

DISRUPTIVE INNOVATION

Peregrine Dalziel, MBBS and Tina Shah, MD

Introduction

“Disruptive innovation” (DI) has recently been heralded as a tool to mitigate out of control health care spending in the United States,^{1,2,3} however few doctors are familiar with the concept. Overall, there is a tendency in medical culture to regard changes to established treatment and management models with some reticence, increasing the difficulty for reform. In this article we will introduce readers to the concept of DI as a means to reduce costs in the American health sector. We will illustrate current uses of DI in health care, using the particular example of the expanding role of nurse practitioners (NPs). It is not our intention to debate the virtue of NPs per se, but we will examine arguments for and against the development of the NP role that illustrate traditional barriers in health care to DI adoption, and some of its potential synergies.

The Need to Cut Costs

Health care is clearly in need of reform in the United States. Health sector spending is 3 times the national defense budget. Health care cost inflation consistently outstrips the average increase of the Consumer Price Index and constitutes 17% of the GDP; nearly 1 out of 5 dollars spent in the US is spent on healthcare. Furthermore, 62% of bankruptcies in the US have medical debt as a major contributor.⁴ Unfortunately, pressures that increase costs are getting worse: our population is aging, chronic disease and comorbidities are increasing, the primary care workforce is shrinking, and there has been an increase in high-tech services and government commitment to universal health coverage. Doctors are in an unenviable position of having to devote more time to increasingly complex patients with complex treatment options, while having to also meet the demand for higher quality services. Clearly the incumbent medical model will need to change.²

Allowing DIs in health care delivery may be a method of achieving these seemingly opposed goals of providing greater access to health care whilst controlling costs.

Disruptive Innovation

A DI is one that displaces a “status quo” technology or process by offering a reliable, cheaper, though generally lower quality alternative. This innovation is adequate for the average consumer’s needs and can be used by less skilled or trained users.^{2,3}

Figure 1 illustrates the key features of DIs.⁵ Initial innovation in an industry is targeted toward the high-end/advanced users who fund its development and are prepared to pay higher prices for better quality. This incremental “sustaining” innovation continues with improvements on the existing technology and

provides higher and higher quality and performance with more “bells and whistles” [blue line]. Eventually, these added features become beyond what is necessary for the average purchaser [red line]. On a greater scale, institutions that are built upon the sustaining innovation are so invested in its continuation that it is impossible to change their business model to then target the average consumer.³

The DI enters the market providing a lower functional or quality level product/process, but this satisfies the needs of less demanding consumers. The lower price makes it more affordable and opens the market to previously excluded users. Eventually, the new product becomes widespread and subsequent improvements in quality and performance make it good enough to satisfy even high-end consumers [dotted line]. It may then completely supplant the old technology.²

Examples of DI abound in the non-medical realm. Mainframe computers had their market dominance interrupted by smaller, cheaper, though less powerful, personal computers. Telegraph operators were disrupted by the telephone. Compact discs overtook LPs, followed by MP3s that now provide a smaller, cheaper, and more convenient alternative to CDs with a loss of sound quality that is accepted. Internet calling services and mobile phones have made traditional domestic telephone lines nearly obsolete for many users in developed countries.

DI has been less forthcoming in redefining the health industry. There have been some notable examples of cost-saving DIs, such as coronary artery stenting which disrupted cardiac surgery, or the development of hemoglobin A1C testing and hand-held glucose monitors that enabled diabetes management by non-specialists. Use of bedside emergency ultrasound also disrupted the need for expensive computed tomography scans in emergent settings. Overall however, the capacity for disruptive change in health care has been stifled by heavy industry regulation and lobbying by specialist interest groups.³

Disruptive Innovation Allows Transmission of Routine Tasks to “Value-Added” Processes

Hwang & Christensen explain 3 basic overarching models for service delivery:¹

1. *The “solution shop” model.* Highly trained professionals provide “bespoke” care using their training, experience and intuition for individualized solutions to problems. The value of this model is brought by the professional’s skill and experience. Examples include consulting firms, some law firms, engineering and design firms.
2. *The “value added” model.* Resources and labor are used to create an essentially uniform, re-creatable product or service on a larger scale. Examples include manufactured

goods, department stores, and most service businesses. Here the value lies in the process and the ability to faithfully reproduce the product at a lower cost.

3. *The facilitated network.* Consumers largely solve their own problems through the provision of an interface with other consumers, for example buying goods on eBay, or finding a partner on a dating website.

Hwang and Christensen argue that medical training and practice has largely developed based on the “solution shop” model, where practitioners are highly trained to deal with complex healthcare situations. Much of this skill set is unnecessary to meet the needs of most health consumers, who present with simple complaints that are best suited to a “value-added,” algorithmic approach.¹

A byproduct of the “solution shop” approach is the development of evidence-based and process-oriented solutions which are used by less trained providers to provide quality care, thus transitioning to a “value added” model. Under this DI, specialists are disrupted by generalists, physicians by other clinical staff, and ultimately trained staff by patients themselves (e.g. home glucose and blood pressure monitoring).

A Major Barrier to Disruptive Innovation

Physician led healthcare is the paradigm that is taught in medical schools, granted by virtue of considerable knowledge and practical experience from university and residency training. Notions of health system performance and evidence-based cost containment methods are not considered core requirements of physician activities. If physicians, the governing bodies that represent them, and the supervisory groups that they make up want to remain as a strong force in medicine, widespread change will need to occur, likely at the medical student and resident level. Going from the teachings of history, we should learn to adapt DIs such as NPs, in order to avoid being the obsolete mainframe computer or LP. Others echo such opinion. Dr. Thomas Lee, network president for Partners Health Care system in Boston, MA states it well: “A shift to value-oriented, performance-driven health care requires doctors to adapt or even reject some ways of working that are embedded in medicine’s past...they have no choice. Defending the status quo is no longer a viable strategy, even in the near term.”²²

Nurse Practitioners as a Disruptive Innovation

The use of “mid level care providers” such as NPs is not a novel concept. As policy makers are undertaking what will be the largest overhaul of the health sector in recent history, use of mid-level providers arouse considerable interest. NPs are a good illustration of DI for several reasons: they are not a new concept, NPs are already involved in primary care and in role substitution in hospitals^{6,7,8} and nurses are the largest group of healthcare professionals in the US.⁹ Evidence suggests that NPs provide an equivalent quality of care compared to physicians

in a number of settings.¹⁰ The increasing autonomy of NPs as a DI has raised significant opposition from the “sustainers,” the incumbent care providers.^{7,11}

We will briefly outline the key features of the NP role as well as some the pros and cons of its utilization in the health system.

Background and Current Role of Nurse Practitioners

The NP role was created in 1965, as a collaborative position with physicians.¹² NPs are a type of “advanced practice nurse,” alongside nurse-midwives and nurse anesthetists. NPs are required to have a master’s degree in nursing with certification from a professional nursing organization. There are about 158,348 practicing NPs.¹³

NPs differ from physicians in several ways. Fiscally, NP salaries are lower in comparison to primary care physicians. Scope of practice varies across state lines but generally allows independent prescribing authority for non-schedule IV drugs and some autonomy for delivery of health service. In Pennsylvania where NP autonomy is high, prescribing authority is almost equivalent to that of physicians: NPs can prescribe all levels of DEA controlled substances but are limited to writing a 30 day supply for schedule IV drugs.¹⁴

Pennsylvania law allows NPs to work in a range of areas including surgical practices, inpatient wards, primary care offices, and retail clinics. NPs can function independently, provided that they have a predetermined plan for emergency services, and immediate availability of a licensed physician directly or via radio, telephone or telecommunications. In addition, a doctor must be available for referrals and review of standards of medical practice on a regular basis.¹⁵ NP organizations are currently lobbying to remove the requirement of “supervision” by physicians.

Nurse Practitioners Could Be A Successful Disruptive Innovation

NPs offer a number of appealing prospects to policy makers and private insurers as a complement to physicians that make them an example of a successful DI.

NPs typically receive lower reimbursements from insurance companies and demand lower incomes. For instance, Medicare rebates are set at 85% of the physician fee for an equivalent service.¹⁶ A recent RAND study conducted in Massachusetts highlighted that costs of NPs were on average 35% lower than those of physicians. Under conservative predictions where NPs constitute less than 10% of the workforce, and autonomously treat 6 core conditions, costs were reduced by 4.8 billion dollars.¹⁷ NPs have a median salary of \$85,200 and upper limit of \$113,000, compared to a range of \$121,068 – \$155,294 for primary care doctors.¹⁸ If similar, high quality service can be

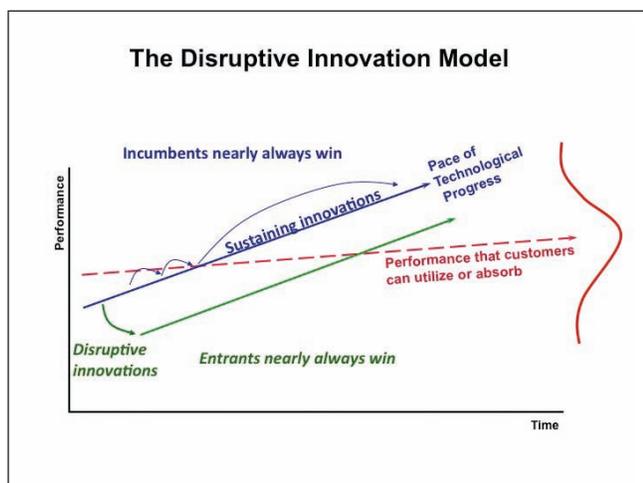


Figure 1. Illustrates the key features of DIs⁵

provided, utilizing these physician extenders can help control national health care costs.

NPs already provide a range of services that are traditionally given by physicians^{8,9} and are utilized in a number of medical settings with equivalent results.^{7,8,19} New technologies and the development of clinical algorithms mean that NPs can fully deal with a variety of routine clinical scenarios. For instance, current diagnostic kits for Group A Streptococcus pharyngitis allow for easy diagnosis, and evidence-based treatment protocols almost “automate” management of uncomplicated pharyngitis.³ Decision rules based on diagnostic scoring systems such as the Ottawa ankle rules or Wells criterion for deep venous thrombosis promise to facilitate more complex decision-making by NPs.

Much of the policy debate between physician and NP groups revolves around establishing authority of ultimate patient management and gaining or maintaining professional autonomy. In this context NPs and primary care physicians are perceived as “substitutes” in competition with one another.¹³ Proponents for NPs highlight that their different clinical background improved care through patient focused, team approaches.⁹ Anecdotal evidence and some research even suggests that physicians working with NPs report greater job satisfaction.^{8,20} Under this model, physicians and NPs do not compete but tackle tasks more suited to their training and experience; doctors work on “solution shop” problems that fall outside the realm of strict protocolized care and NPs perform in a “value added” task role. This emphasis on multi-disciplinarianism is something that few would consider unhealthy in medical care, even though it challenges some older physicians’ notions of themselves as “lone healers.”²¹

Nurse Practitioners May Not Be A Successful Disruptive Innovation

Some believe that the growing role of NPs will not be effective. One major argument against expanding NP roles is the delivery of lower quality health care. The American Academy of Family Physicians (AAFP) is one group that opposes giving NPs more autonomy. They argue that family doctor training requires 4 years of medical school and 3 years of family practice residency with training in 6 major areas, while NP programs require only 2 additional years of classroom and clinical training.²² While some studies have shown that mid-level providers perform equally to physicians with algorithmic approaches to common primary care conditions,²³ there is a concern that NPs may be ill equipped to deal with complicated patients. Former AAFP president Warren A. Jones stated in a 2002 editorial, “This may be appropriate training for an NP, but it certainly is not adequate to prepare an individual to face the diagnostic complexities that even the least complicated of patients bring to a family physician.”²⁴

Current policy recommendations are also criticized as having flaws that will lower the quality of primary care. The 2010 Institute of Medicine report, “The Future of Nursing: Leading Change, Advancing Health” advocates eliminating legislative barriers to practicing medicine for NPs to meet the demand for primary care providers. However, there is no mention in the report about how to maintain NP competencies or ensure patient safety.²³ Physician providers have established regulatory bodies and are part of data networks that can be and are utilized for quality improvement. If there are no policies set in place to ensure NP education for the latest standard of care and for outcomes research, the quality of primary care as a whole may decrease, worsening the American health sector.

NPs as independent providers in primary care could have other ramifications. For instance, there may be a prolonged time-to-diagnosis, due to limited NP clinical experience and having to go through additional visits before seeing the doctor. Instituting health services that control costs at the primary care level but cause lag-times to diagnosis could increase utilization of expensive technologies later on, diminishing perceived savings. With the filling of the primary care gap by less expensive NPs, market forces could lower reimbursements to family physicians, further decreasing the incentive for medical school graduates to enter primary care. A lack of physicians in primary care may undermine the whole model of mid-level providers by quality issues.

On an ethical level, the emerging use of this DI could be a strike against libertarianism. The right to choose is a value embodied in the American psyche. If insurers shift to reimburse only primary care given by NPs, patient autonomy and their right to seek medical care from a doctor may be lost here.

Conclusion

DIs such as the NP role in primary care may be a positive force for change in this environment and will help catalyze a shift away from physicians having to provide “value-added” tasks that can be performed by personnel with narrower training. This model may in turn encourage DIs elsewhere in the system, shifting care from specialist to generalist for instance. Significant efforts need to be made on the part of policy makers and administration to ensure that utilization of such change enhances rather than compromises patient care. Necessary monitoring of quality and adequate supports for appropriate education will be needed. Well-constructed policies and strong leadership in the face of predictable opposition will be required. We also argue though that combined with any specific policy changes for a particular DI, there must be considerable effort to reform current hegemonic thinking in medical culture. We must educate new doctors to embrace, rather than reject such changes—especially where patient and health service benefit is demonstrated.

References

- Hwang, J., Christensen, CM., “Disruptive Innovation In Health Care Delivery: A Framework For Business-Model Innovation.” *Health Affairs*. 2008; 27(5):1329-1335
- Christensen, C., Bohmer, R., & Kenagy, J., “Will Disruptive Innovations Cure Health Care?” *Harvard Business Review*. Sep.– Oct. 2000; 103–112
- Robinson JC., & Smith, MD., “Cost-Reducing Innovation In Health Care.” *Health Affairs*. Oct. 2008; 27(5):1353-1356
- Donahue, John. “Venture Capital and Managing Health Care Cost.” *Harvard School of Public Health*. Boston, MA. 16, Dec. 2010
- Figure 1. Slide courtesy of J. Hwang by personal communication.
- Pohl, JM., Hanson, C., Newland, JA., et. al. “Unleashing Nurse Practitioners’ Potential To Deliver Primary Care and Lead Teams.” *Health Affairs*. May 2010; 29(5):900-905
- Flanagan, L., “Nurse Practitioners: Growing Competition for Family Physicians?” *Family Practice Management*, 1998; 5(9):34-43
- Riportella-Muller, R., Libby, D., Kindig, D., “The substitution of physician assistants and nurse practitioners for physician residents in teaching hospitals.” *Health Affairs*. 1995; 14(2):181-191
- Kuehn, B. “IOM: Boost Nurses’ Role in Health Care” *Journal of the American Medical Association*. 2010; 304,(21):2345-2346
- Kinnersley, P., Anderson, E., Parry, K., et al. “Randomised controlled trial of nurse practitioner versus general practitioner care for patients requesting ‘same day’ consultations in primary care.” *British Medical Journal*. 2000; 320:1043–1048
- Jones, WA., Phillips, RL., “Nurse Practitioners: Only Part Of The Team.” *Health Affairs*. 2002; 21(6):269-270
- Philips, RL., Harper, DC., Wakefield, M., et. al. “Can Nurse Practitioners and Physicians eat Parochialism Into Plowshares?” *Health Affairs*. 2002; 21(5):133-142
- “Number of Nurse Practitioners in US - American College of Nurse Practitioners.” American College of Nurse Practitioners. *American College of Nurse Practitioners*, 2010. Web. 29 Dec. 2010. <<http://www.acnpweb.org/14a/pages/index.cfm?pageid=3353>>
- United States. Department of Justice. Drug Enforcement Administration, Office of Diversion Control. Mid-Level Practitioners Authorization by State. Washington. 12 Dec. 2010. <http://www.deadiversion.usdoj.gov/drugreg/practitioners/mlp_by_state.pdf> accessed 2 Jan. 2011
- The Commonwealth of Pennsylvania. “Subchapter C. State Board of Nursing Certified Nurse Practitioners.” *The Pennsylvania Code*. Nov. 2010. Web. 1 Jan. 2011.
- Frakes, MA., Evans, T., “An overview of Medicare reimbursement regulations for advanced practice nurses.” *Nursing Economics*. 2006; 24(2):59-65
- Eibner, C., Hussey, P., Ridgely, MS., et. al. “Controlling Health Care Spending in Massachusetts: an Analysis of Options.” Santa Monica (CA): RAND Corporation; 2009
- “PayScale - Board Certified Primary Care Certification Salary, Average Salaries.” Certification: Board Certified Primary Care. PayScale, 24 Dec. 2010. Web. 2 Jan. 2011. <http://www.payscale.com/research/US/Certification=Board_Certified_Primary_Care/Salary>
- Munding, MO., Kane, RL., Lenz, ER., et. al. “Primary Care Outcomes in Patients Treated by Nurse Practitioners or Physicians, A Randomized Trial.” *Journal of the American Medical Association*. Jan. 2000; 283(1):59-68
- Koperski, M., Rogers, S., Drennan, V., “Nurse Practitioners in General Practice—An Inevitable Progression?” *British Journal of General Practice*. 1997; 47(424):696–698
- Lee, TH., “Turning Doctors Into Leaders.” *Harvard Business Review*. Apr. 2010; 88(4):50-58
- Arvantes, James. “AAFP Takes Issue With IOM Report Calling for Greater Nursing Role – AAFP News Now – American Academy of Family Physicians.” AAFP News Now. American Academy of Family Physicians, 6 Oct. 2010. Web. 1 Jan. 2011. <<http://www.aafp.org/online/en/home/publications/news/news-now/professional-issues/20101006iomnursingreport.html>>
- Undeland, DK., Kowalski, TJ., Berth, WL., et. al. “Appropriately Prescribing Antibiotics for Patients With Pharyngitis: A Physician-Based Approach vs a Nurse-Only Triage and Treatment Algorithm.” *Mayo Clinic Proceedings* 2010; 85(11):1011-1015
- Jones, WA., “Nurses Only Part of the Team.” Editorial. *Health Affairs*. Nov. 2002