone layer. From a cost perspective, hospitals would spend \$90,000 more annually if single-use anaesthetic equipment was used exclusively (39). Hence, opting for total intravenous anaesthetic, regional anaesthesia, or peripheral nerve blocks when clinically appropriate can significantly reduce emissions.

Operating rooms are energy-intensive relative to other areas of healthcare facilities, in part because of the required airflow rates that help maintain a sterile surgical environment (42). As a result, heating, ventilation and air conditioning (HVAC) systems are responsible for 90-99% of energy demands within the OR. Installing LED lighting and switching to renewable energy sources can be beneficial. However, implementing HVAC setbacks when facilities are not in use is the most effective way to reduce energy usage in operating rooms (39). This initiative requires coordination on a hospital-wide level to install occupancy sensors and override switches in case of emergency. However, it can result in savings from both an environmental and cost perspective. Facilities can reduce energy costs by one-third per operating room over the course of a year by using occupancy sensors to reduce air turnover (39).

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