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The Diffusion and Value of
HEALTHCARE
Information Technology

Anthony G. Bower

Sponsored by Cerner Corporation, General Electric, Hewlett-Packard, Johnson & Johnson, and Xerox

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Summary

Virtually no one would argue that the \$1.6 trillion spent annually (as of 2002) on U.S. healthcare is spent efficiently. Americans are not any healthier than citizens in most other developed nations, despite the mammoth expenditures.

There is a well-documented productivity renaissance in the U.S. economy, dating from the mid-1990s. A number of prominent industries, including wholesaling and retailing, have greatly increased productivity over the last decade.¹ At the heart of their efforts was information technology (IT) transformation, although not all heavy IT-using industries have experienced increased productivity.

The purpose of this study is to investigate four sets of questions designed to help determine if healthcare can duplicate the IT-enabled gains seen in other industries, and if so, how:

- What is the current diffusion of HIT, especially the complex electronic health record (EHR) systems² that hold out the promise of healthcare transformation?
- How does EHR diffusion compare to other innovations, especially IT innovations, in other industries? And how fast will EHR likely diffuse if the healthcare system does nothing differently?
- How much would HIT diffusion likely be worth to society (1) if nothing is done differently and also (2) if adoption were quickened?
- What should the government do, if anything, to assist in the purchase or implementation of HIT and specifically EHR? Is speeding the adoption of EHR worth the costs of doing so?

¹ The primary productivity measure used in this report is labor productivity, which is simply output divided by labor hours.

² A basic EHR system provides electronic remote user access of results in the form of text, including lab reports, radiology, transcribed notes, current medications, problems, demographics, and possibly some scanned reports. More advanced EHR systems have guideline-based content and patient- and condition-specific reminders, population management, and interprovider communication.

Brief Overview of Research Approach

To answer the question of the current diffusion of HIT (Chapter Two), we analyzed an industry data source and compared our results to others' results. To answer the question of why HIT has diffused the way that it has (Chapter Three), we surveyed the diffusion literature to find diffusion drivers and then assessed HIT and particularly EHR on those drivers.

Part of our assessment relied on a series of surveys and interviews conducted at facilities that were using or contemplating the use of EHR. Our survey used a purposive sample of a variety of healthcare stakeholders identified through literature and expert recommendations. Sixteen sites were visited. Later visits were specifically to gather cost and HIT-related process improvement information from sites identified as engaging in these activities.

Site visits were supported by telephone interviews with leading HIT professionals. The site visit goals included fact finding and hypothesis development, identifying barriers, enablers, value measurement, range of implementation strategies, and costs.

The second part of our assessment relied on an extensive literature review. The two approaches when combined yielded a prediction of future EHR diffusion. To answer the question of what HIT (and especially EHR) diffusion is worth to the nation (Chapter Four), we found case studies that identified the worth of IT in other industries. We synthesized the case studies and other literature to arrive at a cross-industry theory of IT value and assessed HIT on those drivers using information from literature and interviews with providers. Finally, in asking the question of how or why should government help (Chapter Five), we started from a welfare economics perspective and attempted to identify failures in the HIT market, if any. Our review of all of the evidence from our interviews and the HIT implementation and policy literature revealed several market failures, and on that basis we recommend further study of specific plausible policy interventions.

Our key findings are summarized below.

- EHR is diffusing at a rate consistent with other similar IT technologies in other industries. EHR diffusion is explicable using modern diffusion theory applicable to complex, highly networked IT products.
- Complex electronic medical records are, after a 20-year waiting period, rapidly diffusing in many segments of our healthcare system, with about 30 percent of acute-care hospital providers reporting by the end of 2003 that they had ordered EHR products, and will reach 80 percent saturation in hospitals by about 2016—or earlier if assisted by government or other organizations. Diffusion among physicians' offices is 10–16 percent, depending on the measure.
- More important than hastening adoption, which appears to have taken off since 1999 without intervention, is ensuring that appropriate incentives are in place so that complex EHRs will be used effectively.

- The benefits of the current increase in HIT spending are arguably a *cumulative* 1 percent per year,³ but the range varies widely depending on what else the government and healthcare players do. Other industries have shown quantifiable IT labor productivity benefits ranging from 0 percent to perhaps 4 percent per year.
- Speeding up adoption may be beneficial, although it depends on the presence of other factors such as competition and regulation. There is very strong evidence that HIT will complement other pro-productivity features such as competition and deregulation. HIT is an enabler of change in how work gets accomplished. This is especially true of complex electronic medical records.

Promising Policy Avenues Identified by This Research

Our research has revealed a number of attractive policy avenues that deserve further study. The policy avenues discussed below are active priorities among the many policymaking stakeholders. The purpose of this report has been to provide a better conceptual and empirical basis for pursuing certain general lines of policy, rather than to discuss specific current proposals in much depth (which are better addressed in a series of ongoing, brief issue papers, for example, than in full reports). Note also that the list below is still very broad. The question may be asked: Ultimately, is HIT not a narrower concern within healthcare, albeit an important one, that deserves a shorter and less ambitious list? There are at least two reasons for the broad list below. First, HIT and especially EHR is a technology that affects virtually all players in the healthcare community. It is a broad technology and requires broad policy to be effective.

Second, the value of HIT is maximized when complementary investments are made. The value of HIT swings widely (perhaps by a factor of 10) depending on what else is going on in the system. In healthcare, there is a lot going on, much of it unhelpful to maximizing the HIT investment. Accordingly, the policy remit to optimize HIT efficiency touches on a number of healthcare problems, many all too familiar to health policymakers.

This report's research lends support to developing policy and solutions in the following broad policy avenues:

Coordinate standards immediately. It is important to continue to coordinate standards and push for initiatives that improve the chances for interoperability, especially within regional communities. Standards should be improved without reducing competition among competing EHR vendors.

³ That is, benefits in the first year are a 1 percent increase in labor productivity, in the second year a 2 percent increase, in the third year a 3 percent increase, and so on, for as long as IT continues to change the organization of work within an industry.

Work to improve quality measurement. The benefits of improving quality measurement are twofold: First, improving quality measurement will help to overcome the healthcare market failure of inadequately recognizing quality, which will spur the adoption of quality-improving innovation, including EHR. Second, there is a feedback loop: Adoption itself will reduce this market failure, because EHR holds the promise of improving quality measurement, largely by automating an otherwise dauntingly labor-intensive process of quality management. This difficulty in measuring and competing on quality is arguably the most important problem in healthcare and EHR could be an important part of the solution.

In addition to these two strong rationales for policy in this area, there is still a third: The government is not just a regulator but a key customer and has the opportunity and indeed the right to improve provider cost effectiveness over time. A strong series of results in the theory of innovation show that a “smart buyer” can drive an industry to higher efficiency. (For example, consider the effects of Japanese consumers’ tastes in consumer electronics on Japanese consumer electronics companies.) To date, the government as a buyer has done much to affect the system but much less to reform the system. HIT can help transform the system and help government push through complementary changes in quality measurement and pay for performance that should improve the system. Perhaps this is the area that holds out the greatest promise for truly transformative change.

Reduce network externalities.⁴ The government can work to lessen network externalities, which should lead to more adoption of EHR and especially more effective adoption. Our analysis suggests that the federal government could lead an intervention, but a successful policy needs to encourage linking the local providers for any specific patient. To assist with these efforts, the government may need to consider further relaxing inurement of benefit regulations with respect to HIT. Because of network externalities, some selective grants or subsidies *may* be optimal for underfunded physicians’ offices, but we do not view this as proven. Alternatively, allowing transfer payments (connect fees or bonuses) among members of the regional network may be a good idea (and less expensive for the government). The allowed financial incentives should be targeted at improving community connectivity directly (e.g., IT hardware), or indirectly (e.g., digitizing patient paper records). However, there needs to be further, detailed research at the firm and regional level to guide policy here.

Recognize that HIT requires complementary investments. It has been shown in other industries that IT is much more effective when combined with vigorous competition and deregulation. Complex IT such as EHR is definitely not a stand-alone or plug-and-play type of benefit. Rather, it can, if (and only if) used appropri-

⁴ A network externality exists when a user’s benefit *increases* as the number of other users increases. A fax machine is an example of an IT innovation with network externalities.

ately, deliver dramatic changes in the overall delivery of care that could radically improve quality and lower the cost of delivering that higher quality.

The reverse side of this observation is that preventing complementary changes in work processes by stifling competition or direct regulation might prevent HIT gains from occurring.

Make policy decisions that turn HIT into a competitive weapon. Industrial history shows that IT is most efficiently used when used as a competitive weapon central to a firm's business. This result is highly consistent with a more general theory of successful innovation in a modern economy. In the context of health policy, one way to sharpen the competitive advantage of IT might be to reimburse quality in Medicare more directly, where measuring quality is possible only with an EHR-enabled quality tracking system. Another fruitful line of research would be to study whether Medicare should pay for EHR-enabled claims. In such a world, providers improve profitability by using EHR and using it well and having the credible quality measures to prove that they are using it well. (Note that this policy prescription is related to the quality-measurement policies above, because they both address the fundamental market failure of poorly measured quality.)

Discuss and agree whether 100 percent EHR penetration is a societal goal, because history suggests that it will not happen without intervention. EHR diffusion has reached more than 20 percent of acute-care hospitals and may soon go over 50 percent. However, the analysis in Chapter Two suggests, based on review of other IT innovations, that penetration will not reach 100 percent of the provider community. If 100 percent EHR is a societal goal, because society wishes to maximize network gains or avoid a two-tier system, or both, then some form of subsidy for the more disadvantaged and isolated practices is likely necessary. The issues for these offices should likely be interoperability and community connectivity to maximize gains from HIT and EHR in particular.

Adopt an incremental, evolutionary perspective on policy development. There are few more important areas for proper government economic policy than healthcare, specifically HIT. It is only a slight overstatement to say that future U.S. competitiveness and the health of its citizens depend upon it.

Given the enormous stakes, the uncertainty in the effects of policy, and the latency of the gains from HIT implementation, it might be wise to heed organizational theorists' views on evolutionary policy analysis. It is usually best to be able to evaluate policies and business strategies early and adapt quickly. Such a perspective is almost certainly wise in this context.

This suggests incremental government interventions with rapid review of results, with follow-on funding for successful interventions.