MEDINFO 2007
HISA Ltd Australia
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Collective Intelligence and a Sustainable Healthcare System

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Abstract

Collective Intelligence is Mother Nature's way of cooping with evolving complexities. For a sustainable healthcare system, we must cast a critical look at our traditional episodic based healthcare delivery model and focus more on disease prevention and chronic disease management. This in part is possible by way of having access to timely and accurate lifetime patient medical information. A National Health Information Infrastructure initiative is the catalyst needed for such dramatic changes in our healthcare system.

Keywords:

national health information network

Unsustainable healthcare system

The Centers for Medicare and Medicaid Services (CMS) recently released projected health care expenditures for the 2005 through 2015 period. [1] Total health expenditures are estimated to be $2.16 trillion in 2006, and are projected to rise to over $4 trillion in 2015. Per person health spending is $7,110 this year and is projected to increase to $12,320 by the end of the period.

Health spending continues to increase much faster than the overall economy (i.e., gross domestic product, or GDP). Since 1970, health care spending has grown at an average annual rate of 9.9%, or about 2.5 percentage points faster than GDP. [2] In recent decades, the growth rates for health spending and GDP have slowed, but health spending growth remains consistently above GDP growth. As a share of the economy, health care has risen from 7.2% of GDP in 1965 to over 16% of GDP today, and it is projected to be 20% of GDP just 10 years from now.

Despite such overwhelming expenditure:

- Medical errors is the third leading cause of death in the United States. [3]
- 250,000 people die in the U.S. each year due to surgical errors, mistaken diagnostics, incorrect prescribing, hospital-acquired infections and inadequate care.
- There are over 46 million uninsured persons in US. [4]

Clearly this is not a sustainable healthcare system. The time has come to take a few fundamental steps away from our traditional business and clinical models.

Business model

The current financial incentives in healthcare system undermine efforts to improve preventive and primary care, manage chronic conditions, and coordinate care. It is based on claim-based transaction model which forces providers to focus more on patient volume and less on healthy patients. Revamped payment models should reward more effective and efficient care, with focus on value. Indeed US government, health plans, employers, and "watch dog" groups are all moving towards the implementation of quality measures, public reporting of both hospital and physician performance, and the tying of those outcomes to reimbursement.

Clinical model

In a sustainable healthcare system healthy population is as important as individual patient treatment. More often, in the present hospital-based systems:

- Physicians and other clinicians sometimes provide patient care while lacking knowledge of previous medical history, resulting in both wasteful duplication and clinical decisions that do not take into account critical data related to patient health. In fact, studies show that paper hospital records are unavailable when needed approximately one-third of the time.
- Hospitals and physicians are often unable to obtain usable information that is essential to research breakthroughs in confusing particularities of individual patients or in avoiding preventable medical errors and malpractices.
- Public health agencies and providers are unable to exchange information critical to identifying, tracking, and responding to public health threats ranging from traditional epidemics to deliberate bio-terrorist attacks.
- Health services researchers do not have ready access to data required to develop improved processes of care, which would lead to improved health outcomes.
- Patients who wish to collaborate with their doctors in managing their own health have little information to work with. Meanwhile, private and governmental payers, as well as individual workers, and consumers, continue to bear the financial burden of clinical inefficiency.

Higher quality of care and efficiency is achieved when up-to-date best practice information is universally available replacing opinion-based decision-making to evidence-based decision-making. The constraining tunnel vision created by the present silos of clinical information must give way to a bird's-eye view of patient lifetime medical encounters.

Collective intelligence

By definition Collective Intelligence is an intelligence that emerges from the collaboration and competition of many individuals, an intelligence that seemingly has a mind of its own.

The field of collective intelligence is seen by many as primarily a human enterprise in which mind-sets, a willingness to share, and openness to the value of distributed intelligence for the common good are paramount. Participants are confident of their own abilities and recognize that the whole is indeed greater than the sum of any individual parts.

As complexity and crises increase, more people and institutions are recognizing that our collective intelligence - at every level and especially in its wiser forms - has tremendous potential to produce positive change and even turn major breakdowns and crises into evolutionary breakthroughs. [5]

Thus collective intelligence is a holy grail of social change and social creativity. If we could better understand how to support it, increase it and facilitate it, we would be more able to effectively co-create a better world. Doing that, of course, involves significant political, economic, social, cultural, organizational and spiritual challenges. But the rewards, when these challenges are successfully engaged, are tremendous.

Harnessing collective intelligence

As patients move through various episodes of care, it becomes evident that to enhance quality of care various stakeholders' business processes must be woven together into an integrative delivery mechanism. National Health Information Infrastructure (NHII) is a new paradigm for the achievement of real-time information integration. It is a platform for sharing information and knowledge appropriately so it is available to people when they need it to make the best possible health decision.

NHII includes not just technologies but, more importantly, values, practices, relationships, laws, standards, systems, and applications that support all facets of individual health, health care, and public health. It encompasses tools such as clinical practice guidelines, educational resources for the public and health professionals, geographic information systems, and health statistics at all levels of government, and many forms of communication among users. [6]

Concisely, National Health Information Infrastructure:

- is an initiative set forth to improve the effectiveness, efficiency and overall quality of health and health care,
- is a comprehensive knowledge-based network of interoperable systems of clinical, public health, and personal health information that would improve decision-making by making health information available when and where it is needed,
- is the set of technologies, standards, applications, systems, values, and laws that support all facets of individual health, health care, and public health,
- improves public health through advanced bio-surveillance methods,
- streamlines collection of data for quality measurement and research,
- is voluntary,
- is NOT a centralized database of medical records or a government regulation,
- is an information infrastructure, not information system,
- sits beside the legacy systems of providers, payers, etc,
- reduces local implementation barriers while making the meaning of content in local systems increasingly explicit with time,
- facilitates direct access to external information if permitted by patient consent,
- facilitates incorporation of practice guides,
- decouples the management of information about patients from the systems that automate practice.

To meet the Nation's health needs, the NHII must serve all individuals and communities equitably. The interconnections made possible by the NHII would allow information capacities that now exist or are developing in the health field to be put to fuller use.

Ready access to relevant, reliable information and secure modes of communication would enable consumers, patients, healthcare and public health professionals, public agencies, and others to address personal and community health concerns far more effectively.

NHII architecture

A successful NHII architecture must address three fundamental layers of (1) Systems Integration which is concerned with publication, description, and translation, (2) Organizational integration which deals with consensus, and credentialing, and finally (3) Semantic Integration which handles integration at business process level.

The overarching goal of adopting NHII is to achieve progressive homogeneity across the nation healthcare delivery system, respecting the federated environment, and a balance between what is common and what is decentralized.

Federated model

The interweaving fabric is based on an integrated but decentralized/federated delivery system, which maintains each organization's brand and identity. Its objective is not to impose uniformity throughout the System: instead it recognizes that the agility and autonomy are significant contributing factors to system's overall success.

Conversely, it also recognizes that more synergy needs to be leveraged across entities and that critical functions exist (such as common patient identification, providers registry, referral network etc.) where nation-wide consistency/commonality must be implemented to achieve a holistic healthcare system.

Therefore, NHII federated architecture is about relations between system parts, and between people. It recognizes organizational politics and admits conflict would better reflect reality than a model of unstinting cooperation and unfettered exchange of information. Federalism is preferred archetype, where potentially competing or non-cooperating parties are brought together by negotiation.

NHII federated architecture identifies closely related (people and supporting systems) activities in an organization, along geographical, process, or functional lines. It divides the organization into clusters (domains) with their own administrative and control mechanisms, and supporting systems. The internals of a domain are to be opaque to other domains. It lets domains communicate exclusively via messages to be placed on a federal nation-wide information highway guaranteeing message delivery. Data flow is only by a domain publishing, and other domains subscribing to, specified agreed upon information. A domain itself can consist of a federation; therefore, in this sense, this federation pattern is recursive.

NHII federated architecture is a direct response to the healthcare market challenges associated with fragmented provider structure and rapid changes of affiliation among providers. Independent clinics are constantly bought out or are forming to be more competitive. Physicians' affiliation to hospitals and health plans are constantly evolving. The overall framework supports a complex, adaptive system, which aims to create a global healthcare community by the physicians for their patients.

Governance model

NHII Governance Model defines the policies and practices all services should follow. With no clear guidelines on how an enterprise would govern its services, national initiatives would fail to deliver the results.

Governance is determined by the policies, rules, and regulations under which an organization functions, as well as the processes ensure compliance. While design-time governance deals with capturing information about services and policies, run-time governance enforces those policies during service discovery, management, and execution. For effective governance, a federated control within the NHII infrastructure is needed to ensure that organizational policies are consistently applied.

NHII governance model supports:

- Central registry to store all services, associated metadata, plus business and technical policies.
- Directory services that accurately certify, identify, and categorize clients and providers of health care services.
- Federated identity, verification, and authorization.
- Local, regional, and federal access control mechanism with fine-grain granularity.
- Audits and logging

Trusted third party

Following the successful Model of Internet's Domain Name System, there needs to be regional central authorities which facilitate interactions between stakeholders who both trust the third party. They need to use this trust to secure their own interactions.

Core services provided by the trusted authority include:

- PKI services for distributed authentication, identification, and verification of engaging partners.
- Registry and directory services that accurately identify clients (white pages) and providers (yellow pages) of healthcare services.
- Person meta-data object repository which keeps track of individual's lifetime encounters with the nation's healthcare system.
- Transactional queuing system to support asynchronous nature of healthcare processes.

Conclusion

The NHII would serve important national interests. *Implementation of the NHII will have a dramatic impact on the effectiveness, efficiency, and overall quality of health and health care.* Serious problems such as public health emergencies, medical errors, and health disparities could be addressed in a more timely and comprehensive fashion. Furthermore, even though NHII itself will deliver huge benefits, much like other public infrastructures such as roads, communications, electricity, etc. main outcomes will be derived by additional services. It will spawn new business activities that would otherwise be economically unfeasible.

References

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