

## Chapter VIII

# Healthcare Network Centric Operations: The Confluence of E-Health and E-Government

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### Abstract

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*Health care has yet to realize the true potential afforded by e-health. To date, technology-based health care operations are conducted chaotically, at a wide variety of nonintegrated fronts, with little or no long-term strategy, and at a tremendous and ever increasing cost. This chapter proposes that in order for health care to ever reap the full benefits from e-health, it is imperative for the development of a doctrine of health care network centric operations. Otherwise, millions if not billions of dollars will be spent on a futile chase of the definitions of how and when the computer, health care provider, and health care administrator interact most efficiently and at least expense. The concept of a doctrine, "conceptual platform," that outlines the consequent, goal-oriented way forward, and integrates all constituent elements into a smoothly operating whole, is utilized to great effect in the military. Drawing upon the strategies and techniques employed by the military to develop a network centric doctrine, the chapter outlines the essential components necessary for the establishment of the doctrine*

*for healthcare network centric operations (HNCO), and in so doing not only highlights the integral role played by information computer and communication technologies (IC<sup>2</sup>T) but also the pivotal role of policy makers and governments. In fact, HNCO underscores the important yet rarely acknowledged confluence of e-health and e-government.*

## Introduction

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The rules of competition are changing as a result of the growth of global markets, the increased speed of business transactions, the technological revolution, and continued change in customer expectations. The growth, integration, and sophistication of information computer and communication technologies (IC<sup>2</sup>T) are changing our society and economy. Consumers and businesses have been particularly quick to recognize the potential and realize the benefits of the Internet and Internet-facilitated computer networks. The resultant “e-revolution” changed many aspects of the traditional “way of doing business,” facilitated substantial changes in internal and external management styles, enabled increased efficacy of virtually all production stages and operations, and helped to extend the customer reach. As e-commerce or the application of IC<sup>2</sup>T to business matures, more attention is being placed on maximising its potential benefits to all areas of society. Two areas where much focus is now being placed regarding the use of IC<sup>2</sup>T to improve access to information and provide better access to services include public institutions and governments and health care.

E-government is defined as the use of IC<sup>2</sup>T to provide citizens and organizations with more convenient access to government services and embrace interactions within governments (government-to-government), between governments and citizens (government-to-citizen), and between governments and businesses (government-to-business) (Turban, King, Lee & Viehland, 2004). An analogous definition holds for e-health, which involves the use of IC<sup>2</sup>T to provide all participants within the health care domain with better access to information and services (Wickramasinghe, Geisler & Schaffer, 2005).

IC<sup>2</sup>T are without doubt the source and the platform of one of the greatest transformations of society since the invention of print and permit-free flow, access, and exchange of information, and the development of universal means of contact among humans. In practical terms, these technologies offer the possibilities for vast improvement of efficiency and cost reduction in business, provide a platform for dissemination of high quality education, facilitate health care delivery, and limit the potential for conflict. Already today, the impact of the increasingly more intensive IC<sup>2</sup>T use can be measured in the way local, national, and global political, economical, or social transactions are conducted. Yet, with the growing employment of IC<sup>2</sup>T in daily operations, it is also apparent that neither the optimal pattern of use has been developed (we need look no further, for example, than the productivity paradox (Haag, Cummings & McCubbrey, 2004; Jessup & Valacich, 2005; Laudon & Laudon, 2004; O’Brien, 2005), nor a philosophy guiding such use has been contemplated despite the emerging chaos that threatens the future growth of the field. The impeding state of chaos is exemplified by the collapse of e-businesses in the 1990s (Affuah & Tucci, 2001; Kalakota & Robinson, 1999; Stiglitz, 2003; Wickramasinghe & Sharma, 2004). The need for optimization and doctrine development is most evident in the arena of health care that, at the moment, is the most costly

budgetary item in the world's economy (McGown, Overhag, Barnes & McDonald, 2004; Reinhardt, Hussey & Anderson, 2002; Stats & Facts, 2002; von Lubitz & Wickramasinghe, 2005a; Wickramasinghe & Ginzberg, 2001; Wickramasinghe & Mills, 2002).

Irrespective of the particular health care system adopted by a country, governments will always be one of the major influencing forces and key actors of the health care stage. It should therefore be a logical extrapolation that e-government and e-health should share a significant overlap. One might even go to the extreme and suggest that e-health, especially for countries which only have a public health care system, is in fact a subset of e-government. And yet, the two are rarely if ever discussed together. This confluence between e-health and e-government is best highlighted in the doctrine of Healthcare Network Centric Operations (HNCO). We believe that by acknowledging this confluence, more effective policies and protocols can be developed which will facilitate the adoption and diffusion of HNCO and in turn will lead to more effective and efficient health care delivery.

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## Background

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In health care, despite their relatively late arrival, computer-based technologies will play the major role in management of services at all levels. Yet, while the concept of "e-health" brings the promise of improved economy, increased efficiency, greater equality, and wider range and availability of services, the increasingly diverging goals and philosophies, disparity in the emerging approaches, and frequent incompatibility or limited nature of the available or developed electronic platforms mitigate against such optimistic future. Moreover, the tendency to convert precise terms describing individual components of "e-operations" (operations or activities where IC<sup>2</sup>T have been applied to make them electronic) into often meaningless "household" terminology adds superficial linguistic grandeur to quite nonglamorous and very common-sense notions, and transforms the latter into profoundly sounding expressions of a trivialized credo. The misconceptions serve to produce chaos that, in turn, diffuses the true value of the "electronic" in the context of health care, reduces its impact, and, consequently, delays its most significant contribution toward elimination of spatial and temporal barriers, and energized operational facilitation.

Presently, existing networks and e-health initiatives in health care represent distinctive and disconnected entities whose operation is, essentially, platform-centric, that is, concentrates on the operations of a single system (platform) without any regard for the operational interaction among different systems (a "system of systems" or systems network, see von Lubitz & Wickramasinghe, 2005a, b, c, 2006). The consequent fragmentation and broad incompatibility of individual efforts has, in turn, a major influence on the access range to and sharing of high quality information existing among (or even within) the existing individual systems (ibid). For these reasons, despite providing very significant advantages to the local users (Wickramasinghe & Ginzberg, 2001; Wickramasinghe & Mills; 2002), the overall impact of the electronic information systems on either national or international health care operations continues to be relatively limited (von Lubitz & Wickramasinghe, 2005a) and nor does it provide the promised superior quality of care (Institute of Medicine, 2001).

Health care operations are conducted in a complex operational space. The limitations of a platform-centric approach in such environments are compounded by the fact that the limited (or inadequate) information extraction, gathering, and manipulation capabilities of individual systems are amplified by their frequent lack of interoperability (von Lubitz & Wickramasinghe, 2005a, b, c, 2006). Such limitations severely degrade the possibility of integrating inputs of complex, highly relevant data both from a wide variety of relevant (clinical data banks, for example) as well as seemingly nonessential sources (e.g., political, economical, geographical, ethnographic data pools) and has been the justification for taking a systems approach (Checkland & Scholes, 1990; Churchman, 1968). Environmental complexity of health care operations is often magnified by the presence of multiple actors (agencies, governmental bodies, global organizations, etc.) performing within the same space but using a wide variety of independent and non-intercommunicating platform-centric tools. As a consequence of the resulting chaos, the attainment (mission) of health care goals (objectives) is uncertainty, rather than information-driven (von Lubitz & Wickramasinghe, 2005c).

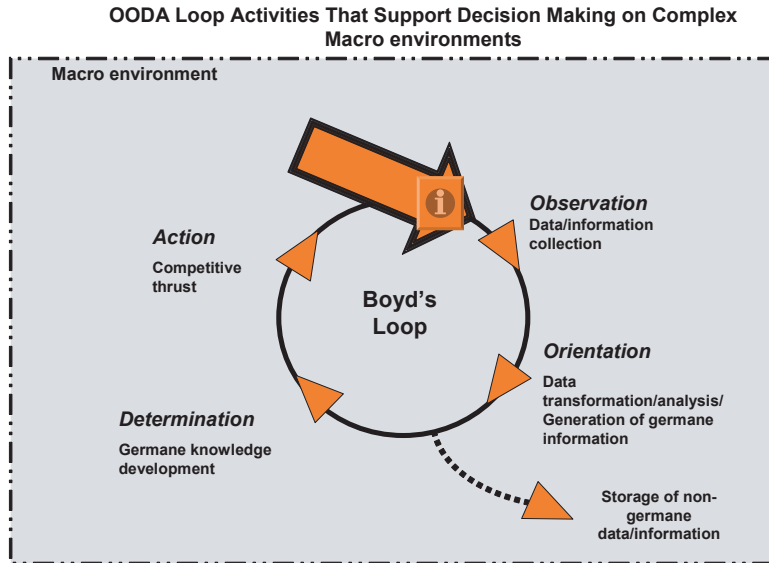
## **Main Thrust of Chapter:**

### **Healthcare Network Centric Operations (HNCO)**

The *network-centric approach* stands in direct apposition to platform centrality (Alberts, Garstka & Stein, 2000; Cebrowski & Garstka, 1998; von Lubitz & Wickramasinghe, 2005a, b, c, 2006). Its underlying conceptual framework is drawn from the pioneering work of Boyd (1987), who synthesized decision making, interaction with and control of a fast paced and unpredictably changing environment into a loop-like process (OODA Loop) (Figure 1) (Boyd, 1987; von Lubitz & Wickramasinghe, 2005b, c, d, 2006). Decision making in complex macroenvironments, particularly those characterized by a very rapid revolution cycle and a vast array of multispectral information inputs, is the primary beneficiary of the practical applications of Boyd's Loop. Application of Loop methodology allows for the interpretation of the environment of multidimensional action space (in this case, health care) as a set of simultaneous and intertwined events that characterize the space, and are both influencing and are influenced by the actor (e.g., a health care organization, clinician, or disease). Boyd's Loop-based thinking forces the actor into continuous extraction and synthesis of pertinent information and germane knowledge. Without such extraction / synthesis, information chaos and overload will rapidly ensue and force the operator into subjective selection of *seemingly* relevant inputs and disregard of other inputs *that appear, at the time of the analysis, to be inconsequential* (von Lubitz & Wickramasinghe, 2005c, 2006; von Lubitz et al., 2004). The ensuing responses to the objective pressures will thus derive from increasingly subjective data interpretation, leading to suboptimal decision making and the ultimate danger of catastrophic errors.

Application of Boyd's Loop and the associated continuous extraction and analysis of high quality information from the environment of the "operational space" provides yet another major advantage: the development of "information superiority" and the reduction of "information asymmetry" relative to the environment.

Figure 1. Boyd's (OODA) Loop depicting how the processes for making critical decisions can be framed in terms of the four key stages of Orientation, Observation, Determination, and Action. Note that the Loop revolves both in time and space, and that termination of



Each environment contains a complete set of data (information) that describe it. By extracting this information, the actor shifts the knowledge of the given environment from fully unknown (i.e., the environment containing all information that is hidden from the observer) to fully known (the observer uncovers the entire information content of the environment). In the process of uncovering the informational content of the environment, the actor shifts information asymmetry (from environment contained to actor extracted) in his favour and, at the same time, attains the state of “information superiority” (the actor knows progressively more about the faced environment, while the density of the unknown information contained within the environment diminishes during the extraction process). Hence, the highest possible rate of the shift of information asymmetry in favour of the actor and the maximum reduction of time needed for the attainment of valid information superiority are the principal goals of the actor acting in a complex, dynamically evolving environment. Both actor-biased information asymmetry and information superiority are also the principal countermeasure to the “information chaos” or information overload (Lehto, 1991; Prietula, Feltovich & Marchak, 2000; Tole, Stephens, Harris & Eprath, 1982) — elements that also characterize many aspects of today’s health care (Arellano & Weber, 1998; d’Alessandro & Kreiter, 1999; Geiger, Merriles, Walo, Gordon & Kunov, 1995).

In summary, information superiority provides asymmetric operational advantage not only assures complete control of the direction and tempo of all activities in a collaborative yet highly coordinated manner, but also facilitates attainment of the objective in the most effective and economical way possible.

The state of information superiority can be attained only through the effective use of IC<sup>2</sup>T — a critical architectural element of doctrine of “network-centric warfare” created and currently implemented by the U.S. Department of Defense (Stein, 1998). The approach calls for the development of interconnected information grids creating a multilayered, robust network that facilitates information sharing among all participants within the operational space (Arellano & Weber, 1998; d’Alessandro et al., 1999). Drawing upon these ideas and the underlying logic of Boyd’s OODA, a doctrine for health care network-centric operations has been proposed recently (von Lubitz & Wickramasinghe, 2005a), of which the principal element is the creation and employment of an effective integrated worldwide collection / dissemination / exchange IC<sup>2</sup>T grid that will allow free flow of standardized / structured data / information among worldwide actors within the health care space necessary to allow the development of global information superiority state.

The doctrine of HNCO is thus defined as:

*unhindered networking operations within and among all three domains that govern all activities conducted in health care space and are based on free, multidirectional flow and exchange of information without regard to the involved platforms or platform-systems and utilizing all available means of ICTs to facilitate such operations.* (von Lubitz & Wickramasinghe, 2005a)

The three distinct domains are:

- The **physical domain** is the target that the health care intends to influence directly or indirectly. In addition to the most obvious goal of eliminating disease, other aspects of health care, for example, research and its policies, fiscal issues, political environment of health care, provider personnel, and patient education, belong to this domain. The data / information / knowledge within physical domain relate to its *present rather than future state* and are the easiest to collect. Cumulatively, the physical domain represents *the current state of health care reality*.
- The **information domain** consists of all elements needed to generate, store, manipulate, disseminate / share / transform information, and disseminate / share the product of such transformation as knowledge in all its forms. All sensory inputs gathered are gathered within the information domain with the sensors representing a wide variety of entities (people and devices.) The output of the sensors may have a wide variety of forms / sensitivity (e.g., basic research data, diagnostic data from individual / multiple patient encounters, electronic health records, etc.) The information existing in this domain may not fully represent the current state of reality. However, all knowledge about that state emerges from and through the interaction with the information domain, and all communications about that occur through interactions within this domain. The information domain is particularly sensitive to incursions that may affect the quality of information contained within the domain. Hence, it must have appropriate security measures that prevent hostile intrusions in any form.
- The **cognitive domain** constitutes all human factors that affect health care operations, such as education, training, experience, personal engagement (motivation), “open-

mindfulness,” or even intuition of individuals involved in relevant activities. All these represent highly intangible quantities that are difficult to measure but form the basis for the selection of right timing, right place, and right effect of all actions undertaken within the health care. Even in the presence of well developed decision support systems provided by the information domain, deep situational awareness is created and decisions are made within the cognitive domain.

The technological backbone of network-centric health care is the World Healthcare Information Grid (WHIG) (von Lubitz & Wickramasinghe, 2005a, b, c, 2006) which utilizes Web and related Internet technologies, for example, HTML, TCP/IP, Web, JAVA, XHTML, and so forth (The Cleveland Clinic Foundation, n.d.; E-Health and the Practicing Physician, n.d.; E-health in the Medical Field, n.d.; Eysenbach, 2001; Eysenbach & Diepgen, 1998; Glaser, 2002; Health Technology Center, 2000; The higher the connection speed, 2001; McGown et al., 2004; Odyssey Research, n.d.; Online health information, 2000; PricewaterhouseCoopers, 2003; Sharma & Wickramasinghe, 2004a; Sieving, 1999; Umhoff & Winn, 1999; Web Based Second Opinion, n.d.; Wickramasinghe & Ginzberg, 2001; Wickramasinghe & Mills, 2002). Figure 2a depicts the WHIG with its three distinct yet interconnected domains, each made up of interconnecting grids while Figure 2b identifies the key elements of the grid with its smart access portals, analytic nodes, and intelligent sensors (von Lubitz & Wickramasinghe, 2005b). Implementation of principles based on ASP (Application Software Provider) philosophy and fusing them together with the concept of smart portals allows direct worldwide access to the WHIG that is essentially independent of the technology existing at the user site and that opens network-centric health care operations to practically all involved entities — whether individual health care providers or national / international bodies providing health care governance, monitoring, and policy development.

*Figure 2a. The relationship among the operational domains in health care. Network-centric health care operations (NHCO) exist only in the territory where all three domains overlap.*

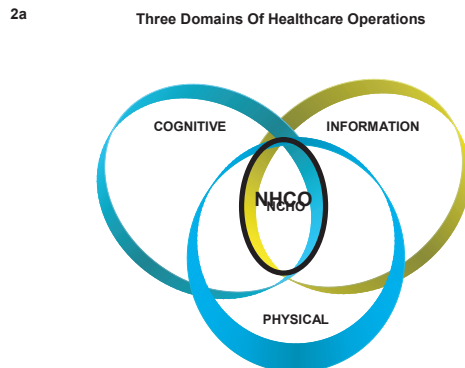
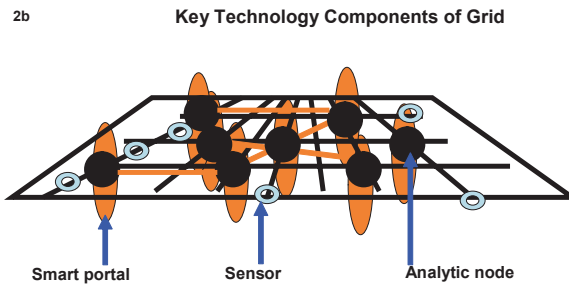


Figure 2b. The critical components of WHIG, including the smart portal, analytic nodes, and sensors (adapted from von Lubitz & Wickramasinghe, 2005a, b, c, d)



## Future Trends: Implications for Policy Makers and Governments

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WHIG provides the technology backbone of HNCO; however, for WHIG to function as intended, providing pertinent information and germane knowledge in a seamless, effective, and efficient fashion to a decision maker anywhere anytime, various protocols and procedures must be developed at a global level. Without such standardization even the simplest of functions, such as the exchange of documents and other procurement information, connectivity, and e-commerce enabled benefits, become problematic while the critical goal of decreasing information asymmetry becomes unattainable. Unfortunately, standardization is woefully lacking in too many areas of health care let alone e-health. Given the global nature of WHIG, it is here that global bodies, such as the World Healthcare Organization (WHO) in conjunction with governments and policy makers, must develop policies, procedures, and standards that will enable the seamless functioning of WHIG. We identify four key areas that must be addressed:

### 1. **Information Computer Communication Technology (IC<sup>2</sup>T) Architecture / Infrastructure:**

The generic architecture for most e-health initiatives is similar to that required by WHIG. However this infrastructure that consists of phone lines, fiber trunks and submarine cables, T1, T3 and OC-xx, ISDN, DSL and other high-speed services used by businesses as well as satellites, earth stations and teleports must be available globally.

A sound technical infrastructure is an essential ingredient to the undertaking of e-health initiatives by any nation. Such infrastructures should also include telecommunications, electricity, access to computers, number of Internet hosts, number of ISPs (Internet Service Providers) and available bandwidth and broadband access. To offer a good

multimedia content and thus provide a rich e-health experience, one would require a high bandwidth. ICT considerations are undoubtedly one of the most fundamental infrastructure requirements.

Networks are now a critical component of the business strategies for organizations to compete globally. Having a fast microprocessor-based computer at home has no meaning unless you have high bandwidth based communication infrastructure available to connect computers with the ISP. With the explosion of the Internet and the advent of e-commerce, global networks need to be accessible, reliable, and fast to participate effectively in the global business environment. Telecommunications is a vital infrastructure for Internet access, hence also for e-commerce. One of the pioneering countries in establishing a complete and robust e-health infrastructure is Singapore which is in the process of wiring every home, office, and factory up to a broadband cable network which will cover 98% of Singaporean homes and offices (APEC, 2001; A report prepared for Asia Pacific Foundation, 2002a).

It is estimated that over 70% of world telephone lines are in countries with 15% of the world's population (Parker, 1998). The average number of telephone lines in industrialized countries is one for every two persons as compared to 13 lines per thousand people in emerging economies such as India and China (ibid). A sound technical infrastructure is a key ingredient to the future economic health of any given nation and should be a priority for all governments.

For example, in the Asia-Pacific region (APEC, 2001; Beal, 2000; Oxley & Yeung, 2001; A report prepared for Asia Pacific Foundation, 2002a; A study report on Thailand, 2001; Turpin, 2000), there are a number of "digital divides," not only between the richer and poorer countries, but divides between urban and rural populations and between more and less educated or affluent groups. Although the number of female Internet users in a number of countries in the region is catching up quickly with those of male users, women are less present when it comes to the actual use of the new technologies. Furthermore, in many of these countries, women make up the majority of the rural population, which is often marginalized in areas of telecommunication infrastructure, education, and training. Therefore, governments should formulate national IC<sup>2</sup>T and e-commerce strategies that help to ensure universal access for all socioeconomic groups. A number of prerequisites for access to IC<sup>2</sup>T include education and training, local content, sociocultural awareness, and a stable social, economic, and political environment. Appropriate technologies need to be developed to address the needs of disadvantaged communities.

## 2. **Building Human Capital / Resources:**

The disparity between educational standards of developed and developing nations in the world is significant (Roquilly, 2002; Sharma & Wickramasinghe, 2004a, b; UNCTAD, 2002). In order for health care network-centric operations to fully maximize the potential afforded by WHIG significant enhancement of human capital through education and training is required. Many of the developing nations through investment and foreign aid need to concentrate on developing human capacity, and increasing basic access to IC<sup>2</sup>T, as well as rapidly increasing the presence and access to the Internet. Moreover, the governments of disadvantaged countries must also exercise significant international pressure to lower costs of hardware and software while, at the

same time, contemplating to form larger multinational user blocks capable of effective implementation of ASP principles. E-commerce adoption in general requires improved e-commerce knowledge and skills, and improved language proficiency (especially in English as it is as the recognized principal technology / commerce language). For example, governments in many countries have started to introduce basic education in digital literacy in primary and secondary schools. Such training courses should be constantly updated as new innovations and practices emerge very rapidly in this field. Institutions responsible for human resource development of e-commerce personnel should provide appropriate incentives for e-commerce courses to be kept up-to-date. Increasing the number of programs or activities for human resource development for IC<sup>2</sup>T and especially Internet use will only be effective if the education and training matches the changing needs of the industries concerned. It is important to note that only medical specialists require medical training but all people globally who need to interact with WHIG must have basic familiarity, training, and proficiency with use of IC<sup>2</sup>T. Once again much of the onus falls on governments to set the agenda and priority for such an emphasis.

### 3. **Fostering Consumer Trust:**

Consumers are also concerned about a number of dimensions of trust; trust in the security of value passed during electronic transactions with organizations that are “virtual” in a disconcertingly ineffable way and trust in the privacy of personal data arising from electronic transactions (Fjetland, 2002; Ghosh & Swaminath, 2001; Panagariya, 2000; Roquilly, 2002). Other than in North America, Japan, and integrated Europe, the infrastructure for e-commerce is not in place for effective e-commerce transactions. The key reason for slow penetration has been the scale of investment in infrastructure, and the small volume of transactions over which to amortize (Dutta, 1999; A report prepared for the Asia Pacific Foundation, 2002b).

The security issue in particular is perceived as very important across the Asia-Pacific region, and the majority of SMEs, for instance, have a fear of electronics. This is primarily due to the low level of technology diffusion and awareness making it a psychological barrier for SMEs as confirmed in various reports (APEC, 2001; Beal, 2000; A report prepared for the Asia Pacific Foundation, 2002b). Many of these SMEs do not have technical expertise, and are not convinced that the technology standards, such as encryption, will protect them. Thus, SMEs are not willing to use electronic payment systems.

Given such a general lack of trust in developing nations with using e-commerce, it is likely that the trust issue will be a significant factor in e-health initiatives given the general sensitivity of health care information. Once again government and national bodies must make every attempt to foster trust. This will not be an easy task since in many developing countries people have a low level of trust for governments, corruption tends to be significant, and especially in rural areas, people tend to be very superstitious and leery of “modern methods.” However, in many instances WHIG and health care network centric operations will offer these groups of people the best health care alternatives and thus significant effort must be made to build and foster trust.

Ethical concerns are inevitably related to health care operations based on network centrality. The notion of the governmental bodies having ready access to health care

information of the citizens is among the major concerns in the U.S., and similar reservations are also voiced in Europe. The possibility of security breaches, similar to those that recently affected millions of credit card customers in the United States, demands a very stringent layer of protective layers that will assure prevention of commercial misuse of health care data. The seriousness of such intrusions is emphasized by the dynamic development of molecular biology and genetics that allow early determination of the likelihood to develop long-term debilitating diseases at the later stages of life. Misappropriation of such information may then affect the subsequent chances of employment, nature and availability of health insurance, and even acquisition of credit. While laws preventing such discrimination already exist in several Western countries, their enforcement is not simple and the fear of clandestine stratification into “health risk” classes whose quality and freedom of life is directly related to the long-term risk is a threat that needs to be addressed with utmost vigor now. At a less threatening, albeit far more practical level, the problems of the responsibility for the delivery of health care also need clarification.

Among the major obstacles to the development of an efficient national telemedicine network in the U.S. is the difficulty of assigning responsibility for treatment conducted across state borders. The dilemma becomes even more pertinent when health care expertise is projected across national borders. While there is no doubt that the rule of the “best medical practice” ought to be the prevailing one, the best practice has different definitions in different countries and what is considered the standard of care in one country may not be so in another. There is thus a clear need to develop generally accepted standards of delivery and the current acceptance of the concept of “evidence-based medicine” may offer the most useful foundation for further deliberations of such standards. These are but two of several problems that already either influence or are about to influence e-health in all its forms.

The magnitude of network centrality and its global nature will add even greater urgency to the need for their effective operational rather than merely political or legislative solution. At a purely technical level, while network centrality strengthens the efficacy and economy of global health care, it may also have an impact on access to it. Ideally, network-centric operations will support a continuously broadening access to high quality health care across the entire globe. In practice, however, there is a chance it may support improvements there where the level of the preexisting technology and sophistication in its use are already high while leaving those who lag behind, yet needing rapid improvement of even basic health care in the same position they are now – desperately struggling to satisfy the most elementary health care needs of the local population. It is thus evident that introduction of network centrality and the creation of WHIG require a fundamentally different approach to the one currently practiced: they can be made functional only when a state of intense, multilateral, and determinedly synergistic collaboration exists between corporate and governmental entities not only at the national but, even more importantly, at the international level. Ultimately, transparency, international synergism, and adherence to the highest ethical standards of operations will be among the most instrumental factors to convince the users (i.e., both deliverers and recipients of health care) that network centrality in health care offers tangible benefits that have been unattainable prior to the implementation of the concept.

#### 4. **Creating Synergies between National and Regional Economic Blocks:**

For WHIG and HNCO to be fully functional, it is vital that synergies are created between national and economic blocks. For example, in similarity to the EU, all countries in the Asia-Pacific region should improve access to IC<sup>2</sup>Ts, design the necessary legal and institutional frameworks to educate the governments, businesses, and civil society to more efficiently use IC<sup>2</sup>Ts in their daily practices, and create an environment for further development of IC<sup>2</sup>T use in general and in particular with a focus on health care. There is a tremendous need to support the integration and interoperability of regional e-commerce initiatives through various international and regional economic blocks such as the Asia-Pacific Economic Cooperation (APEC), North American Free Trade Agreement (NAFTA), and the European Union.

Another critical aspect that requires significant consideration to enable and facilitate the required synergies is that pertaining to legal and ethical issues. In general the Internet community has developed its own distinctive culture and a great part many of these behavioural norms function outside the realm of International Law given the current maturity of International Internet Law (Commission of the European Communities, 2003; De Ly, 1992, 1999, 2000; Nielson, 2000; Polanski, 2005; Polanski & Johnston, 2002). Given the sensitive nature of much of the information contained with health care interactions, this poses a significant problem and major stumbling block for the adoption of HNCO. This is clearly an area that requires significant discussion and will form the center of future research; we mention it here only in passing to note that it remains as yet a key area that needs to be addressed

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## Conclusion

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It is beyond the scope of this chapter to discuss the details of the technology configuration of WHIG or provide guidelines for practitioners. Interested readers can refer to other research (von Lubitz & Wickramasinghe, 2005a, b, c, d; von Lubitz, Wickramasinghe & Yanovsky, 2005) for details. The primary focus here is to highlight the key role for governments if we are to ever realize the full benefits of e-health.

The idea of WHIG and HNCO is to span many parties and geographic dimensions. To enable such a far reaching coverage, significant amounts of document exchange and information flows must be accommodated. Standardization is the key for this. Once a country decides to undertake e-health initiatives and become a “WHIG member,” standardization policies, protocols, and procedures must be developed at the outset to ensure the full realization of the goals of e-health. The transformation to e-health by any country cannot be successfully attained without the deliberate establishment of standardization policies, protocols, and procedures which play a significant role in the adoption of e-health and the reduction of many structural impediments (Panagariya, 2000; Samiee, 1998). Fortunately, the main infrastructure of WHIG is the Internet which imposes the most widely and universally accepted standard protocols such as TCP/IP and http. It is the existence of these standard protocols that has led to the widespread adoption of the Internet for e-commerce applications.

Access to the technologies of e-commerce is defined by the WTO (World Trade Organization) as consisting of two critical components: (1) access to Internet services and (2) access to e-services (Health Insurance Portability and Accountability Act, 2001); the former deals with the user infrastructure, while the latter pertains to specific commitments to electronically accessible services. The user infrastructure includes number of Internet hosts and number of Web sites, Web users as a percent of the population as well as ISP availability and costs for consumers, PC penetration level, and so forth. Integral to user infrastructure is the diffusion rate of PCs and Internet usage. The United States and the United Kingdom have experienced the greatest penetration of home computers (Samiee, 1998). For developing countries, such as India and China, there is, however, a very low PC penetration and teledensity. In such a setting it is a considerable challenge then to offer e-health, since a large part of the population is not able to afford to join the e-commerce bandwagon. Countries, thus have to balance local call charges, rentals, subscription charges, and so forth, otherwise the majority of citizens will find these costs a disincentive. This is particularly significant for developing and emerging nations where access prices tend to be out of reach for most of the population. Upcoming new technologies hold the promise to increase the connectivity as well as affordability level and developing countries will need to seriously consider these technologies. In addition to access to PCs and the Internet, computer literacy is important and users must be familiar not only with the use of computers and pertinent software products but also the benefits and potential uses of the Internet and World Wide Web (*ibid*).

The key challenges regarding e-health use include (1) cost effectiveness that is less costly than traditional health care delivery; (2) functionality and ease of use: that is, they should enable and facilitate many uses for physicians and other health care users by combining various types and forms of data as well as be easy to use; and (3) they must be secure. One of the most significant legislative regulations in the U.S. is the Health Insurance Portability and Accountability Act (HIPAA) (2001).

Given the nature of health care and the sensitivity of health care data and information, it is incumbent on governments not only to mandate regulations that will facilitate the exchange of health care documents between the various health care stakeholders but also to provide protection of privacy and the rights of patients. Some countries, such as China and Singapore, even control access to certain sites for moral, social, and political reasons while elsewhere transnational data flows are hindered by a plethora of regulations aimed at protecting domestic technology and related human resource markets (Ghosh & Swaminatha, 2001; Gupta, 1992; Samiee, 1998). Irrespective of the type of health care system; that is, whether 100% government driven, 100% private or a combination thereof, it is clear that some governmental role is required to facilitate successful e-health initiatives.

HNCO also serves to underscore the inextricable connection and intertwining of e-health and e-government which to date has rarely been researched let alone acknowledged. Moreover, for HCNO to become adopted successfully, it requires governments to develop policies and protocols which will in turn facilitate its usability. We identify four key areas that will have an important impact on the development of the necessary policies and protocols as IT education, morbidity, cultural / social dimensions, and world economic standing as elaborated upon below. It is interesting to note that these areas also impact the development of numerous e-government initiatives (Turban et al., 2004), once again highlighting the inextricable link between e-health and e-government.

## **Impact of IT Education**

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A sophisticated, well educated population boosts competition and hastens innovation. According to Michael Porter, one of the key factors to a country's strength in an industry is strong customer support (Porter, 1990). Thus, a strong domestic market leads to the growth of competition which leads to innovation and the adoption of technology enabled solutions to provide more effective and efficient services such as e-health and telemedicine. As identified earlier, the health consumer is the key driving force in pushing e-health initiatives. We conjecture that a more IT educated health care consumer would then provide stronger impetus for e-health adoption.

## **Impact of Morbidity Rate**

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There is a direct relationship between health education and awareness and the overall health standing of a country. Therefore, a more health conscious society, which tends to coincide with a society that has a lower morbidity rate, is more likely to embrace e-health initiatives. Furthermore, higher morbidity rates tend to indicate the existence of more basic health needs (World Health Organization, 2003) and hence treatment is more urgent than the practice of preventative medicine and thus e-health could be considered an unrealistic luxury and, in some instances, such as when a significant percentage of a population is suffering from malnutrition related diseases, is even likely to be irrelevant, at least in the short term. Thus, we conjecture that the modifying impact of morbidity rate is to prioritize the level of spending on e-health vs. other basic health care needs.

## **Impact of Cultural / Social Dimensions**

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Health care has been shaped by each nation's own set of cultures, traditions, payment mechanisms, and patient expectations. While the adoption of e-health, to a great extent, dilutes this cultural impact, social and cultural dimensions will still be a moderating influence on any countries e-health initiatives. Another aspect of the cultural / social dimension relates to the presentation language of the content of the e-health repositories. The entire world does not speak English, so the e-health solutions have to be offered in many other languages. The e-health supporting content in Web servers / sites must be offered in local languages, supported by pictures and universal icons. This becomes a particularly important consideration when we look at the adoption and diffusion of evidence-based medicine as it will mean that much of the available evidence and case study data will not be easily accessible globally due to language barriers.

Therefore, for successful e-health initiatives it is important to consider cultural dimensions. For instance, an international e-commerce study by International Data Corp. indicates that Web surfing and buying habits differ substantially from country to country (Wilson, 1999) and this would then have a direct impact on their comfort to use e-commerce generally and e-health in particular, especially as e-health addresses a more fundamental need. Hence, the adoption of e-health is directly related to ones comfort with using the technology and this

in turn is influenced in a major way by cultural dimensions. Also connected with cultural aspects is the relative entrepreneurial spirit of a country. For example, a study (Hofstede, 1984) indicates that in a cultural context, Indians score high on “uncertainty avoidance” criteria when compared to their Western counterparts. As a result, for example, Indians do not accept change very easily and are hostile towards innovation. This then would potentially pose a challenge to the starting up of e-health initiatives whose success depends on widespread adoption for their technological innovations. Thus, we conjecture that fear of risk and absence of an entrepreneurial mindset as well as other cultural / social dimensions can also impact the success of e-health initiatives in a given country.

## **Impact of World Economic Standing**

Economies of the future will be built around the Internet. All governments are very aware of the importance and critical role that the Internet will play on a country’s economy. This makes it critical that appropriate funding levels and budgetary allocations become a key component of governmental fiscal policies so that such initiatives will form the bridge between a traditional health care present and a promising e-health future. Thus, the result of which would determine success of effective e-health implementations and consequently have the potential to enhance a country’s economy and future growth.

A healthy society is in the interests of all governments. As labor costs increase and productivity is critical to economic development, a healthy population is naturally able to contribute more significantly to increasing GDP. Coupled with the fact that health care remains the most expensive item for any government, it behooves governments to make health care a top priority on their agenda. The doctrine of HNCO serves to outline a coherent and systematic approach for harnessing the full potential of IC<sup>2</sup>T for health care and the ability to realize the promises of e-health. However, if this is to occur, e-health must become a top priority on all government agendas. Moreover, governments must go further than just acknowledge the importance of e-health to focusing their energies and efforts to address the key impediments we have identified and that currently preclude the ubiquitous adoption of HNCO.

The World Economic Forum’s Global competitiveness ranking measures the relative global competitiveness of a country. This ranking takes into account factors such as physical infrastructure, bureaucracy, and corruption. It is a simple extrapolation of the combination of these factors to postulate that the combination of a weak physical infrastructure with high levels of bureaucracy and corruption will constitute a significant impediment to the establishment of successful e-health initiatives. Surely, network-centric health care operations will not change these realities. On the other hand, the possibility for a rural health care provider working in an even most oppressive political and economical environment to enter WHIG and benefit from the combined global health care expertise will be without doubt a step in the right direction. And many steps in the right direction will ultimately help to redress the level of current inequalities in access to the most fundamental right of all humans across the globe — health.

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# **Part II: E-Government Applications**