VIEWPOINT

Sustainability as a Strategy to Protect From Supply Chain Shortages

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For the past 30 years, health care in the US has largely transitioned from reusable supplies to single-use disposables for infection prevention and efficiency.[1] Although some of these changes were necessary to optimize patient outcomes, much of this transition was driven by theoretical infection prevention through external forces such as regulatory agencies, group purchasing organizations, and medical device companies. These changes have created a throwaway culture in medicine, which is pervasive today. The constant need for new supplies made of petroleum-based plastics and rare earth materials puts immense strain on the environment[2] and creates dependency on a supply chain that threatens our ability to provide patient care.

Our throwaway supplies have evolved from simple single-use plastics to complex devices such as advanced energy sources, scopes of all kinds (eg, bronchoscopes, cystoscopes, endoscopes, hysteroscopes), motors contained in surgical staplers and tissue extractors, batteries, light-emitting diode (LED) lights, and even robotic arms, which have a planned obsolescence of 10 uses before disposal. The widespread use of these advanced disposables has created considerable reliance on the manufacturing and extraction processes that make the components.[1] These supplies contain a myriad of rare earth minerals and components, which are hard to obtain and represent a finite resource whose mining practices cause environmental degradation.[3]

Additionally, the SARS-CoV-2 pandemic showed what happened when US hospitals' dependence on single-use supplies was met with shortages in the supply chain and disruptions from shipping—supply costs went up by as much as 2000%, outpacing the costs of labor in health care.[1] This volatility in pricing and availability of products is not conducive to predictably providing patient care and managing health care costs.

The current fluctuations in global trade restrictions have led to new challenges in this area, as few raw materials are manufactured domestically. Whether a medical device manufacturer can no longer produce their devices, hospitals can no longer afford to stock them, or the Centers for Medicare and Medicaid Services decides to cap the price that could be passed onto patients, the opportunity costs are manifold. A recent restriction on the trade of rare earth minerals limits access to gallium (used in LEDs), germanium (used in fiber optic cables and thermal imaging devices), and antimony (used in flame retardants, batteries, and semiconductors).[3] The importance of these minerals in the manufacturing of semiconductors, essential to nearly all our modern medical devices, means that procedural supplies could be significantly affected.

Treating rare earth components as disposables destabilizes the medical supply chain and propagates the negative environmental impacts of the health care industry on human health. Hospital systems and suppliers can do several things right now to mitigate the effects of the mineral restrictions and enhance resiliency in the supply chain.

First and foremost, hospitals should invest in their capital equipment by updating service contracts and ensuring the equipment is well maintained. Hospital administrators can empower clinical and nonclinical staff to take ownership of and protect equipment in limited supply. Bringing vendor servicing in-house can improve working relationships with sterile processing departments to make capital equipment last as long as possible. The most sustainable option is maintaining and reusing what we already own.

Second, hospital procurement should switch out new single-use items for reusable or reprocessed items. Reprocessed items have been found to be just as safe as new items and have fewer instrument errors and failures, as reprocessed items are all individually tested while new items are batch-tested. Purchasers within the hospital supply chain might have committed to contracts requiring a certain percentage of supplies to be purchased new; however, these contracts should be scrutinized when supply chain shortages occur. Consideration should be given to contracts that primarily focus on reusable products and provide enough flexibility to keep critical supplies and resources in stock for patient care.

On the manufacturing side, many medical device companies are beginning to look at reposable models—devices where the single-use portion can be disconnected from the expensive and advanced components, allowing for sterilization and reuse of those components. As these products are developed, consideration should be given to ease of use to maximize collection and reprocessing rates. For example, plastic casings that snap open, rather than being glued internally, ensure staff safety and compliance. Companies can then pick up their parts and reprocess their instruments instead of competing with third-party processors. This approach saves the manufacturer costs on components and makes their products more sustainable while providing hospitals with an important waste reduction service.

The US Food and Drug Administration (FDA) does not incentivize the making of reusable, reposable, or reprocessed instruments because usability and sterilization cycle testing is expensive. It is much easier for manufacturers to designate an item as single-use and forego reusability testing.[4] The FDA could require a life cycle assessment (LCA) with each new 510(k) medical device submission (the FDA application process for new medical devices), prioritizing creative medical device manufacturing that protects our supply chain and environmental health over single-use supplies. Policy changes are needed to reverse the incentives to favor a stable and sustainable medical device economy.

In addition to making the health care system more resilient in the face of supply chain uncertainties, the above strategies will also improve sustainability and mitigate the environmental impact of

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the health care industry. Over 15 years ago, *The Lancet* called climate change the greatest threat to human health,[5] and a growing body of literature documents the negative health effects of increasing heat, pollution, waste, toxic substances, and extreme weather events. Although the health care sector serves to protect human health, it has been shown that 8.5% of greenhouse gas emissions in the US come from health care.[2] Worldwide, health care accounts for double the emissions of global aviation.[2]

Sustainability focuses on both the economics of health care and the effect on the environment. Whereas most of the carbon emissions in health care come from the creation of single-use supplies from native elements, additional emissions arise from the entire life cycle of an item, including packaging, sterilization, transport, use, and disposal at end of life, most of which is incorrectly triaged as biohazardous waste.[2,6] *The New England Journal of Medicine* has called for LCAs to be performed with all randomized clinical trials, as the environmental impact of clinical interventions needs to be weighed against any benefit.[7]

Improving health care sector resiliency, developing sustainable practices, and, perhaps most importantly, improving human health all begin with changing the throwaway culture of medicine. Our limited resources must be protected and preserved. This action will require a concerted effort from all parties: hospitals need to invest in long-term sustainable capital, manufacturers need to move away from disposable devices to those that can be reused or reprocessed, and policy change needs to support these efforts. The way forward is to build a model that is beneficial to manufacturers and hospital systems. Taken together, these steps can reduce health care costs, build resiliency in the supply chain, and reduce our impact on the environment and human health.

ARTICLE INFORMATION

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