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Disruptive Innovation in Healthcare

The theory of *disruptive innovation* was first proposed in 1995 by Clayton Christensen, a Harvard Business School professor, to describe innovations that allow smaller market participants, with relatively few resources, to challenge large, established incumbents.[1] While often misapplied, in its original conception, disruptive innovation refers to the process wherein smaller players meet the demands of consumers that established incumbents have overlooked in their quest to provide for the most profitable customers.[2] In these cases, the smaller players are often able to provide more-suitable functionality to mainstream consumers, at prices that are lower than those offered by the larger competitors.[3] The theory of disruptive innovation operates similarly in the healthcare industry. Instead of requesting complex, expensive institutions and specialized professionals to move down-market, disruptive innovation allows the provision of healthcare to be done in more cost-effective and convenient ways.[4] For instance, prior to 1980, diabetics could accurately test their blood glucose levels only by visiting a doctor who drew a blood sample and then measured the glucose level using expensive laboratory equipment.[5] Today, diabetics instead possess the ability to have a portable blood glucose monitor with them at all times.[6] Although disruptive innovations may threaten the economic viability of established institutions, professionals, and investments (as portable blood glucose monitors did for some endocrinologists and manufacturers of laboratory equipment), they can ultimately improve the quality and accessibility of healthcare.[7] This Health Capital Topics article will discuss the current environment for disruptive innovation in the healthcare industry and will examine the potential effects that disruptive innovation may have for patients and providers.

Competition in the healthcare industry may be examined through the lens of Michael Porter's *five competitive forces*, i.e.: (1) the threat of new market entrants; (2) the bargaining power of suppliers; (3) threats from substitute products or services; (4) the bargaining power of buyers; and, (5) rivalry among existing firms.[8] Disruptive innovation incorporates elements of two of Porter's five forces, specifically, the threat of new market entrants and the threat of substitute products or services.

The threat of new entrants to a market is determined, in part, by the barriers to entry extant in that market.[9] Porter described seven key sources that may bar entry into an industry: (1) supply-side economies of scale, which can force a new entrant to produce a similar product at higher cost than the established competition; (2) demand-side benefits of scale, which describes consumers' preference for established products, forcing new entrants to sell at lower prices in order to compete; (3) customer switching costs, which are expenses that consumers incur when switching suppliers (e.g., retraining employees to use a new vendor's product), thus making those customers more likely to stay with the established producers; (4) capital requirements, which are the initial investments necessary in order for a new entrant to the market to compete (e.g., the cost of research to develop a new product); (5) advantages of incumbents independent of their size, such as proprietary technology or preferential access to resources; (6) inequalities in access to distribution channels, which require new entrants to displace the established competition in order to distribute their product to customers (for example, a new food item must replace an established product on grocers' shelves in order to be purchased by consumers); and, (7) restrictive government policy, which can directly hinder (or help) new market entrants, or indirectly influence markets by amplifying or nullifying other barriers to entry.[10]

The cost-effective nature of many disruptive innovations[11] may mitigate the impact of the first two sources of barriers to entry, which typically force new entrants to accept reduced profits in comparison to the competition, either through relatively high production costs or relatively low prices.[12] However, other barriers to entry may present major challenges to entrepreneurs in the healthcare industry. For example, the inventor of a highly accurate, portable, and low-cost x-ray machine was unable to dislodge conventional x-rays as a result of multiple barriers to entry, including: (1) opposition by radiologists who control licensing standards, who feared that the new, highly accurate product would negate their specialty's usefulness to other providers (i.e., an advantage of incumbents independent of their size); (2) lack of hospitals' interest in purchasing the new x-ray machine, due to the hospitals' incentive to funnel business to their existing investments in traditional x-ray machines (i.e., customer switching costs); and, (3) the refusal of large-scale x-ray equipment suppliers to deal with the inventor, because the newer, cheaper

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product threatened their business model (i.e., an inequality in access to distribution channels).[13]

As described above, in addition to acting as a new entrant to an industry, disruptive innovation may also constitute a rival product or service in an existing industry. Michael Porter argued that the threat posed by a substitute product is high if: (1) the substitute *"…offers an attractive price-performance trade-off to the industry's product"* in that the substitute can fulfill a similar function more efficiently than the industry standard product; or, (2) "*the buyer's cost of switching to the substitute is low*," such as the cost to consumers of switching from a brand-name pharmaceutical to a generic version.[14] By their very nature, disruptive innovations meet the first criteria, in that they address the unmet needs of mainstream consumers, typically with relatively low prices.[15] In the healthcare industry, where the cost of services is often prohibitively high, low-cost substitutes provided by disruptive innovation may be critical to the ongoing effort to reform the United States' healthcare system.[16]

In the coming years, continued disruptions within the healthcare industry are anticipated to arise due to a number of factors, such as: (1) the automation of information collection, storage, analysis, and dissemination; (2) the facilitation of access to care; (3) the push for reduction of the cost of care per interaction; and, (4) the increase of decision support services.[17] Perhaps most importantly, many modern consumers of healthcare services (i.e., patients) are demanding transparency and convenience, which the healthcare system has not provided,[18] which may create opportunity for disruptive innovation. As noted above, government regulatory action can either bar entry to an industry, potentially hindering disruptive innovation, or mitigate other barriers to entry, potentially assisting disruptive innovation.[19] With respect to healthcare, governmental actions have created an environment that has allowed for the development of disruptive innovations. For example, the *Health Information Technology for Economic and Clinical Health Act* (HITECH Act), a subset of the *American Recovery and Reinvestment Act of 2009* (ARRA), sought to strengthen the infrastructure for health information technology, such as *electronic health records* (EHRs).[20] Building off of this infrastructure, the Blue Button Initiative, created by a collaboration of the *United States Department of Veterans' Affairs* (VA) and the *United States Department of Health and Human Services* (HHS), grants millions of Americans secure online access to their personal health data,[21] which has in turn spurred entrepreneurs to introduce novel personal health records based on data from the Blue Button Initiative.[22]

In the years since the passage of the HITECH Act, patient access to, and control over, healthcare information has become increasingly widespread. Some companies have targeted developments that simply allow patients to better track their own health, such as Fitbit, which created wearables for health and fitness tracking, allowing for quantifiable health metrics and guidance.[23] Other companies, such as MedWand, which created a hand-held, multi-function diagnostic tool for basic patient vitals, facilitating more frequent and convenient diagnostic testing at a greater number of locations,[24] may provide a much more direct source of competition for established providers of healthcare services. Similarly, Qualcomm, an electronics company, is hosting a $10 million competition that challenges contestants to create a device that can identify anemia, atrial fibrillation, diabetes, pneumonia, sleep apnea, urinary tract infection, food-borne illness, shingles, and other health conditions.[25] Additionally, the devices are expected to keep track of blood pressure, heart rate, oxygen saturation, respiratory rate, and temperature.[26] Developments in mobile telemedicine, such as the Babylon application, may cause the most disruption to traditional healthcare providers, as they may provide a convenient alternative to traditional healthcare. Specifically, the Babylon application allows subscribers to quickly receive medical counseling from physicians remotely via smart phone, and in the near future this application may use artificial intelligence to provide diagnoses.[27] These types of technologies (i.e., the products produced by Fitbit, Medwand, Qualcomm, Babylon, and other similar developers) bear the hallmark of disruptive innovation, in that they may meet consumers' needs more efficiently and effectively than the traditional, established suppliers currently are. As such, disruptive innovation in the healthcare industry may lead to greater control for patients and greater competition for providers.

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