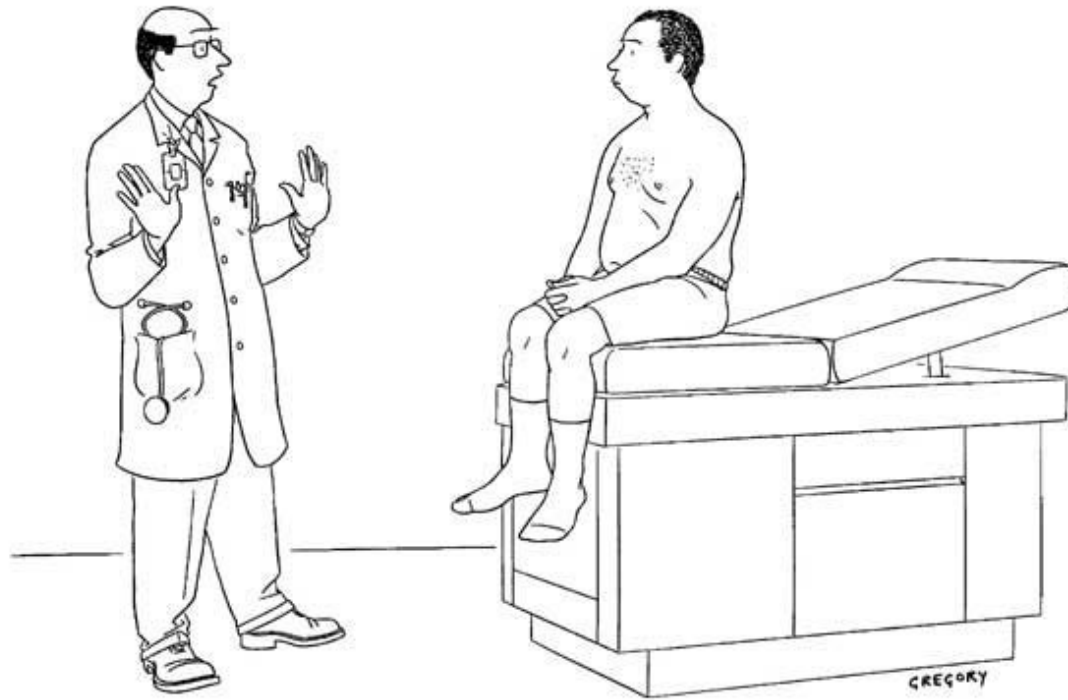


Influence, Information Overload, and Information Technology in HealthCare.

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"Whoa—way too much information."

Inspiration: a clinical trial of an IT-based decision support technology

- ❑ The IT system constructed a digital electronic medical record from insurance billing records and used these to send messages to docs about deviations from protocols.
 - ❑ One of these messages contained important new knowledge: the expanded use of ACE inhibitors based on the results of the high profile HOPE trial completed just before the experiment began.
 - ❑ The HOPE trial findings were widely promoted through conventional channels (disease management programs, journal articles etc.) Yet, we found that the computer generated messages doubled the rate of compliance with the new protocol.
 - ❑ Why was the IT system more influential than other channels of information to which physicians were exposed?
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Why Was the IT system influential?

- A partial answer likely has to do with the nature of the message.
 - Physicians have a hard time keeping up with the rapid pace of change of medical technology. They may have already heard of the HOPE trial, but hadn't connected it to a specific patient.
 - The computer's recommendations included reference to:
 - a specific patient
 - a specific protocol
 - a cite to a specific article.
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Why Was the IT System Influential?

- A more complete answer requires a model of how information technology interacts with the other sources of information that influence physician decisions.
 - Economic theory has lagged behind these developments, in part because we have focused on settings with “too little” information (e.g. principal-agent problems), but IT innovations often address problems arising from “too much” information.
 - We present a first cut at an economic model of the influence of IT based decision support
 - Our approach is conventionally microeconomic, but we highlight the non-market and non-pecuniary influence activities typical of the sociological literature on technology diffusion
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Influence and Information Technology

- Important players are placing big bets that IT enabled decision support tools can help physicians avoid errors, improve quality and more rapidly incorporate new protocols into their practice.
 - Much of the interest is coming from insurance companies.
 - In today's fragmented IT infrastructure, insurers play a central role as aggregators of patient information.
 - The company whose technology we studied relied on insurance data and was later acquired by Aetna for \$400M
 - Hospitals are also making large investments in electronic medical records, but linking these to outpatient information is often hard.
 - The Federal government is also encouraging investments in health care IT. "By computerizing health records, we can avoid dangerous medical mistakes, reduce costs, and improve care." President Bush State of the Union Address 2004
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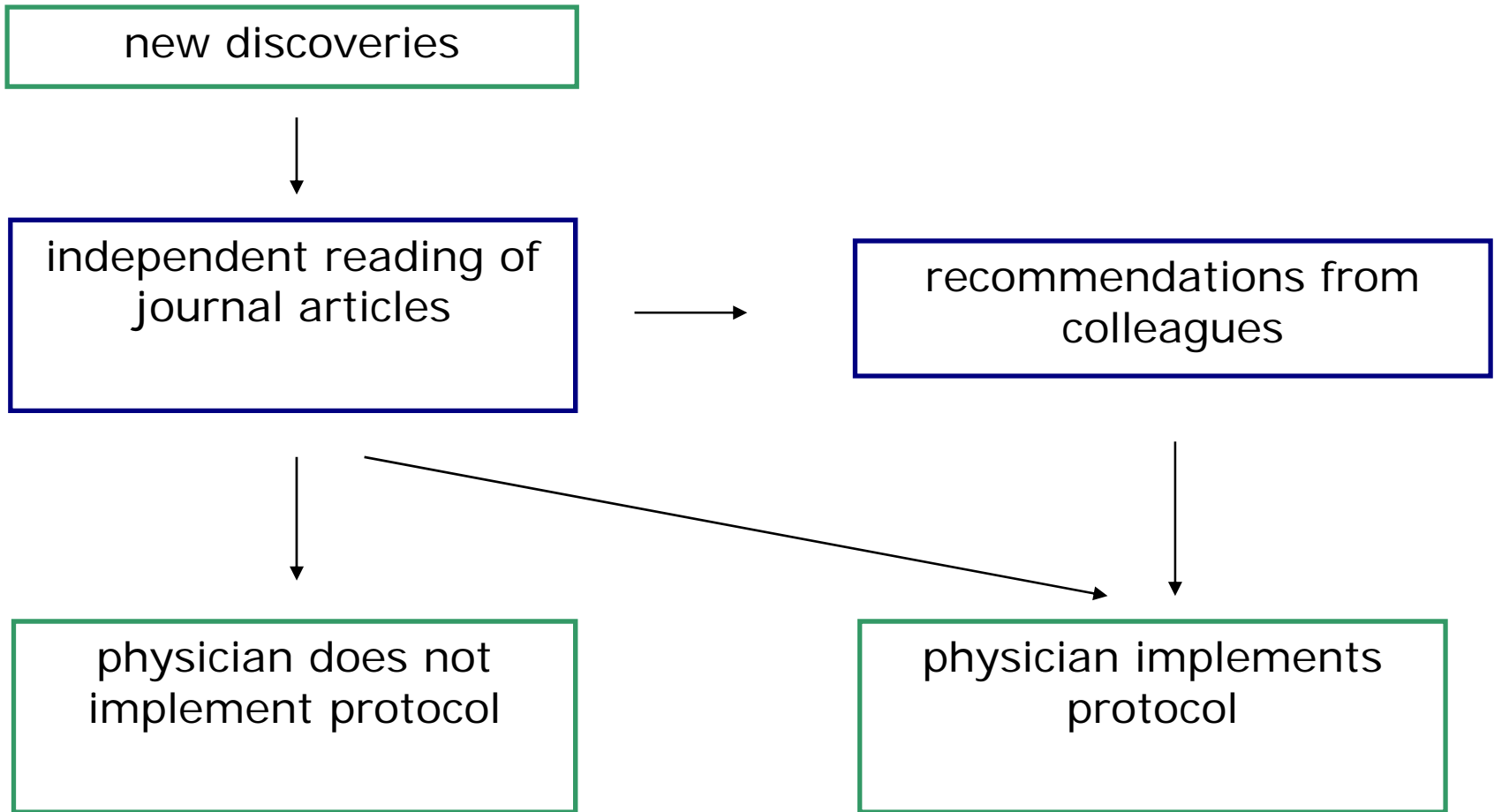
Our Model of Physician Information Acquisition.

- The health care system produces a constant stream of new protocols and treatments. A subset of these may be relevant to a physician's patients.
 - Physicians have cognitive limitations.
 - The flow of new information exceeds the information processing capacities of physicians.
 - It is difficult to link newly acquired knowledge to specific patients
 - These cognitive limitations ensure that there will always be a stock of relevant new treatments the physician will have missed.
 - Advice from other, physically proximate, physicians help fill this gap and also lead to geographic variations in treatment patterns.
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Information and Influence in the Absence of IT

- Physicians acquire information via two channels:
 - Reading in medical journals
 - Advantage: the journals contain most recent stuff.
 - Disadvantage: ex ante doc can't judge relevance to their patients.
 - Recommendations from other geographically proximate doctors:
 - Advantage: recommendations relate ex-ante to specific patients.
 - Disadvantage: recommendations may not reflect latest knowledge.
 - Physicians allocate their fixed “mental shelf-space” to these channels in order to best treat their patients.
 - With these assumptions we solve for the steady diffusion of information.
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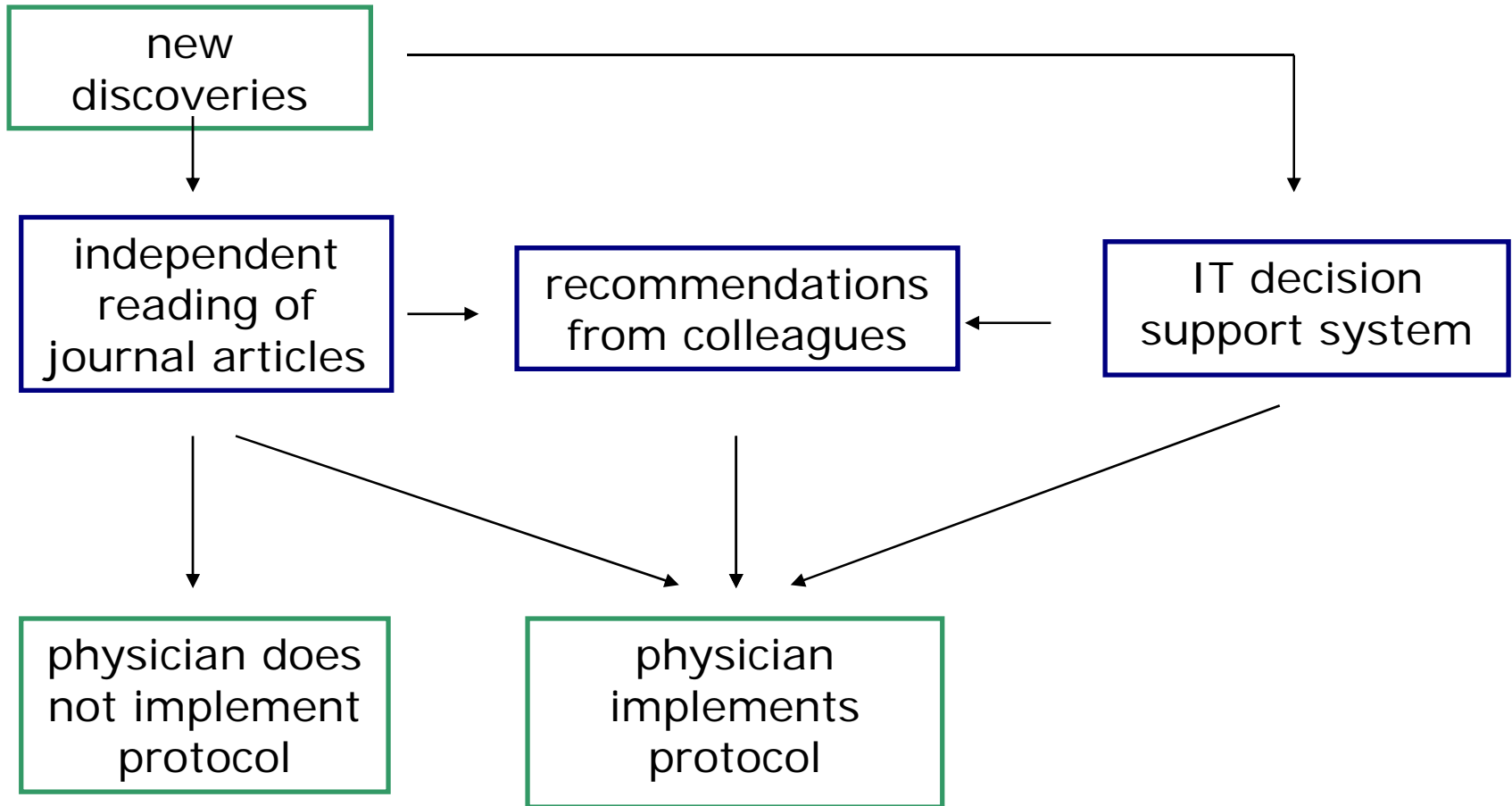
Information and Influence in the Absence of IT



Introducing IT Based Decision Support

- Assumptions:
 - IT messages include new information targeted towards a specific patient. The IT system combines the best attributes of two prior information channels and therefore is more influential.
 - Adding new protocols to the IT decision support tool is costly enough that the system will never include all new treatments and protocols.
 - IT systems in health care are fragmented, so the decision support tool covers only a fraction of physicians in an area.
 - Physicians who have the system benefit directly by messages.
 - Physicians who don't have the system benefit indirectly by the recommendations of those directly exposed to the system
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Introducing IT Based Decision Support



IT-Based Decision Support

- Model parameters are such that in steady state all three information channels will be used
 - Doctors with the system will read about all messages sent by the IT system and by colleagues and also do independent journal reading.
 - Doctors without the system will read about all suggestions from colleagues and will do more reading in independent journals than doctors without the system
 - Result 1: Introducing computer based decision support (or expanding its scope):
 - Displaces independent reading in medical journals.
 - Enhances the overall rate of diffusion of new knowledge
 - Reduces geographic variations in treatment patterns
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Who Invests in IT Based Decision Support?

- Because of the central role of insurers as IT aggregators, we analyze their incentives to invest in decision support technology.
 - We assume that purchasers of insurance will pay more if their insurer uses its data to offer decision support to physicians that improves outcomes.
 - Result 2: Health insurers will under-invest in computer based decision support technology.
 - Intuition: knowledge spillovers create a positive externality. Insurers will capture some, but not all, of the social value of decision support systems.
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Who Invests in IT Based Decision Support?

- Result 3: Pharmaceutical and device makers can have more powerful incentives to invest than insurers.
 - Intuition: Subsidizing the costs of the information support software can be a profitable way of informing physicians about their products.
 - Result 4: Pharma and device makers have incentives to overinvest-
 - Intuition: Adding their products to the database creates a negative externality by displacing other forms of learning that might lead physicians to adopt other treatments.
 - Google finances enhanced information flow on the internet through the use of marketing dollars. Does our framework suggest that marketing resources of pharmaceutical and device makers can be used to support enhanced information flows about treatment protocols?
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Ambiguity, Influence and Marketing

- ❑ We have so far considered messages whose information is unambiguously correct.
 - ❑ In many settings, the right drug or treatment is less clear. There may be competing anti-ulcer drugs, but none dominates the other. Each works best on a hard-to-identify subset of the population.
 - ❑ A pharmaceutical company with an ulcer drug might profitably pay for a decision support system to suggest its drug be sent to all physicians with ulcer patients because the message may prove relevant to some physician's patients.
 - ❑ If physicians know that the system includes marketing messages but can't distinguish these from others generated by the IT system, the rate of diffusion of new knowledge will be reduced because physician resources will be taken up with these relatively low value messages.
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Ambiguity, Influence and Marketing

- Result 5:
 - It can be privately profitable for pharmaceutical companies and device makers to pay for the inclusion of marketing messages into computer-based decisions support system.
 - These marketing messages need not eliminate the influence of the system over physicians, but they will reduce the rate of diffusion of new knowledge and overall welfare gains.
 - Thus financing investment in improved information flows with marketing dollars may undermine the social value of physician decision support systems.
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Conclusion

- Information overload acts as a drag on the diffusion of new knowledge in medicine. IT based decision support tools offer a promising approach to reducing this drag and so improve care quality and enhance the dynamic efficiency of the health care system.
 - Insurance companies play a central role as information aggregators and are in a good position to finance investments in decision support. Our analysis suggests, however, that their incentives to finance these investments will be inadequate.
 - Fragmentation of health care IT creates positive externalities
 - Limited mental “shelf space” and clinical ambiguity creates negative externalities.
 - Given the surge in investments in health care IT and the attendant externalities, the role of public policy in guiding these investments should be an important area of future research.
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