Towards sustainability for medical devices and consumables

The radical and incremental challenges in the technology ecosystem

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There is global recognition that health care is one of the most carbon-intensive sectors, accounting for 4.4% of global net greenhouse gas emissions and toxic air pollutants.[1] The International Panel on Climate Change and the World Health Organization have made a call to action to reduce health care's ecological impacts,[2,3] while 14 countries have pledged to develop carbon-neutral health systems.[4] In practice, this will mean reducing emissions from buildings and major infrastructure, encouraging public transport for staff and patients, reducing waste in hospitals, and using the 'purchasing power' of the health sector as a large purchaser of high-carbon products (including medical devices and consumables).[5]

Purchasing environmentally sustainable medical devices and consumables is a worthwhile goal, but the realities of achieving this are challenging and require a better evidence base or, at the very least, further thinking and nuanced guidance. In this editorial, we follow the life of a medical device, equipment, or consumable from design and manufacture, to purchase, use and disposal to demonstrate key challenges and opportunities in achieving environmental sustainability within the wider technology ecosystem.

Design, manufacture and regulation

While external targets and incentives (such as extended producer responsibility policies) are generally moving towards environmentally sustainable manufacturing, part of the challenge is that the market for medical devices (rightly) prioritises safety and infection control. As a result, for example, consumables often have laminated packaging that are difficult to separate for recycling. The use of single-use devices or consumables over reusable ones has also been a subject of debate: single-use have been prioritised for decades but there is no compelling evidence that they reduce health care–acquired infections.[6] Disposable or single-use medical devices increase confidence, but also promote the consumption of raw materials and the creation of waste. This reliance has become a barrier for manufacturers to design sustainably, despite motivations to do so.[7] There is an opportunity for industry and researchers to create the evidence base that demonstrates that reusing, remanufacturing or recycling is not necessarily unsafe. This can influence the regulatory landscape, allowing new devices to be deemed safe on the market, and create new business models in which consumables and devices can be reprocessed and delivered back to the hospital, or at least integrated into closed-loop supply chains.

Purchasing and acquisition

Previous work has advocated the 'purchasing power' or leverage the health sector can use to influence suppliers.[5] However, there is not yet a solid evidence base on how purchasing functions in healthcare organisations can be improved, let alone whether they can be designed to include sustainability as a purchasing criterion. In a comprehensive review of literature of materials logistics in hospitals, studies focus on optimising efficiency and minimising cost,[8] and this is echoed by a study comparing medical device purchasing across five countries that found that there is more focus on cost-containment and less on quality and health outcomes.[9] One study focussing on the purchase of MRI scanning equipment found that environmental and social sustainability dimensions were 'personally relevant but professionally secondary to cost, performance, and ability to use the equipment in their organizations' physical infrastructure.'[10(p445)] Creating a strong evidence base for what is possible in improving environmentally sustainable hospital purchasing will be needed. This will balance any existing priorities and trade-offs in individual purchasing decisions (for example, between patient safety, cost, and environmental sustainability) and create new business models for suppliers, such as leasing contracts for equipment or 'pay per scan' models.[11]

Use, reuse, reduce or refuse

While measures such as the use of washable instead of single-use gowns could be regulated through standardised purchasing, others require behavioural changes by clinicians and nursing staff (for example, whether they choose to use gloves or disinfect their hands, or the frequency with which gloves are replaced). Behaviours, habits, and protocols once a product is in use can also drive or hinder environmental sustainability. This implies we also need behavioural research into how products are used once

purchased, and how staff can be motivated into supporting sustainability goals for their organisations.

Dispose

Waste management also requires behavioural changes, taking the time within hospital wards to separate out recyclable components and placing them in the recyclable-waste bin.[12] Far more hospital waste is incinerated than is necessary, meaning the reprocessing of waste generally is also a responsibility of the hospital and its waste collection schemes.

A systems and quadruple-helix approach

Each stage above involves a separate group of actors, processes, protocols, and tensions or trade-offs that need to be considered on the road towards environmental sustainability. We note that progress has been made incrementally within each stage, thereby building the evidence base of what is possible for other hospitals and countries to follow. These developments help develop 'proof of principle' solutions and interventions for individual sets of actors along the supply chain.

However, of equal importance is to acknowledge the interdependencies and linkages between these stages, and that decisions and actions taken by actors within each stage affect the value chain in both directions of the lifecycle of a specific technology. This implies that each actor in the full supply chain (designer, manufacturer, regulator, purchaser, and user) needs to be considered in the design and implementation of interventions and solutions that are sustainable, implementable, cost-effective and safe.

If we want to move towards more radical and long-term shifts in designing interventions towards transitions, a quadruple-helix approach will be necessary. This will involve cross-disciplinary and cross-sectoral research and implementation across (1) industry, (2) government, (3) academia and (4) the public. Mission-innovation systems, co-design and participatory approaches can provide the necessary formation for design and evaluation of these interventions, as well as the use of Living Labs and other collaborative approaches that enable cross-sectoral and cross-disciplinary activities. Such dedicated and open engagement is necessary to generate new modes of thinking, acting, regulating and designing across the wider technology eco-system of medical devices and consumables.

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