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Commentary

Is There a Market for Sustainable Healthcare?

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1. Background

During a healthcare event, care efficacy is the primary concern. The environmental cost or impact of healthcare is not typically considered when weighing healthcare options. However, when considering the needs of society, particularly over the course of generations, the environmental impact of healthcare should be examined. All else equal, the environmental impact of the US healthcare industry will be proportional to the size of healthcare spending, which is twice the OECD average (OECD, 2021). US spending on healthcare is the highest in the world, representing one-fifth of the nation's GDP (Centers for Medicare Medicaid Services, 2021). The pursuit of a higher quality of life and longer life expectancy translate to increasing demand for healthcare goods and services, driving yearly increases in healthcare spending. Ironically, the US has the highest suicide rate, chronic disease burden, obesity rate, hospitalization from preventable causes, and lowest life expectancy among the OECD (most developed) countries (Tikkanen & Abrams, 2020). This commentary explores the predicates of a sustainable healthcare system and the questions that must be addressed to get us closer to that state.

2. Healthcare Exceptionalism

Healthcare reveals a unique moral tension between the needs of an individual versus stewardship of population resources. This tension manifests itself in the complex regulatory environment in which healthcare is practice (Mclean, 2016). Extensive spending for an individual patient, which is ultimately borne by society, reflects the importance attached to human life. Decreasing spending to reduce the burden on society can increase the burden of disease for patients. Efforts to reduce the environmental impact of healthcare must be balanced against the risk of unintended consequences.

In this paper, we discuss some macro and micro principles related to sustainable healthcare. We take the perspective that healthcare, as in all domains of human activity, is practiced in resource-constrained contexts. The best conceptual model to describe this situation is the market, in which the buying and selling of products and services are carried out against a background of limited resources. We first compare tradi-

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tional markets and healthcare markets to highlight the differences. We then discuss what sustainable healthcare means, suggest some key principles of sustainability, and conclude with a list of suggestions for society.

3. What is a Market?

A market can be any physical or virtual space in which the voluntary exchange of goods and services occurs. The primordial form of a market is barter, in which two parties participate in direct exchange that mutually increases their consumption frontiers. The financialization (intermediation through a medium such as seashells or money) of a market makes possible complex, multi-party, and indirect forms of exchange, as well as the means to defer consumption with minimal transaction costs. In a well-functioning market, actors' preferences are revealed by their choices, which are determined by personal knowledge of their current and future needs, and current and future wealth endowments. The products of such a system are prices that signal the amount of tomorrow's consumption opportunities (or wealth) that consumers are willing to forego for today's goods and services and consequently, the quantity of those goods and services that producers can provide. This price signal, which tells producers what and how much to produce and consumers what and how much they can consume, is the underpinning of modern markets.

4. The US Healthcare Market

A hallmark of the US healthcare market is a lack of price transparency, associated inefficiencies, and wasteful use of resources. These contribute to increased expenditure and are intertwined with environmental impact. The average patient in the US healthcare system does not know the cost or expected efficacy of her care and must rely on the healthcare provider for that information. This is because the system lacks a reliable price signal. In simplistic terms, if patients are the customers and providers (doctors and nurses) are the sellers, then the seller has an information advantage in the relationship. Patients are generally unaware of their future consumption needs, which makes deferred consumption impossible. Unlike in traditional markets, this renders the notion of tradeoffs, key to a market exchange, inapplicable. An accidental fall fracture of the hip can easily lead to long-term care needs that permanently alter the consumer's choice set. Yet, while providers may know the efficacy and rationale for the care they provide, they often do not know how much it costs.

In effect, exchange takes place in the absence of a price, and therefore it is not surprising that a misalignment between preferences and resources regularly leads to over and under-consumption. If, instead, we consider public payers such as the Centers for Medicare and Medicaid Services (CMS) and private insurance as the buyers and healthcare systems as the sellers, the case for price transparency is stronger because both parties have cost and efficacy data. They simply must find the incentives to share these data with each other, especially given that CMS accounts for nearly half of US health expenditures and is the pricing authority for healthcare. Even so, environmental costs have not traditionally been part of healthcare cost and benefit calculations. Under the current administrative system for healthcare financing, a vast infrastructure would be needed to collect and analyze the necessary data to price environmental costs; perhaps outweighing any potential efficiencies.

In addition to price transparency exceptionalism, healthcare in the US also suffers from a moral tension to deliver patient care at the technological frontier today while conserving resources to serve future generations (Ubel & Jagsi, 2014) . This tension has traditionally been resolved by continually increasing the public budget for healthcare. The share of healthcare expenditures relative to GDP in the US has grown more than three times in the last sixty years (Nunn et al., 2020). It represents the fastest growing component of the Federal budget by far. According to CMS, healthcare spending is projected to grow at an annual rate of 5.4 percent through 2028, whereas the OECD countries average healthcare spending growth rate is 3.3 percent (Centers for Medicare Medicaid Services, 2021). A 2010 report by the National Academy of Medicine estimates that a third of US healthcare expenditures is used to cover payer (public and private) administrative costs, a number that may have grown in the intervening 13 years (Jiwani et al., 2014). Concurrently, the pursuit of care at the technological fron-

tier for the individual comes at the cost of future care for the community. We also observe that this dynamic has led to the strengthening of incentives for specialist care, which shifts clinical talent away from primary and preventive care, as well as other sectors including sustainable care.

Finally, supply and demand distortions lead to the inefficient and wasteful use of resources. The financial burden created by waste means that the current US healthcare market is not sustainable from an environmental perspective. Environmental sustainability is achieved, in the first instance, by producing and consuming at the efficiency frontier. Hence, the immediate solution is to boost the productivity of healthcare labor and infrastructure by increasing the share of innovative technological capital in health services. In the second instance, sustainability can be achieved by downshifting consumer expectations and improving health seeking behaviors to support lower levels of limited healthcare resources. However, lowering expectations for health care consumption is fraught with political and social objections. 'Death panels' became the rallying cry for activists who opposed limits on healthcare spending growth. Yet, the fast-aging population in the US means more age-related disease, progression of chronic disease and severe morbidity from acute healthcare events create an increasing gap between demand and supply for healthcare services. This situation cannot be sustainably solved without initiatives to affect demand, health literacy, preventive medicine, and an environmentally sustainable health care system.

5. What is Sustainable Healthcare?

A succinct description of sustainability can be found in the 1987 Brundtland Commission report, Our Common Future, which states, "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (Keeble, 1988). Hence, sustainable healthcare systems should meet the healthcare needs of the current generation in a fashion that does not unduly burden future generations. A key component of sustainable healthcare systems involves the adoption of circular supply chains. Circular supply chains focus on designing and producing products that can be reused in different ways at different stages of their life cycles (extending useful life), minimizing the amount of solid waste, toxic effluent, and greenhouse gases (GHG) by maximizing the proportion of reusable components, simplifying the recapture of secondary raw materials for manufacturing new products, and making transparent the connection between energy production and the environmental load on raw material extraction (Arruda et al., 2015).

Considering the features of circular supply chains, as translated to sustainable healthcare, we propose five policy principles:

1. Reduce healthcare demand through increased diffusion of preventive medical services and adoption of preventive healthcare behaviors by consumers.

2. Reduce the administrative burden of care delivery by shortening the "distance" between provider and patient.

3. Encourage sustainable patient care choices by reducing patient out-of-pocket costs for preventive and health promoting services, while retaining higher patient responsibility for lower value, elective health services.

4. Redesign therapies, devices, and care delivery models to reduce environmentally persistent raw materials use, enable low-cost recycling and reuse, and increase durability.

5. Audit carbon consumption in the healthcare value network to facilitate continuous reductions.

Sustainable healthcare is, therefore, related to the idea of value-based care (Porter & Teisberg, 2006; Yong et al., 2010), but with a difference. Both approaches are aimed at reducing the costs and improving healthcare outcomes. Value-based care focuses on current costs and opportunity loss, but sustainable healthcare necessarily extends the calculus to include potential costs incurred in the future. In other words, value-based care is linear and is an attempt to quantify costs and benefits to improve current resource use. Sustainable healthcare is circular and involves reducing the volume of virgin resources used while increasing the number of times "consumed"

resources are recycled in the value chain. Evolution towards value-based payment systems requires that payers and providers improve the cost-benefit ratio of care; as such, they would have every incentive to simultaneously push for sustainable healthcare. The following section expands on the five policy principles.

5.1. Reduce total healthcare demand through preventive medicine

The environmental cost of delivering healthcare is proportional to the amount of care provided. Cost effective prevention of disease reduces the proportion of a population that becomes sick and hence, would reduce healthcare demand, and waste and environmental impact. Reducing post-disease processes with cure-focused healthcare approaches can lead to sustainable healthcare by minimizing resource use (Loeppke, 2008; Woolf, 2008; Berwick et al., 2008). Many of the leading causes of death in the US, such as heart disease, cancer, diabetes, stroke, respiratory disease, and renal disease, are disproportionately affected by high blood pressure, diet-related inflammation syndromes, and substance abuse. Therefore, a substantial proportion of disease burden is preventable (Danaei et al., 2009).

Despite policy intentions, preventive care is not specifically funded in the current healthcare financing model. In part, this is because of the many obstacles to effective disease prevention, including healthcare and patient culture (Berwick et al., 2008; Danaei et al., 2009; Hudon et al., 2004; Wender, 1993; Al-Doghether et al., 2007; Yarnall et al., 2003). Additionally, much of policy evolution is directed towards evolving reimbursement models for disease-related care that is rendered rather than preventing the need for care. Prevention is presently difficult to implement over scale, as specific rewards and incentives to patients and providers are systemically absent (Kiran et al., 2015).

Producing a plan for effective preventive care is beyond the scope of this report but the matter deserves specific attention as it is potentially the most potent driver of sustainability in healthcare. Sustainable marketers, who specialize in product development research, could play a very important role in this area by working with healthcare providers and administrators to help develop market-based preventive care products that appeal to both practitioners and consumers, increasing the provision of and demand for such services.

5.2. Reduce the administrative burden of care

5.2.1. Telemedicine and Digital Health

Until the Covid-19 pandemic, healthcare delivery took place primarily in face-to-face settings. In-person delivery is associated with carbon emissions caused by patient transportation, lodging, construction costs for healthcare delivery centers, and so on. The rapid shift to telemedicine caused by infection control measures during the pandemic demonstrates what is possible in remote care. For the most part, services such as follow-up consultations, second opinions, and even initial consultations for non-emergent complaints have been widely delivered via telemedicine (Contreras et al., 2020). A permanent shift away from in-person to remote healthcare delivery would contribute to a reduced healthcare carbon footprint, and, more importantly, expand access to expert care for patients living in geographically dispersed areas of the country. Digital first health systems require less physical space for clinical encounters, which fosters the centralization of highly complicated therapies, while enabling the distribution of routine clinical encounters at the point of need. The sustainability savings of reduced building space, parking, and other infrastructure from routine care is analogous to the efficiencies associated with e-tailing versus bricks and mortar retailing businesses (Schöder, 2016).

Here are multiple opportunities for sustainable marketing researchers to collaborate with clinic and hospital managers/providers to ensure that telemedicine and digital health systems are sufficiently attractive to achieve economies of scale and financially viability.

5.2.2. Data Storage and Services

The US healthcare industry consumes 73 billion kWh of electricity annually (Campion et al., 2015). A large proportion of that energy is expended in documentation and related technologies. While it is estimated that digitalization can reduce document-related emission by 99% (Pu & Lam, 2021), the total environmen-

tal costs of electronic medical records, data storage and transfer, and digital- healthcare delivery are yet to be determined. Modern electronic medical records make retrieval and transfer of healthcare information easier and nearly instantaneous. However, there is an energy cost to the transfer, storage, and manipulation of healthcare data, and the sustainability and dollar cost of that energy will vary by the energy sources of the hospital and the data storage facility. Server farms produce large amounts of heat that must be dissipated by actively cooling, which in turn consumes energy. In recent years, there has been an exponential increase in the amount of electronic medical data generated, from genomic data to medical results to operational data. With an increasing use of blockchain technology to improve privacy, more layers of data storage and transfer needs are introduced, adding to the energy cost.

Medicine has been at the forefront of the artificial intelligence revolution driven by deep learning and massive medical image databases. Given the data-intensive nature of deep learning, there have been concerted efforts at various large medical organizations to systemically collect, curate, and store an ever-increasing number of medical images, which are energy intensive enterprises (Jiang et al., 2021; Howson, 2019). To this end, studies have shown that better data center designs have the potential to reduce energy consumption by up to 25% which, in the US, is equivalent to more than 13 billion kWh per year (Shehabi et al., 2011). Lucivero et al. (2020) recognize the non-explicit costs of massive data storage centers and that these must be weighed against the benefits (Lucivero, 2020). Managing the data costs of healthcare, in terms of energy, environment, and financial costs will require more attention, in addition to the usual sensitivities surrounding privacy and data security typified by HIPAA (Cohen & Mello, 2018) , and the unique data safety considerations in healthcare (Abouelmehdi et al., 2018).

The key to the sustainable implementation of energy-intensive data operations will lie in the widespread adoption of sustainable energy generation. Hence, sustainable marketers specializing in B2B sales research could make important contributions from identifying effective approaches based on theory and validated by real world testing to working with healthcare providers and managers to implement renewable energy systems in their facilities.

5.3. Encourage sustainable patient choices

5.3.1. Value Based Care

Value based care is a stated goal of most US healthcare organizations. As initially articulated by Porter (Porter & Teisberg, 2006), value is equal to quality times the ratio of outcome/cost ($quality \times \frac{outcome}{cost}$). Increasing value in healthcare means reducing waste and improving outcomes, which reduces the environmental impact of healthcare.

Despite widespread interest, there has yet to be generally accepted mechanisms to achieve value-based care (Steinmann et al., 2021; Busse et al., 2013) . In a health services research review, Steinmann et al. (2021 , p. 1) conclude that their research "raises the question whether… [Value Based Health Care]'s widespread international uptake indicates its actual implementation or… an inspiring idea." Whether hospital systems that say they practice value-based care, in fact do so depends on what they mean by the term. For many, value-based care may simply be another word for cost cutting. In addition, it is simple to control costs by bundling care and fixing a payment value. In the traditional diagnosis-related groups (DRG) payment mechanism, for example, the payer fixes a payment for a given diagnosis that covers all expenses for the healthcare event. This often results in a transfer of value from the healthcare provider to the payer, rather than a true enhancement of value throughout the health ecosystem in which all participants gain (Van Herwaarden et al., 2020; Woo & Anderson, 2020). Inherently, these payment models reward healthcare systems that predominantly see straightforward versions of a disease state wherein spending may be reined in more effectively. In complex disease states, the DRG model may be insufficient or become inoperably complex to capture all the variables that inform the total cost of care (Woo & Anderson, 2020).

We suggest adding a patient-empowering dimension to the implementation of value-based care by adjusting the systems of financial responsibility for care placed on

patients (such as co-pays and deductibles) to encourage patients to choose high value care. For example, small financial incentives could be used to encourage patients to participate in preventive care and health promoting practices, and to discourage unnecessary or low value care. Such a system would require providers and payers to collaborate to specifically identify services that qualify as high value care based on strong evidence spanning efficacy, outcomes, costs, and sustainability. Similarly, specific examples of unnecessary or low value care could be identified, and providers (and patients) could be educated about services that fall into both categories. Over time, this approach may improve the alignment of interests between patients and payers, and could alter the specialization choices of providers as the balance of care services aligns towards sustainable care choices.

New programs using risk sharing methodology link payers and providers incentivizing the parties to reduce unnecessary care and improve patient outcomes, most recently using Direct Contracting Entities (DCE) (Antonanzas et al., 2019). These are private contractors that receive funding from CMS to care for a patient cohort up front and administering care from this pool of funds for the healthcare of the cohort. Like the DRG model, the provider organization profits when the cost of care is less than their contracted pre-arranged payment. Whether these entities achieve their intended goal of achieving value remains to be seen.

5.3.2. Price Signaling and Market Forces

While many parts of the US healthcare system are tightly regulated, there are parts of the system, such as elective cosmetic procedures, that remain largely driven by patient choice. Here, transparent prices that reflect the value of the care are more easily seen, since they are the products of demand and supply. In a sustainable healthcare system, there should be more parts of the healthcare system that are typified by such dynamics. For example, therapies to extend end-of-life care can be very costly in dollar value and societal resources. Yet, we know that most fail to meaningfully extend life or preserve the quality of life. The transparent pricing of care to reflect these difficult realities may help patients and their families make better decisions about the kind of care they choose. If even a larger fraction of patients chose palliative care rather than heroic measures at end of life, the cumulative value of such decisions will allow scarce resources to be directed at health conditions that will benefit from them.

Sustainable marketers who specialize in pricing can play important roles in more effective, transparent, and equitable ways to employ pricing strategy and signaling to reduce waste while ensuring sufficient resources are available to parts of the healthcare system, such as primary and pediatric care, that can truly benefit from proactive investments in quality and safety.

5.4. Redesign therapies, devices, and care delivery models

5.4.1. Healthcare Waste

Waste of resources is antithetical to sustainability and across the ideological spectrum there is consensus that waste in healthcare is undesirable (Berwick & Hackbarth, 2012). An OECD report in 2017 estimated that up to 20% of healthcare spending is wasted (Limb, 2017). Zygourakis et al. (2017) estimated that approximately 968 USD of operating room waste such as unused surgical supplies was generated per case, or 2.9 million dollars per year in the University of California San Francisco neurosurgery department, representing a relatively small division in a large academic medical center. Separately, Gillerman and Browning (2000) estimated that roughly 26% of drugs in an anesthesia department that are issued are not used, and so have to be disposed. Part of this problem is primarily the result of inadequately tuned business and operational processes. Sustainable marketers who work in the domain of customer driven business processes can lead the development of standards to reengineer processes to fine-tune them to the needs of the process customers, e.g., designing systems for issuing anesthesia drugs on demand during procedures, rather than pre-packaging for surgery or reducing the size of the pre-op instrument tray and optimizing modular instrument sets to reduce the volume of unused instruments that need to be re-sterilized or discarded post-op.

5.4.2. Healthcare Infrastructure Costs

The US healthcare system is estimated to generate about 10% of the country's greenhouse gases (Chua

et al., 2021). Healthcare systems are multibillion dollar construction projects that require high quality electricity, air flow, and biosecurity to sequester infectious agents. Maintaining the computers, machines, and personnel in such structures requires substantial resources. For instance, in an assessment of greenhouse gases generated in an interventional radiology suite, Chua et al. (2021) calculated that 23,500 kg of CO2 is created over the course of 97 patient procedures, the majority of which is related to the energy spent on climate control and disposable surgical supplies (Chua et al., 2021). Buckley and Macmahon (2021) identified digital workstations and data storage equipment as other sources of greenhouse gases. In addition to increasing the share of clean energy in total energy utilized, clinics and hospitals can proactively manage and reduce the energy demands such as designing buildings that generate renewable energy for non-critical systems (Bardineh et al., 2018) and that harvest rainwater (Fulton, 2018) for gray use, contributing to the goal of sustainable healthcare.

5.4.3. Packaging, Drugs, and Devices Redesign

Packing reduces spoilage, conveys product information, preserves sterility, and facilitates efficient transportation of the product. However, packaging also adds costs, increases energy use in transportation and manufacturing, and can introduce waste. This is particularly true with single-use consumables such as surgical swabs, probes, suture packaging, and so on. The use of single-use disposables in healthcare can be costly and wasteful (Karlsson & D, 2005; Tudor et al., 2007; PGH Waste Management Practice Greenhealth, 2008; Swensen et al., 2011) with an estimated 5.9 million tons contributed to medical waste annually. Medical waste is produced when packages are incorrectly sized, resulting in unused items (e.g., surgical swabs) being discarded into the waste stream.

The solution to the problem of packaging and single user waste is more nuanced than simply reducing their use. The need for sterility in healthcare devices is the reason for high quality packaging materials for single use disposable devices (King, 2011) and drugs (Pareek & Khunteta, 2014) . While sterilization of reusable devices may seem to be more environmentally friendly, the energy and human resources costs associated with sterilization are not trivial. Mcgain et al. (2017) estimated that the 30,000 AUD direct savings from sterilizing reusable devices was offset by costs associated with twice the water use and 10% greater CO2 emissions (Mcgain et al., 2017) in their 6-operating theater hospital.

Therefore, designing operating room devices that maintain sterility during use, for example with persistent anti-microbial coatings, can lead to less packaging. Doing so is challenging because of the regulatory and other constraints that come with complex procedures. Thiel et al. (2018) argue that in the case of surgeries, a combination of approaches should be used to reduce environmental emissions, for instance, by minimizing materials, increasing reuse, reducing heat-trapping anesthetic gases, and reducing off-hour energy use in the operating room. In their study, they estimate that this strategy can lead to an 80% decrease in the carbon footprint of laparoscopic hysterectomy procedures (Thiel et al., 2018). Eckelman et al. (2012) found that replacing their disposable laryngeal air masks with reusable masks decreased GHG by 25% (Eckelman et al., 2012) .Shockingly, up to 33% of prescription drugs go unused in the United States, with at least 5 billion USD of drugs incinerated or disposed each year (Lenzer, 2014). Strategies to reduce drug waste include take-back programs (Fass, 2011) and more carefully individualizing prescriptions, but these approaches have yet to gain traction.

Once again, multiple opportunities exist for sustainable marketing researchers to play a role in better understanding patient and provider attitudes/behaviors that are critical to identifying packaging and prescription drug consumption communications that can result in a reduction of GHG emissions and post-use pollution. For example, sustainable marketers who work in the domain of product/packaging design and marketing communications can play important roles in understanding the tradeoffs between communication tactics, packaging, and efficient resource use. They can also help develop principles and standards for more sustainable medical product packaging, distribution, inventory handling, and post-use recycling.

5.4.4. Toxicity

Many products used in the provision of healthcare are inherently toxic or radioactive. Gadolinium, a toxic heavy metal used as a contrast reagent for magnetic resonance imaging (MRI), has been found in aquifers near metropolitan centers (Bau et al., 2006; Rabiet et al., 2009), prompting the development of approaches to chelate free gadolinium in the environment so they are less harmful (Ferreira et al., 2020). Research into nontoxic alternatives is ongoing; manganese, for instance, may prove to be a non-toxic alternative to gadolinium for MRI (Pan et al., 2011; Erstad et al., 2019).

Nuclear waste from diagnostic and therapeutic medical procedures requires special handling and disposal (Ring et al., 1993; Sundell-Bergman et al., 2008). The use of these substances adds cost to hospital systems and risk to patients, and while non-radioactive and non-toxic alternatives are available, they are less efficacious. As a result, the economic case for investments to develop non-toxic alternatives can be difficult to make unless marketers can help determine the value proposition for a premium price. Lastly, the production of healthcare products may result in toxicity and pollution that is not obvious to providers, patients, or payers, such as cobalt mining and sourcing that are required to produce many advanced orthopedic implants. For instance, over two-thirds of the global cobalt supply is produced in the Democratic Republic of Congo. The mining of cobalt in that country is fraught with safety, environmental, and social harms because of laxed regulatory standards and enforcement, and governmental corruption (Williams et al., 2021). Hence, sustainable healthcare must include matters of supply chain integrity, like the audits that multinational companies are regularly subject to for child labor.

Many sustainable marketers who focus on ethical and social justice issues related to supply chain design and management can make important contributions in researching current practices and testing supply chain models that lead to better design, implementation, and certification of fair-trade practices within global medical device supply chains. Such questions are best investigated by multidisciplinary teams that include experts in marketing, operations management, law, and cross-border trade.

5.5. Audit carbon consumption and waste to facilitate continuous improvement

The current system of healthcare does not explicate the carbon footprint of services delivered. A carbon footprint is the total amount of carbon dioxide and other GHG, expressed in CO_2 equivalents emitted directly or indirectly from the provision and consumption of a product or service (Smyrl, 2022). The basic tenet behind carbon footprint audits is to understand the likely impact of a health care service along its value chain to facilitate the development of interventions to reduce or offset that impact through value chain reengineering and/or initiating net negative carbon emission activities, such as greening healthcare facilities (Phelps, 2006). Carbon audits can facilitate innovation in health services because they help identify places in the value network where carbon production is above the network average or that are not sequestered. Hence, audits can drive delivery models toward carbon neutral status over time. As mentioned earlier, renewable energy sourcing provides a path towards sustainability (Bawaneh et al., 2019). Finally, carbon audits can support payer negotiations and consumer choices for elective health services. Once established in a hospital administrative system, carbon audits should simply be part of an operational dashboard in the acquisition and purchasing system for technology, billing system for services, and cost accounting system for regulatory reporting.

Sustainable marketers are in an excellent position to research the extent to which carbon audits and other relevant data are provided in Corporate Sustainability Reports in ways that stakeholders can easily understand and monitor progress toward ESG goal achievement. Using the same paradigm for measuring brand equity, and customer experience, marketers and colleagues in activity-based accounting, can develop evidence-based metrics for carbon production and consumption in the healthcare value network to guide policy making in hospital acquisitions.

6. The Nascent Market for Sustainable Healthcare

Rodriguez et al. (2020) report in their study of private hospitals that "The empirical findings also revealed marginal progress or even negative progress of sustainable development in the studied healthcare organizations. This finding stresses the importance of continuous attention to and the review of sustainability initiatives, and whether sustainable development progress is being maintained or not." We cannot agree more.

Healthcare organizations are faced with the enormous challenge of providing patient care with constrained resources in a setting of increasing demands for patient care, safety, and satisfaction. Academic medical centers have the added burden of financing basic and applied research, balancing budgets, and managing complex billing systems. A recent review of sustainability in healthcare assessed 3,688 papers and yielded only 8 in healthcare, 50 in medicine and 1 in dentistry (Nosratabadi et al., 2019). A review by Ertz and Patrick (2020), assessing the market for extending product life cycles, concluded that a major barrier to progress in sustainability was the singular focus on patient safety without regard for other priorities (Ertz & Patrick, 2020). Some authors have suggested the need to reframe sustainability considerations to better communicate within hospital management frameworks (Rodriguez et al., 2019).

To illustrate this challenge, in the current setting, a startup company developing a sustainable therapy, device or health delivery model will find it extraordinarily difficult to reach profitability. In part, because the healthcare financing system was built around the reimbursement of procedures and their attendant consumables and continues to be the case, even with value-based incentives, this startup would have to compete with existing products that do not include the cost of their carbon footprints in their prices. In short, without a wholesale restructuring of the health care finance system, which drives all resource allocation decisions, progress toward sustainability will have to come from innovation and a reimagining of care models so they do not compete with existing models. We believe that this situation represents an opportunity for sustainable marketers, working with colleagues in product design, to unleash design thinking principles to redefine healthcare and how healthcare provision is embodied in therapies, products, technologies, and services. In this regard, and based on our discussions so far, we offer a series of recommendations for getting us from the current state of healthcare to one that is sustainable. We caution that these ideas should be taken as starting points for further discussion, rather than as specific policy prescriptions.

7. Recommendations for achieving sustainable healthcare

1) Reduce the use of healthcare services through prevention, such that waste and environmental impact are reduced.

a. Prevention is a positive externality that is generally not captured or profitable in the current healthcare climate, and specific policies to fund prevention are necessary and are beyond the scope of this paper.

2) For healthcare interventions that are performed, a value-based concept should be engaged, employing public funding towards care that either improves outcomes or reduces costs and ideally both. Pricing should reflect healthcare value to utilize market dynamics.

3) Reducing unnecessary distance both physically and administratively between providers and patients reduces administrative burden and wasted resources.

a. Telemedicine has been shown to be practicable during the pandemic. Optimization of platforms and telemedicine centered delivery has not yet occurred.

b. Reduced in-person care reduces spending on buildings needed for care delivery.

4) Conduct lifecycle analyses for mature medical devices and drugs to reduce the environmental impacts of materials where possible.

5) Streamline regulatory barriers to introducing sustainable alternatives.

6) Refine energy use and sourcing.

8. Conclusion

The market for sustainable healthcare is immature, but given rising healthcare costs, environmental

degradation, and the need for the rational delivery of healthcare, we believe that society cannot avoid confronting this opportunity. Evolution toward a sustainable future will require conversations at all levels of society to produce a set of guiding principles that recognize the economic imperative of supply and demand, scare resources, effluence from the health care value network, and the need for equitable access to health care regarding the socioeconomic status of individuals.

In this regard, we believe there are three near-term levers that can actuate the journey toward sustainability. First, is to double down on the technologies, research, and operational modeling that intensify effective primary preventive care for all members of society. This is the clearest path to reducing healthcare waste by eliminating avoidable disease and morbidities. Second, the energy currently used in healthcare institutions and services can be rebalanced to privilege renewable sources, where they are available and can be acquired for the same cost. Hospitals, which are large resource intensive installations, can be redesigned to reduce energy use, recapture energy waste such as heat, and sequester rain and runoff water as experiments around the world have demonstrated[44] Third, CMS, as the single largest payer for health care in the US, can create demand by fiat (USFHealth, 2021), as it did with electronic medical record (EMR) systems on January 1, 2014, as part of the American Recovery and Reinvestment Act, for sustainable versions of drugs, devices, and protective equipment. Finally, while this article is best read as an exploration into the future of sustainable healthcare, we cannot help but point out that environmental health and human health are deeply interlaced. Human health cannot presently exist without environmental health.

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