

Redefining patient care through a Design-Driven Sustainable approach to Healthcare and Environmental Stewardship

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Associate Professor Wong Hon Tym, the Clinical Director of the Centre for Healthcare Innovation (CHI), Singapore's Tan Tock Seng Hospital "The future of sustainable healthcare is set to be environmentally conscious, patient-centered, and cost-effective, characterized by a proactive approach that prioritizes prevention and personalized care"



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The healthcare industry is at a critical juncture, facing mounting pressure to provide high-quality, patient-centered care while minimizing its environmental footprint. By leveraging regional manufacturing and distribution capabilities, global organizations are bringing clinical trials, manufacturing, distribution and patient essentials closer to the care continuum. Consequently, reducing carbon emissions in hospitals while driving towards net zero for planetary health must become an integral part of the healthcare ecosystem.

As a rejuvenating strategy, a Design-driven sustainable healthcare offers a groundbreaking solution, integrating design thinking, sustainability principles, and cutting-edge technology to revolutionize the healthcare landscape. By embracing a holistic approach to design, healthcare facilities can reduce their ecological impact, improve patient outcomes, while increasing operational efficiency. Moreover, Design-Driven Sustainable Healthcare can reduce greenhouse gas emissions, lower operational costs and boost resource management. As the healthcare industry evolves, this sustainable approach has exciting prospects - one that prioritizes health and the planet. Thus, healthcare organizations are now more inclined towards creating facilities that promote healing, well-being, and environmental stewardship by integrating sustainable design principles leveraging cutting-edge technology.

Interestingly, a visionary, **Associate Professor Wong Hon Tym, the Clinical Director of the Centre for Healthcare Innovation (CHI), at Singapore's Tan Tock Seng Hospital** revealed more insights with *Biospectrum Asia*.

- **Describe the concept of design-driven sustainable Healthcare?**

A sustainable healthcare system is one that is able to deliver excellent care today without compromising resources and capacity for future generations of patients and providers. Design-driven sustainable healthcare is a user-centric approach that allows healthcare professionals to ideate solutions that continue to prioritize patient care while incorporating sustainable elements. It is ideated from a user's point-of-view rather than a "systems provider" point-of-view; something that will be convenient for the users and entice them to come onboard this journey.

- **Can design-driven solutions reduce healthcare's carbon footprint, medical waste, and resource use? How have they been implemented in Singapore's healthcare?**

A key principle is to build the solutions as invisibly as possible, so that nurses and doctors can continue with their day-to-day routines with only small tweaks in their processes, or perhaps not even knowing that there is any difference at all.

For instance, in cataract surgeries where the field of operation is only confined to the face, we replaced the standard full-body drape with a more resource-efficient half-body drape. Kidney dishes can also be reused at the start and end of the procedure without compromising patient care.

At the recent Design Futures Forum 2024, I discussed small yet impactful solutions from a collaboration between the Centre for Healthcare Innovation (CHI) and students from the National University of Singapore. For instance, adding visual markers in sinks used for cleaning endoscopy tubes eliminated overfilling and reduced water wastage. Another example involved redesigning patient forms from landscape to portrait, maximising space for additional records, saves paper, lowered costs, and reducing the carbon footprint.

Finally, design-driven infrastructure projects in Singapore's healthcare sector exemplify how patient and provider needs can be balanced with environmental sustainability. At Woodlands Health Campus, energy-efficient systems, water conservation practices, and sustainable building materials are seamlessly integrated, while green spaces, natural light, and ventilation reduce energy use and promote mental well-being. Similarly, Yishun Health Campus utilises smart building technologies to minimise waste and optimise energy consumption. Features such as solar panels, rainwater harvesting systems, and rooftop gardens maintained by the community further enhance its sustainability efforts. These initiatives highlight how embedding thoughtful design into infrastructure enables Singapore's healthcare sector to pioneer impactful and globally inspiring sustainable solutions.

- **What is Singapore's strategy for building a more sustainable healthcare ecosystem through energy-efficient technologies and promising practices?**

Singapore aims to achieve net zero carbon emissions by 2050, but its healthcare sector is currently one of the top carbon emitters globally, ranking second among 68 countries. Most emissions come from Scope 2 and Scope 3 sources. The GreenGov.SG initiative, part of the Singapore Green Plan 2030, promotes environmentally sustainable practices in the public sector, focusing on energy efficiency, waste reduction, and green building design. Key mid-term goals include achieving net zero emissions by 2045, reducing energy and water use by 10% by 2030, and transitioning to 100% green vehicles by 2035.

The public healthcare sector has already implemented several energy-saving projects, such as the largest solar panel array at the Institute of Mental Health and the first Green Mark Platinum SLE certifications at Tan Tock Seng Hospital and Yishun Health.

The Ministry of Health (MOH) is also working with the National University of Singapore's Centre for Sustainable Medicine to establish a comprehensive carbon emissions baseline, addressing the significant Scope 3 emissions that account for up to 80% of healthcare's carbon output. This initiative will help identify areas for improvement in energy use and waste management, ultimately supporting Singapore's commitment to sustainability in healthcare operations. The report is expected to be published in 2025.

- **How is Singapore redefining sustainable healthcare operations through innovative waste management solutions? How are Singapore hospitals reducing environmental impact by redesigning processes, and minimizing medical waste?**

Singapore is making significant progress in creating a sustainable healthcare system through innovative waste management and process improvements. One of the key efforts by the National Healthcare Group (NHG) is waste minimization and recycling. NHG has set up effective systems for safely disposing of expired or unused medications. They collaborate with community pharmacies to offer pharmaceutical take-back programs.

All 3 public sector healthcare clusters are adopting digital health initiatives to enhance sustainability. By promoting telemedicine, they reduce the need for in-person visits, which lowers transportation emissions and improves access to care for patients in remote areas. The use of electronic medical records (EMRs) further minimizes paper use, improves communication, and reduces duplicate tests. Another example is the National University Hospital's (NUH) closed-loop recycling program for plastic medical devices, which collects, sterilizes, and reuses items like syringes. Hospitals are also replacing single-use plastics with reusable alternatives, such as surgical gowns, and are using more environmentally friendly anesthetic gases, significantly lowering emissions. Furthermore, Singapore hospitals are implementing waste segregation and recycling.

- **Could you elaborate on the efforts at CHI Sustainability Academy, aimed at training healthcare professionals in sustainability and design thinking, fostering a community for innovative green initiatives?**

The CHI Sustainability Academy (CHI SA) is dedicated to enhancing capability, culture, and thought leadership necessary to improve the resilience and reliability of healthcare systems and the environment. CHI SA partners with healthcare leaders and professionals to actively reduce carbon emissions, contributing to the global goal of achieving net zero carbon emissions by 2045.

To achieve this, CHI SA collaborates with organizations who are leaders in sustainability practices to co-develop curricula and case studies relevant to the healthcare sector. Several impactful projects are selected for coaching and connection with industry experts who can offer alternative approaches to more environmentally sustainable practices. During coaching, project teams learn about Design Thinking methodologies and are connected with outside experts to develop user-centered solutions.

- **What do you see as the future of sustainable healthcare? How do different stakeholders, including patients, clinicians, and administrators, can collaboratively maneuver through design-driven sustainable healthcare?**

The future of sustainable healthcare is set to be environmentally conscious, patient-centered, and cost-effective, characterized by a proactive approach that prioritizes prevention and personalized care.

Key components include **precision medicine**, which customizes treatments based on individual genetics and lifestyle; **digital health technologies** that improve access to care and reduce travel emissions; and the implementation of **circular economy principles** to minimize waste and optimize resource utilization. Furthermore, the integration of **renewable energy sources**, **sustainable building designs**, and a transition towards **community-based care models** will enhance health and well-being through preventive measures and accessible primary care. **The best thing that healthcare must do is to help build health and happy communities that consume less healthcare!**

As for the stakeholders:

Patients, becoming increasingly aware of the environmental impact of healthcare, can drive demand for sustainable practices by opting for greener choices and participating in initiatives like recycling programs and advocacy. They can also actively participate in healthcare decisions, choosing sustainable options like telehealth and reusable medical devices. **Clinicians** can promote sustainability within their organizations by integrating it into clinical decision-making, using environmentally friendly materials, minimizing waste, and encouraging energy-efficient operations. Their involvement in sustainability training fosters a culture of sustainability. Meanwhile, healthcare **administrators** are pivotal in implementing sustainable policies and practices; they can allocate resources for sustainability initiatives, set measurable goals, and develop frameworks to assess the environmental impact of healthcare operations. By collaborating with clinicians and patients, administrators can ensure that sustainability is embedded in the strategic planning and operational processes of healthcare organizations.

- **How is Singapore engaging with healthcare organizations and policymakers to implement sustainable design solutions?**

Singapore is actively engaging with healthcare organizations and policymakers to implement sustainable design solutions through various initiatives and collaborations. The government promotes sustainable healthcare practices by providing guidelines and frameworks, such as the Green Mark Scheme, which encourages healthcare facilities to adopt environmentally friendly designs and operations. Additionally, Singapore's Health Ministry collaborates with healthcare providers to integrate sustainability into their planning and development processes, ensuring that new healthcare projects align with national sustainability goals.

A key aspect of this effort is the GreenGov.SG mandate, made collaboratively across state boards, ensuring that everyone is involved. Ministries actively listen to public opinion and continuously refine the policy and direction based on feedback. Providing training programs for healthcare professionals and architects on sustainable design can enhance awareness and expertise in these solutions. Finally, supporting research initiatives focused on sustainable healthcare can drive innovation and improve the effectiveness of sustainability efforts in the healthcare sector.

All the above measures have been implemented in Singapore to good effect, and we feel that they would be key starting points for any country committed to sustainable healthcare.

- **What are some common barriers to implementing design-driven sustainable healthcare, and how might they be overcome?**

There are many, although progress is being made on all fronts:

High upfront costs associated with sustainable technologies and practices can be a significant obstacle for healthcare institutions facing budget constraints. Furthermore, a **lack of awareness and knowledge among healthcare professionals** regarding the environmental and economic benefits of sustainable practices can pose challenges. **Resistance to change** from staff members due to disruptions in existing workflows and routines can also impede progress. Key pillars in healthcare like **patient safety and infection control** often warrant practices that may be at odds with waste reduction efforts. Additionally, the **absence of clear guidelines, targets and standards for sustainable healthcare** can make it difficult for healthcare institutions to measure their progress and demonstrate the value of their sustainability initiatives. **Limited access to sustainable products and services** can further complicate the transition to more sustainable practices.

To overcome these barriers,

- **A strong leadership commitment** is essential to drive sustainable healthcare initiatives and overcome resistance to change. A recent ESG-focused CEO Townhall at Tan Tock Seng Hospital did much to rally the staff around the issue, and kicked off many initiatives.
- Providing **education and training programs** for healthcare professionals on sustainable practices, including waste reduction, energy conservation, and the use of sustainable technologies, is crucial.
- **Government support and incentives**, such as tax breaks and grants, can encourage the adoption of sustainable practices in the healthcare sector.
- **Open dialogue between sustainability teams with “at odds” groups** (eg: patient safety, finance and infection control) will pave the way to finding commonalities and acceptable changes.
- Collaboration and **partnerships with suppliers, vendors**, and other stakeholders can facilitate the development and promotion of sustainable products, supply chains and services.

Finally, **utilizing data and metrics to track progress**, identify areas for improvement, and demonstrate the return on investment of sustainable initiatives is vital for effective implementation.

- **How can we scale up design-driven sustainable healthcare solutions to have a greater impact on global health?**

Scaling up design-driven sustainable healthcare solutions is challenging and requires a multifaceted approach.

Firstly, fostering **global collaboration and knowledge sharing** is crucial. Such networks can facilitate the exchange of best practices, lessons learned, and innovative solutions. Additionally, creating online platforms and databases to disseminate information, share research findings, and facilitate access to resources on sustainable healthcare practices can significantly enhance knowledge dissemination. Such a platform is the CHI Learning & Development platform (CHILD), a knowledge management system currently hosted on CHI's website.

Secondly, **investing in research and development** is paramount. Prioritizing research and development of sustainable technologies, such as renewable energy sources for healthcare facilities, innovative waste management systems, and environmentally friendly medical devices, is essential. The Centre of Sustainable Medicine at NUH is a leading light in the area.

Thirdly, **promoting supportive policy and regulatory frameworks** is vital. Establishing and promoting **green procurement guidelines** to encourage the use of sustainable products and services can further incentivize sustainable practices.

Fourthly, **empowering healthcare professionals** is crucial. This involves providing capability building and leadership development programs. The CHI SA was set up to achieve this end.

Finally, **engaging with communities** is paramount, to raise awareness about sustainable healthcare practices and engage them in the development and implementation of local solutions. Educating patients about sustainable healthcare choices and empowering them to participate in their own care is also crucial.

By implementing these strategies, we can accelerate the adoption of design-driven sustainable healthcare solutions globally, leading to improved health outcomes, reduced environmental impact, and a more equitable and sustainable future for all.

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