

**TELEMEDICINE SPECIAL PROJECT GRANTS:
CONNECTING COMMUNITIES FOR BETTER HEALTH**



**HEALTH
INFORMATION
EXCHANGE: FROM
START UP TO
SUSTAINABILITY**

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Final Report

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eHEALTH INITIATIVE
Real Solutions, Better Health

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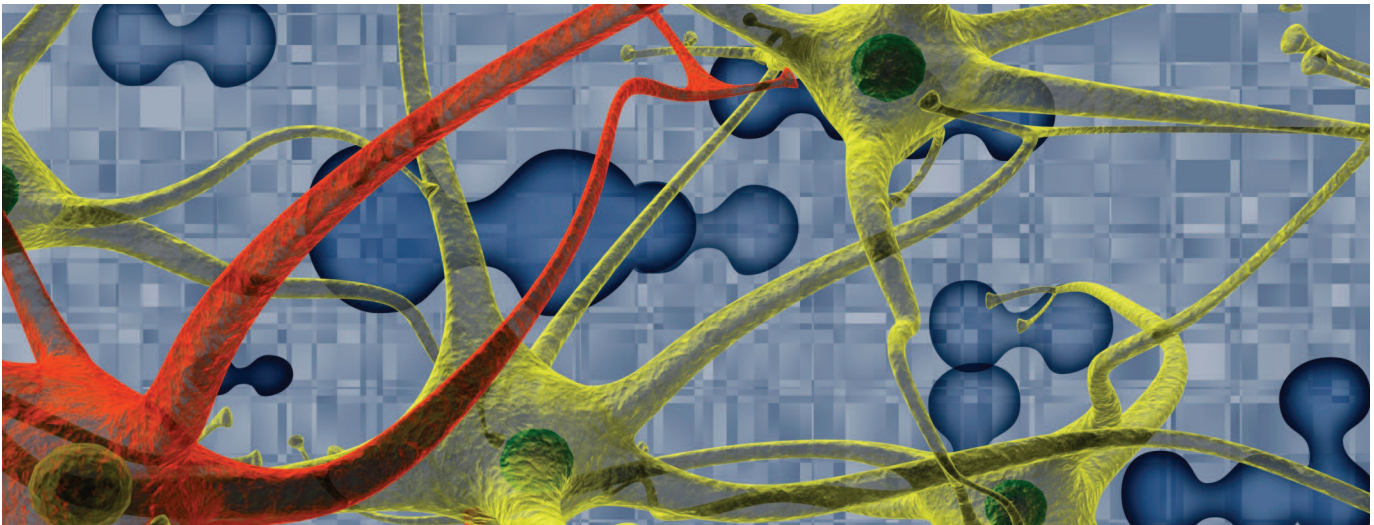


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1.0 PREFACE

AMERICA'S HIE OPPORTUNITY

There is no silver bullet for achieving sustainability in health information exchange. As much as we would like to report a spectacular finding that eluded all others investigating the question of sustainability, it became more and more apparent as we moved through our observations that smooth and simple glide paths do not exist. In fact, as we made progress through the various components of our research, the difficulty of America's quest to build a Nationwide Health Information Network (NHIN) only made itself more manifest. Despite the many benefits that would certainly accrue from attaining a fully interoperable system of exchanging health care data, sustainability still faces an uphill battle: The embedded infrastructure resulting from over 70 years of third-party, fee-for-service insurance has yielded a fragmented delivery system whose competitive instincts and insular self interests foment little demand for, and much institutional resistance to, interoperable exchange. No matter how advantageous to patients it might be.

That said, however, we have come to the conclusion that Health Information Exchange (HIE) can be sustainable, and that an NHIN is possible. But neither will be easy. And as much as many would like, government cannot will it into existence; the private sector cannot wish it into existence. The answer lies in good old-fashioned business smarts and hard work, i.e., changing people's minds on the ground, at the very institutions in which they work, one locality at a time, by dedicated teams of HIE professionals armed with the tools other industries have employed to make sound business case decisions. There are a number of lessons in this. First, the most direct answer to the problem of sustainability is that there is no real market demand for HIE (owing to the economics of the American health care system). Yet in some of the communities we have observed, success itself has bred nascent market demand where it had previously not existed. This means, ironically enough, that there is market demand, but most beneficiaries and stakeholders *are not yet aware of it*. It is hidden or latent within the system and must be teased out, one case at a time, as a matter of perception realignment and operational success. We refer to this as the Central Paradox of HIE Sustainability. That is, there is a compelling business argument for aligning self interests with common interests if a neutral, *trusted* third-party agent acts as a catalyst for change, uncovering new opportunities for value extraction. Well-run HIEs are that catalyst.

The second is related to the first. Many observers see HIE primarily as a non-profit, social utility enterprise having more to do with good works than entrepreneurial acumen; therefore, they reason, sustainability must rely upon community goodwill or government largesse. But the truth is that where success has occurred, it has come about precisely because HIE managers do not see themselves as philanthropic supervisors, but as strictly accountable business managers. This holds true regardless of non-profit status. They do not view community stakeholders as noble angels who should adopt HIE because of its high ends, but as customers whose self interests as businesses must be satisfied by a return on investment. And then they skillfully execute.

The third lesson is that while an NHIN may be the ultimate goal, its foundation is firmly grounded in the local efforts of grassroots organizations. The NHIN cannot be commanded from the top down. It can only be raised from the bottom up in a series of concatenated links, HIE by HIE, over time, as a function of incremental success. A recent unpublished Center for Information Technology Leadership (CITL) study with which we were involved demonstrated that costs to each HIE of linkage to a “network of networks” is minimal, hovering somewhere between \$.18 to \$2.67 per person covered in the HIE service area, for a cumulative deployment cost nationally of approximately \$166 million. While we cannot vouch for the absolute accuracy of the numbers, they are probably not far off, and it should be intuitively obvious that the bottom-up costs of building a thin NHIN are a bargain compared to some of the estimates given for a top-down federal initiative. To stay with the point, if some critical mass of Regional Health Information Organizations (RHIOs)/HIEs does not come into existence and find sustainability, there will be no NHIN. Period. It makes little sense, then, to add additional burdens on already cash-strapped RHIOs and HIEs to both comply with and “plug in” to a new federal infrastructure. It makes even less sense to erect new command and control barriers to creative innovation.

A fourth lesson, and one that seals the case for a bottom-up approach, is the need to build social capital (which will be discussed in greater detail). Before an HIE can even begin to think of operations, it must undertake the arduous task of realigning community interests and building a new “radius of trust” that encompasses the many and oftentimes complex mélange of preferences and competing priorities among multiple parties. In other words, constructing social capital paves the way for exchange. Every community is different, each with its own dialect and unique basket of considerations. It is hard enough for one community to achieve this, even when HIE leaders have the advantage of being intimately acquainted through personal relationships with stakeholders. Is it difficult to see how a set of federally commanded imperatives can unilaterally accomplish the myriad nuances of building social capital, community by community.

But further, consider this: In the social capital building phase for just one community, thousands of decisions have to be made, and they have to be made with little room for error within the narrow confines of multiple concerns. Once achieved, the human capital phase begins, requiring the mastery of whole new skill sets and technologies, and the execution of thousands of business decisions, again, with little room for error. Multiply that by hundreds of communities, each acting as a microcosm for experimentation, and the resulting product—with its incalculable permutations—overwhelms any probability that Washington might get things right. More likely, such a command and control attempt would meet resistance at almost every community level. If a national network for exchanging data on a fully interoperable basis is to become a reality, then it must be allowed to transpire almost as a result of organic evolution. Almost.

The federal government can and should play an active role. Chiefly, it must promulgate standards for data exchanges and privacy/security issues so that the transaction costs of linking health care providers on a local level, and on non-local levels, can be inexpensively coordinated by regional operators. Next (and this will take time), federal law and policymakers must review the negative impact Medicare/Medicaid reimbursement forms have on HIE/Health Information Technology (HIT)

adoption (let alone the negative impact they have on quality). Last, congress and state legislatures should grapple with the need for subsidizing RHIO/HIE start-ups and electronic health record adoption, and commit themselves to directed action, but understand that over-subsidization could be as damaging as no subsidies at all. To assist policymakers in the granting process, we have created a Risk Assessment tool that will aid governments in finding the “sweet spot” for balanced funding levels. There is no need to pump out large and never-ending amounts of cash subsidies to “sustain” HIE. At most, governments should act like public venture capitalists, providing staged start-up funds tied to specific performance obligations. Beyond that, HIEs must be expected to carry their own weight.

None of this will happen quickly; yet in the meantime, RHIOs and Health Information Exchanges are cropping up all over the land. They cannot wait for the larger macro issues to resolve themselves. It is to this short-term need that the balance of this report is dedicated; to wit, how sustainability can be established in a system riddled with institutional barriers and no easy solutions. Reaffirming what was earlier stated, the answer is based in solid business execution and building robust financials founded upon meaningful net present value calculations for the products and services any HIE wishes to offer, and cultivating management teams that can effectively execute. This could be especially important to linking federally qualified Community Health Clinics to HIEs operating in underserved areas, of which the Oregon Community Health Information Network is a good example.

In short, it is up to HIEs to create market demand, and it can be done. Further, one of our more surprising findings is the ability of pioneer RHIOs to “franchise” themselves into less mature communities. A franchise model would allow proven HIE platforms to rapidly capture new gains from both economies of scope and scale, and more importantly, accelerate the adoption of interoperable exchange at lower costs for start-up HIEs. Thus, franchising would fuel the transition from nominal Stage 1 Transaction Models, which are the norm today, to Stage 2 Infomediary Models, laying the foundation for a streamlined NHIN that will not require 20 years to build. It could be done in 10 or less.

The methods and tools that were formulated under this Cooperative Agreement were designed to help HIE managers forge sustainability through execution on sound business principles, and to keep them from having to return again and again to the public till. We believe that it is possible for HIE to become a net producer of social wealth, as opposed to a net drain, and set the stage for the transformation of health care delivery. To that end, we hope our efforts will be helpful.

Douglas W. Emery, MS
Principal Investigator
May, 2007

2.0 ACKNOWLEDGEMENTS

Health Information Exchange: From Start Up to Sustainability is the product of many talented and dedicated individuals who worked with great ardor and none too little passion to make this project possible. The Foundation for eHealth Initiative would like to take this opportunity to recognize these people and their specific contributions. First, we would like to thank Janet Marchibroda, CEO of eHealth Initiative and its Foundation, for originally conceptualizing the Connecting Communities for Better Health project and securing its funding. Francois de Brantes, COO of eHI, was particularly valuable in helping us negotiate the complex budgeting and administrative processes to bring this project to full completion. The Foundation for eHealth Initiative's Board of Directors played an instrumental role in identifying the challenges of and barriers to health information exchange, providing input to the goals and objectives of the contractual funding approaches for both the Period 1 and Period 2 contracts, and providing overall strategic input and guidance to the project.

The project was divided into two periods. In Period 1, seed funding contracts were awarded to nine communities to help them develop health information exchanges (HIEs), and allow us to disseminate their lessons learned along the way. Ann Barcome, MBA, was primarily responsible for managing these contracts, and, together with Bill Braithwaite, MD., PhD., was also responsible for much of the evaluation conducted related to Period 1 in this document. The Period 1 scope of work also included many elements related to the development of common principles, policies and tools and the dissemination of project outputs, through a combination of vehicles, including online resource center, learning forums, working groups, and hands-on technical assistance. Meryl Bloomrosen, Jennifer Covich Bordenick, Lammot du Pont, and Lori Evans all played a critical role in the Period I scope of work.

For the Period 2 work, it was decided that bringing in a small collection of industry “outsiders” who had expertise in economics, finance and system modeling was necessary to examine the issue of HIE sustainability—without also bringing along many of the biases that have accumulated over the past several years. José Blanco, PhD., CFO of Central Valley Fund, introduced the essential analytics used in private sector investment activities to bear on HIEs; the concepts of Marketing Risk, Operational Risk and Execution Risk were exported by Dr. Blanco into our model and are vital to the concept of HIE sustainability. Chris Fawson, PhD., professor of economics at Utah State University, developed the idea of Social/Human Capital and its application to HIE building as well as being the pivotal author behind the Analytical Framework used throughout the project. Edric Engert, MBA, President of Abraxeolus Consulting, devised the methodological approach behind the value calculation process, net present value analyses and business modeling; he always kept the group anchored in quantitative and logical rigor. Guy D’Andrea, MBA, President of Discern Consulting, worked ceaselessly to build the initial methods into useable tools and, together with Sean Ziegler, found a way to modify the Market Readiness Assessment Tool so that it could measure the amount of Social Capital in any given community. Seth Foldy, MD, MPH, Associate Clinical Professor, Medical College of Wisconsin, and Principal at Health.eVolution Consulting, kept us rooted in clinical reality and also provided an in-depth understanding of the necessary HIE structural issues impinging on the practice of medicine; his work on secondary uses of data generated from HIE and public health were particularly insightful. John Mellin, MBA, assembled the interactive business plan pro forma, and despite some trying circumstances, came through like a real champ.

The project benefited from an Advisory Board of industry insiders who acted as a reality check on the internal work. The Board was composed of Holt Anderson, Carol Diamond, Tom Fritz, John Glaser, Richard Hillestad, George Isham, Barbara Johnston, Jeffrey Kang, Alan Korn, Ron Peele, Russ Ricci, Bill Schroth, Martine Sepulveda, and James Walker. They made many suggestions that forced us to rethink certain aspects of the overall evaluation.

One of the primary research objectives of this project in Period 2 was to take a deep dive into at least three HIEs that have distinguished themselves as pioneers in the new industry, and were managed by individuals whose vision and expertise on the subject are unmatched. The three HIEs that were awarded contracts to collaborate in this evaluation were HealthBridge, Cincinnati, OH; the Indiana Health Information Exchange (IHIE), Indianapolis, IN; and THINC RHIO/MedAllies, Fishkill, NY. We would particularly like to express our gratitude to the leadership of the three respective HIEs – Robert Steffel and Keith Hepp, CPA of HealthBridge; J. Marc Overhage, MD, PhD of Indiana Health Information Exchange; and John Blair, MD of THINC/RHIO and MedAllies and their staffs, for making indispensable contributions to our effort. They not only produced a great deal of material for the project, they spent many hours vetting our concepts and tools, making them a far better product than they would have been otherwise. Although we benefited mightily from their collaboration, we wish in no way to infer that they agree with all the positions we have taken (same for the Advisory Board), nor do we want to state that they think all the tools we have created from this project are perfect. There still remains much work and field testing to be done.

For special technical work, the contributions of Michael Pine, MD, MBA, and John Williams, MD, MBA, cannot go unmentioned. Dr. Pine delivered a masterful piece on episode pricing and the need for clinical data provided by health information exchange to accurately measure and risk-adjust the content of care, as did Dr. Williams, who drove home the point of claims data requiring the complementary use of clinical data to defensibly power pay-for-performance.

Recognition also must go to the eHI staff and the Booz Allen Hamilton (BAH) project management team involved in this project. Donny Gonzalez and Rachel Hoelt were extremely helpful with the administrative minutia that daily governed a very complex grant. Leah Secunda kept a vigilant eye on the numbers, and Ann Barcome ushered the details of compliance in a way that made things run far more smoothly. We are very grateful to Harold Willis, BAH, who often went well beyond the call of duty to make sure deliverable schedules were met and timelines did not get scrambled. Noteworthy too was Bob Conte's technical editing and John Milano's graphics and layout work.

Finally, we wish to acknowledge and thank the Office of Advanced Telehealth/Health Resources and Services Administration for sponsoring this evaluation and making it a genuinely collaborative effort. Dr. Dena Puskin and LCDR Kathleen Manning were especially helpful in aiding our thinking on the substance of this work and how it should be presented. They were very open to our suggestions for work plan modifications as new features and insights cropped up, and truly held our feet to the fire.

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CHAPTER 3

EXECUTIVE SUMMARY

President Bush has called on all health care providers to adopt Electronic Health Records (EHRs) for every American by the year 2014. Toward this end, the President established the Office of National Coordinator for Health Information Technology. Its purpose is to oversee the establishment of a Nationwide Health Information Network (NHIN) that would link all EHRs to a network of fully interoperable health information exchanges (HIEs).

However, for the NHIN to materialize, a critical mass of HIE sub-networks must first emerge and achieve financial sustainability. This work focuses on the path to sustainability for first-generation HIEs, leading to the establishment of the NHIN and, ultimately, a fundamental transformation of American health care.

The Economic Problem of Health Information Exchange

Everyone can agree that the provision of excellent medical care is highly dependent on sound information. So why doesn't the U.S. health care system look like other sophisticated industries that have electronically transformed themselves? Even worse, why is it so stubbornly archaic?

The answer is simple: The economics of our health care system militate against the mobilization of interoperable data where it is needed most – at the point of care. Chiefly, the manner in which we reimburse care transforms clinical information into institutionally self-interested and fragmented information streams. These streams are controlled by non-aligned health care corporations that have little financial interest in cross-institutional data. Monetary and information asymmetries give payers and providers powerful incentives to silo information, despite the negative impact on patient care. Forsaking innovation on the frontiers of information science and reimbursement reform will only ensure that asymmetries and opacity continue to dominate health care production and consumption.

Because most reimbursements are made on a fee-for-service or capitation basis (which relate poorly to clinical reality from the patient's point of view), no pricing mechanisms exist to underpin a market for interoperable health data exchange. As a result, organizations designed to mobilize health data and correct opacities, such as HIEs or Regional Health Information Organizations (RHIO), are starved for revenues to pay down the costs of technology that make interoperability possible.

In today's environment, HIEs have little access to traditional start-up funding, and must rely on public/philanthropic grants and small advances. To the extent that business cases have been made, they have centered on transaction efficiencies that answer to stakeholder interests. Thus, HIEs face an economic dilemma. They must create a transaction-efficiency market that depends on highly local networks of trust and altruism, but yields only modest revenues based on barely progressive status quo efficiencies – hardly a transformation of the American delivery system.

Against these odds, successful HIEs have devised micro-economic stimuli for providers to participate in exchange activities. Examples include HealthBridge, THINC, RHIO and the Indiana Health Information Exchange. These exchanges reduce administrative costs for hospitals, labs, physicians and others. As a result, providers have realized internal cost savings that more than offset the associated costs.

How Health Information Exchanges Can Create Value

Our research leads to four observations about value creation in health information exchange.

First, stakeholder goodwill, or “social capital,” is the primary foundation for an HIE. All groups exhibiting social capital have worked hard to build a radius of trust, so that individual stakeholders come to embody the same cooperative norms. A belief and trust in the value potential, safety and governance of health information exchange among the relevant community of stakeholders is the essential element of success.

HIEs necessarily bring together a diverse set of economic actors. Perceptions of ulterior motives undermine the capacity to create trust within the community, and thus “poison the well” for social capital formation. Against this backdrop, social capital facilitates information sharing, collective action and decision-making through established roles and networks. In most cases, the founders of HIEs must exert tremendous energy aligning the interests of stakeholders to a mutual vision of the potential benefits of collaboration. The need to build new “communitarian markets of trust” sets these enterprises apart from traditional business start-ups.

Second, value in human capital enables the HIE. People drive the process. Because technology diffuses within market systems over time, social institutions must align to create new forms of human capital that facilitate the operations of exchange. As venture capitalists say, a great idea is important, a viable business plan is necessary, but the decision to disburse funds is ultimately based on the people involved in managing the enterprise and executing the strategy. The short-term pathway to sustainability rests squarely on HIE executives to skillfully manage capital.

Third, value in HIE functionality may evolve dynamically. Above, we referred to exchanges that are transactional in scope. We will call these *Stage 1 Transaction Models*. The HIE succeeds by creating a platform of valued information that facilitates stakeholder decisions toward improved clinical efficiency, increased service quality and administrative efficiency. In turn, this information exchange, and the new forms of human capital within it, acts as an incubator for dynamic evolution in the market for information. This evolutionary process opens up value creation opportunities that are obscure within the current market structure. As HIEs, providers, hospitals and public and private payers act on these opportunities, the ways in which value is accounted for will change radically.

Fourth, HIEs grow more valuable as they become agents of market transformation.

Consider a higher prize—a *Stage 2 Infomediary Model* that is not merely transactional, but truly transformational in character and impact. Such Stage 2 value accrues from aggregated patient care data that is sought not only by providers, but also by other data users not actually touching the patient.

If HIEs are allowed to advance free of the government restrictions and interventions that protect today’s power asymmetries, the evolution of the exchange and the geographical diffusion of Health Information Technology (HIT) will fundamentally alter the structure of health care markets. These market transformations will lead to a more efficient allocation of our scarce health care resources. Some examples include precise outcomes reporting, improved quality of care, episode of care pricing, lateral integration of specialized care teams, cost transparency and ultimately, a new science in our understanding of how technology, providers and patients interact – something very poorly understood today.

In short, the transformation of American health care.

If a Community Wishes to Invest in HIE, What Models Are Available?

There are two models available for realizing an HIE.

Model 1: Integral Corporation. This is the *de novo*, or custom-build, option. This decision must either derive from expectations of superior performance in a locally developed system, or a desire to address unique local priorities for which proven, scalable and transferable technologies have not been developed. However cost, development time and architectural and content considerations will likely steer nascent HIE communities away from this option. As technology and standards mature, there will be fewer communities for whom the Integral Corporation is advantageous.

Model 2: Franchising. We coin the term “franchising” for the emerging and more promising format for future HIEs. Successful pioneer HIEs may sell their experience, expertise and technology to emerging exchange communities, providing the franchisee with an established model and complete plan for all aspects of operating the business. HIEs may be attracted to the franchise model for its proven success, established technology and management, faster time to market, training and support resources, lower capital requirements, patents, trademarks and many other important reasons.

Where Might the Convergence Occur toward the NHIN?

In considering the national agenda of an interoperable NHIN, an attempt to patch together *de novo* exchanges into a single national solution would run into insurmountable complexities. Our study suggests that hundreds of independent HIEs achieving sustainability as a precursor to an NHIN is highly unlikely. Even if a majority could survive organically, they may not achieve the accelerated development or underlying stability required to sustain a national network. With several hundred sub-networks in place, a viable national superstructure would need a high degree of sophistication to provide true interoperability.

In contrast, a small number of franchisers plugging into a national network will greatly reduce this complexity, and have the advantage of an installed base of standards and interoperability. Once the various HIE expansions from pioneer communities to franchisee communities reach critical mass, standardization among a handful of scaled out models—as opposed to many hundreds—could occur, leading to a single national exchange.

We argue that the pathway to an NHIN lies in the wake of community-based HIEs organizing around medical trading areas (MTAs), finding creative revenue models and developing new social capital that reshapes the configuration of health care institutions. We emphasize the importance of business planning disciplines and recommend the franchise model as a way forward.

A Framework for Progress with HIE

To date, only a handful of HIEs have accomplished their functional promise. When they have done so, their dominant model contains Stage 1 Transaction Models that link sectors of a local health care economy (hospitals, physicians, labs, etc.).

Unless local HIEs evolve throughout the nation as precursors to wide-scale exchange, an NHIN is unthinkable. And unless there is sufficient interoperability to enable the added value from Stage 2 Infomediaries, an NHIN will underperform its potential. It follows that developing interoperability on a national scale requires replicating proven Stage 1 Transaction Models, and making possible Stage 2 Infomediaries that capture the potential of aggregated patient care data.

To realize the full potential of health information exchange, several strategies must work together.

First, the universal adoption of electronic medical records will be a big step in enabling clinicians to both access data from and import data into HIE. Continued failure to encourage adoption in all provider settings, including small physician practices, will hamper the ability of data exchange to reduce waste and inefficiencies and create higher-quality health care.

Second, if health care payers provide incentives to adopt health information technology and use information that currently resides across the health care system. Bridges To Excellence has observed that physicians who are eligible for financial rewards engage in practice transformations that are commensurate to the financial benefits offered.

Third, progress will accelerate if HIEs migrate to the role of Infomediary. Today, providers are the primary customers for HIEs. But when HIEs operate as valued health care information intermediaries, five additional customer categories could be recruited: researchers, public health agencies, pharmaceutical and medical device/technology manufacturers, payers and third-party application vendors. HIEs that can establish themselves as infomediaries for their communities could increase their revenue base to a level where non-provider customers would pay most of the costs of managing the exchange. As a result, the transaction (or subscription) costs paid by participating providers could be reduced or eliminated.

Fourth, it is impossible to talk about sustainable HIE without discussing macro reform in U.S. health care. The Institute of Medicine labels the current payment system “toxic,” and long-term sustainability of HIE rests squarely in reimbursement reform. One way to reform the system so that incentives align toward adopting health information technology is to reimburse care on a fixed budget that compensates episodes of care. Episodes of care are the complete sequence of interactions between a patient and providers resulting in a defined clinical objective, and, as such, represent the socioeconomic reality of care *from the patient’s point of view*.

The purpose of pricing episodes of care is to create an upfront, transparent price on clinically homogeneous pathways, whether acute or chronic, so that: (1) patients have a measure of the cost of medical treatments; (2) providers have an incentive to organize treatments around clinical care paths; (3) plans can measure the cost and effectiveness of integrated care teams; (4) risk-based contracting erodes fee-for-service purchasing; (5) patient and provider choice at the point of service becomes the engine of efficiency; and (6) interoperable health data exchange becomes the market norm.

With this, a powerful new incentive comes into play. Providers will have a profound interest in organizing as coordinated teams, not as current institutions but as disease-focused delivery systems. Also, individual service charge codes will disappear, subsumed as inputs to an overall production of care centering on the patient. Not only will incentives for better information take hold, but the budgetary discretion to invest in the technical means for appropriating better information will become available.

CHAPTER 6 THE ECONOMIC CHALLENGE OF HEALTH INFORMATION EXCHANGE

Introduction

In 2004, President Bush called for the widespread adoption of Electronic Health Records by the year 2014. Through Executive Order 13335, issued that same year, Bush established the Office of National Coordinator for Health Information Technology (ONCHIT) to oversee the establishment of a Nationwide Health Information Network (NHIN). More recently, the President signed another Executive Order, “Promoting Quality and Efficient Health Care in Federal Government Administered or Sponsored Health Care Programs,” to push federal purchasing efforts toward transparency in health care quality and price. All this Executive Branch activity reflects a larger national consensus that the current system of fragmented, opaque and paper-based delivery systems, combined with what the Institute of Medicine calls a “toxic payment system,” is no longer acceptable.

But how will this problem be solved?

Establishing new federal agencies and regulations helps to legitimize health information exchange (HIE). It underscores the need for progressive action at all levels, while promoting the development

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 institutions that
 control information not
 only lack incentives to
 invest in sharing it,
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 incentives to maintain
 the status quo.*

of standards. But if an NHIN is to be established to connect hundreds of local and regional sub-networks, don’t these sub-networks first need to be established and operating on a self-sustaining basis? And further, don’t these sub-networks need to achieve financial sustainability to the point that an NHIN can actually reach critical mass?

While the evolutionary path toward widespread dissemination of HIE technologies remains in question, the authors of this study believe that market forces are converging to catalyze solutions that seemed impossible just a few years ago. To make this case, we turn our analytical attention to the economic problem of sustaining Health Information Exchanges.

These will surely comprise the bulk of the foundational nodes feeding data into and receiving data from the envisioned NHIN. Even as we

write, hundreds of these organizations are ramping up, initiating operation or, in a small handful of cases, exchanging health care data on a sustainable basis.

However, this begs another fundamental question: If there is nearly universal agreement that fully interoperable digital health care data is a “good thing,” and will be of great benefit to all involved (especially patients), then why doesn’t it already exist? Why doesn’t the U.S. health care system look like other industries that have electronically transformed themselves? And, most importantly, why are the newly emerging HIEs, specifically designed to address this issue, having so much trouble obtaining start-up capital and gaining sustainable revenue from ongoing operations?

The answer is simple: The economics of the American health care system work strongly against the mobilization of interoperable data where it is most needed – at the point of care. The way we reimburse care transforms clinical information into complex and fragmented streams designed to flow through a non-aligned system of delivery institutions. This fragmentation process is controlled by

institutions that have little short-term financial interest in bearing the costs of sharing standardized data. Indeed, they have powerful incentives to preserve the market power imbedded in the status quo. Hence, there is no real market demand for information exchange.

Historical Context for the Economic Problem

The 1960s were seminal days in health services and economics research. Beginning with Kenneth Arrow's groundbreaking paper, "Uncertainty and the Welfare Economics of Medical Care,"

Health care consumes 1/7 of the nation's GDP; the lack of data on interactions between producers and consumers is a big reason why the system fails to return comparable value.

researchers and policy experts have grappled with the extreme information asymmetries of the health care industry.¹ These asymmetries exist when both producers and consumers act with vital pieces of information not uniformly obtainable throughout the marketplace. In the U.S. health care system, plans and providers have powerful incentives to silo information, and use asymmetries to gain profits over the actual value that might be produced in a transparent market. Conversely, these asymmetries can diminish parties whose actual production value is high, but whose institutional power is low. Even worse, asymmetries warp market information and introduce distortions and opacities that make value determination and optimal resource allocation almost impossible.

In "The Ecology of Medical Care," Kerr White attacked the same issue from a different angle. White argued that while large amounts of public funds had been spent on the science of studying disease and creating techniques to treat it, scant resources had been invested in creating a science for understanding the dynamics between patients and providers in the delivery marketplace.² White and his colleagues proposed creating a new unit of analysis to capture this information, "the natural history of the patient" (an idea inspired by the epidemiological concept, "the natural history of disease"). Jerry Solon extended the contextual framework in papers published in 1967 and 1969, creating the concept of an "episode of care," not only as a higher unit of analysis for health services research, but as a health services management tool, outcomes measurement standard and even as a basic unit of reimbursement.³

The common theme unifying this seminal research is the appalling lack of reliable information on the dynamic interactions between health care producers and consumers. It creates a shadowy archipelago composed of myriad corporate islands that zealously silo fragmented patient information for economic advantage. It's a major reason why our health care system swallows 1/7 of the total U.S. Gross Domestic Product (GDP), with abundant evidence showing that the nation receives nothing close to comparable value in return.

¹ Kenneth J. Arrow. "Uncertainty and the Welfare Economics of Medical Care." *The American Economic Review*. Vol. LIII, No. 5, pp. 941 – 973 (December 1963).

² White K.L., T.F. Williams and B.G. Greenberg. "The Ecology of Medical Care." *New England Journal of Medicine*. 265(18) pp. 885 – 892 (1961).

³ Solon, J.A., C.G. Shepps and S.S. Lee. "Delineating Patterns of Medical Care." *New England Journal of Medicine*. 50(9) pp. 1104 – 1113 (1967); Solon, J.A., et al. "Episodes of Medical Care: Nursing Students' Use of Medical Services." *American Journal of Public Health*. 59(5) pp. 401 – 408 (1969).

Many studies amply demonstrate that patient care remains uncoordinated; that billions of dollars are wasted on redundant duplications of tests and diagnostics; and that patients are far too frequently at risk of being harmed by the very system designed to help them – *all because the data on their past interactions are so difficult to obtain or transmit in an error-resistant electronic format.*⁴ The inevitable conclusion from the work of these authors, and many others since, is that without innovation on the frontier of information science that facilitates integrative information feedback loops, asymmetries and opacity will continue to distort American health care finance and production.

The Economic Realities of Financing a Regional Health Information Organization

Although it is never stated this way, HIEs are really forming as a response to system asymmetries. But, as noted earlier, the reimbursement mechanisms of American health care erect, and institutionally embed, a number of daunting obstacles. At the primary level, health care dollars are channeled through tax collections and private premiums into an uncoordinated system of public/private insurance pools. Once collected, premium dollars are then injected, like water through thousands of showerheads, into the delivery system archipelago. Because most health care reimbursements are made on a fee-for-service (FFS) basis through tens of thousands of CPT-4, ICD-9 Level 3, DRG and NDC codes—all institutionally biased toward different islands of the archipelago—only the slimmest margins are left over for capitalizing information exchange investments. And those margins are largely trapped within the confines of each island; there is practically no money for new entities like

Regional Health Information Organizations (RHIOs) to earn income from building bridges between them.

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Today, organizations maximize profits by maximizing volume, not value. And those that try to reengineer care systems to enhance value are financially harmed.

Because FFS bears little relationship to clinical reality and the value of health care delivery, no truly functional pricing mechanisms currently exist. Consequently, no incentives are in place to induce health care providers to clinically integrate through specialized episodes of care. In fact, under the current system, providers who try to reengineer care and optimize the total value of a care episode are financially harmed. As Leatherman et al. state in *The Business Case For Quality: Case Studies And An Analysis*, “Current payment mechanisms allow, and even reward, defective care because they are unable to reward future benefit.”⁵

FFS reimbursement fundamentally alters the dynamics of capital allocation. As a result, each island in the archipelago maximizes its profits not by maximizing value, but by maximizing volume in an institutionally fragmented production space. This precludes the evolution of budgetary horizons across episodes that would create both demand and capital for exchanging data. Thus, no substantive market exists for HIE products and services that would generate enough revenues to offset the large start-up costs needed to build technology hubs that make interoperable data possible. HIEs have little appeal to traditional investment or lending institutions; they are seen as too risky with meager rates of return. Therefore, they must rely on public/philanthropic grants or small stakeholder advances usually based on intuitive leaps of faith rather than meticulously reasoned business cases.

⁴ See the Institute of Medicine’s series of reports on the Quality of Care in America, www.iom.edu

⁵ S. Leatherman, et al. “The Business Case For Quality: Case Studies And An Analysis.” *Health Affairs*. 22 (2) pp.17 – 30 (2003).

To the extent that business cases have been made, they have been grounded in transaction efficiencies between providers sharing patient data (e.g., lab results) or electronic claims reimbursement between providers and plans. Thus, HIEs face a business dilemma: they are forced to create a transaction-efficiency market that depends on highly local and complex networks of trust/altruism, and yield only modest revenues. The transaction costs alone of forming these “communitarian markets of trust” place HIEs in a far more difficult position than general business start-ups. Then, to make

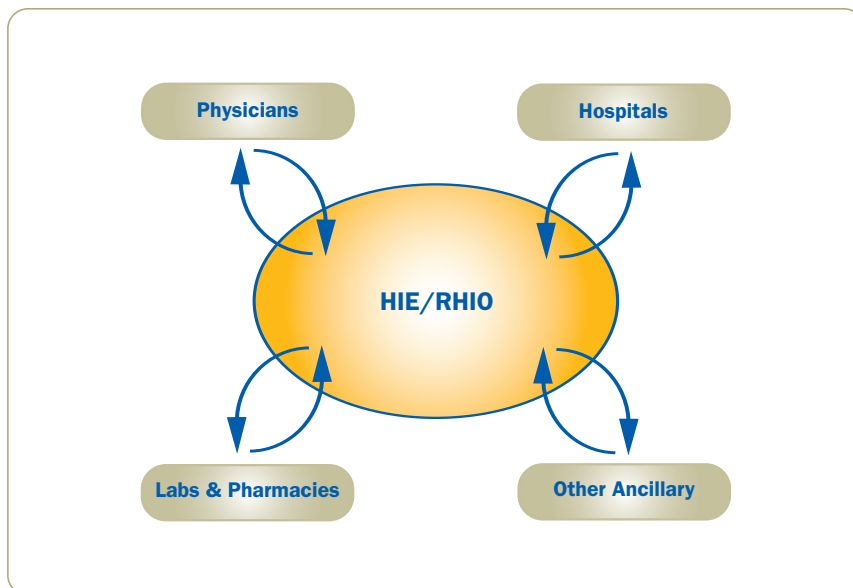
matters worse, modest returns on transaction efficiencies cannot amortize the investments needed to create large-scale, fully functional interoperability. And this reveals a terrible irony. Even though HIEs are indispensable precursors to interoperability, they face the same dilemma small and medium-sized physician practices face with electronic medical record system (EMR) adoption: the return on investment is dubious at best.

However, since the macroeconomic environment does not create a financial stimulus for this information to be shared, HIEs have devised microeconomic stimuli for providers to participate in data sharing and exchange activities. These stimuli can best be described as productive efficiencies; HIEs such as HealthBridge, THINC and the Indiana Health Information Exchange are good examples of how that model has been

built and sustained.⁶ Simply put, these exchanges reduce some administrative burden in data gathering for hospitals, labs, physicians and other local providers by creating a hub through which these data can be gathered and disseminated, as depicted in Figure 1.⁷

While indispensable to society, HIEs as business entities face tough odds: they require huge capital costs and lots of cooperation with competitors, with dubious short-term returns.

Figure 1



⁶In work conducted for the Agency for Health Care Research and Quality, RAND is creating a typology of efficiency in health care in which they describe the differences among productive, technical and allocative efficiency.

⁷deBrantes, et al. “The Potential for HIEs as Infomediaries.” Journal of Health Information Management. 21(1) pp. 69-75 (2007).

As a result of these administrative simplifications, providers that have participated in the exchange (either by paying a transaction fee or a subscription fee) have realized internal efficiencies that more than offset the associated costs. For example, from its inception to today, the New England Healthcare EDI Network has reduced the costs of administrative data transactions from \$5.00 to \$0.25 for participating organizations, bringing total transaction costs down from \$12.5 million a month to \$625,000.⁸ But while the value created is undeniable, it may have reached a point of diminishing returns, much like productive efficiency gains in other industries. Unless the scope of the transactions is expanded or the total number of participants is increased, the value will simply plateau.

While important, the net margin realized on these transactions may not be enough to amortize the capital cost needed to acquire the electronic medical record system needed to fully participate in an exchange. For small and medium-sized practices (typically less than five physicians), which constitute the majority of physician practices in the U.S., the acquisition of a fully functional EMR can cost up

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Most providers participating in HIEs are hospital systems and large practices that have already invested in information systems; for smaller groups, costs of entry are too daunting.

to \$15,000 to \$20,000 per physician for the initial investment, plus \$5,000 to \$10,000 per year in incremental investment.⁹ Adoption rates of EMRs in markets with functional HIEs have not been demonstrably higher than in other markets, which suggests that the HIE's production-based efficiencies have failed, by themselves, to motivate significant adoption of HIT. For the Indiana Health Information Exchange, the net reduction of transaction costs for participating providers is about \$0.50 per transaction. To fully amortize the capital investment in an EMR, each physician in a practice would need to realize these savings on at least 20,000 transactions a year. That's why current providers participating in HIEs are mainly hospital systems and large provider groups. They've typically invested in clinical information systems that include some

level of EMR functionality, and don't need a significant incremental capital investment to benefit from HIE-derived efficiencies.

Value Creation at the Point of Information Exchange

To understand how value is created through an information exchange process, it is necessary to start with a generalized framework that establishes the core institutional and market linkages between information "users" and "producers." The primary focus of the analytic framework (Chapter 7) is on the fundamental principles of market exchange. On one side of this process, individuals (and intermediaries who operate on their behalf) present themselves to markets as users, expecting to enhance their sense of well-being through an exchange process. On the other side, individuals and organizations arrive at the point of exchange with products and services they hope will appeal to users while also furthering their own individual (or collective) economic interest. It is in this context that the HIE network operates as an intermediary for facilitating mutually beneficial exchange – and thus creates value.

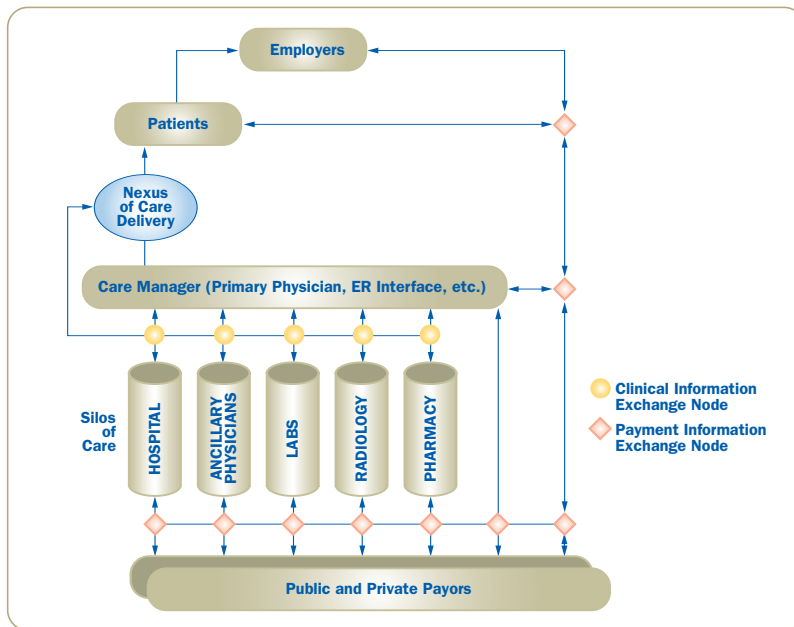
⁸ See the eHealth Initiative HRSA Funded Communities MA-SHARE Business Plan, <http://ehr.medigent.com/assets/collaborate/2006/03/02/eHI%20HRSA%20Funded%20Communities%202005-1220%20MA-SHARE%20Business%20Plan%202005.pdf>

⁹ See Center for Information Technology Leadership (CITL), www.citl.org; and RAND Research Brief, "Can HIT Lower Costs and Improve Quality", www.rand.org

To understand how an HIE fundamentally alters the exchange nexus, we start with a look at the status quo. Figure 2 below summarizes the current market and institutional context in which those who generate information and utilize information interact in the health care services market.

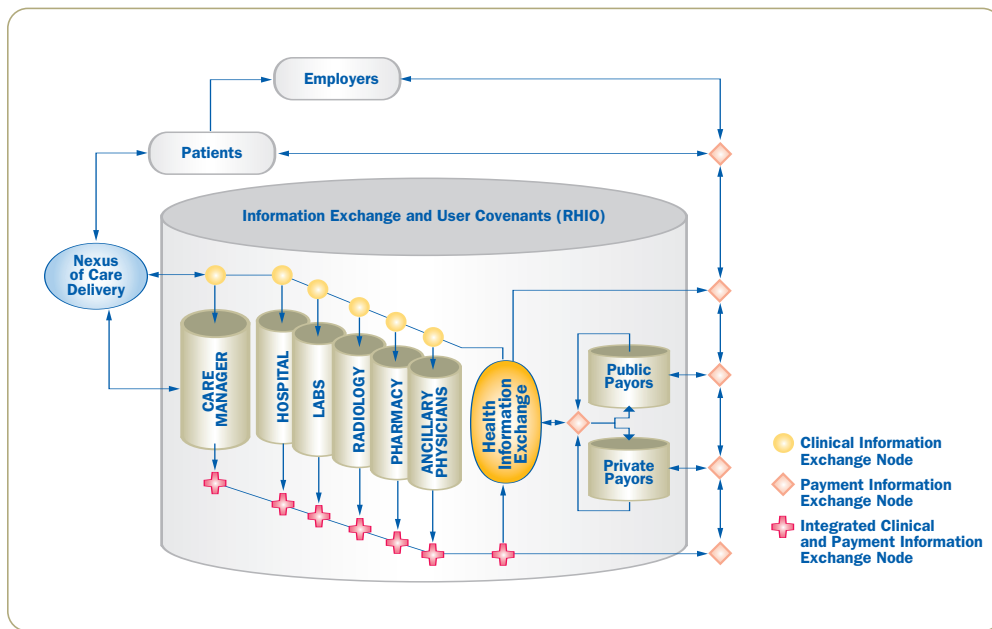
In the current communication stream, information has strategic value within each silo, but may never reach those who need it most – like the primary physician or primary care manager.

Figure 2



As shown here, clinical and payment information is identified with functionally separated silos of care. While each of the points at which service is provided can communicate directly with other points of service, the current communication stream is marked by high levels of friction, where information has strategic value within each silo of care. In some cases, the primary physician and/or primary care manager does not have the capacity to close the clinical protocol loop, since information skirts through lines of communication that do not include him or her. Conversely, the model of information creation, processing and dissemination under a generalized HIE framework is presented in Figure 3 below.

Figure 3



How the economic problems of health information exchange can be overcome: reform, redefine, reconceive.

In this case, efficiencies can be gained from a more robust information exchange network, as long as the exchange and use covenants do not restrict such value creation exchanges. In our model, users are defined as individuals and groups who have the potential to receive value by utilizing information that would be resident and/or accessible within the HIE network. Producers are defined as individuals and groups that have the potential to create information that will be of value to users, and have the capacity to

execute a plan to populate the HIE with granular data perceived to be relevant to health care service delivery.

Clearly there is another “producer” engaged in the HIE market—one who takes raw data and repackages it for sale to users who value processed data. An HIE system may choose to contract the role of information “processing” to a secondary party, it may arise spontaneously as part of an independent entrepreneurial activity or it may be done as part of the internal operation of the HIE. From a modeling perspective, we don’t distinguish among these various forms of data processing and dissemination—but rather argue that whatever form it takes can be encompassed within the set of HIE functionalities.

Structurally, one can view the HIE system as part of the health services market system as depicted in Figure 3. This demonstrates the value-producing market interfaces that are necessary to sustain the HIE organization. While the actual complexity of the market interface will vary, this format defines the core elements that create new value in the health care services marketplace.

At a very basic level, the HIE is a market-based entity that exists to facilitate more efficient exchange among the diverse set of participants in the health care services market. In the process, it creates further benefits by extending the capacity to extract value from a coordinated collection of data relevant to more efficient delivery and consumption of health care services.

Moving toward Stage 2 Infomediaries

To overcome the economic problem of health information exchange and realize its full potential, three strategies are essential:

- Fundamentally **reform** the reimbursement system so that the incentives for adopting health information technology (HIT) in general, and health information exchange in particular, reduce or eliminate the current financial and institutional barriers (Chapter 9)
- **Redefine** the role of HIEs as clinical data and information intermediaries (infomediaries) by expanding their customer base (Chapter 12)
- **Reconceive** the role of RHIOs not as local non-profits that build everything, *de novo*, needed for exchange, but as social capital generators that build the necessary trust relationships needed for health information exchange (Chapters 7, 8 and 12)

What follows is a theoretical, analytical and financial model of how this can be achieved. To do this we must explore the concepts of Social and Human Capital, because they are what ultimately allow us to distinguish between the definitional activities of a RHIO and those of an HIE.

CHAPTER 9 HEALTH INFORMATION EXCHANGE AND REIMBURSEMENT REFORM

NHIN or Local HIE: The Classic Chicken and Egg Dilemma

Today, the desirability of transforming the American health care system from a paper-based patchwork to a fully interoperable system of local and national data exchange is widely accepted. Yet the best way to do this in a sustainable manner remains elusive. Erecting a Nationwide Health Information Network (NHIN) is one proposed concept receiving a good deal of federal government attention. This would act as a foundational support for connecting hundreds of local, regional and national sub-networks (SNO) in an integrated national grid.

There are two main problems with this idea: timing and infrastructure. Unless hundreds of community Regional Health Information Organizations (RHIOs) or Health Information Exchanges (HIEs) find traction on a sustainable basis, there will be little information to exchange and integrate on national level. The path to an NHIN must be blazed by community-based health information exchanges organizing around natural medical trading spaces, adapting to unique community needs, finding creative revenue models and carving out new forms of social capital that reshape institutional arrangements. And this is only the first step toward building a foundation for the new types of human and technical capital that will make exchange possible.

Organizing a local HIE is an incredibly complex undertaking. It demands very sound business skills to manage the many moving parts of conflicting institutional interests. And it's discouraged by a reimbursement regime that impedes market demand for exchange and provides strong incentives to silo data within the walls of corporate territorialism.

Yet without many local HIEs evolving as precursors to wide scale exchange, an NHIN is unthinkable. Instead of beginning with an NHIN and debating several competing visions of its architecture, it

makes more sense to establish a common framework for national standards. This way, the many disparate HIEs and other subnational (SNO) entities can begin to communicate with each other without having to bear the incremental costs of building new interfaces with each new relationship.

At the same time, the reimbursement system must be reformed to incent all sectors of the health care economy to seek arbitrage opportunities through health data exchange. That's because health information exchange and reimbursement reform go hand in hand. Current payment modalities are toxic to efficient high-quality care, and they erect intense barriers to economic demand for health information exchange. As a result, reform policies must contemplate both simultaneously.

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 Because today's
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 for HIE, reform efforts
 must address
 both simultaneously.*

In the current environment, local HIEs face a kind of an economic “double whammy.” Because economic demand for their services is weak, they have little access to traditional start-up funds. Hence, returns on equity are both meager and highly risky. They are therefore left with the daunting task of generating new forms of social capital, or communitarian markets of trust, within their own local areas before they can even consider engaging in sustainable business operations. This can take years.

To date, only a handful of local HIEs have accomplished this feat, all due to unique conditions nearly impossible to replicate in other communities. Even after overcoming formidable obstacles, they can at best be considered Stage 1 Transaction models. That is, they reduce certain transaction costs for participating stakeholders, but are years away from reaching their full potential as transformational agents of care delivery. To do so, they must transition from Stage 1 models (with very limited sustainability potential) to Stage 2 Infomediary models that centrally connect all sectors of the local health care economy (plans, hospitals, physicians, labs, etc.). In other words, they are far from being able to aggregate patient care data for providers at the point of care, and for secondary uses on a national basis. And the sobering truth is that this must be accomplished dozens of times across the nation before an NHIN can even dream of going live.

RHIOs versus HIEs

Until now, we have examined the underpinnings of health information exchange in the context of current arrangements. That is, all three communities examined in this evaluation are Stage 1 Transaction models. But as noted in Chapter 6, there may be a natural ceiling precluding pure Stage 1 models from reaching the full potential of exchange. A revenue path that extends beyond local community settings would transcend the kinds of limitations Stage 1 models face. This means turning their activities from an inward community perspective to an outward national perspective, and transforming themselves from transaction models to information intermediaries, or infomediaries. These are defined as organizations that provide specialized information on behalf of producers of goods and services and their potential customers. We believe such a transformation is essential to large-scale sustainability.

As was noted in Chapter 4, we have tended to use the term “HIE” as both a noun and a verb, connoting both the activity of health information exchange and the organization conducting exchange, all the while acknowledging that many of these organizations and the people running them refer to them as “RHIOs.” But, again, for the purposes of our analysis we are making a distinction between them, while maintaining our preference for HIE. A RHIO can be defined as an organization whose chief objective is to bring disparate community leaders together around a vision of health data interoperability. By advocating the systemic improvements that result from fully mobilized patient data, they initiate a process of trust building, in which competing actors are brought into convergence. This process is almost wholly a social phenomenon, since status quo arrangements work against exchange, and embedded economics inhibit demand for it.

As momentum around the idea gathers energy, conversations lead to negotiations, and stakeholding leaders start making binding decisions on governance, mission statements, business plans, choices of applications or functionalities, privacy and security policies, management teams, financial

Today's RHIOs are driven by personalities representing diverse interests in unique community settings. Because each one has its own idiom of convergence, a RHIO is usually not replicable.

commitments and covenants. This is the hard work of building social capital. Its literal effect is to bend divergent institutional interests toward a point of convergence, a brand new market of trust that often functions more on faith than anything else.

The result of these hard-won efforts is a RHIO, usually a non-profit organization composed of influential stakeholders bound by covenants and vision. Its chief utility is political; it is the indispensable catalytic agent of change upon which all economic and technical exchange functions depend. Because it is driven by personalities representing diverse interests in unique community settings, each RHIO has its own idiom of convergence. Therefore, a RHIO, as a rule, is not replicable.

In contrast, HIE is what emerges from RHIO activities as social capital gives birth to human capital. Human capital is the specialized knowledge and skill sets, ranging from executive team business acumen to technology platforms, which make exchange possible. All RHIOs reaching this point are not only acting as catalytic agents of social capital, but also as incubators for whole new sets of skills and technology applications that constitute the means of exchange, from data hubs to edge system connectors.

This is the aspect of exchange that is so disruptive. People working within the new nexus of exchange must acquire novel skills to successfully leverage the new potential. Management must develop creative services and revenue models to support them, along with inventive applications of traditional finance and accounting disciplines. Technical staff must master vendor products, frequently reengineering them to suit community needs, and in turn be able to support and teach edge system users how to deploy the new functionalities. End users such as physician offices must alter workflow practices to leverage enhanced information flows.

It is the human capital side of the equation that makes mastery of Execution Risk, Operation Risk and Marketing Risk so vital to exchange sustainability. None of this is easy. But while the learning curve is steep, it is far more formulaic than the curve for social capital. Because human capital is what makes equity capital and technical capital work, it lends itself more readily to scale and replication.

Scalability

Here, then, comes an important insight. Because building social capital entails the transformation of institutional self-interest, it is very difficult to accomplish, very political in nature and very idiosyncratic. One small blip in the dialectic of convergence can derail the entire effort, especially early on. This is why charismatic leadership is observed in nearly every instance of successful RHIO building, and why the tapestry of trust is so varied from one community to the next. Like accents in the same language, each community has its own dialect. Erecting social capital is like managing a United Nations peace process among antagonistic nations, where leadership and diplomacy tend to go farther than business logic and a good ROI analysis.

Where RHIOs are local phenomena that cannot be exported, HIEs are highly exportable. A successful HIE platform can be easily marketed and scaled out to less mature RHIOs, because it is a proven process. This is key to understanding sustainability on a national level.

But human capital is more like a machine, and much more amenable to the standard configurations of business operation. Where RHIOs are local grassroots phenomena that cannot be exported, HIEs are highly exportable. Having been incubated in the supportive RHIO cradle, a successful HIE platform can be marketed and scaled out to other, less mature RHIOs because it is a tested and proven process. In other words, the transaction costs of scaling human capital are far lower than scaling social capital. This is critical to understanding sustainability on a national level.

At the moment, conventional wisdom seems to indicate that, for an NHIN to operate, it must subsist on the pushes and pulls of data across hundreds of *de novo* SNOs scattered across the nation. While we agree that a critical mass of these SNOs must be in place to make an NHIN viable, our analysis leads us to question the probability that hundreds of *de novo* SNOs/RHIOs/HIEs are going to rise from their community settings, find traction, successfully evolve as HIEs and

achieve sustainability as Stage 1 Transaction models.

While a dozen or maybe even several dozen may complete this arduous journey, a majority will likely fail. The only thing that can prevent it is the injection of massive federal and state subsidies to prop up poorly executed models. Setting aside the fact that such large sums of taxpayer money might not be available, over-subsidization could be as ruinous to value creation as under-subsidization. Either way, a large number of failures will stall momentum for change, and quite possibly return us to the CHIN experience of the 1990s.

But if we see RHIOs as performing one set of activities and HIEs another, a more plausible scenario emerges. What if a handful of pioneer RHIOs that have successfully navigated the transition from social vision to Stage 1 HIEs franchise themselves? We believe this would introduce an invigorating dynamic with a higher probability of success. Instead of myriad *de novo* RHIOs independently building everything from scratch – a very costly endeavor – it makes more sense for RHIOs to limit themselves to local social transformation and governance issues, and co-opt HIE solutions from pioneer organizations like IHIE, HealthBridge or MedAllies, as they seek to expand their entrepreneurial opportunities.

Indeed, in Hudson Valley, New York State, the community effort there has organized a non-profit governance initiative called THINC RHIO, and a for-profit sustainability arm called MedAllies, which functions as a Health Information Services Provider (HISP) operating the exchange. John Blair, CEO of MedAllies, hopes to export the HISP capabilities to other communities within the next two years or so. Without anointing any one organization or model, we believe this is the correct theoretical vision of sustainability. Many others are considering it; moreover, discussions with the leaders of these organizations have revealed a growing discomfort with the term RHIO as a general umbrella for all their activities.

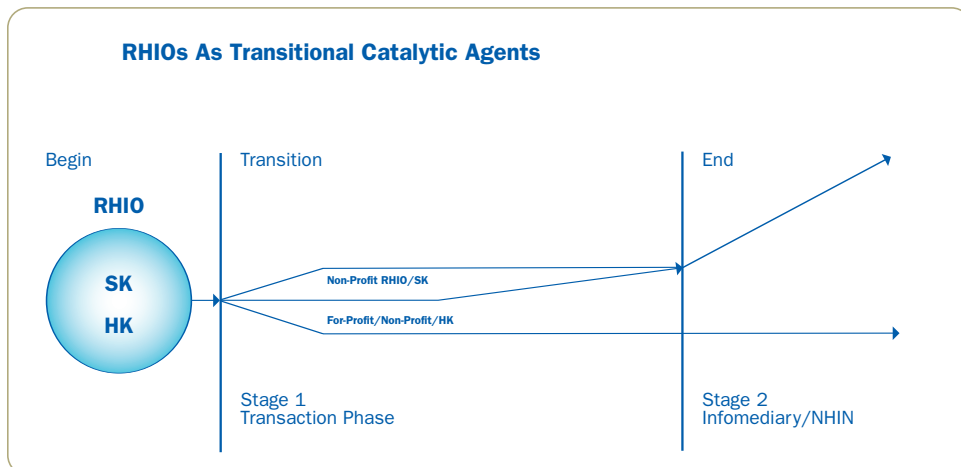
What if pioneer RHIOs that have successfully made the transition to Stage 1 HIEs franchised themselves? This could introduce an invigorating dynamic, reduce overall costs and increase the probability of success.

Regardless of nomenclature, however, there are a number of reasons why franchising makes sense. First, it would radically lower the cost for community RHIOs to acquire technology. Consider: The Delaware Health Care Commission’s Health Information Network awarded a six-year contract for up to \$24.5 million to Medicity of Salt Lake City to build a statewide health information exchange. Keith Hepp, CFO of HealthBridge, calculates that in this deal, the cost of acquiring the technology works out to something like \$5 to \$10 per person of the proposed Delaware RHIO coverage area. By comparison, the HealthBridge platform has weighted average transaction costs of roughly 12.5 cents per person, soon to merge on seven cents—a palpable difference. This is also an example of how large state subsidies can radically over-inflate the costs of technology

acquisition; news of these types of arrangements terrify the leaders of all three HIEs in this evaluation.

Second, the technology platforms acquired from pioneer HIEs are tested and proven, and nowhere near as “buggy” as *de novo* platforms. Third, franchises come with experienced management teams and field staff. Fourth, if a handful of pioneer HIEs could replicate themselves, say, 50 times over, a critical mass of HIEs would emerge, making a NHIN feasible much more quickly. Fifth, economies of scale would lower the need for large subsidies, and possibly make it cheap enough for rural communities to acquire HIE capabilities as satellites of wealthier urban sponsors. And sixth, the costs of adopting standardized interfaces with a NHIN would be greatly reduced.

Such a scenario opens another possibility. Again, assume the purpose of RHIOs is to generate the social capital needed to make exchange feasible. Once Stage 1 Transaction models make the transition to Stage 2 Infomediaries, the need for RHIOs dissipates and may even go away. As non-profits, RHIOs have the ability to seek grants and government subsidies. As a long-term strategy, however, this is a poor substitute for earned income. HIEs, in comparison, are naturals as for-profit corporations, and their ability to attract private sector investment capital makes them perfect candidates as expansionary infomediaries. The question, therefore, is how best to move toward Stage 2 Infomediaries.



Provide Incentives that Create Demand for HIE

In most industries, economic agents are constantly encouraged to improve the value of their services and products by a market that rewards these efforts with greater revenue. This principle holds true in health care as well, according to experiments conducted by Bridges To Excellence (BTE). In several markets, BTE has observed that physicians and practices eligible for financial rewards will transform certain areas of their practices, commensurate with the financial benefits they are eligible to earn. In other words, if payers reward providers that deliver higher-value health care services, they can potentially motivate providers to improve their processes and outcomes.

For example, payers could base their reward programs on performance reported and achieved by physicians. They could give special rewards to those using electronic medical records (EMRs) that have been certified by the newly created Certification Commission for Health Information Technology, and are compliant with HITSP (Health Information Technology Standards Panel) and actively participating in an HIE. In addition, those with EMRs plugged into HIEs could receive their rewards much faster than those using manual processes, due to their ability to report their data continuously. And those without EMRs may find it increasingly difficult to achieve the same level of performance as those with EMRs.

If payers designed community-wide programs that tied 5%-10% of a physician's income to the quality of care delivered, there would be significant incentives for that physician to adopt the systems of care necessary to achieve stated goals.

Furthermore, focusing reward programs on clinical outcome and process measures would benefit the adoption and use of EMRs as a means to connect to the HIE and participate in the coordination of care with other providers. For example, the reduction of blood pressure and lipid levels in patients with congestive heart failure can require coordination among many primary and specialty caregivers. This may be greatly facilitated through the HIE. If payers designed community-wide programs that tied 5%-10% of a physician's income to the quality of care delivered, there would be significant incentives for that physician to adopt the systems of care necessary to achieve stated goals.

Payment Reform and Market Structure

The analytical framework for an economic theory of sustainable health information exchange begins with one central observation: There is no viable price system in the marketplace for health care delivery. At the point where consumers, as patients, seek care, there is no sustained mechanism to rationally tell them what specific treatments will cost and what value will be rendered. This holds true for all institutional actors in the health care economy. Seventy years of third-party, fee-for-service (FFS) reimbursement have created a delivery system that is opaque, riddled with information asymmetries, structurally fragmented and devoid of a rational pricing system like that of every other functioning marketplace.

The distortions reflected in health care service market institutions are deeply embedded within the institutions of American health care, and directly affect the question of economically sustainable data exchange. We start with an attempt to characterize the multi-faceted and fractured nature of health care service markets as they are currently configured.

The Single “Marketplace” Myth

For years, various health care reform movements, whether universal single-payer concepts, Managed Competition or Consumer Directed Health Plans, have all begun with a misconceived assumption.

Namely, their advocates believed that if we reform the payment platforms reflected in various forms of health insurance, we can solve the structural market imbalances that perpetuate resource misallocation in the health care services market.

There are really two health care marketplaces: the Ex Ante Marketplace for benefits, and the Ex Post Marketplace for medical delivery. While certainly intertwined, they require radically different solution sets.

While “reforming” inefficiencies in the health insurance market will certainly alter the way insurance products interface with the actual delivery of health care services, it does not solve the basic problems caused by the lack of an operating price mechanism in the market for the delivery of health care services. A bias toward reform in insurance markets saturates all levels of policy thinking. In reality, there is not one marketplace in health care, but two: the Ex Ante Marketplace for health care benefits, and the Ex Post Marketplace for medical delivery. While both markets are definitely intertwined and reflect on one another, they require radically different solution sets.

The Problem of Risk in Health care

For nearly 40 years, economists have noted that the traditional third-party, cost-plus system of medical benefits reimbursement leaves both producers and consumers with the perception of a virtually risk-free environment. This enables all parties to consume and produce without regard to cost/benefit consciousness. Orthodox managed care theorists picked up on this economic truth and proposed a solution which either fully integrated the functions of insurance with medical delivery (in Health Maintenance Organizations [HMOs]), or delegated some portion of a health plan’s premium budget to subsets of providers on a fixed, per-member, per-month basis.

Sustainable HIE has power to address cost and outcome risks for all stakeholders in the American health system. By offering powerful new streams of information, HIE can also support the design of marketable risk-management products.

A major problem with these approaches is that they gloss over the true nature of risk. Different economic activities produce different types of risk, and they must be recognized and institutionally allocated as such. A second problem is that these arrangements often make medical providers and their patients adversaries in the provision of desired services. Patients bear little or no personal economic burden when demanding more services, and both parties lack transparent information on the costs and benefits of services. However, our ultimate conclusion on the issue of sustainability in HIE ultimately resides in its power to address risks (related to both costs and health outcomes) for all stakeholders in the American health system. By making available powerful new streams of information, HIE has potential to add significant value in the design of marketable risk-management products.

The Need for New Feedback Loops²⁹

That the health care service delivery marketplace is opaque and distorted is hardly a new observation. But to look further into the problem, we need to answer a fundamental question: What is the social/economic reality of modern health care? What basic unit of analysis, when rolled up into statistically significant populations, can reveal the most useful and actionable form of information?

To fully leverage the potential of markets to allocate resources efficiently, this unit of analysis must reflect a consumer-centric orientation. It also must facilitate an information generation and dissemination mechanism that supports the grinding forces of Shumpeter's "creative destruction" in bringing increased sensitivity to the core demands of consumers at the nexus of exchange in the health care services market.

While many forces increase the responsiveness of service providers to the needs of their patients and consumers, we believe the primary unit of analysis should be the episode of care. This is an analytical

concept developed in the late 1960s specifically to address opacity in the medical delivery marketplace. Episode analysis is compelling because it makes the patient, moving in pursuit of clinical objectives, the basic unit of observation in the marketplace.

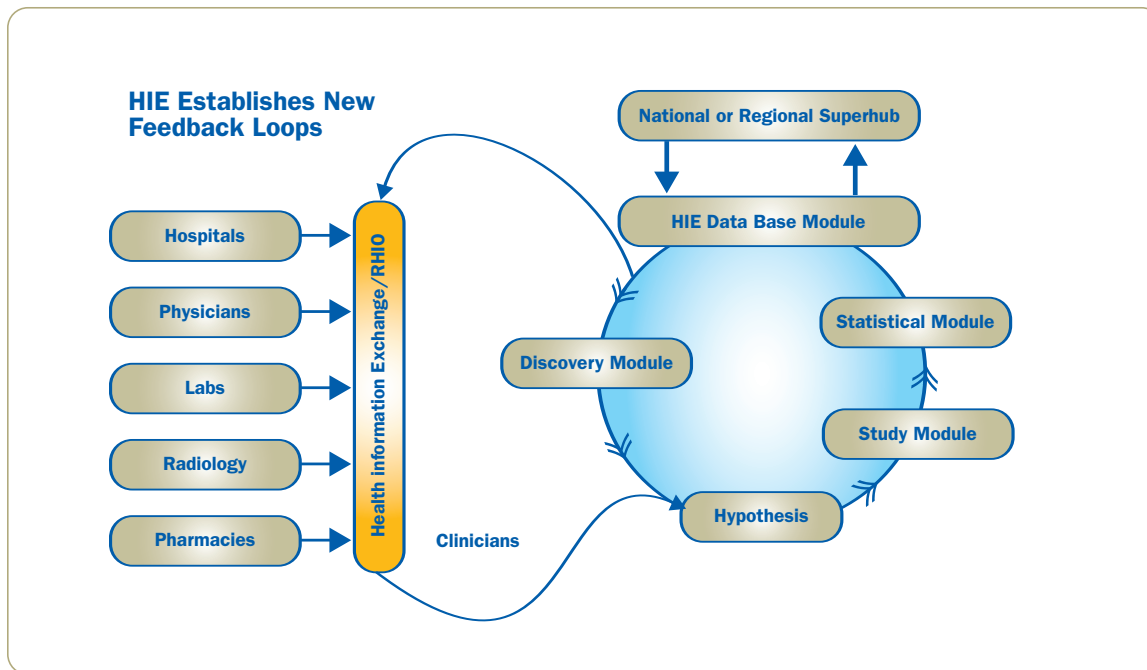
Most forms of episode of care analysis today are not fully persuasive because they rely on claims-related (HCFA-1500 and UB-92) data populated with CPT-4/ICD-9-CM codes. These fail to include the clinical information that helps define the circumstances and benefits of care. They are also generated in the pursuit of maximizing income. Thus, they communicate opportunities for strategic behaviors that "game" the market in a variety of ways – and ultimately serve to reduce market efficiency and effectiveness in the delivery of health care services.

HIE has the potential to provide far more granular and clinically relevant data than claims data, and to do so more cheaply and reliably

than specialized research studies. Therefore, the sustainability of HIE lies in its ability to unlock access to value imbedded in streams of patient-centered data. In this context, patient-centered information feedback loops will unveil opportunities for participants in the value-creation marketplace, catalyze opportunities for efficiency gains and lend increased value to the delivery of health care services. The following figure represents how these new feedback loops can transport Ex Post Market data through the entire system. We will soon discuss these feedback loops further. But first we must explore the true nature of health care markets and the three major forms of institutional risk that govern them: probability risk, technical risk and choice-utility risk. Understanding these dynamics yields the key to sustainability in health information exchange.

HIE can provide data that's far more granular and clinically relevant than claims data – and do it more cheaply and reliably. Therefore, the sustainability of HIE lies in its ability to unlock value imbedded in streams of patient-centered data.

²⁹ de Brantes, et al. "The Potential for HIEs as Infomediaries." Journal of Health Information Management. 21(1) pp. 69-75 (2007).



A Framework for Understanding the Barriers to Sustaining HIE Functionality within Health Care Markets

Patients, as consumers, are at the center of our analysis. In this regard, our proposed view of the health care services market is at odds with the predominant form of inquiry, which places various third-party payers at the center of the “consumer/producer” exchange nexus. Because this payer-

centric modeling construct dominates nearly all market-oriented health care reform dialog, policy makers and patients have been led to assume that a competitive market exists in health care, so long as there is competition for the purchase of health insurance.

While these constructs have contributed much to illuminate the American market for health care insurance, their analyses fail to recognize that purchasing health insurance and purchasing health care are fundamentally different activities. Moreover, it’s a gross simplification to assume that a competitive market for health care follows naturally in the wake of competition for health insurance, as the past 30 years of reform experience show. Thus, a credible theory must reject this one-dimensional analysis so common in health care research and policy creation.

As mentioned, there are at least three unrelated types of risk within the broadly defined health care market: probability risk, technical risk and choice-utility risk. To advance a theoretical foundation for HIE sustainability, our market assessment starts with a careful inquiry into each form of risk. This sets our line of investigation along a path very different from that of underlying orthodox managed care and single-payer theories.

Purchasing health insurance and purchasing health care are fundamentally different activities. A competitive market for the first does not naturally lead to a competitive market for the second.

A critique of any theory that relies solely on health insurance reform must begin by asserting that it is impossible for society to optimally buy health care goods and services solely through the market for insurance, whether private or public. A market must exist apart from the functions of insurance to allocate scarce resources, based on pricing and information sets that work within the structure of institutions that actually deliver health care services to patients. Let's start with a microeconomic interpretation of the functions of insurance.

In an environment of uncertainty, a person lives with a bundle of assets for which he or she can expect some utility or level of satisfaction, derived from the probability of various future events occurring. For example, in one scenario, a homeowner expects to enjoy the services of a vacation house in retirement. Or, in the event of some catastrophic health care episode, the owner can sell the house to pay the hospital bills. Ex Ante, or before either of those states occurs, that person has no way of knowing which scenario will prevail. Since most people are risk-averse, it is reasonable to conclude that this person would sacrifice some percentage of assets now to buy assurance that, no matter which scenario unfolds, he or she can count on enjoying the benefits of her vacation house well into the future.

Formal economic models show how the quantity of insurance an individual purchases is determined by the subjective values placed upon potential loss from adverse events. This decision is weighted by the probability of these events occurring, and the prices for insurance products as revealed through the interaction of forces of supply and demand. At a competitive equilibrium, the risk-averse individual purchases all the claims he or she desires at the market price.

In this context, the price mechanism for contingent claims to uncertain states of the world allocates risk efficiently between those who want to purchase claims and those who want to sell them. In non-economic terms, people purchase insurance and incur a small certain loss today to ensure they will be protected from a large uncertain loss tomorrow. That is, we sacrifice some predictable level of consumption today to enjoy a guaranteed level of consumption tomorrow, regardless of whether the good state or the bad state of affairs occurs Ex Post. Therefore, the only economic commodity people can efficiently purchase through insurance is peace of mind that their assets are protected. Nothing more, nothing less.

Most health care reform proposals limit their focus to the market for health insurance. They claim to

Insurance can never operate as a surrogate market for the pricing and efficient allocation of health care services. It can only purchase peace of mind for those who buy it, and increase the economic well-being of those who sell it.

have solved the health care problem if their proposal induces an efficient market solution in the Ex Ante Market, as if health insurance is the price of health care. But for that to be true, the premium would have to exactly equal the cost of each individual's medical consumption, which is never true. And if it were, it would not be insurance.

Of course, the actual way in which insurance is priced and provided is much more complex than the analysis above. This is due to inefficiencies and market failures that exist in that marketplace. But even so, the fundamental principles of market behavior and the resulting insight hold true. Insurance can never operate as a surrogate market for the pricing and efficient allocation of health care services. It can only purchase the peace of mind of those who buy it, and increase the economic well-being of those who provide it. For some, this is

clearly manifest in the observation that, over time, cost shifting and risk segregation have become the major activities of health insurance systems. Neither has much to do with the efficient provision of health services and risk management of stable populations.

The appropriate role for insurance is to mitigate the risk exposure of a broad-based population that faces future states of uncertainty regarding health care needs. When insurance is used as the payment mechanism for certain health events (like annual check-ups); or used as a mechanism to transfer costs from one segment of the population (uninsured) to another (insured); or used to undermine consumer sovereignty by negotiating prices and services without the knowledge or consent of the insured, it fosters inefficiencies in the insurance marketplace. And it undermines the integrity of market mechanisms that would enhance efficiency in the allocation of resources for health care service delivery.

Health care is composed of many heterogeneous goods and services. It is impossible to efficiently price them all through an insurance premium, whose purpose is altogether different from that of people seeking medical treatment. The theory of managed competition relies on this highly flawed assumption. It promised that, if we restructured health insurance by combining it with health care and standardizing the benefits package, the rest would take care of itself.

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Both consumers and providers of health care must manage a fixed set of financial resources against potentially endless demands for those resources. This pits one individual against another – money allocated to satisfy eligible claims by one person is not available to satisfy the eligible claims of another.

But once trades for contingent claims in the Ex Ante market of medical uncertainty are completed, the work has only just begun. The insurance company (indemnity, HMO, PPO, etc.) now faces the probability risks associated with managing a lively portfolio of contingent claims in a multiple-state environment. This portfolio is a highly unstable aggregation of myriad costly events, permuted by countless possible future states. Perhaps if health care did not have so many discretionary elements and was not so fragmented, this would not be so problematic. But in the face of uncertainty about the appropriate level of health care services to consume, consumers (patients) are left to decide with providers (physicians) the level of the health care resources that will be applied.

Adding fuel to the fire, this discretionary environment involves another series of trades. Because risk-neutral insurers have sold claims to bad states of the world, both consumers and providers

of health care must face the challenge of managing a fixed set of financial resources and a potentially unbounded set of demands upon those resources. Because the resources available to pay claims are constrained by the accumulated funds largely generated through insurance premiums, the diverse set of individuals who will present the insurance company with claims against that limited set of resources are pitted against each other.

In the end, patients and physicians do not face a budget constraint that reflects the full cost of the choices they make. If they can justify a medical procedure, then the insurer will pay for it—regardless of its cost/benefit efficacy.

In economics this is called the common pool dilemma; money allocated to satisfy eligible claims by one individual is not available to satisfy the eligible claims of another. Note that this dilemma is generated by exchanges that take place in the Ex Post Market, where consumers seek medical attention after they know they need it. The best way to understand a common pool dilemma is to picture a scenario in which individuals in the marketplace bear only a fragment of the real cost for the decisions they make to consume health care services.

In the end consumers (patients) and producers (physicians) do not face a budget constraint that reflects the full cost of the choices they make. If they can justify a medical procedure, then the insurer will pay for it—regardless of its cost/benefit efficacy. This eliminates

individual incentives for the efficient use of scarce resources, because no individual fully accounts for his or her impact on the aggregate (social) benefit/cost calculus.

While the American system is considered a non-socialized health care economy, it has ironically created the same common pool dilemma that exists in Canada and Western Europe, which have genuinely socialized insurance systems. With the steady flow of new technologies (accelerated by a lack of regard for cost/benefit returns), the enactment of Medicare/Medicaid and other government subsidies (tax policies, the Hill-Burton Hospital Reconstruction Act, etc.), and the stagflation of the 1970s and early 1980s, the national economy ultimately exceeded its carrying capacity for health care.

Because most health care costs are covered by insurance, consumers demand services at artificially high rates. Of course, other costs to the patient (time, pain, inconvenience and opportunity costs) may decrease demand. But we would still expect consumers' demand to be higher than it would be without insurance, which acts to disconnect economic costs from use. Under capitation, the price of medical care for consumers is still close to zero. Thus, consumers are insensitive to the individual costs of the procedures and diagnostic tests they receive. If the procedure has even a small marginal value to them, they will demand it.

In this setting, providers may seek to increase other costs to consumers through queuing (waiting times, discomfort levels, gatekeeping, restrictions on self-referral, pre-authorization requirements, closed panels, etc.). These costs are imposed to ration access to medical resources and keep consumers from depleting the cap pool. But here's the ironic point: Because orthodox managed care perpetuated the problem of the medical commons, it was forced to institute command and control rationing techniques on patients and providers.

The question is: Who is in a position to make the decision about whether care is unnecessary, and how are they empowered to make that decision? A decision made by a paternalistic government or health plan provider will always be viewed with skepticism. But if consumers (patients) and producers (providers) are empowered to make this decision as a participant in a non-distorted market exchange, and are held accountable for their decision, then the common problem is solved.

Orthodox managed care theorists set out to design an approach that reformed the distortions in the Ex Post market by integrating it with the Ex Ante market for health insurance. As formulated by Richard Kronick:

Although traditionally the main functions of health insurance were to spread risk and to process claims efficiently, supporters of private health insurance are now required to argue that the raison d'être for maintaining multiple insurers is to foster innovation and quality and efficiency improvements in the delivery of health care.

Hayek (1944) argued that in a world of perfect and costless information, social goods would be provided most efficiently by benevolent engineer-bureaucrats. However, he recognized that mechanisms to collect enough information to promote efficient social production are fraught with problems; information is very costly to collect, process and digest.

But while the market is cumbersome, it is incredibly efficient at processing information. Thus the information efficiencies of unfettered markets trump all possible organizational efficiencies from government production and distribution. Of course, social engineers don't believe this, because they

can easily see all the cumbersome inefficiencies of markets that appear to be chaotically churning—but never reaching a stable equilibrium. But in fact this churning process is what generates value—by constantly creating billions of nodes of digestible information that are critical to consumers and producers seeking opportunities to create value through exchange.

Social Efficiency in the Ex Post Market

Although some trace capitation-like arrangements all the way back to the mid-19th century, capitated managed care as a payment mechanism represented a relatively new form of financial arrangement. And its institutional properties were never thoroughly investigated. While much analysis has focused on capitation

incentive structures relative to fee-for-service incentive structures, these were generally intuitive studies that tested whether providers utilized fewer services under a capitated budget as compared to fee-for-service. Unfortunately, little theoretical modeling of capitation was ever performed to evaluate whether its assumptions met the criteria economists use to measure social efficiency—an order of much different magnitude.

Capitation is an attempt to place incentives in the medical commons, so that providers have the steady prod of “risk” to remind them that resources are always finite. Viewed through this coarse lens, risk is considered a homogenous thing. And as such, it can be shifted over to physicians, where it holds out the threat that economic losses are linear in increasing magnitude. That is, as we travel from left to right across the “risk continuum” of different payment modalities, we press deeper and deeper into the realm of potential economic loss. And as we press deeper, there is an unstated but commonly accepted notion of normative advancement; this is the direction of social progress in health care reform.

As a payment mechanism, capitated managed care represented a relatively new form of financial arrangement. And its institutional properties were not thoroughly investigated.

This assumes a categorical and logical continuity between these different types of payment. If true, the next logical step is to assume that risk is fungible; which is to say organization A can pass off “risk” to organization B, so long as organization B is ready and willing. Of course, in reality, an element of coercion has played a powerful role in some markets where providers have felt compelled to accept “risk” contracts. It is doubtful that, in a position of strength, many providers would have agreed to these new arrangements. But in fact different kinds of economic activities produce different kinds of risk in health care. To assert a categorical continuity between the ranges of payments, from fee-for-service to percentage of premium, is economically meaningless. No such continuity exists. Consequently, the concept of a “risk continuum” has not been helpful.

The health care universe is far subtler. What appears to be an intuitive surface truth will show upon closer examination a deeper reality, which will seem counterintuitive to many. Risk is not the simple one-dimensional phenomenon most in managed care conceived it to be. On the contrary, a correct economic understanding of risk requires a multidimensional frame of analysis.

Probability Risk

Insurers are in the business of probability risk. This, in essence, is managing the law of large numbers. Insurance is based on the utilitarian assumption that people prefer small, predictable losses to large, uncertain losses. Insurance works by transferring the losses associated with risk from one individual to many, by pooling individual risk and spreading the costs associated with risk through a premium base. Since most insurance arrangements or financial security systems indemnify against losses that can be measured in monetary units, the risk they protect against is deprivation of owned assets. Financial security systems, then, are in the business of managing probability risk, i.e., the ability to price as a product the indemnification of their clients’ financial assets from unforeseen economic loss. Krane and Emery have written:

Probability risk is the risk assumed by one entity (the insurer) when it agrees, in exchange for a payment (premium), to do something of value for another (the insured) upon the happening of a contingent, future event. Premiums for similar risks are pooled, and the premium charged is calculated to be sufficient to fund the performance obligation from the pooled premium. Therefore, probability risk is the risk that total premiums collected will be adequate to fund total performance obligations due upon the occurrence of contingent, future events. Capitation is an example of probability or insurance risk because a health care provider (insurer) agrees, in exchange for a fixed, per-member per-month payment (premium), to assume the risk of providing potentially unlimited amounts of defined health benefits (something of value) to the HMO (insured) upon the happening of sickness or injury (a contingent, future event).

The logic of managing probability risk is fundamentally different from the logic of managing patient care; it reflects the difference between the way an actuary thinks and the way a doctor thinks.

In health care economics, probability risk is defined as the business of pricing and managing the performance obligations of future, unresolved medical states of the world. Although clinicians can have a positive impact on the total amount of resources consumed under a fixed premium budget like capitation, the logic of managing probability risk is fundamentally different from the logic of managing patient care. It reflects the difference between the way an actuary thinks and the way a doctor thinks.

The probability risk in a capitated payment is fundamentally a reflection of indemnified insurance risk. Advocates of capitation, and vertical integration of the market for health care services with the market for health insurance, rest their entire case on a flawed assumption. They assume that, because payments are fixed, the provider has an incentive to be efficient. But the science of economics tells us that efficiency in production requires the supplier of goods and services to have control over the level of goods and services provided to the market. To demonstrate this assertion, we turn to a more direct analysis of technical risk.

Technical Risk

Technical risk is the risk of financial loss faced by resource managers if they do not allocate factors of production efficiently. While market imperfections may at any point undermine the binding demands of technical risk on the choices of producers, these forces are typically bid away through market arbitrage over time. So we start with competitive markets as an idealized reference point to uncover the basic market dynamics behind technical risk.

In a simple model, the efficient allocation of productive resources requires that producers equilibrate the internal rate of substitution between inputs (subject to certain constraints) with the external rate of substitution as revealed in market prices for resources. Translation: a global price for a given product forces the firm to search for the most efficient inputs it can find. If it can find a new input that boosts quality or reduces the costs of output, the firm will substitute it in.

Say a physician uses a particular disease management protocol based on habit and preference, rather than current science. If a competing physician restructures the protocol to be more effective and efficient, the first may eventually be put out of business. That's an example of technical risk.

This quest—minimizing costs so that a firm can maximize profits by either adjusting output to the market demand price or substituting more efficient inputs—is what marks the rational decision processes of all profit-maximizing firms. If the firm performs these functions well, it prospers; if it cannot, it will sustain losses. This is technical risk.

An example of technical risk would be a physician using a particular disease management protocol based on habit and preference, rather than current state-of-the-science. Therefore, if a competing physician restructures the disease management protocol in a more efficient format that uses current knowledge of market and science processes, he or she will be more effective and, over time, put the other physician out of business.

In a competitive market, a physician practice faces “technical risk” by not keeping current with best practice and market forces that are pricing inputs in the marketplace. A common example of this dynamic is when specialty hospitals and clinics exert severe pressure on traditional full-service medical practices, clinics and hospitals. It also explains why there are numerous attempts to limit competition in the health services market, so that the efficient practice of medicine cannot encroach on traditional established practices that are clearly inefficient (such as Certificate of Need, Any Willing Provider, etc.).

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A capitated model is not about providing the best patient service that the market can bear. It's about structuring care in a way that protects the insurer from the very risks it is in the business to manage.

By blurring the distinction between probability risk in the Ex Ante Market and technical risk in the Ex Post Market, managed care and capitation actually act as a barrier to the iterative creation of price information based on market demand for discrete, clinically homogenous episodes of care. The capitation price for purchasing a bundle of contingent claims on unresolved future states of the world is, by any other name, still an insurance premium. A global fee for purchasing a bundle of clinically homogenous input factors, as determined by the production function of an episode of care, is a production price. They are *sui generis*, completely different types of information sets. As such, they communicate facts about completely different types of relative scarcities. Hence, the effort to purchase

efficient sets of clinically homogenous care through capitation is inconsistent with the optimizing allocation rules that govern the delivery of service in the Ex Post Market for health care services.

To see why, simply ask who is at the center of creating value in a capitated model. It is not about providing the best services to patients that the market can bear, but rather about structuring care in a way that protects the insurer from the very risks it is in business to manage. The perception that capitation forces providers to manage technical risk by managing their cost structures more efficiently is misguided. Technical risk is not in play in a capitated system because the focus is not on enhancing capacity to deliver efficient episodes of care. Rather, the focus is on minimizing actuarial volatility with little regard to efficiently meeting a market test for quality end product delivery.

Separating technical risk from probability risk sets the context for how a fully functioning health information exchange can bring value in managing each kind of risk—regardless of the payment system. Without this separation, the unified administrative machinery needed to tightly align homogenous care processes simply does not exist.

Choice-Utility Risk

Every purchase made by a consumer is risky to some extent. This is because information is costly; institutional context for the acquisition and dissemination of information may skew the signals it conveys; or cultural context may alter one's ability to efficiently process it. Obviously there is little risk when buying, say, a pencil. We all have lots of experience with pencils, i.e., good information. And for most, a pencil purchase represents but a tiny fraction of our budgets. But consider the purchase of a computer, a car, a house – or a coronary artery bypass graft. Such items aren't just much larger fractions of our budgets, they often exceed them by far.

More importantly, good information on quality can be hard to come by. So here's where choice risk enters the picture. We all have certain expectations about the levels of satisfaction we will receive from our purchases, and if the product fails to meet our expectations, we experience a loss. The more we sacrifice in terms of money, transaction costs and opportunity costs to obtain the product, the greater the risk that if our purchase does not meet our expectations, we will feel a commensurate sense of loss. Although the case is often overstated, in health care, it can sometimes be a matter of life and death.

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When people spend from their own budgets, they seek to maximize value with every purchase. Each spending choice is grounded in real prices and its capacity to generate value to the chooser. But a genuine price system has never existed in health care.

One way to think of the economic foundations of optimal consumer choice is to imagine a person with a fixed budget. Where people are constrained by spending from their own budgets, they become very aware of value, and seek to maximize it with every purchase. An individual can buy a Porsche and go naked, or buy a Ford Escort and be clothed, or choose among infinite other options. But to stay within his budget, he must make trade-offs when evaluating consumption opportunities.

Evaluating the relative merits of each opportunity to spend resources must be grounded in the realities of prices associated with each choice, and relative capacity of each choice to generate value to the chooser. (This is the logic behind an HSA or personal savings account.) These forces that govern the capacity to make optimal choices require consumers to balance their tastes and preferences

with the realities of how markets price the products they value.

Economists use the terminology of balancing the consumer's internal rate of exchange with the external rate of exchange reflected in relative product prices. A consumer is said to be in an optimal consumption state when these forces are in balance. Put another way, he cannot reach the point of optimal consumption until the rate at which he is willing to make substitutions in his consumption bundle equals the rate at which he can make trades within the budget constraint. Optimally, then, a person purchases health care up to the point where its price (marginal opportunity cost) equals its marginal benefit.

Three issues affect this optimal condition in the health care market. First, the optimal allocation of consumer resources assumes that the consumer actually realizes his expected level of benefit. This is what we have termed the choice-utility risk component of the model. Second, a genuine price system has never existed in health care; therefore, globally priced episodes of care would represent a new phenomenon in the Ex Post Market. And third, as a result of the medical commons, people have been so used to paying close to a zero price for so long that they have become desensitized to the true value of their purchase.

However, the fact that people want value for their money constitutes a very potent force for bringing discipline to markets. Suppliers of goods and services are forced to meet consumers' expectations at a reasonable price or face the risk of going out of business. This dynamic has never been present in health care. Some would argue that in the market for health care service, consumer sovereignty is not relevant since consumers are in a poor position to judge quality of the medical outcome. However, this view obscures the capacity of consumers to develop simple heuristics to gauge quality that are used in markets for other complex products. At a fundamental level, patients can generally judge whether they feel better after they go to the doctor. That "feel better" phenomenon may be totally unrelated to a final resolution to their perceived medical problem, but that is largely irrelevant to the efficiency engendered through the exchange process.

Some argue that in health care, consumer sovereignty is not relevant since patients are in a poor position to judge quality of medical outcomes. However, this obscures the capacity of consumers to develop simple heuristics to gauge quality that are used in markets for other complex products.

It is not enough to apply choice risk only at the level of purchasing health insurance; the Ex Post Market must also be able to play its allocative role in dynamically sampling consumer preferences at the point of care. That sampling process, in turn, has to be channeled through competitive prices into the productive consciousness of those rendering care.

Without these conditions, patients have no way of effectively acquiring the information they need to reconcile the choice risk of consuming health care against their own budget constraints. Thus, they literally surrender their preference rights as expressed through their internal rates of exchange to a third-party payer. And since the medical commons leaves providers without the technical risk that would result from participation in competing, episodically priced production processes, they too surrender their capacity to manage technical risk to the third-party payer.

The HMO, then, has but one choice. It must aggregate patient and provider rates of substitution and rank them according to its preferences for optimal substitution, which, as we have seen earlier, can only be enforced by command and control authoritarianism. Without the market mechanisms that empower patients to observe price and equilibrate their choice risk against the price of provider's technical risk, third-party payers have no way of determining anything other than how to maximize the dollar value of the probability, technical and choice risks they assume *in loco parentis*.

Patient and physician demand for choice in the Ex Post Market spelled the end of closed-model HMOs and capitation as universal reform models. This is the only reasonable explanation for the halt in HMO growth, and the rapid expansion of choice-based insurance products such as PPOs, point-of-service plans and open-access plans, and the emergence of Consumer Directed Health Plans. The time has come for theory to move up to a new level. And the new level is to recognize that the true objects of integration should be clinically homogenous episodes of care, and the unified provider-owned delivery systems needed to orchestrate them.

Patient and physician demand for choice spelled the end of closed-model HMOs and capitation as universal reform models. Rather, the focus should be on clinically homogenous episodes of care, and the unified provider-owned delivery systems needed to orchestrate them.

Integrating the Ex Ante Market with the Ex Post Market is a fundamentally flawed approach. Health insurance companies should be in the business of managing probability risk (that holds for CMS as well). Health care providers (doctors, nurses, hospitals, physical therapists, labs) should be in the business of managing technical risk. Patients, in cooperation with both payers and providers, should manage their choice risks.

By conflating these three bodies of risk, the current market and institutional structures have created a socially inefficient and non-sustainable market arrangement. Conversely, efficient information creation and dissemination mechanisms—centered on data generated through patient-centric clinical outcomes—can eventually lead to optimal deployment of assets in the Ex Ante Market and the Ex Post Market.

Capitation

Much has been written of capitation over the past 15 years, both positive and negative, and we feel there is little we can add. However, one of the promises of creating new incentives for quality and HIT adoption is that providers will find it worthwhile to invest in EMRs. Any payment technique that creates a fixed budget over a population or a span of care achieves something FFS does not: it allows for a budgetary process with capital allocations for reengineering and care improvement, including investments in Health Information Technology (HIT).

Whatever the criticisms against capitation, one positive aspect has manifested itself in large integrated delivery systems (IDS) and independent practice associations (IPA) that accept global and sub-capitation. They have large capital budgets in which management can make allocations for HIT investment. There are many examples in California, for instance, where globally capitated provider systems have made major investments in EMRs. Kaiser Permanente is an excellent example. While this in itself does not bring about interoperability between systems, it does prove that fixed budget payments create both incentives and available capital to invest in HIT.

Pay for Performance (P4P)

Pay for Performance (P4P) is riding a wave of increasing preeminence in the quest to unlock

efficiency gains in the U.S. health care delivery system. However, a recent survey in the *Annals of Internal Medicine*, the authors of the study (hereafter called the PWUDS study) question the base of knowledge that is driving the emergence of P4P in the market.³⁰ While most studies in the literature document an increase in measured indicators of quality when financial incentives are introduced, there is considerable room to question the significance of these findings. In particular, evidence of systematic gaming of the incentive structure through improved documentation (rather than actual improvement in outcomes) appears to mitigate some of the evidence that P4P incentive structures actually change the quality of care delivered to patients.

If there is insufficient information about health care practice at the granular clinical level—rather than the reimbursement level—it will be impossible to design optimal incentive structures to encourage more effective health care practice.

³⁰ Petersen, Laura, LeChauncy Woodard, Tracy Urech, Christina Daw and Supicha Sookanan. "Does Pay for Performance Improve the Quality of Health Care?" *Annals of Internal Medicine*. 15 August. Vol. 145, No. 4, pp. 265-272 (2006).

Change within a market structure is fundamentally linked to the ways information is acquired, processed and disseminated. As new forms of clinical information emerge, new forms of human capital will arise to exploit opportunities and create the platform for fundamental change.

Interestingly, the PWUDS study identifies noncompetitive market structures that limit the flow of clinical information between patients and service providers as one of the most pervasive barriers to fully understanding the linkage between financial incentive structures and improved outcomes. Regardless of the incentive structure, if there is insufficient information about health care practice at the highly granular clinical level—rather than the reimbursement level—it will be impossible to design optimal incentive structures to encourage more effective health care practice.

In a recently published editorial in the *International Journal for Quality in Health Care*, Berg, de Brantes and Schellekens offer a four-pronged approach to improving health outcomes.³¹ Their prescription centers around a system of universal coverage for “necessary” care (to mitigate adverse selection within the health care system); the emergence of integrated delivery systems based on

episodic care; the emergence of a market rationalized pricing system for episodes of care; and the emergence of enhanced information exchange systems designed to inform both providers and their patients of the efficacy of treatment protocols and treatment pricing.

Few would argue with the core prescriptions offered by Berg, de Brantes and Schellekens. But many would argue that the path to reach this health care market scenario is blocked by impenetrable barriers between the ideals of market-based reforms and the reality of reaching them. In particular, Gail Wilensky has recently taken Porter and Teisberg to task for not articulating a rational path for transition between the current state of the health care delivery system and the world governed by a more efficient and effective patient-centric market-oriented allocation system.³²

Wilensky’s criticism is particularly important in the context of the evolution of health information exchange. The transition path to more effective and economically efficient care cannot be fully articulated within the context of an analytical framework, because too much remains unknown about the future evolution of human knowledge and technical capacity. What we do know is that the catalyst for change within a given market structure is fundamentally linked to the ways in which information is acquired, processed and disseminated. As new forms of granular clinical information enter the health care service delivery stream, new forms of human capital will arise to exploit arbitrage opportunities in the market space and create the platform for fundamental change in market structures.

For example, no one could have envisioned the emergence of new forms of human capital and information-induced technical change in the creation of advanced global financial transaction systems. Yet, looking back, we now understand the critical role information played in the emergence of new streams of value creation. While naysayers can continue to worry about the transitional path

³¹ Berg, Marc, Francois de Brantes and Wim Schellekens. “The Right Incentives for High-Quality, Affordable Care: A New Form of Regulated Competition.” *International Journal for Quality in Health Care*. Volume 18, No. 4, pp. 261-263.

³² Wilensky, Gail. “Health Reform: Thinking Big, But Ignoring Big Obstacles.” *Health Affairs Blog* (<http://healthaffairs.org/blog/2006/10/16/health-reform-thinking-big-but-ignoring-big-obstacles/>) October 16, 2006. Also, see Porter, Michael E. and Elizabeth Olmsted Teisberg. *Redefining Health Care: Creating Value-Based Competition on Results*. Boston, MA: Harvard Business School Publishing (2006).

to market reform, the power of information continues to nibble away at seemingly insurmountable barriers to change. The experience of successful RHIO/HIE learning laboratories demonstrates the capacity of information—molded through the thoughtful and energetic efforts of entrepreneurs—to fundamentally alter market relationships.

It is important to remember that the primary goal of pay for performance is not to merely create differential payment mechanisms for service providers. Rather, it is to fundamentally alter the way in which the art of medicine is practiced—with a focus on intermediate and long-term improvements in performance. As Epstein et al. report:

*The most pragmatic hope for improving the quality of care lies in efforts that implicitly or explicitly call for investment in information infrastructure and the fundamental redesign of office practice.*³³

As improved information systems and social networks emerge, new bonds are forged, leading to the development of the social, human and physical capital needed to help markets serve consumers more effectively.

Global Fees for Episodes of Care

The American system of reimbursing health care providers renders few rewards for delivering high-quality care.³⁴ As Leatherman et al. state in *The Business Case for Quality: Case Studies and An Analysis*, “Current payment mechanisms allow, and even reward, defective care because they are unable to reward future benefit.”³⁵ Often, in fact, improvements on behalf of physicians to reengineer care can leave them making less money. And it is not just a lack of incentives to improve care that is worrisome. The existing payment system actually entrenches poor-quality care.

Current payment mechanisms offer few rewards for delivering high-quality care. Far too often, they actually reward defective care. This is why the Institute of Medicine labeled the current payment system “toxic.”

The problem is so glaring that in its landmark report “Crossing the Quality Chasm,” the Institute of Medicine labeled the current payment system “toxic.”³⁶ This fact, combined with widening knowledge about real gaps between the quality of actual care provided and what best evidence guidelines would suggest, has spurred activity by health plans to make extra money available to providers who meet certain quality benchmarks. These pay-for-performance bonus programs have been gaining momentum since the mid-1990s. A search through the LeapFrog Group’s Incentive and Reward Compendium catalogues nearly 100 various P4P programs around the nation.³⁷

³³ Epstein, Arnold, Thomas Lee and Mary Beth Hamel. “Paying Physicians for High-Quality Care.” *New England Journal of Medicine*. 350;4 pp. 406-410. January 22 (2004).

³⁴ Newhouse, J. P. “Why is there a Quality Chasm?” *Health Affairs*. 21(4) pp. 13-25 (2002).

³⁵ S. Leatherman, et al. “The Business Case for Quality: Case Studies and an Analysis.” *Health Affairs*. 22 (2) pp. 17-30 (2003).

³⁶ Institute of Medicine. “Crossing the Quality Chasm: A New System for the 21st Century.” Washington, DC: National Academy Press (2001).

³⁷ <http://ir.leapfroggroup.org/compendium/compendiumresult.cfm>

The jury may still be out as to whether P4P programs will bring about the desired change, but one thing is for certain: The widespread and growing adoption of incentive programs has legitimized differential pay. Purchasers now recognize that not all providers are equal, and are now ready to recognize top performers with top pay. But there is unease about P4P even among its advocates, in part because most P4P incentives are layered add-ons over a fee-for-service system that remains unchanged. Wouldn't it be more effective to go straight to the heart of matter and reform the very basis of FFS reimbursement?

One way to alter the current regime would be to reimburse care not through fragmented unit pricing, nor through actuarial pricing (capitation), but through production pricing: a fixed budget compensating episodes of care as individual patients experience them, and the services required for providers to produce them. If an episode of care is defined as *the complete sequence of interactions between a patient and providers of health care services in pursuit of a defined clinical objective over a specified period of time*,³⁸ it may be more sensible to make episodes the natural unit of reimbursement. This is especially relevant in a market environment where Consumer Directed Health Care (CDHC) is growing, and where consumers as patients are increasingly asked to manage the complex interface between benefits and health care delivery.

Taken in that context, then, the point of globally pricing episodes of care would be to create the equivalent of an upfront “sticker” price on clinically homogenous pathways, whether acute or chronic, so that:

- Patients have a predictable measure of the cost of medical treatments;
- Providers have an incentive to organize and reengineer treatments around clinically homogenous care paths rooted in evidence-based guidelines;
- Plans can measure the cost and effectiveness of integrated care teams;
- Risk-based contracting that avoids the pitfalls of capitation gradually erodes the predominance of fee-for-service purchasing; and
- Patient and physician choice at the point of service becomes the engine of efficiency instead of the driver of inflation.

The Importance of Fixed Budgets in Health Care Delivery for HIE

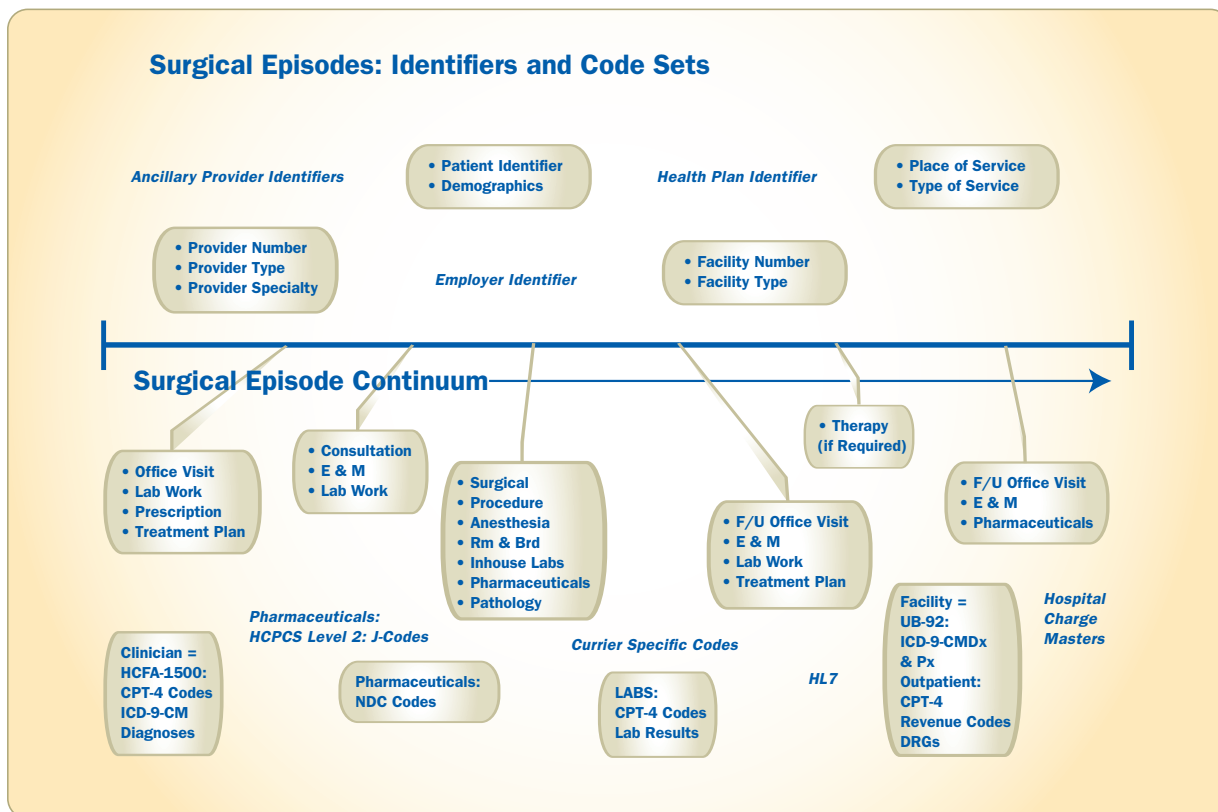
We have noted the harmful effect FFS has on capital formation and market demand for HIE. As long as the majority of American health care reimbursements are based on FFS, little market demand will evolve on its own for better information on care delivery. But imagine if payments revolved around patient experience instead of delivery system institutions. In other words, if a patient experiences an episode of illness, the dollars would coalesce around the outcome of having successfully treated that patient. In this scenario, a whole new dynamic surfaces.

³⁸ Emery, D.W. and M. Pine. "Episodes of Care: The Scope and Sequence of Medical Reality." Emery, D.W., ed. *Global Fees for Episodes of Care: New Approaches to Healthcare Financing*. New York: McGraw Hill (1999).

If payments revolved around patient experience instead of delivery system institutions, providers would have a profound interest in organizing as coordinated, specialized, disease-focused teams.

First, a powerful new incentive comes into play. Providers would have a profound interest in organizing as coordinated teams, again, not as current institutions like vertically integrated HMOs, but as disease-focused delivery systems. They would begin to integrate around what economists refer to as the production function of care; that is, all the necessary delivery inputs to take care of patients as specialized delivery teams. This would evolve with no regard to hospitals, physician practice settings, labs, diagnostic centers or any other status quo institutional setting. Once more, evoking Joseph Schumpeter’s paradigm of creative destruction, it would sweep aside all present considerations and bring a new entity to the fore: The Patient.

Second, because the dollars now surround the episode of care, a pool of money is created whose sole purpose is cure or palliation. The pool, added up over many patients of the same demographic cohort, has “play” within it. Like any other corporation operating in a price system, managers would have general ledgers and accounting systems to allocate money in a way most propitious to increasing margins. If those margins are based on transparency of price and outcomes, then literally any kind of information that gives them a better chance to compete in the open marketplace is highly valued. And since they now have pooled budgets and “play” within them, information and information technology would be highly valued, and they would have the monetary discretion to invest in information management improvement. Think of this as represented in a simple surgical episode in the figure below.



In the status quo, a patient flows through the fragmented system, which finds revenue in the equally fragmented billing system of CPT-4, ICD-9, NDC and Revenue codes. Each island in the archipelago grapples for its piece of the episodic pie, preserving evanescent margins for the costs of the slender service code, and finding revenue satisfaction in only one overpowering incentive: pump up the volume.

Now imagine the same figure with a price boundary around it: a global fee for the entire episode of care. Suddenly, the importance of individual service codes disappears. They now all represent, in an imperfect way, inputs to an overall production function of care centering on the patient. And if part of the global fee is determined by measurable outcomes, surely the primary incentive converts to the productive efficiencies of lateral integration and information optimization.

With episode pricing, incentives for better information take hold, and the budget to invest in the technical means for appropriating that information becomes available.

Moreover, multiplied against iterative episodes, a budgetary dynamic unknown in the FFS world appears. Not only do incentives for better information take hold, but the budgetary discretion to invest in the technical means for appropriating better information becomes available. This is the power of pricing technical risk in the Ex Post marketplace.

The above example was made using the current claims coding regime, but obviously, there is clinical information at the point of delivery that cannot be captured in claims data. In this simple observation, there is gold for health information exchange and EHR adoption. We will return to this insight in a following section. But first, if episode pricing

is powerful, then why doesn't it prevail everywhere now? Has it ever been tried? What was the experience and the lessons learned? Appendix 3 explores these questions.

Although the concept is simple, its pragmatic implementation is not, due to the fragmentation of the delivery system and the current billing and coding infrastructure. In order to explain how such an approach can be accomplished, it is necessary to explore global pricing in more detail, and to explain why HIE is indispensable to reimbursement reform.

The next two chapters will delve into these matters, but before we proceed, the essential points relative to HIE can be best visualized as a new “channel” of information added to the already existing channel of claims information. It is broadly recognized that claims data are highly problematic when used as a means of measuring care. The purpose of the following arguments is to establish the fact that no defensible system of reimbursement reform tied to provider performance can rely on claims information alone; this we will refer to as “Channel 1” data. To forge a credible approach, we need a second channel, “Channel 2,” composed of clinical data derived from electronic health records and the interoperable exchange of that data between providers via health information exchanges.

CHAPTER 12

STAGE 2 INFOMEDIARIES AND THE FUTURE OF HIE SUSTAINABILITY

Having reviewed some critical concepts, such as the difference between Regional Health Information Organizations (RHIOs) and Health Information Exchanges (HIEs), reimbursement reform and the need for Channel 2 clinical data to complement Channel 1 claims data, it is essential to boil the whole argument down to its primary source: the universal adoption of electronic medical records.

Continued failure to encourage adoption of mechanisms to access or input information electronically such as Electronic Medical Records (EMRs) in all provider settings, including small physician practices, will hamper the true potential that data exchange holds in reducing waste and inefficiencies, and increasing care coordination and information sharing to create a higher-quality health care system. It will also inherently limit the role of health information exchanges to act as clinical data exchange facilitators.

To realize the full potential of IT adoption in health care, there are two important strategies to follow. First, create a framework for providing incentives that reduce or eliminate the negative financial

consequences to adopting and using Health Information Technology (HIT). Second, redefine the role of HIEs as clinical data and information intermediaries by expanding their customer base.

Universal adoption of electronic medical records is a must. Continued failure to encourage this will hamper every aspect of efforts to create a higher-quality health care system.

- Provide incentives that reduce or eliminate the negative financial consequences to adopting and using HIT.

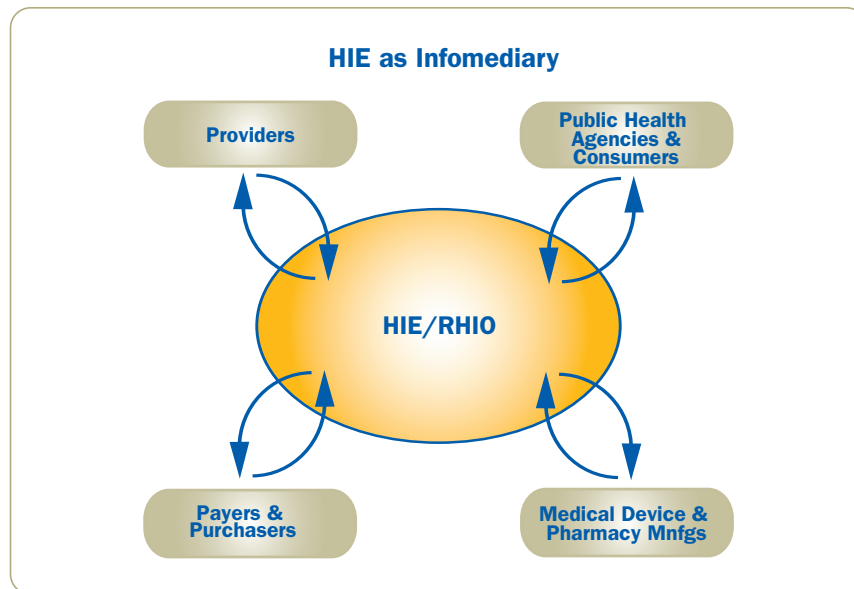
In industries other than healthcare, economic agents are constantly encouraged to improve the value of the services and products they deliver, because the market will reward them with incremental revenue. If payers offered financial rewards for providers that delivered higher value health care services, they could motivate them to improve their processes and outcomes of care in order to compete for these rewards. That has, in effect, been the lesson learned through market experiments conducted by Bridges To Excellence (BTE).

- Redefine the role of HIEs as clinical data and information intermediaries by expanding their customer base.

HIEs can, in fact, operate as valued health care information intermediaries (infomediaries) in the communities they serve. While today their primary customers are providers, they could have four additional customers: (1) payers – both public and private, (2) consumers – and in particular third-party application vendors, (3) public health agencies and (4) pharmaceutical, medical device and other medical technology manufacturers.

The common interest of each of these customers is some level of data reporting that can emanate from the HIE. And while many of these self-interested parties are in direct competition with one another in the health care “marketplace,” they can be united by their common interest in improving the quality of care. The HIE can provide information, using appropriate policies for privacy and confidentiality, to all these customers, not in an attempt to reconcile the varied self-interests, but rather in the simple attempt to create value for each, and thus for society as a whole. Figure 1 depicts the central role an HIE could have as an information infomediary.⁶⁹

Figure 1



HIEs that can establish themselves as infomediaries for their communities, while maintaining public trust could increase their revenue base to a level where their non-provider customers could pay the majority of the fixed and variable costs of managing the exchange. As a result, the transaction (or subscription) costs paid by the participating providers could be significantly reduced, and perhaps completely eliminated.

The infomediary functions should not be deployed as a means to profit from that information, but mainly to free information for those who can use it best. If it wants to, the HIE can become an important infomediary in the health care industry, freeing up information, while maintaining privacy and confidentiality, that is currently siloed and creating the mechanism for a real market to emerge – an environment in which value is created by the appropriate interactions of competitors and other stakeholders with their customers.

Each of these customers has some self-interest in accessing clinical data-based information:

- **Payers** would benefit from comparative performance reports on the quality of care delivered by providers in the community, especially at the individual provider level, and for measures that have significant actuarial importance and are difficult to gather without going through medical records (e.g., blood pressure for patients with hypertension).
- **Application vendors** that provide consumers with information tools to help them manage their health would benefit from accessing personal health record data for an individual consumer, on that consumer’s behalf.

⁶⁹ de Brantes, et al. “The Potential for HIEs as Infomediaries.” *Journal of Health Information Management*. 21(1) pp. 69-75 (2007).

- **Public health agencies** would benefit from the reporting of aggregated reports on population health in their community as well as early indicators of public health emergencies.
- **Medical device and pharmaceutical manufacturers** would benefit from comparative analyses on the relative impact of an innovation they have introduced or are planning to introduce.

Let's review some of these in more detail.

Public Health Agencies

Before we examine the potential sources of value created by HIEs for public health functions, it is useful to define “public health.” While many use the term to refer specifically to the work of governmental health agencies, a more contemporary definition is “what we, as a society, do collectively to assure the conditions in which people may be healthy.” (Institute of Medicine, 1988).

Our use of the term falls between these two extremes: We will primarily refer to activities performed by local, state or federal public health agencies, but include activities that may be performed by non-profit (or even, conceivably, for-profit) entities. While we cannot address every government health activity relatable to HIE, pharmaceutical regulation, medical research, mental health services, health

care or insurance for the elderly and indigent and even the promotion of HIT and HIE are essential public health functions performed, funded and promoted by government agencies.

HIEs may be able to help public health agencies achieve some of their strategic goals. In turn, public health may be able to provide some level of financial support for HIE activity.

This section will focus primarily on communicable disease control, population-level assessment and epidemiologic research on health and health hazards, management of public health emergencies, occupational and environmental health, maternal and child health and chronic disease prevention and management.

Public health departments are, by and large, poor. Even so, a state public health department may well have on the order of \$1 million per year budgeted for processes an HIE may be able to provide. Since the anthrax exposures of October 2001, a great deal of funding and

attention has been focused on biosurveillance or the capacity to identify disease outbreaks based on routinely collected clinical data. The Centers for Disease Control (CDC) has provided funding to state and local health departments to support biosurveillance over the last several years, but these funds are likely to be reduced.

Health departments also receive funds for specific surveillance activities such as pandemic influenza surveillance. HIEs may be able to assist public health in achieving a subset of their goals in this area, and public health may in turn be able to support this activity financially at some level. Because this level of support is likely to be modest, it has to be for services an HIE can provide at very low incremental cost.

If an HIE delivers services that can reach providers, it may be able to support public health's need for a Health Alert Network or the ability to notify providers about public health information that may be relevant to their practices. For example, if public health recognizes an outbreak of shigella in a market, they may need to notify clinicians to adjust their prior probability of this diagnosis when seeing a patient with diarrhea. This may lead to additional or more targeted testing and treatment. An HIE may be able to provide this type of communication at a modest incremental cost, making it an attractive alternative to public health building its own system.

While the economic benefits from these activities are enormous, they accrue to different persons and sectors to varying degrees, and are typically difficult to measure. The benefits, because they largely represent events that fail to happen rather than those that do occur, are typically underestimated by the public and policymakers. Yet public health measures are credited with adding 25 out of the 30-year increase in longevity Americans experienced over the last century.⁷⁰

For example, in the early 20th century, water filtration and chlorination were responsible for nearly half the total mortality reduction, three-quarters of the infant mortality reduction and nearly two-thirds of the child mortality reduction in major cities. Rough calculations suggest that the social rate of return to these technologies was greater than 23 to 1, with a cost per person-year saved by clean water of about \$500 in 2003 dollars.⁷¹ Benefits and examples of indices used to measure them are outlined in Table 1.

Benefit	Example measurement indices
Longevity	Life expectancy, premature years of life lost, infant mortality, childhood mortality
Quality of life, preventable disability	Quality-adjusted life years, disability-adjusted life years, health-related quality of life
Disease reduction	Incidence, prevalence, transmission (infection)
Disease severity	Case fatality rate, five-year cancer survival (cancer), amputation rate (diabetes)
Health care cost reduction	Prevention quality indicators, ambulatory care, sensitive hospitalizations
Productivity	Days of work lost, workforce productivity
General economic stability	Lost income, trade levels (disruption avoided), risk-adjusted discount rate (risk constrained by regulation, prevention infrastructure and disaster mitigation infrastructure)
Corporation economic stability	Same as above, adding liability risk constrained by regulatory adherence

⁷⁰ Bunker, J. P., H. S. Frazier and F. Mosteller. "Improving health: measuring effects of medical care." *Milbank Quarterly*. 72 pp. 225-58 (1994).

⁷¹ Cutler, D. and G. Miller. "The Role of Public Health Improvements in Health Advances: The Twentieth Century United States." *Demography*. Volume 42, 1, pp. 1-22 February (2005).

Public health organizations are not always viewed as high-priority participants in regional health information exchange. Still, most HIE initiatives surveyed in 2006 reported that they involved local or state public health agencies in their planning processes.

Because such benefits accrue at the population level, payment for public health activities occur primarily at the government level, and secondarily at the level of organizations accountable for the health of discrete populations (under the rubric of “population health”). These include employers, school systems, residential facilities, correctional agencies and more recently, health maintenance organizations. A relatively minor source of funding comes from fines and regulations (which generally seek to distribute costs toward entities that create hazards). Increasingly, public health activities (both publicly and privately funded) are performed by non-governmental agencies, community-based organizations and other entities perceived to be more flexible or more effective in reaching specific populations.

Potential Roles for HIE in Public Health

Public health agencies and their private partners should not be seen as passive recipients of information. They are also significant data providers, both at the individual level (e.g., reporting a laboratory

result or providing a case-management update) and population level that affect the activities of others, such as clinicians.

Public health organizations are not always viewed as high-priority participants in regional health information exchange. This may be due in part to many agencies’ continued reliance on paper record systems, and their perceived inability to bring much capital to the table for the early development of HIE. Nevertheless, 71% of HIE initiatives surveyed in 2006 reported that they involved local public health agencies in planning, and 64% reported involving the state public health agency.⁴ Also, in many communities, public health agencies have played an important role in catalyzing or convening movement toward regional exchange. Examples include Colorado, Rhode Island, New York City, Milwaukee and Lansing, Michigan.

The importance of the HIE-public health connection extends back to the earliest conceptualizations of a “national health information infrastructure” by the National Committee on Vital Health Statistics in 2001, which was the precursor for the concept of a Nationwide Health Information Network.⁷³ Recognizing the need for common data vocabulary and transmission standards to permit interoperability between public health and clinical health information systems led to the establishment of the Public Health Information Network concept.⁷⁴

The Robert Wood Johnson Foundation funded many public health agencies to address opportunities presented by the emergence of regional health information organizations in 2005.⁷⁵ Also, biosurveillance has been identified as one of four “breakthrough initiatives” of the American Health Information Community convened by Secretary of Health and Human Services Michael Leavitt in 2006, followed by immunization records and emergency department capacity monitoring in 2007.⁷⁶

⁷² “Improving the Quality of Healthcare through Health Information Exchange: Selected Findings from eHealth Initiative’s Third Annual Survey of Health Information Exchange Activities at the State, Regional and Local Levels.” p. 29 (2006). Available at <http://toolkit.ehealthinitiative.org/assets/Documents/eHI2006HIESurveyReportFinal09.25.06.pdf>. Accessed January 21, 2007.

⁷³ “NHI – Information for Health: A Strategy for Building the National Health Information Infrastructure.” (2001) Available at <http://www.ncvhs.hhs.gov/nhiilayo.pdf>. Accessed January 21, 2007.

⁷⁴ See www.cdc.gov/phih. Accessed January 21, 2007.

⁷⁵ See <http://www.informationlinks.org/>. Accessed January 21, 2007.

⁷⁶ See <http://www.hhs.gov/healthit/breakthrough.html>. Accessed January 21, 2007.

Public health agencies and health care entities routinely exchange a wide range of vital documents. Efficient electronic exchange can improve the process significantly.

A workshop including public health and health information exchange experts met in 2005 to help define leading opportunities for public health interaction with regional health information organizations and HIE. The four most immediate opportunities included optimizing reporting to public health; coordinating and improving continuity of care through communication and collaboration; empowering patients to improve their own health through personal health records; and consolidating and integrating information to improve both individual health care (point-of-service information) and epidemiologic analysis and research.

Over the longer run, two additional opportunities were felt to be highly transformative: to facilitate linkage of clinical decision-support tools to both patient-and-population-level data; and to facilitate participation of a more diverse community around each patient's care (by creating a "collaboration zone" controlled by the patient).⁷⁷

Just as making information available to health care providers does not guarantee it will be used to produce value, simply increasing the flow of electronic information to public health agencies will not automatically translate into health or economic benefits. Information flow must be closely coupled with the business processes in each agency to achieve optimal benefit.^{78, 79}

The public health role for HIE in the "infomediary" role is potentially highly significant. But it should first be noted that public health organizations, similar to other health organizations, can also benefit in many ways from the movement of individual transactions.

The Potential of Stage 1 Transactional Models in Public Health

Public health agencies receive or transmit individual patient-level and other reports with health care entities on a routine basis. These could be greatly facilitated by efficient electronic exchange.

These include:

Vital Records

In virtually every jurisdiction, health care professionals must report every birth and death to local or state health authorities, including demographic information and other public health-related information such as risk factors affecting the newborn, or underlying causes of death. In some jurisdictions fetal deaths (stillbirths) and therapeutic abortions must also be reported. These represent at least 6.5 million annual transactions nationwide. Because these events often occur in hospitals, these organizations play an important role in facilitating the flow of information. Unfortunately, there is not standardization among all states and territories regarding the content or coding of vital record reports. Thus, reporting systems must be customized on a state-by-state basis. In addition, many vital record agencies still rely heavily on paper forms and legacy database systems.

⁷⁷ Foldy, S. and D. Ross. "Public Health Opportunities in Health Information Exchange." Public Health Informatics Institute (2005). Available at http://phii.org/Files/Opportunities_0605.pdf. Accessed January 21, 2007.

⁷⁸ S. Foldy. "Linking better surveillance to better outcomes. Syndromic Surveillance: Reports from a National Conference 2003." MMWR. 53 (Suppl.) pp. 12-18 (2004).

⁷⁹ Public Health Informatics Institute. Taking Care of Business: A Collaboration to Define Local Health Department Business Processes. Decatur, GA: Public Health Informatics Institute (2006).

States use a standard format to report a minimum data set regarding each birth and death to the National Center for Health Statistics. A project addressing inter-jurisdictional exchange of records is building off this standard content.⁸⁰ Some of the uses of such inter-jurisdictional exchange include:

- Transmitting events (births, deaths, fetal deaths [stillbirth] and induced abortions occurred to non-residents) sent to the jurisdiction of usual residence.
- Deaths sent to the jurisdiction of decedent's birth.
- Births sent on request to the jurisdiction of death when decedent's age at death was less than one year.

While access to vital records is controlled by laws that differ from state to state, the development of such universal standards between jurisdictions may increase the standardization of data collection overall and permit greater uniformity of reporting applications nationwide.

Rising demand for vital records related to immigration control and homeland security is also increasing the pace of automation and standardization. Electronic Validation of Vital Events (EVVE) is an application that seeks to meet this demand.⁸¹ As the number of events for which vital records validation increases (driver's licenses, passports, possibly even voting registration) the potential number of transactions becomes very large. However, if the number of agencies requesting EVVE remains modest, there will be little need for HIE to serve as the route of transaction.

Mandated Disease Reporting

Each jurisdiction mandates that health care providers (and typically laboratories) report each new case of certain infectious or environmental disease diagnoses. These permit health agencies to detect and control outbreaks, clusters or individual cases, and provide necessary follow-up to protect the health of the individual and of others. Early detection of a single case of disease is often a signal that many more people are at risk. As a result, prompt and complete reporting (especially when data can electronically populate case management programs) can significantly reduce community morbidity and mortality.

Reporting today is well documented to be incomplete and slow, and reporting by physicians is much less reliable than reporting of specified positive laboratory results by laboratories.^{82, 83} Such reporting is fairly burdensome. Over 1.5 million disease reports were collected nationally on infectious diseases alone in 2004.⁸⁴ After reports are submitted to public health authorities, local agencies further collect a set range of information relevant to each type of disease. Infectious disease reporting is guided by national consensus documents, but laws and regulations are idiosyncratic by state or territory, and sometimes by smaller jurisdictions.

⁸⁰ National Association of Public Health Statistics and Information Systems (NAPHSIS). See <http://www.naphsis.org/projects/index.asp?bid=468>. Accessed January 20, 2007.

⁸¹ Ibid, <http://www.naphsis.org/projects/index.asp?bid=403>.

⁸² Silk, B.J. and R. L. Berkelman. "A review of strategies for enhancing the completeness of notifiable disease reporting." *J Public Health Management Practice*. 11(3) pp. 191-200 (2005).

⁸³ Jajosky, R. A. and S. I. Groseclose. "Evaluation of reporting timeliness of public health surveillance systems for infectious diseases." *BMC Public Health*. 4 p. 29 (2004). Available at <http://www.biomedcentral.com/1471-2458/4/29>. Accessed January 21, 2007.

⁸⁴ Centers for Disease Control and Prevention. Summary of notifiable diseases—United States. *MMWR*. 52(54) pp. 18-19 (2003).

Efforts to automate these transactions fall into several categories. First is electronic laboratory reporting of mandated results to public health. This has been hindered by lack of standardization of both laboratory test and clinical syntax, and by the idiosyncrasy of laboratory information systems and disease reporting requirements.⁸⁵ The former issues have been addressed for several years by the Centers for Disease Control and Prevention⁸⁶ and the latter by the Public Health Informatics Institute and Association of Public Health Laboratories.⁸⁷ Nevertheless, implementation of compliant systems continues to lag.⁸⁸

A second approach is to automate disease reporting and report management using Electronic Disease Surveillance Systems. These enable both electronic import of some information types, and continued electronic management of case investigation, and are also assisted by some of the CDC-sponsored standardization mentioned above.

Environmental illness reporting (of which childhood lead poisoning is by far the largest program) is even less standardized nationwide. At local, state and national levels, reporting requirements vary based on different program requirements. Some degree of national standardization may occur with the further development of the national Public Health Environmental Tracking program.⁸⁹

Existing HIEs such as those in Indianapolis and Cincinnati have facilitated electronic reporting of reportable diseases to local public health agencies.⁹⁰ Fourteen percent of health information exchanges surveyed in 2006 said they planned to implement electronic laboratory reporting to public health agencies.⁹¹

Laboratory Order-Entry and Result Reporting

Many public health laboratories serve as primary or reference laboratories for clinical specimens, particularly related to infectious or environmental conditions. These laboratories have the same need to receive specimen requisition information and to transmit results as hospital-based or commercial laboratories.

Newborn Screening

Most states require collection of both blood and demographic information on each newborn to permit early detection and intervention for congenital metabolic and hematologic diseases. Many states have also added routine performance and reporting of hearing tests. Given the number of births, such transactions to the public health testing agency probably exceed 2 million annually. Data management could be facilitated by electronic reporting of demographic information to the public health agency, and by electronic communication of blood test results and follow-up advice to both clinicians and public health nurses.

⁸⁵ Overhage J., J. Suico and C. McDonald. "Electronic laboratory reporting: barriers, solutions and findings." *J Public Health Manag Pract.* 7(6) pp. 60-6 (2001).

⁸⁶ Significantly with the Public Health Information Network PHIN Notifiable Condition Mapping Tables (see <http://www.cdc.gov/phn/vocabulary/ncmt.html>) and the PHIN Messaging System (see http://www.cdc.gov/phn/preparedness/CFC_RSv1.0.pdf). Accessed January 20, 2007.

⁸⁷ See Public Health Informatics Institute. Collaborative Design of Laboratory Information Management Systems Logical Design at <http://phii.org/LIMSdesign.html>. Accessed January 20, 2007.

⁸⁸ Merrick, U.G., S.W. Turner and R. Aller. "Features of existing laboratory information systems and PHIN readiness." 2006 PHIN Conference, available at http://www.cdc.gov/phn/06conference/posters/PosterSession_Merrick.pdf. Accessed January 20, 2007.

⁸⁹ See <http://www.cdc.gov/nceh/tracking/default.htm>. Accessed January 20, 2007.

⁹⁰ Suico, J., J. M. Overhage, P. Dexter, M. Branes and C. McDonald. "Electronic Laboratory Reporting for Public Health." Available at <http://collab.nlm.nih.gov/tutorialspublicationsandmaterials/telesymposiumcd/6B-2.pdf>. Accessed January 21, 2007.

⁹¹ "Improving the Quality of Healthcare through Health Information Exchange: Selected Findings from eHealth Initiative's Third Annual Survey of Health Information Exchange Activities at the State, Regional and Local Levels." p. 28. September 25, 2006. Available at <http://toolkit.ehealthinitiative.org/assets/Documents/eHI2006HIESurveyReportFinal09.25.06.pdf>. Accessed January 21, 2007.

For many critical public health programs, from disease reporting to newborn screening and immunization, HIEs could produce valuable information on a transaction basis, and speed the pace of automation and standardization.

Immunization Registries

Beginning in the early 1990s, communities and states sought to collect information on childhood immunizations to aid the detection of unvaccinated children, and reduce concerns about redundant vaccination as children moved from one provider to another.⁹² Many states have active immunization registries, with reporting of vaccinations by providers performed either on a mandatory or voluntary basis. Many of these registries are expanding to include adult vaccinations, such as influenza vaccination or tetanus boosters as well. Batch data from billing records has helped populate some registries, but clinical information is often more accurate, thus HIEs could produce valuable information on a transaction basis for these programs.

Syndromic Surveillance (Biosurveillance) for Disease

One approach to improving the speed of disease outbreak detection, which has gained particular attention as a means rapid preventive mobilization after a large-scale bioterrorism attack, is to track reports of suggestive symptoms and signs of disease. Such “syndromic surveillance” could speed outbreak recognition because it avoids the time delay needed for laboratory testing and definitive diagnosis. On the other hand, it lacks the precision of diagnosis-based reporting and thus is prone to large numbers of “false positive” reports requiring investigation.

As a result, most such systems rely on detecting statistical aberrations in the number of reports over time and space. Thus, while some public health systems rely on receiving immediate notification of individual cases (a transaction-based model), many others examine aggregate reports over a time interval (compatible with an intermediary model). The former model may be of particular importance for rare and high-impact diseases such as smallpox. The importance of early detection of large-scale bioterrorism events is predicated on the need to deploy prophylactic medication to prevent injury and death to large numbers of persons. The slope of the time-cost curve for delay in prophylactic treatment rises as high as \$200 million per hour in a model of an airborne anthrax attack on a major city.⁹³

Other Health Condition Surveillance

Many states also perform surveillance of cancer incidence and outcomes, birth defects and other conditions, sometimes to ensure that individuals obtain necessary services, and more often to evaluate prevention efforts or to aid epidemiologic research. Frequently the burden of such reporting is placed on providers. Uses of such information are often restricted by the enabling state legislation.

Health Care Utilization and Cost Surveillance

Many states routinely collect aggregate information on hospitalizations and other health utilization for health services and policy investigations. These are typically derived from billing rather than clinical records, and often fail even to link patient identities among multiple events. Clinical information from HIE could greatly increase the value of such health utilization monitoring.

⁹² See Community Immunization Registries Manual (2001) at <http://www.cdc.gov/nip/registry/pubs/cir-manual/cir-manual.htm>. Accessed January 20, 2007.

⁹³ Wagner, M. M., F-C Tsui, J. U. Espino, et al. "The emerging science of very early detection of disease outbreaks." *Journal Public Health Management Practice*. 7(6) pp. 51-59 (2001).

Monitoring and Managing Health care Resources

Particularly in emergencies when demand for health resources potentially exceeds supplies, monitoring of health care capacity (hospital beds, emergency room capability) can alert emergency management of the need for extraordinary measures to increase capacity.⁹⁴ If health care utilization information is sent to health agencies as individual transactions, it could also be used by health agencies to monitor and manage health resources in emergencies. The critical role of such situational awareness was highlighted by the problem managing large numbers of patients combined with disablement of existing facilities and addition of mobile resources after Hurricane Katrina.

Health Professional Alerting

An increasingly important role played by local and state public health agencies is to alert health care providers when rapidly developing public health issues require their attention (for example, an outbreak of whooping cough, the 2001 anthrax powder event and the 2003 emergence of Severe Acute Respiratory Syndrome, or SARS). To the extent that an HIE creates and maintains a role-based directory (or federated distribution system) of clinicians, it could greatly aid public health agencies as they try to distribute information electronically. Twenty percent of surveyed HIE initiatives in 2006 said they planned to incorporate alerts to providers among their services.⁹⁵

Case Management

One traditional public health function that is increasingly utilized by private agencies as well is case management of a condition, either to ensure control of a communicable disease, or to help families prevent complications and access services for chronic diseases or disabilities. Often such case management requires (at minimum) a three-way communication pathway that includes the case manager, the patient/caregiver and the primary clinician. Such communications are currently managed by a combination of visits, telephone calls and written or faxed communications, which are cumbersome, slow and of limited effectiveness.

Electronic communication between case managers and clinicians (aided by an HIE's user directory and secure messaging) is one potential improvement. Another is needs-based, shared access to laboratory results and other patient information for case managers and clinicians. Finally, once patients and caregivers become HIE participants (presumably through the use of Personal Health Record applications), it becomes possible for case managers to increase the efficiency of communications with and from patients. Thus HIE potentially can greatly improve all three legs of the communication pathway. Twenty percent of HIE projects surveyed in 2006 planned to implement disease or chronic care management programs.⁹⁶

Chronic Disease Management and Alerting

One potential application of HIEs is the creation of community-level disease registries of persons sharing a chronic disease or other condition (such as reliance on a particular medical device). Public health agencies could use such registries to inform members of new community services (such as a community class for diabetics), or to alert them of urgent changes that might affect their health (such as informing asthmatics of predicted high-ozone conditions and making recommendations, or warning those dependent on medical equipment of projected rolling power blackouts).

⁹⁴ Barthell, E., S. Foldy, K. R. Pemble, et al. "Assuring community emergency care capacity with collaborative internet tools: the Milwaukee experience." *Journal Public Health Management Practice*. 9(1) pp. 35-42 (2003).

⁹⁵ "Improving the Quality of Healthcare through Health Information Exchange." Op cit.

⁹⁶ "Improving the Quality of Healthcare through Health Information Exchange." Op cit.

Disease Prevention and Health Promotion

As lay people begin to participate in the HIE through the use of Personal Health Records (PHR), it would be possible to improve the precision and effectiveness of disease prevention and health promotion efforts through personalization. Current promotion campaigns involving mass media, location-based (like workplaces, schools and churches), community-based or home-visit based outreach are expensive and highly variable in effectiveness. As an alternative (presumably with permission from PHR users), authorized health departments or community-based organizations could invite persons registering obesity or cigarette smoking on their PHR to participate in in-person or online coaching. Persistence of a digital divide (inequality in Internet access or capability) may reduce the utility of this functionality to reach the highest-risk and neediest people who are the primary targets of public health programming

The Potential of Stage 2 Infomediary Models for Public Health

The above discussion identified several areas of public health work in which HIEs can serve valuable public health functions, primarily by mediating individual transactions between health system participants, including public health organizations. Now we will focus on leveraging the collective power of the local information exchange network to provide the same types of information wholesale (rather than relying on business-to-business transactions), process information for secondary use, or deliver information services on behalf of public health organizations.

These may either be services to public health actors, or to their constituents. Note again that in some cases, public health serves as a data provider, and in others as a data user. Viewing public health organizations solely as passive recipients of information shortchanges the potential value that can be created with public health information.

HIE as Wholesale Information Extractor and Purveyor

In the section above, individual transactions among health care organizations, patients and public health entities (business-to-business transactions) were mediated through the HIE network. For some of these (such as vital statistics reporting, reportable disease reporting, immunization and other health information registries), the HIE itself could potentially extract and transmit information from the data systems or data transmissions of its members.

Rerouting of Reportable Information to Public Health Authorities

Laboratory results and similar information delivered by HIEs could also be copied to public health agencies (when they have a legitimate right to information, such as mandated reporting). The HIE would perform this service on behalf of its participating members. When performed effectively in an automated, universal fashion, such surrogate reporting could replace burdensome reporting by laboratories. This would be likely to improve speed and completeness of reporting to public health agencies, and replacing paper with electronic reporting also adds value to public health agencies. As noted above, these services are already being provided by some existing HIEs.

Individual Patient-Level Clinical Data Mining

Much of the information used in vital statistics registration, immunization registries, mandated communicable and environmental disease reporting and disease registries relies on stand-alone systems for manual data entry and reporting. This information can potentially be mined from electronic medical records and other clinical databases associated with an HIE, or derived from laboratory reports transmitted through the HIE. To the extent that public health agencies can receive standardized information for these functions, it can increase the ascertainment of cases and the speed and completeness of data received, and greatly reduce data entry costs. Meanwhile, the burden of mandated reporting on health providers could also be meaningfully reduced. Indiana has initiated such efforts.⁹⁷

De-identified or Aggregated Clinical Data Mining

One of the most widely anticipated public health products of HIEs is the creation of periodic aggregate reports to inform biosurveillance efforts. In this case, the HIE would obtain, de-identify and as appropriate, aggregate information from its members to be used by public health authorities for syndromic surveillance or monitoring of health system capacity.

Integrated Views of Patient Information

Several types of public health data can contribute to a holistic summary of a patient's electronic health record. Efforts are under way to consolidate data from currently siloed information sources that could potentially include information from the birth record, newborn screening program, lead poisoning registry and immunization registry.⁹⁸ Such a product would be highly useful to both clinicians and public health professionals working with a child. Ideally, the HIE infrastructure could be used to assemble and deliver securely such information from public health sources in the same fashion as information from personal health care providers.

Other HIE Functionalities

Channel Marketing and Reuse of Public Health Information

Vital records, reportable disease and health care utilization databases have been mounted by public health agencies to permit mining of aggregated data without violating the confidentiality of individuals, with increasing levels of automation.⁹⁹ Such information can be of great use in health services planning, program evaluation, marketing and other functions.

The HIE can serve as a channel marketer of such information, increasing access to and use of such data through the same channel that clinicians and other stakeholders will increasingly use for information. In addition, an HIE could integrate such information with information from other sources to create added-value products. Examples include:

⁹⁷ Grannis, SJ, Biondich PJ, Mamlin BW et al. How Disease Surveillance Systems Can Serve as Practical Building Blocks for a Health Information Infrastructure: the Indiana Experience. AMIA Annual Symposium Proceedings 2005. 286-290.

⁹⁸ Saarlal, K. and M. Hastings M. "Integrated Child Health Information Systems: An update on the status and near-term future of information systems that consolidate information about the multiple health care services a child receives." Decatur, GA: Public Health Informatics Institute (2004). Available at http://phii.org/Files/Integrated_CHIS.pdf. Accessed January 21, 2007.

⁹⁹ "A Guide for Public Health Agencies Developing, Adopting, or Purchasing Interactive Web-based Data Dissemination Systems." Available from <http://www.cdc.gov/epo/dphsi/ash/oromacro.htm>. Accessed January 21, 2007.

- Integration of vital statistics or disease prevalence data with other commercially used demographic databases for more powerful market research (for both social and commercial marketing). For example, cancer registry information has been combined with commercial market information to refine prevention marketing efforts.¹⁰¹
- Integration of near-real-time disease prevalence information into clinical decision-support systems to improve the interpretation of diagnostic testing, ranking of differential diagnoses, infection control provider alerts and other automated logic. For example, the predictive value of a rapid influenza test is highly dependent on the prevalence of influenza in the community; prolonged cough might trigger whooping cough isolation and testing during an outbreak.

An HIE can deliver powerful benefits to pharmaceutical companies, payers and purchasers, researchers, hospitals and many others. The potential advantages to society are enormous.

Broadcasts

Once an HIE has created reliable directories for secure communication with providers, and potentially with patients who have their own PHRs or are enrolled in community disease registries, it becomes feasible to offer targeted broadcasts of alerts, advisories or health promotion materials. As previously noted, like any other medium, the value of these services depends in part on the degree of penetrance for the market sector desired (e.g., physicians, or low-income community residents).

PHARMACEUTICAL INDUSTRY¹⁰¹

There are number of value chains that can be constructed for the pharmaceutical industry. First, pharmaceutical developers spend \$800,000,000 to conduct clinical trials for each drug that comes to market. There is tremendous motivation to control these costs. One way to control them is to optimize clinical trial design. If the trial designers can improve the inclusion and exclusion criteria, they may be able to reduce the number of patients they need to enroll, decrease enrollment time and get drugs to market faster. One advantage of this value chain is that the size of the population required for necessary data thresholds is more modest – a million or two – compared to those needed for safety and benefit analysis. A HIE could potentially make data available to the pharmaceutical industry that would enable them to make these determinations at a lower cost.

Second, but requiring a significantly larger population of patients, is mining data for risk benefit analyses. The value to the pharmaceutical industry in this scenario is that (a) there is substantial pressure on the industry to proactively monitor safety of marketed drugs, and (b) there is potential to identify new uses or benefits for compounds that are marketed for other indications. Our rough estimate is that a population of 20 million patients will be needed for these applications. The potential value to the pharmaceutical industry is very large; some have estimated the current size of this market as \$50 billion, with substantial growth potential.

Third, today pharmaceutical companies use very poor data on provider prescribing for marketing purposes, and they pay dearly for this data. An HIE could potentially (though with some risk of angering their members) provide similar, perhaps better, data. This is a market of several billion dollars per year.

¹⁰⁰Miner, J.W., A. White, A. E. Lubanow, et al. "Geocoding and social marketing in Alabama's cancer prevention programs." *Prev Chronic Dis.* November (2005). Available from: http://www.cdc.gov/pcd/issues/2005/nov/05_0073.htm. Accessed January 15, 2007.

¹⁰¹"We are grateful to Marc Overhage, CEO of IHIE, for supplying the content of this section."

Payers and Purchasers

In order to support quality improvement initiatives, HIEs may be able to contribute clinical data to augment claims data, in a way that ensures the payers derive value. There is a significant discount rate applied to the potential savings. A per-member per-month fee from the payers would be a rational model for this application. IHIE now has payers who have committed to fees of up to \$0.30 PMPM to support aggregation and reporting of quality improvement data. For a more detailed analysis of the need for complementing claims data with clinical data for health plans, see Chapters 10 and 11.

For a more structural view of how a RHIO/HIE can greatly facilitate the measurement of outcomes tied to payment reforms like P4P, it is best to break down each of the necessary operational tasks that must be performed by the RHIO (operating as social capital generator) and the HIE (operating as human capital generator). The need and opportunity begin with a brief contextual scan of doctors practicing medicine under the microscope of performance measurement programs.

Outside of a staff model setting, today's typical physician in private practice is increasingly confronted with several incentive programs at any given time. Usually they are based on a combination of Health Plan Employer Data and Information Set (HEDIS) measures, patient satisfaction surveys and sometimes efficiency, but they vary widely from one to another. Also, since each incentive program usually represents a fraction of the physician's practice, each alone has negligible financial impact on the physician's income. These two factors markedly reduce the potential impact of quality improvement incentive programs. Widespread Electronic Health Records (EHR) adoption with quality reporting capabilities, particularly coupled with HIE interoperability, would create the foundation required to eliminate these obstacles.

Currently quality measures are primarily based on administrative claims data. This is understandable, since that is the most abundant source of data. However, claims data was never intended for building quality measures and is a poor proxy at best. Unfortunately, until we have wide adoption of HIEs and EHRs across the county, claims data will continue to be the only plentiful source of information.

A RHIO/HIE can help in several ways, but first some essential concepts need to be detailed that are necessary to get to robust quality reporting.¹⁰²

1. Moving from health information exchange to quality reporting requires several key components:

- A functional *HIE (as opposed to a functional RHIO)*
- A common *information model*
- A *unified data repository* with clinical and administrative data
- Credible and accepted *quality reports and metrics*
- A *delivery and presentation* mechanism for reporting
- Interested *end-users* to consume and act on the information

2. When assembling the key components, three phases of realization need to be ensured:

- *Development* – creating it and getting it ready for use
- *Deployment* – releasing it into the operational environment
- *Support* – ensuring it remains operational and trouble-free

¹⁰² "We are grateful to John Blair, CEO of MedAllies, for supplying the content of this section."

◦ **Functional HIE Model**

Development

- HIT product selection & integration—HIE
- Data source integration—HIE
- Data quality program development—RHIO
- Data normalization for exchange—HIE
- Data retrieval mechanism creation—HIE
- Hosting identification—HIE
- Implementation planning—HIE
- Workflow redesign—HIE
- Testing—HIE

Deployment

- Training—HIE
- Installation—HIE
- Data cleansing activity—HIE
- ETL/import activity for sources—HIE
- Release management—HIE
- Testing—HIE

Support

- User incident management—HIE
- System incident management—HIE
- System upgrades & maintenance—HIE
- Data maintenance—HIE
- Change management—HIE

◦ **Common Information Model**

Development

- Integration of HIT product models—HIE
- Incorporation of administrative models—HIE
- Identification of derived data elements—HIE
- Terminology development—HIE
- Semantic harmonization—HIE
- Inspection testing—HIE

Deployment

- Publishing of model—HIE
- Incorporation into business usage—HIE
- Local harmonization with existing models—HIE

Support

- Accommodation of new data elements—HIE
- Accommodation of new derived data—HIE
- Change management—HIE

◦ Unified Data Repository with administrative and clinical data

Development

- Meta-data model development—HIE
- Logical and physical data modeling—HIE
- Extract/transform/load development—HIE
- Hosting environment setup—HIE
- Enjoining claims/admin data—HIE
- Data quality program development—HIE
- Testing—HIE

Deployment

- Training—HIE
- Installation—HIE
- Data cleansing activity—HIE
- ETL activity for sources—HIE
- Release management—HIE
- Testing—HIE

Support

- User incident management—HIE
- System incident management—HIE
- System upgrades and maintenance—HIE
- Data maintenance—HIE
- Change management—HIE

◦ Credible and accepted quality reports and metrics

Development

- Metric development—RHIO
- Report development—RHIO
- Validation of data support, utility, etc.—HIE

Deployment

- Incorporation into business operations—HIE

Support

- Requirement changes/augmentation—RHIO/HIE
- Change management—RHIO

◦ **A delivery and presentation mechanism for reporting**

Development

- Business intelligence (BI) product selection and integration—HIE
- BI meta-data model development—HIE
- Hosting environment setup—HIE
- Security model development—HIE
- Alpha/Beta testing—HIE
- Testing—HIE

Deployment

- Training—HIE
- Installation—HIE
- User role assignment/credentialing—RHIO/HIE
- Testing—HIE

Support

- User incident management—HIE
- System incident management—HIE
- System upgrades & maintenance—HIE
- Ad-hoc report creation—HIE
- Change management—HIE

◦ **Interested end-users to consume and act on the information**

Development

- P4P/Utilization Review/etc. program development—RHIO
- Transition plan development—RHIO/HIE
- New/enhanced organizational role development—RHIO/HIE

Deployment

- Training—HIE
- Switch to P4P paradigms internally—RHIO/HIE
- Verification of metric applicability to participants—RHIO/HIE
- Rollout of P4P programs to clinicians—HIE

Support

- Participant incident management—HIE
- Inservice forums for feedback and correction—RHIO/HIE
- Change management—HIE

The RHIO can act as a coordinating body to help employers, health plans, physicians and hospitals develop consensus on a uniform quality reporting program. The program would include a core standard report from the HIE that each payer could use as the sole report for each provider, group or community. The payer could also include additional measures or evaluation parameters that could be added to the core report.

This level of community engagement requires large amounts of social capital, because consensus is required among competing stakeholders to get to a core standard report. Also, consensus is required among the providers to get them to fully embrace the value of collecting and reporting on the measures. Only a RHIO overseeing an HIE that has moved to the level of a Stage II Infomediary will have a chance at this.

Currently, the Certification Committee for Health Information Technology plans to require Electronic Health Records (EHR) vendors to capture the data necessary to build quality measures in a standard format. The Centers for Medicare and Medicaid Services is currently funding regional pilots to produce performance measures, which are entitled the “Better Quality Information to Improve Care for Medicare Beneficiaries (BQI) Projects”. One pilot is leveraging the use of an HIE to develop performance measures.

Many of the above-outlined activities come with minimal dollar costs, but tremendous social capital costs. A revenue model will be needed to cover both. Revenue may come from the providers doing the reporting or the payers receiving the reports, or a combination of both. We must be careful to note, however, that until many of the privacy issues have been resolved, it will be difficult to forge ahead at full steam toward business models based on data reuse.

Life Sciences and Non-Commercial Research

A wide variety of clinical researchers in university and government agencies could benefit from access to the clinical data that an HIE could provide. As in the pharmaceutical industry, researchers might use data for study design (in preparing a grant proposal, for example), recruitment and improving a trial’s efficiency by reducing the cost of data capture. There are a number of policy issues that need to be navigated, but an HIE may want to offer access to data for these purposes. The size of this market is difficult to estimate, but is not likely to be very large.

Physicians and Hospitals¹⁰³

Pay for Performance

As noted earlier, P4P will continue to gain acceptance in commercial and government markets. Much of the data required for real-time certification of physician office compliance with treatment standards is generated at a physician lab machine instead of a commercial lab site. This data can be flowed back to HIEs for a fee as a tool to enable physicians to report more efficiently in P4P programs.

¹⁰³ "We are grateful to Keith Hepp, CFO of HealthBridge, for supplying the content of this section."

Billing Services

Specialty physician offices need improved billing information for inpatient professional services. The data created during the pre-operative H&P process at the physician office is frequently subject to insurance error, and rework in the physician office can create billing delays and write-offs. During the admission process, hospitals frequently receive and correct billing errors when connected to eligibility verification systems after the initial registration event. Errors are frequently corrected using hospital medical records while the patient is in the hospital. A billing feed can be created for specialists to review for corrections from this data file to correct the professional portion of the bill before it is sent to the payer.

Operating Room Data Searches

Lab and radiology information needed for pre-op at one institution is frequently needed at another. Each hospital also has multiple OR nurses, who chase information that may have been generated by a national lab or by a competing hospital prior to a surgery. The opportunity cost for a hospital of not performing an operation is significant – time not utilized in the OR is a wasted asset. Therefore, a repository product to search for pre-op testing would be a significant revenue retention strategy for hospitals, and would foster cooperation because of mutual self-interest, reducing costs and yielding revenue. While this is a similar “product” to other repository capabilities, identifying and quantifying the value to each constituent in a hospital will yield an ROI-justified revenue stream.

EMR Data Loads

EMR can mean “Empty Medical Record” when an EMR is first purchased, since the cost of loading data from paper charts is extremely high, and comprehensive data sources are not always available absent an HIE data repository. HIEs can facilitate easy and efficient access to disparate information that resides across multiple settings.

Physician Report Distributions

Physician offices face a smaller but similar cost (and dissatisfaction) with paper report distribution for office consult notes to referral sources. Current distribution through EMRs and transcription systems are primarily faxes, with some printing and mailing. Physicians who receive hospital lab data electronically through an HIE also want their other referral documentation electronically as well. The value to connect is a) cost avoidance, b) satisfaction of referring sources and c) the resulting changes in referral patterns.

Telecom Management

HIEs are the center of telecommunications among many parties, and IT skills within the HIE are critical to making this work better. Physician offices frequently do not have in-house IT skill sets and are willing to pay HIEs to manage their IT infrastructure needs. HIEs can manage both desktops and network connections.

Accurately Linking Patient Data

Regardless of HIE type, a method for accurately linking patient data is required for managing its business. Some HIEs use a CPI as a primary routing element, and others use a route primarily based on physicians of record (HealthBridge and IHIE, for instance). A by-product of this index is the development of a community asset that can be leveraged in multiple settings to reduce cost or create additional revenue streams. Patient linking methods can support hospital Abstract Data Type (ADT) systems, EMRs, physician billing companies and ancillary ordering systems, which would find value in a better understanding of patient demographics.

Pooling of Software Costs

Significant cost savings can be found in purchasing items counted as fixed costs for many entities, through one entity in one discounted volume purchase. Many vendors sell the same software to multiple hospitals, labs and physicians. HIEs can purchase software for these entities and save them money by reducing overlapping seat licenses. Many of these applications can be offered by HIEs on an ASP basis, spreading the costs of applications further across large regions of providers. This is one of the more attractive aspects of the franchise model.

EMR Insertions

Value is created by having a single pipe to which all EMRs in a region can connect. Fully allocated costs can be as high as \$20,000 for a single connection to a single lab system. HIEs can standardize outputs so that an EMR vendor has one specification to which it must conform; thus, the number of interfaces is dramatically reduced. All parties (labs, hospitals and physician offices) benefit economically and would produce yet another revenue stream for HIEs.

Expanded Provider and Provider-Related Bases

Other parties outside the usual provider base have a need for the data transferred through an exchange. Billing companies, home health agencies, nursing homes and others need results and billing data, and can be charged for access to this data. (HealthBridge earns \$40,000 per year from these activities – all bottom line.)

Printing Services

HIEs can be organized to eliminate the cost and inefficiencies of printing and faxing results. However, there are also opportunities to create efficiencies for printing reports that will never be electronic, because the marginal revenue is less than the marginal cost to provide and support an electronic tool. Direct costs for printing through legacy systems range from \$.55 to \$1.25 per report. With the HIE's ability to combine printed results across the community in one outgoing envelope to each addressed provider, there is an opportunity for substantial economies of scale. In addition to reducing costs, sending all results through an HIE allows a content provider to be certain that all results were delivered, unlike fragmented processes that can lead to errors.

Centralized Credentialing

Primary care physicians, specialists and hospitals spend significant time and duplicated efforts in obtaining basic information on physicians needed to grant privileges. Although the medical staff by-laws of each hospital will always be different and approval will remain a hospital function, much of the basic information required across institutions is the same. This creates duplication at each hospital system (and frequently within the same system) and across the community. A single trusted source will reduce duplication of effort for all participants.

Disease Management

Lifestyle changes after significant adverse health events such as heart attacks are critical to improved long-term prognosis. Currently, employer-based intervention programs rely on claims data to notify an interventionist that an employee has an event managed by the program. The problem with relying on claims data is that it triggers the intervention only after discharge, thereby reducing patient compliance with protocols. HIEs can include information on employer participation in intervention programs, and route messages to interventionists based on initial diagnosis in the ADT data feed upon Emergency Department or inpatient admissions. Fees to employers would be based on improved productivity due to improved compliance and quicker return to work.

Aggregation of Administrative Transactions

Building electronic conduits for claim submissions, eligibility verifications and precertifications is a natural business space for HIEs. The charges to physicians and hospitals are generally volume-sensitive, and can be aggregated to reduce the per-unit charge to all members while still leaving a margin for HIEs. Although it might constitute one of the smaller revenue flows for a medical HIE, it can be the mainstay for HIEs such as UHIN in Utah, and form the basis for expansion into medical exchanges.

Clinical Trial Database

Much of the data that flows through an HIE may not be rich enough to provide data on clinical trials if it is not connected to a large percentage of EMRs. But where such connections exist, or come to exist, richer data sets can be achieved by combining physician office data with HIE data. HIEs with a repository can include relevant office-based information with the kind of external data sets sought by pharmaceutical companies. The incremental costs are fairly negligible, but the potential revenues could be substantial.

Capital Grants as Payment for Services Rendered

Although funding for ongoing operations is difficult to obtain, many state and public health agencies can provide capital for the purchase of equipment or the creation of new products and services. This is because the need for data by granting organization is ever increasing. HIEs can obtain grant funding and “credit” governmental agencies as recognition of the ongoing value received.

In other words, if a granting party can provide a million-dollar grant for the purchase of HIE core data sets, and it is paid as a subscription fee at \$250,000 a year for ongoing participation, the government agency is considered a dues-paying member for four years. This type of arrangement encourages operational participation without creating budgeting complications for the HIE, because cash is fungible. If the granting agency adds value over the four-year period, it also provides an incentive for the agency to find other types of grants, and relieves some of the grant-searching burdens HIEs normally experience.

Research Grant “Tax”

Stiff competition for grants exists for universities today. Many research institutions have inpatient and outpatient data from affiliated hospitals and physician groups, but do not have a “community-wide” population to study; this can skew results or provide distorted outputs. Because research grants from the National Institute for Health, for example, have overhead built into their grants for research institutions, some of that overhead money can be allocated to HIEs to encourage HIE willingness (and ability) to participate in ongoing studies and operations. This would have the happy effect of reducing the cost of line item analysis required to justify participation and, in the end, improve research outcomes because of the richer data set flowing into research studies.

PHR Routing

Employers and patients are the primary beneficiaries of Personal Health Records (PHRs). Much of the data needed to manage chronic care and populate PHRs is routed through HIEs and cannot be obtained through health plan claims data or employers’ HR systems that sponsor PHRs. For example, the fact that a Hemoglobin A1c test was completed can be substantiated from claims. But the value of greatest interest over time is the relevant clinical measure of Hemoglobin A1c levels, which cannot be determined from claims.

While health plans do have some direct connectivity with national labs, large amounts of local lab and hospital lab data are not part of that flow. Additionally, much of the information related to patient care is generated by physicians through exams. The results of those exams need to be part of the overall data flow. Some PHRs are seamlessly attached to physician EMRs. But the problem is that complex and expensive patients tend to receive care from primary care physicians who make referrals to multiple specialists, none of whom share the same platforms (or rarely do). HIEs can function as bridging infomediaries to route common patient data between different physicians and their differing systems.

EMR Hosting

Many EMRs in physician offices remain server-based, duplicating infrastructure. EMRs can be more efficiently hosted and managed on a community level, reducing infrastructure costs and providing a revenue stream from physician offices.