Innovation Policy Post-Doctoral Fellowship Proposal

Technology Diffusion in Health Care

Rapid growth in health care expenditures poses a daunting challenge to national and individual fiscal health in the U.S. Over the past five decades, U.S. health expenditures have outpaced GDP growth by an average 2.5 percentage points annually, with health spending accounting for 17.6 percent of GDP in 2009.[1] In combination with an aging population, these rising costs are projected to increase the U.S. federal government's financial obligation to mandatory public health insurance programs such as Medicare and Medicaid from 5.6 percent of GDP in 2011 to 9 percent or more of GDP by 2035.[2] These facts have driven both policy makers and payers to search for effective ways to "bend the cost curve" and put spending growth on a sustainable path.

Substantial evidence points to the diffusion of new health care technologies as the primary driver of rising health costs, placing these technologies on center stage in the debate over health care financing (Chernew, 2011). Key to this debate is that technological advances in health care have, on the whole, provided significant gains in survival and other clinical benefits. Yet health care technologies vary widely in their productivity, from innovations that are highly cost-effective to those that are ineffective or have uncertain benefits (Chandra and Skinner, 2011). Effective management of cost growth in health care requires weeding out ineffective technologies without discouraging the development and diffusion of effective innovations. To do this, it is critical to understand the drivers of health technology adoption, especially which factors encourage the adoption of highly productive over marginally productive technologies.

To begin to shed light on this issue, my proposed research [1] (joint with Leila Agha) explores the diffusion of new chemotherapy drugs by testing the influence of pioneer physicians who participate in clinical trials.[3] In particular, we test whether proximity to a pioneer investigator, either through geography or shared professional networks, influences the speed or efficiency of technology adoption.

This work will combine data from four sources, linking a novel data collection effort with three existing sources of administrative records. First, we will create a new data set to identify clinical trial sites and principal investigators for new chemotherapy agents, by linking information from FDA disclosures to articles in the medical literature. Second, we will use purchased data from the American Medical Association's Physician Masterfile to map oncologists' professional networks on the basis of their residency and fellowship training. Together, these two data sources will allow us to identify the

[1] Source: Centers for Medicare & Medicaid Services, Office of the Actuary, National Health Statistics Group. https://www.cms.gov/NationalHealthExpendData/downloads/tables.pdf.
[2] Source: CBO's 2011 Long-Term Budget Outlook.
[3] The study of drug diffusion dates back at least to Coleman, Katz, and Menzel's (1957) landmark work.

physicians with earliest access to a new chemotherapy agent and the set of physicians who are proximal to those early investigators, through either a shared professional network or geography. Third, data on drug diffusion and health outcomes will come from Medicare claims records. Fourth, we will exploit the subsample of Medicare claims that are linked to the Surveillance Epidemiology and End Results (SEER) cancer registries to further enrich the clinical information available; SEER data will allow us to identify more precisely the characteristics of patients receiving the new treatments and the medical returns to adoption.

Using these data, we will study how physician proximity to the principal investigators of early clinical trials corresponds to the speed of adoption following FDA approval for the drug, and whether it differentially predicts adoption of more effective drugs. A natural extension of this project is to explore how timing of adoption relates to the propensity to use or disuse a drug as subsequent research reveals that drug to be more or less effective than expected. For this future work, we will complement the data described above with a targeted review of the medical literature to track post-approval information about the drug's side effects, target population, and efficacy.

Information Spillovers and Technology Diffusion

To gain insight into how to reduce medical spending without sacrificing quality, the Dartmouth Atlas Working Group has contributed a significant amount of research comparing medical practices across regions of the U.S. Two important findings are the existence of a) dramatic heterogeneity in per capita health spending and treatment patterns which are not explained by demand-side factors such as illness or income, and b) a flat cross-sectional relationship between spending and health outcomes. A common interpretation of these findings is that 20-30% of health spending ($700 billion annually) could be saved without sacrificing quality by moving high-spending regions to behave like low-spending regions.[4]

However, there may be important learning spillovers across regions (e.g. a pioneering research hospital discovers or tests an innovation perhaps at some cost, which then spreads to other regions if the innovation proves to be sufficiently cost-effective). If these spillovers are substantial, regional analyses that fail to account for them will yield biased cost-benefit correlations. Generally, identifying whether laggards enjoy a positive externality from pioneers is difficult, because there is selection into who adopts an early innovation.

One way to overcome the selection hurdle in the chemotherapy setting described above is to exploit the information network through which innovations diffuse as a source of variation in early adoption. We then can test whether the potentially costly early experimentation by pioneers generates learning

[4] I provide a brief review of this literature in [2].

spillovers to late adopters. The results of this study could inform policy about the optimal number and placement of clinical trials, as well as the extent to which early experimentation with a drug reduces the total costs associated with learning about its effectiveness.

Human Capital and Technology Choices

Technology adoption in health care is fundamentally connected with how individual medical providers such as physicians choose amongst competing technologies. Economists have long recognized that past experiences may impact future technology choices and productive efficiency. Experience with a particular technology may lead to expertise in that technology through the acquisition of technical skills or special knowledge which may arise either directly via learning-by-doing or by observing the choices and experiences of others. Because of this, it is possible for early experiences to have long-run impacts on an individual's technology choices.

My paper *The Evolution of Physician Practice Styles: Evidence from Cardiologist Migration* [2] seeks to identify the extent to which physician practice styles (i.e. a physician's tendency to use a particular treatment) persist when faced with changes in their environment. To answer this, I exploit changes in a physician's practice environment that occur when physicians move across practice settings. My results imply that 20-30% of a physician's practice style persists following a move, suggesting that the human capital component of treatment choices is significant. In future work, I hope to uncover the mechanisms through which this human capital is developed, such as medical training or experience. For example, the role of medical training could be evaluated by exploiting quasi-random variation in where medical students are matched for residency training through the National Residency Matching Program.

Research discussed above

[1] Agha, Leila and David Molitor. In progress. "Technology Diffusion and Learning Spillovers in Health Care: Evidence from New Cancer Drugs," NBER and MIT.

[2] Molitor, David. 2011. "The Evolution of Physician Practice Styles: Evidence from Cardiologist Migration," MIT.

Works cited

Chandra, Amitabh, and Jonathan Skinner. 2011. "Technology Growth and Expenditure Growth in Health Care." NBER Working Paper 16953.

Chernew, Michael. 2011. "Health Care Spending Growth: Can We Avoid Fiscal Armageddon?" Inquiry. Vol 47, pp. 285-195.

Coleman, James, Elihu Katz, and Herbert Menzel. 1957. "The Diffusion of an Innovation among Physicians." Sociometry. Vol. 20: No. 4, pp. 253-270.