Diffusion of Medical Technology

Health Economics Common Fund

National Institutes of Health

JUNE 14, 2012 TELECONFERENCE

Executive Summary

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This executive summary was prepared by John Haaga (National Institute on Aging) and Chandra Keller-Allen (Rose Li & Associates, Inc., under contract to the National Institutes of Health, HHSN263200700991P). The statements, conclusions, and ideas contained in this document reflect both individual and collective opinions of the meeting participants and are not intended to represent the official position of the National Institutes of Health, or the U.S. Department of Health and Human Services. We gratefully acknowledge review of and comments on earlier drafts of this report provided by Vivian Ho, Rose Li, and Jonathan Skinner.

The NIH Common Fund

Introduction

The Health Economics Common Fund program held a teleconference on June 14, 2012 with health economists and other researchers with specific knowledge in the area of the diffusion of medical technology. There were no formal presentations, nor background papers for the teleconference. All opinions in this document are those of the participants, summarized by others, and not to be attributed to the National Institutes of Health (NIH).

John Haaga welcomed the participants and thanked the invited guests for their time and expertise. The purpose of the teleconference was to discuss what is known about how and why medical innovations diffuse. Discussion questions included:

1. How well do we understand factors affecting the rate and extent of adoption of new technology in health care?
2. How well do we understand factors affecting the rate and extent of retiring outmoded technology?
3. How well do we understand effects of technical innovation on expenditure growth?
4. How well do we understand effects of technical innovation on disparities in care?
5. Do we understand feedback loops and endogenous technical change—the influence of adoption on innovation?
6. Are there datasets that might be created as a public good, facilitating work on these issues?

The portion of rising medical care expenditures that can be attributed to new technologies is not well understood and often estimated just as a residual. There is a concern that efforts to control costs may result in the unintended consequence of stifling innovation. A better scientific understanding of what affects the diffusion of medical technology could help meet the dual goal of improving quality of care while restraining cost growth. Understanding the diffusion process also may shed light on disparities in care among racial/ethnic, socio-economic status, or geographic subgroups.

Participants in this conference call discussed priorities for future research to increase the knowledge base on the diffusion of medical technology, with particular attention to research gaps and data needs. Throughout the discussion, it was stressed that the focus should not simply be on reducing expenditures but on increasing the value of care.

Technological innovations as discussed here can include:

- pharmaceutical treatments,
- surgical procedures,
- medical devices,
- diagnostic tools and tests,
- and organizational innovations such as payment system reform, accountable care organizations (ACOs), or disease management strategies.

Adoption of Medical Technology and Impact on Expenditures

It is frustrating to note how little is actually known about what causes some hospitals to adopt innovations, both effective and ineffective, more quickly than others. Studies have demonstrated factors associated with the adoption of medical technology, but it is particularly difficult to determine causation. Hospital leadership could be a significant factor yet this is difficult to measure. Case studies have provided many insights into questions of possible causal factors—variation of use of procedure at a point in time, purchase of new technology, response to payment policy, regulatory pressures, and idiosyncratic behaviors. However, the generalizability of the insights learned from case studies and the underlying principles at work are still uncertain. Causes of diffusion are likely to be multifactorial—there is no single factor that will explain the pace of adoption of all new technology or the rate of retirement of outmoded technologies.

Jon Skinner cited a recent study by Curry et al. (2011) that compared hospitals with the best results for acute myocardial infarction (AMI) patients with hospitals with the worst results. The groups of hospitals did not differ systematically in protocols or in intensity of treatment. The differences lay more in the realm of "long-term investment and concerted efforts to create an organizational culture that supports full engagement in quality, strong communication, and the capacity for problem solving and learning" (Curry et al., 2011, p. 389). "Good hospitals are good hospitals," in Skinner's summary—not the quick adopters, nor the slow adopters. Studies of the association of technology diffusion with quality of care and patient outcomes will have to take account of the institutional environment that mediates the association between procedures and outcomes.

There is no clear evidence showing which technologies are leading to the greatest growth in expenditures—pharmaceuticals, surgical procedures, diagnostic tests, medical devices, etc. Such studies could be a high priority for understanding and forecasting expenditure trends. Cross-country comparisons could help in this area. However, cross-country comparison on a wide scale will require efforts to produce comparable data. Countries with single payers or capitated systems, for example, do not have the claims data that the fee for service system in the United States generates.

One weakness of administrative data for many purposes is that detail about the exact content of care is often insufficient. For example, there have been reports in the press comparing the expense of coronary artery bypass graft (CABG) in Europe versus the United States. However, there is no information about exactly what is going on in the surgery (e.g., types of medications, equipment, exact procedures). Simply to compare the price of a procedure in one place or at one time with that of a procedure with the same name in another is invalid unless one knows exactly what was done each time. Electronic health records might be more useful than claims data in achieving the needed granularity—"If we're lucky," as David Meltzer put it.

Vivian Ho pointed to the importance of access to microlevel data, using robotic surgery as an example. With access to health system records, one can track diffusion, preferably with

detailed information on when the machines were acquired. Robotic procedures can generate separate bills, making claims data useful for the study of technology diffusion.

The Pace and Direction of Technological Change

One approach to diffusion takes technological change as given and studies adoption after an innovation has happened for exogenous reasons. But a more inclusive and dynamic approach would look at possible feedback loops—how prospects for adoption affect the pace and direction of technological change. There is strong support for the hypothesis that investors invest where they expect returns. Drugs, for example, have high fixed costs and low variable costs. Payment policies that try to produce payments closer to marginal costs will fail to recoup the fixed costs.

Over the past several decades, there has been a stronger tendency outside the United States to push prices to marginal costs. Many are concerned that declines in U.S. reimbursement rates will decrease incentives for innovation despite U.S. policies (other than reimbursement) that encourage innovation (e.g., research and training, promoting translation, public-private partnerships). A static viewpoint would indicate that any price above marginal cost is too high, while a dynamic perspective would conclude that anything that does not allow the developer to perfectly price discriminate is too low. This is a clear tension in policy making. It is possible that studies of technological change in other sectors can provide insights into the health sector.

Case studies can provide important insights into the factors affecting the diffusion of medical technology. However, the case study literature should be examined in a more organized fashion to begin to draw inferences about generalizability. It would be beneficial for researchers working on technology diffusion to begin working together to shed light on some cross-cutting questions. This would help the field move from case study to underlying principles to projections.

As in other contexts, we need replication of key results in the literature on technology diffusion. Some classic studies such as that led by McClellan and Kessler (2002) on diffusion of treatments for heart attack around the globe have never been replicated for other types of technology.

The role of social networks among providers in technology diffusion is an area of new research opportunities and may provide insights to complement those from studies of formal organizations.

Oncology would be a good area to think about for these types of questions about diffusion. Oncology accounts for a tremendous amount of spending; cancer is a leading cause of death, and it is unclear that many new treatments have worked. Yet, these newer treatments spread and are widely used, even in cases where they are found to be harmful. Oncology includes a variety of well-characterized conditions and treatments and there are valuable data sources. Ho also suggested a concerted effort to learn more about the diffusion of technology for diabetes,

as well, since it is a growing problem. Diabetes care puts great demands on continuity of care and patient adherence.

While participants did favor new case studies of particular diseases and particular technologies, several also argued for more studies of diffusion of methods for treating and managing patients with multiple chronic illnesses. Allison Rosen stressed the need to look at technology in context and to understand what types of technology are effective for what type of patients. Innovations like disease management and care coordination are often overlooked, yet it should be possible to study the uptake of such programs and their impact on care.

It is important to include organizational innovation in the discussion of diffusion of medical technologies. It is not yet understood what characteristics of ACOs are going to help or hinder diffusion of effective technology and lead to better care.

Data Needs and Limitations

The collection of new data would be useful, but participants also agreed that there are untapped opportunities to access or combine existing longitudinal data, such as registries. It is possible investigators have access to various sources of data but have not thought about combining them. Patient outcome data would be needed in order to determine the "right" level of diffusion for a particular innovation or subpopulation.

There was broad support for the idea of a study of physicians and surgeons to dig deeply into understanding the micro-level determinants of how clinicians make adoption decisions (e.g., exposure to new evidence, regional effects, peer pressure, organizational leadership). Such a study seems to be lacking in the literature and would be incredibly useful.

Medicare Part D data on prescription drugs are becoming useful for longitudinal studies. There could be a greater emphasis on making it available to researchers. New drug releases, how they diffuse over time and space, and their effect on patient outcomes (in real life, as distinct from trials) could all be examined.

A National Research Council panel on developing national health accounts is trying to design a minimum dataset starting with a small number of variables. Perhaps the NIH could take the lead in encouraging federal agencies to collect data across agencies and over time to contribute toward such an effort.

It was suggested that a partnership could be developed between the Health Economics Common Fund program and the Clinical and Translational Science Awards (CTSA) to encourage use of CTSA data resources to address these questions.

Although there is a great deal of claims and other administrative data available, which would be adequate for some studies, the increased use of electronic health records could provide more nuanced information for studies of diffusion. For example, Chandra and Staiger (2007) used

detailed cross-sectional data from a cooperative cardiovascular project with 200,000 heart attack patients that included chart reviews to examine the use of thrombolytic drugs. They found larger bleeding risks associated with African Americans; however, they anticipated greater disparities than were actually found. Skinner proposes studies similar to the Cooperative Cardiovascular Project for back surgery, colon cancer surgery, and congestive heart failure.

To assess disparities and the appropriate application of medical innovations to the right populations, it is critical to understand the heterogeneity of treatment effects. Clinicians may read studies of randomized controlled trials (RCTs) and conclude that a particular medical treatment or procedure works or does not work and apply a treatment indiscriminately to a variety of patients. But RCT results are averaged over a specific population and do not adequately address the heterogeneity of treatment effects. Detailed data, analyzed using robust methods to account for selectivity and unobserved heterogeneity, could be used to greater effect to discern the justifiable differences for applying which medical technologies to whom and where these decisions are most cost effective.

In the past, many of the successful and clear case studies of diffusion have focused on prescription drugs or heart disease because there are more data available in these areas. Personalized medicine and genomics are likely to open up new opportunities, new areas in which understanding how, and how fast, new technologies diffuse within the health care system will be vital for realizing their potential.

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