Healthcare and the Effect of Technology:
Developments, Challenges and Advancements

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Chapter 10
Healthcare among the People:
Teams of Leaders Concept (ToL) and the World of Technology-Oriented Global Healthcare

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ABSTRACT

The revolution in information technology and in information and knowledge management contributed to the generation of actionable information and actionable knowledge required to address critical problems of national and global health care. Yet, despite expectations, e-based approaches are far from fulfilling the dream of equitable and universal access to health across the globe. A dramatically new approach is needed if health care is to be brought "among the people." Based on maximum integration of computer technology (CT), information technology (IT), information management (IM), and knowledge management (KM), and multidimensional human expertise, the concept of "Teams of Leaders" (ToL) provides a foundation for such an approach. Utilizing the entire spectrum of IT/IM/KM, irrespective of specific platforms, and harnessing globally distributed human expertise, Teams of Leaders transcend bureaucracies and politics, create "bottom-up" flows of ideas and knowledge, and generate horizontal and vertical collaboration among hitherto isolated actors. By empowering people rather than concentrating on technology-facilitated improvements of processes, ToL may prove to be one of the pivotal concepts behind the desperately needed healthcare revolution.

INTRODUCTION

The past 20 years have been characterized by the unprecedented alteration of the world's political structure. The initially slow changes induced by the collapse of the Soviet Union combined with the explosive growth of information and telecommunication technologies, has led to a global avalanche of new thought, structure, and action. The rapidly developing and enthusiastically embraced spirit of mondialism has been instrumental in shifting international relations from polarization to a meshwork of political and economical alliances spanning the entire globe and most of its peoples. While the

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growing popularity of the Internet and electronic means of conducting business across the boundaries of time and space provided impetus for the rapid change of seemingly immutable attitudes in the West, the new means of communication among individuals and groups facilitated the coalescence of previously isolated isles of social and political dissatisfaction into larger, more structured entities. Unified, their concerted action rapidly transformed into the growing application of historically unprecedented, worldwide pressures applied by militant, non-nation state actors. With ever increasing speed, power started to move from access and possession of money to the level of connectivity and unfettered access to the expanse of global networks (Rothkopf, 2008; Slaughter, 2009).

The striking change of global political and economic frameworks was inevitably accompanied by the emergence of several new destabilizing societal factors. Among the most telling indicators of the growing complexity of factors contributing to worldwide stress is the inclusion of resources, environment, and demographics as elements critically impacting the level of national and global security (Tuchman Mathews, 1989). Despite this awareness, the ongoing globalization of economic and social relations introduced and facilitated by the progress of information and telecommunication technologies (Rifkin, 2001) has done little to assuage problems of the less developed world (Adato & Meinzen-Dick, 2002; Hussain, 2001; but also see Mishra, 2003; Sharma 2005). Despite increasingly frequent warnings of violent consequences (Priest, 2004; Smith, 2007), the process of destabilization appears unstoppable: the gap between the rich and the poor widens.

There is no more doubt that health care has a powerful impact on regional, or even global, stability and security (Associated Press, 2006; Carter, 2008; Garrett, 2007a). Yet, even if equitable access and delivery of healthcare services is a frequent subject of national and international debates (e.g., WHO, 2008), there is a pronounced lack of a coherent strategy leading to a rapid and efficient implementation of sustainable health care in poverty stricken parts of the world (Bazell, 2007; Garrett, 2007a, 2007b; Sachs, 2007; see also Medscape Today Editorial, 2008).

The West entered the period of "technology rapture" and the belief that the IT/IM/KM trinity will solve most of the dilemmas of its ailing and ageing populations. The "Rest" chafes under pressures generated by the scarcity of providers, modern medicaments, adequate training, and the ponderous and bureaucratic methods of their affluent counterparts (Carr 2004; Colgan, 2002; Stuckler et al., 2008). Yet, it is from precisely those regions where healthcare services are at their worst that globally threatening diseases emerge (Bhargava & Chatterjee, 2007; Durbak & Straus, 2005; Fonkwo, 2008; Garrett, 2007 a, 2007b). E-health care, explosively developing among the affluent countries of the world, seems not to make any difference in regions where threats emerge, and whose populations are most exposed to their impact. What is good for the goose is still the distant dream of the gander (von Lubitz, Levine, & Wolf, 2002). Meanwhile, the issue of health care for the world's most impoverished silently crept from a subject occasionally pricking the collective Western conscience to the forefront of global security (Heymann, 2003; US National Security Council, 2008; Zilinskas & Chapman, 2007).

GLOBAL HEALTH CARE IN CRISIS

The Missing Doctor

Health and its maintenance are considered a basic human right (Gruskin & Tarantola, 2002; WHO, 2006), and the Western nations make continuous efforts to assure the widest access of all their citizens to the highest possible quality of health care (European Institute of Medicine, 2003; National Coalition on Healthcare, 2004). Among developing and less developed nations the situa-

tion is far worse: in several regions of the globe even rudimentary healthcare services are often unavailable or even non-existent (Akhtar, 1991; Gesler &Webb, 1983). Statistically, in 1983 the number of physicians per 10,000 people in several African countries was less than one (Gesler & Webb, 1983). Twenty years later, the situation has not improved (Chen et al., 2004; Scheffler, Liu, Kinfu, & Dal Poz, 2008; World Health Statistics, 2008). The scarcity of physicians is matched by the lack of nurses, healthcare technical personnel, inadequate facilities, and the increasing "brain-drain" (Social Watch, 2008; von Lubitz et al., 2002; WHO, 2008). Unsurprisingly, in several countries of the Third World the level of deliverable health care stagnates, or even retreats, rather than advances (Social Watch, 2008).

The Missing Money

Although the EU's healthcare expenditure is about 50% that of the US, Europeans appear to receive an equal, if not better quality of care, compared to US patients (World Health Organization, 2004, 2006, 2008). It seems, therefore, that neither gross nor per capita expenditure on health care provides the best indicator of the actual effect of money spent on maintenance of health. While the United States spent in 2001 nearly $ 4,900 per person, and Mexico, its closest southern neighbor, disbursed $ 370, Mali could afford only $ 12 per person (World Health Organization Report, 2004, 2008; see also Abel Smith, 1989). Mali may have vastly lower administrative burdens, its salary levels may be significantly less, and its population altogether vastly healthier than that of the US. However, the significance of the healthcare expenditure figures becomes deeply alarming when seen in the context of mortality rates caused by "common illnesses" such as cardiovascular disease (CVD). For a very long time CVD has been considered the "malady of Westerners." Yet, a recent study showed that in India and South Africa, CVD mortality rates are now vastly higher than in the West, and nearly identical to those seen in the US thirty years ago, i.e., prior to the development of effective means of treatment (Leeder, Raymond, Greenberg, Liu, & Esson, 2004). Both India and South Africa are approximately at the middle of the healthcare expenditure list. The situation is similar in other developing and underdeveloped countries (World Health Organization, 2004; World Health Statistics, 2008). Hart's observation made in 1995 (Hart, 1995) that increasing demand for health care is accompanied by proportionately fewer resources available to provide such care, holds as true today as when it was made. Moreover, there is rapidly growing evidence that indicates that diseases affect nations not only by forcing them to spend money on their elimination, but also by reducing productivity, and consequently, their gross national product (Hart, 1995; Leeder et al., 2004; Sachs, 2001; World Health Organization, 2004, 2008). The effect of this trend is felt most strongly among the countries with middle to low per capita incomes, i.e., where the incidence of preventable diseases is also the highest (World Health Organization, 2008).

The Price of New Arrivals

Recent outbreaks of potentially pandemic diseases such as SARS or avian influenza demonstrated that in addition to AIDS, malaria, or tuberculosis, there is a growing potential for the emergence of new infectious diseases whose consequences may have a crippling effect on national, or even global, economies (Economist, 2003; Fonkwo, 2008; Garrett, 2007a, 2007b; Lee et al., 2003; Lee & McKibbin, 2003; Zilinskas & Chapman, 2007). The close relationship between disease and economy has also been recognized by the members of the World Economic Forum who stressed that health will not only have a major impact on the future of business, but also on global security (Evans, 1993; Sachs, 2001; US National Intelligence Council, 2008; World Economic Forum, 2002). Moreover, the extent of cumulative consequences

related to the new pandemics appears to be far greater than the regional social and economic destabilization caused by HIV/AIDS (Zilinskas & Chapman, 2007).

Many of the diseases considered major bioterrorism candidates (such as hemorrhagic fevers, anthrax, plague) are endemic to countries within the "non-integrating gap" of Barnett (2004) where a combination of poverty, poor health care, and politico/economical instability serve as the natural breeding grounds for regional conflicts and terrorism (Barnett, 2004; Garrett, 2001; Smith, 2007; US National Intelligence Council, 2008). Addressing problems posed by inadequacy of health care in these critical regions is greatly complicated by Western commercial interests (Bissio, 2008), contributing to the drain of resources spread already thin by the need to rebuild the *entire* social, economic, and political fabric of societies slowly emerging from devastating conflicts (Fukuyama, 2004; Priest, 2004). Based on strategies that lack clarity and precision, the efforts to establish acceptable levels of basic healthcare services in the destitute parts of the world are poorly coordinated, and the outpouring of fiscal resources produces only a minimal ground effect (Garrett, 2007a; Social Watch, 2008; World Health Statistics, 2008).

HEALTH CARE AND ADVANCED INFORMATION AND KNOWLEDGE MANAGEMENT TECHNOLOGIES

Health care is an information rich and knowledge intensive environment. In order to treat and diagnose even a simple condition a physician must integrate and synthesize data from a large number of clinical and administrative sources to allow medically appropriate management of the disease. Medical care must be backed up by efficient administrative systems assuring efficient use of resources. Finally, the overall healthcare structure needs to be supervised and supported by legislative foundations that in turn reflect directly on the manner in which health care is provided. Given the need to combine massive amounts of data and information into a coherent whole and disseminate these findings to practitioners, administrators, and political decision makers in a timely fashion, the benefits of ICT to support healthcare operations are indisputable (Ball & Lillis, 2000; Ellingsen & Monteiro, 2008; Hagland, 2008; Korukonda & Korukonda, 2006; Wu, Huang, Hisa, & Tsai, 2006; Yee, 2007).

Big Problems of the Small, but Vital

Unsurprisingly, the combination of the last decade's development in advanced telecommunications, information technology (IT), and information and knowledge management (IM and KM) resulted in proliferation of healthcare-oriented electronic platforms such as EHRs (electronic health records), PACS (picture archiving and communication systems), CDSS (clinical decision support systems), etc. (Dols, 2001; Wen & Tan, 2005). Paradoxically, the investment in ICT may have also resulted in unforeseen frustrations, elevated rather than reduced operational costs, or even in confusion, with the potential to endanger patient safety (Ash & Bates, 2005; Boaden & Joyce, 2006; Charette, 2008; Joshi, 2008; Miller, West, Martin Brown, Sim, & Ganchoff, 2005; Sidorov, 2006). Until very recently, one of the principal reasons behind these difficulties was the platform-centric application of ICT (Bates, 2005; Binns, 2004; Blobel, 2004; Iakovidis, 1998; von Lubitz, in press; von Lubitz & Wickramasinghe, 2006a). Despite these problems at the micro-operational level, where interoperating single-vendor systems are utilized, implementation of electronic healthcare technologies brought significant benefits. At the macro level however (e.g., national or global) major difficulties emerged (Brewin, 2008; Ellingsen & Monteiro, 2008; Mandl, Szlovitts, & Kohane, 2001): a combination of islands of automation, information silos, and incompatible data/

information and knowledge bases significantly increased the potential for chaos. Consequently, instead of enabling and facilitating smooth and seamless flow of relevant information across the entire spectrum of involved actors, inappropriately employed e-based methods may add to the already existing problems (von Lubitz, in press; von Lubitz & Wickramasinghe, 2006a, 2006b; see also Haux, 2006).

The issue of compatibility and interoperability of platforms and platform systems is not trivial. Health care represents a unique, ultra-complex environment that can be characterized as the *domain of domains* (von Lubitz, in press). As indicated in the Introduction, at the level of large scale operations (national, multinational, and global), the efficient delivery of health care is contingent on a number of seemingly unrelated factors, while simultaneously affecting these factors with equal and reciprocal intensity. Economy, political stability, social structure, infrastructure development and quality within the region, even cultural characteristics of the target population, may have an important bearing on the combined effectiveness of the overall effort. Compounding these difficulties is the fact that the increase in efficiency and quality of the delivered health care does not depend solely on the efficient business models or clinical approaches: translation of research results into clinical practice, development of new drugs, personnel training at all level of their involvement in the process of delivery, and even patient education play an increasingly important role. Implementation of error-free and safe national or international EHR systems is clearly only a single aspect of the very complex territory. It is, therefore, at the level of utmost complexity, where individual domains intersect into a unified field of *healthcare operations* rather than the narrowly defined health care itself that both the major benefits and equally major difficulties of implementing advanced information/communications/computing technologies (IC^2T) become apparent (Joshi, 2008; von Lubitz & Wickramasinghe, 2006a).

Big Headaches of the "Big Hitters"

Grid computing, cloud computing, and network-centric operations have been suggested as the operational platforms capable of sustaining the rapidly increasing demand for information and knowledge processing in health care (Kladiashvili, in press; Sujith, 2008; von Lubitz, in press; von Lubitz & Wickramasinghe, 2006a). Problems of system compatibility and interoperability are particularly acute at this high end of e-operations in health care, and the need for "adapters, shims, and glue" is urgent (Radetzky et al., 2006). Paradoxically, although effective solutions are eagerly sought, (BioMoby Consortium, 2008; Oliveira et al, 2005; Oster et al., 2008; Radetzky et al., 2006; Saltz et al., 2008), the number of different approaches that have been chosen increases uncertainty; it is entirely unknown what will emerge as the universal standard. If, as in the past, purely commercial considerations prevail, there is a strong likelihood that the individual healthcare sub-fields will once again select what is most suitable to the demands and peculiarities of each individual discipline with disregard, or only cursory attention, to the needs of others. In the current commercially driven platform-centric mentality of health care, free market forces and the resulting competition may suppress the overall requirements of the healthcare system as a whole (von Lubitz & Wickramasinghe, 2006a) leading to the renewed fragmentation and solidification of platform-centric philosophy. Consequently, any form of integrative, multi-platform work will demand the development of new middleware that will contribute another layer of problems of reliability, adaptability, and conformity with both the future and legacy platforms. Unsurprisingly, several authors continue to draw attention to the persistently retarding impact of these factors on the

implementation of cross-domain grid computing as a tool in collaborative, broad-scope approaches to national and international health care (Bartocci et al., 2007; Hubbard, 2002; Karasawas, Baldock, & Burger, 2004).

One More Chasm: The Cognitive Gap

Probably the least recognized and yet quite significant concern associated with cloud and grid computing, and network-centric operations is the level of practical user comfort (particularly among healthcare providers). The general level of computer literacy among healthcare practitioners (be it on the delivery or administrative side of the field) is average, and may be the source of significant practical difficulties in interactions with the increasingly complex operational environment of the grid or multilayered nets (Kalawsky, O'Brien, & Coveney, 2005; Shefter, 2006; von Lubitz et al., 2008a; Ward, Stevens, Brentnall, & Briddon, 2008). Although implementation of user-transparent portals has been proposed (Aloisio et al., 2005; Andronico et al., 2005; Ichikawa, Date, Kaishima, & Shimojo, 2005; Neerincx & Leunissen, 2005; von Lubitz & Wickramasinghe, 2006b), in view of the continuing deficiencies in advanced computer literacy and skills among healthcare personnel both in the UK and US (Devitt & Murphy, 2004; Lacher, Nelson, Bylsma, & Spena, 2000), even among those nations characterized by the world's most advanced health care and computer environments, the state of intimacy between healthcare practitioners and "mesh of grids" may still be quite far away (von Lubitz, in press). Consequently, a new class of professionals – the human "grid/net-user interfaces" – may need to be created. Neither the problem nor the solution is new to health care: the analysis and interpretation of complex clinical trials or administrative data relies heavily on professional statisticians. Nonetheless, the need to educate a new generation of specialists familiar with advanced computing methods, and their application in handling extensive IM/KM demands created by the wide range of healthcare-related disciplines will slow down the emergence of grid computing/network-centric operations as an inter-domain collaborative platform even further.

Paradoxically, despite the significant operational impact that e-methods of increasingly greater potency may have, the notions of applying sophisticated, Western style technology to alleviate the health care plight of the poorer nations is unrealistic; in very many LDCs computer-based solutions are simply a secondary issue to the continuous scarcity of the necessary tools, i.e., computers themselves (Bello et al., 2004; Blignaut, 1999; Callen, Buyankhishig,& McIntosh, 2008; Eddirippulige et al., 2007; Social Watch, 2008; UNESCO, 2005). Providing only a partial solution, the use of Personal Digital Assistant interfaces as the entry point to the health care grids and networks of networks (meshes) has been recently suggested (Kalawsky, Nee, Homes, & Coveney, 2005). The combination of the relatively simple functionality of PDAs, ASP (Application Software Provider) philosophy, and wireless access to the Internet may be of particular suitability to providers in the remote/underdeveloped regions where, even with continuing "computer starvation" (UNESCO, 2005), the penetration by information technology and wireless networks continues to improve (von Lubitz & Patricelli, 2006. 2008; von Lubitz et al., 2006; see also Figure 1).

Is it Simply a Matter of Strategy?

Despite the extraordinarily broad scope of current and potential uses, one must bear in mind that the concept of e-health centers on a large-scale adoption of technology platforms, rather than of philosophies that will assure equitable access to health across the globe. Currently, all such platforms are associated with a number of limitations, e.g., standardization, interoperability, and the need for technical expertise to provide maximum utility and functionality. The latter is particularly acute in regions affected by pervasive

Figure 1. Table of worldwide status and evolutionary trend in information science and technology (left arrow: decline, right arrow: improvement. The size of the arrow indicates magnitude of the trend; numbers – number of countries affected) *

	⟸	←	No change	→	⟹	Total
Worse	0	0	6[a)]	50	3	59
Below average	0	0	4	38[b)]	13	55
Above average	0	0	0	6	18	24
Better	0	0	0	6	21[c)]	27
Total	0	0	10	100	55	165

[a)] Note, however, that two out of three countries in Sub-Saharan Africa experience situations worse than average

[b)] Although the situation continues to be below average in South America and the Caribbean significant progress has been made between 2007 and 2008 (Social Watch 2007, 2008)

[c)] Principal beneficiaries are Europe and North America

and persistent poverty where the lack of technical expertise and often rudimentary technology infrastructure combines with the paralyzing scarcity of personnel trained in even elementary aspects of healthcare delivery (Social Watch, 2008; World Health Report, 2008; World Health Statistics, 2008; see also UNESCO, 2005).

E-health appears to have a dual nature: it is embraced enthusiastically (and understandably) by the developed societies, yet it may ultimately widen the global gap in access to the "basic human right" - health (WHO, 2006). One must also realize that even among the Western-minded societies, permeation of grid computing and network-centric IM/KM operations in health care is restricted to the most obvious, and, for the most part, domain-specific activities (e.g., bioinformatics, drug discovery, insurance industries) (von Lubitz, in press). Unsurprisingly, due to the commercial potential of such applications, the thrust of development appears to concentrate on these areas as well. In consequence, and contrary to the best intentions, the collaborative, interdisciplinary efforts based on grid computing and network-centricity (Olive, Rahmouni, & Solmonides, 2008 a; Olive et al., 2008b; von Lubitz & Wickramasinghe, 2006a) are predominantly domain-centered as well (von Lubitz, in press).

As the result of these trends, and despite increasingly wider availability and access to facilitating technologies, much of the information of significance to the broader healthcare community continues to be disseminated in the traditional form of publications, lectures, and university level training. Viewed from the perspective of health care as a "domain of domains" (which is emphatically different from a *healthcare-relevant discipline* perspective – von Lubitz, in press), grid computing is an extraordinarily powerful information management, but only a relatively weak knowledge management, tool. Network-centric operations (or network-enabled capabilities – NEC) (von Lubitz et al., 2008a) are, on the other hand, an excellent tool supporting both knowledge management and generation of new knowledge. However, the output is limited to the exceedingly rich *actionable knowledge* (von Lubitz et al., 2008b) that, as necessary as it may be, is largely inadequate as the substrate for a meaningful, cohesive action on a broad and complex front (von Lubitz, in press).

Altogether, the progress of IT/IM and KM in health care contributed to an unprecedented ex-

pansion of knowledge, methods of delivery, and facilitation of provider-recipient interactions. It led to simplification, unification, and potentially a global range of administrative methods that may, ultimately, improve delivery of health care in the worldwide context. At the same time, however, the impact of technology on health care appears as a largely chaotic series of forays, each with a narrowly defined set of goals, none intended as part of a clearly defined, cohesive action executed by national and multinational entities, and intended to transform the existing chaos into a structured, coordinated global effort. Having the extraordinarily potent weapon made available – technology – we seem not to have the strategy that would allow us to use it effectively, efficiently, and with a definitive purpose in mind. At present, however, the concept of e-health simply does not translate into "effect based operations" on the ground.

MATTERS MILITARY

In 2007 a book appeared in which a British general, Sir Rupert Smith, argued that state-on-state war became the concept of the past, and the classical military conflict transited into the state of "war among the people" (Smith, 2007). One may wonder about the connection between war and health care other than the most obvious: en masse generation by the former of the subjects, in all richness and variety of their broken bodies and minds, to be tended by the latter. However, a closer inspection of Smith's arguments reveals a striking applicability of the classical military tenets to the creation of concepts that should serve as the foundation for the efficient and effective approach to global health care (see Table 1).

The "Healthcare Governing Triad" and the Importance of Strategy

Traditionally, the conduct of affairs among nation-states has been directed by the overarching triad of politics, military, and people (von Clausewitz, 1976; see also Gray, 2006). The interplay among the three results in national policies on which subsequent strategies are built. Oddly enough, parallels exist in the arena of health care whose national and international exercise is the result of push-pull forces governing the interaction of politics, the "military" in the form of the healthcare industry (i.e., the entire spectrum of professionals involved in delivery and administration of health care), and the recipients of healthcare services – the people.

Shifts in the balance of power among the constituents of the "governing triad" are mirrored in the ensuing policies and the subsequent strategies employed in fulfillment of goals defined by those policies. Problems emerge when one of the elements of the triad becomes dominant, and the subsequent policies begin to support interests of only one actor. In the US, vacillating political stances combined with the relative apathy of the citizenry led to a vacuum filled by the health care industry. Until recently the latter played the dominant role in defining the strategy which served its own interests, but also significantly contributed to the present dilemmas faced by politicians (i.e., fiscal chaos, uncertainty about future directions, etc.) and health care recipients that is the public (i.e., lack of universal healthcare coverage, inequity of access, uncertainty about the future) (Carr, 2004). However, the balance within the US healthcare governing triad may yet be restored: following the conclusion of the hotly contested healthcare debate in the US. Whether promises Mr. Obama made during his election campaign are realized fully or only in part, and what will be the nature of that "part" when translated into legislation remains yet to be seen. The seesaw of polarization among US lawmakers combined with the intensity of public sentiment on the future course of US health care may provide powerful counterpoints or impetus multipliers to industrial influences and only time will tell what impact the present turbulence and uncertainty will have on clearly defined strategies

*Table 1. Critical factors determining operational success of global health care operations**

FORMING	Physical creation of forces that are coherent, adequate, and appropriately structured to deal with the specific theater tasks set forth by the predefined strategy. During the process, personnel, materiel, and all resources required to support deployed forces, including political and economical elements, are amassed, their mutual relationships and dependencies defined, and command structure clarified. In multi-organization, multinational operations the process may be complex and subject to individual actor policies and regulations. Fulfillment of prior national commitments or conference-declared intent, subordination of national interests to operational needs, and to the objectives defined strategy may be the most difficult goal to attain at the force formation stage. Forming of forces in health care operations involves both local (e.g., administrative centers, healthcare facilities, policies, local personnel) and external elements (e.g., outside training personnel, outside delivery personnel, distributed technologies, fiscal resources provided by international entities). In environments where possibility of violence exists adequate security elements must be incorporated into the overall force and their security functions approved both by the local governments and at the international level.
DEPLOYING	Actual movement and placement of forces in preparation for operations. Following placement, command structure is tested, and the rule of unity of theater command enacted. Final pre-operations adjustments are made, essential physical constituents (e.g., technology, supply trains, facilities) are checked for operational adequacy. Personnel readiness and adequacy are confirmed.
DIRECTING	The most difficult element of multi-organization/ international/multinational operations in health care. WHO has advisory and coordinating capacity but does not have command authority. Since execution of strategy at the theater and tactical level of operations demands unity of effort and consequent unity of command, these must be defined by the participating actors and declared binding at the force-forming stage. If theater strategy is to succeed, a similar entity to WW2 SHAEF needs to be created and endowed with similar powers of operational theater command. Fragmented command structure typical of current global health care operations creates, sustains, and amplifies chaos.
SUSTAINING	International healthcare operations are characterized by long duration, intensity of effort, and demand for a very wide range of resources. Unless these factors are clearly recognized, and the price of their sustenance accepted and codified by all involved actors, the ground effort assumes characteristics of an offensive running out of momentum. The effort stalls, efficiency is lost, and the goal is never reached. Sustaining global health care operations demands continuous and unwavering support of people, nations, and international bodies.
RECOVERING	Don't send out a force that you can't get back. And don't deploy a force unless, at the end of the deployment, the effort can be managed locally, sustained locally (eventually only with outside fiscal assistance decreasing over time), and further developed through committed actions of local governments/authorities. The overriding philosophy of international healthcare operations must be the development of independence and sustainability rather than transition from inadequacy to subjugation.

* Modified after Smith, 2007

and subsequent actions, and on the ultimate form of the US healthcare ssytem.

In the EU, healthcare coverage is either universal or near-universal, but significant differences among individual member states exist, and center on the inequity of access, cost containment, and divergent philosophies of delivery (European Policy Center, 2008; Jakubowski & Busse, 1998; WHO, 2008). The balance within the European healthcare governing triad has increasingly shifted toward the political element which imposes regulatory pressures that hamper industry's initiative, and also leads to demonstrable problems in the attainment of stated objectives. With multinational bureaucracies of the European Union laboriously grinding toward goals predetermined by both the EU Parliament and the individual member legislatures, the best, albeit slightly sardonic, indicator of the present and future difficulties of European health care is provided by the EU itself - "The whole European health-care System is very complicated." (See para. 2, Council of Occupational Therapists for the European Union - http://www.cotec-europe.org/eng/22/).

Considering difficulties the richest countries of the world have in grappling with their essentially surmountable problems, a firm global approach to health care appears to be unattainable. The com-

plexity of issues that need to be addressed collides with the vast number of principal and peripheral actors, each with their own, often narrowly defined, agenda that is often not only incompatible with the agendas of others, but also not subordinated to the interests of the whole (Garrett, 2007 a; 2007b; see also World Health Organization and its Reports and other publications at http://www.who.int/ publications/en/.) Coherence, which is the critical aspect of complex, large operations (Smith, 2007) is entirely missing. There is no "governing triad", no checks and balances, and virtually no strategies. Hence, the advocated implementation of e-solutions is not the answer to the existing problems, and simpler concepts must be employed before advanced technology can facilitate further progress.

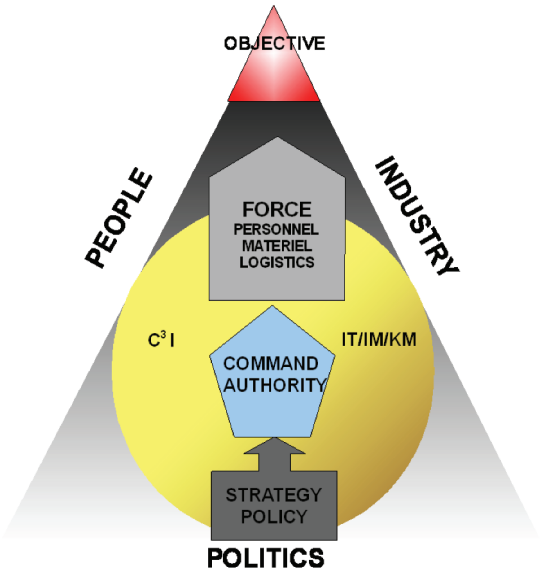
The Concept of Deployment and Employment of a "Healthcare Force"

It borders on being painfully banal when stating that the development of globally adequate, accessible, and efficient health care is a complex task that badly needs to be addressed. The fact has been obvious to most for several years. What is less obvious is that such development is broadly similar to the creation, deployment, and employment of military force. Rules involved in that process can be adapted then adopted in the civilian reality of health care operations.

Ideally, whether at the national or international level, the existing policies determine what constitutes "adequate healthcare," the strategy directing its development, implementation, and sustainment through allocation of suitable fiscal resources (Figure 2). The process of implementing these policies, be it at the regional, national, multinational, or global level, is contingent on a coherent, highly coordinated application of several mutually interdependent elements. First of all, the adequate number of a wide range of professionals responsible for direct delivery and administration of healthcare services is needed. Sufficient and activity-relevant materiel required for the delivery of these services (from syringes to clinics) needs to be available wherever the services are delivered, and the continuous flow of that materiel to wherever it is consumed must be assured by the efficient logistics system. Administrative services must exist to support and assure overall coordination of all elements involved in the intended activities. In essence, the equivalent of a military *force* needs to be created (Smith, 2007; see Table 1).

Following its creation, the force is *deployed*, i.e., all its constituent elements are made physically available for the forthcoming *employment*. *Strategic needs* cause the created force to be deployed to the *theater* of operations, where they are employed in order to reach strategically determined objectives (e.g., increase of access to healthcare delivery professionals, reduction of regional morbidity or mortality, or increase in the number of service access points). Attainment of these objectives leads to the fulfillment of the goals defined by the national/international

Figure 2. The ideal environment and activities of a healthcare force



policies. In the context of health care "theater of operations" consists not only of the physical space in which actual operations are conducted (e.g., Sub-Saharan Africa or South-East Asia) but of *all* elements that affect these operations: political realities affecting all participants, economies, social structures, logistics, infrastructure and its availability, presence or absence of moral and political support afforded the employed force by the local population, etc. Health care "theater of operations" may be also represented by a broad concept, e.g., the worldwide reduction of mortality caused by cardiovascular diseases. In that case, physical regions in which relevant operations are conducted become part of the mosaic factors characterizing the conceptual theater rather than its dominant elements. In either case, a thorough understanding all involved nuances is critical: in its absence the effort fails.

Similarities

Factors affecting major health care operations are similar to those governing deployment and employment of military force as the instrument of national strategy. In both cases the implementation is contingent on national policies and on strategies derived from these policies. Operations implementing the chosen strategy are conducted within a theatre of national, international, and progressively more global dimensions. All operations within the theater are inevitably subject to influences caused by the interaction among unpredictable yet tightly inter-related elements. The outcome of these interactions causes "friction" which retards progress, alters its direction, and introduces uncertainty and hesitation (von Clausewitz, 1976). In similarity to military or complex business activities, the entity commanding and controlling health care operations cannot ignore either the "external confounders" or their direct and indirect consequences without risking collapse of the entire effort (Sachs 2001; Sachs, 2007; WHO, 2008). Not surprisingly, national healthcare crises, such as the outbreak of SARS or the threat posed by avian influenza, are managed using approaches that are ideologically nearly identical to those employed by the military: mobilization of forces that are suitable and adequate to countering the crisis, professionalism of the involved personnel, and support of their effort by technological development (Smith, 2007; see also Figure 2).

Coherence of Effort: Problems of Command and Control in Global Health Care Operations

Similar to the military, the efficiency of healthcare operations is contingent on coherence of effort. Its absence, whether in purpose or due to the divergence between the purpose and resources applied toward its attainment, is the most common and consistent source of failure (Smith, 2007). Current dilemmas of both national and global health care can be tracked to the lack of such coherence. In the US, for example, little is being done to reduce the persistent association between poverty, lack of healthcare insurance, and poor health (Dubay, Holahan, & Cook, 2006; Kaiser Family Foundation, 2008; US Census Bureau, 2008). Largely similar problems are found among other affluent nations (WHO, 2008). Despite billions of dollars spent on healthcare efforts in poor and destitute regions of the world, the missing coherence of effort results in unchanged conditions on the ground (Garrett, 2007a; 2007b; WHO, 2008.)

Lack of coherence among the international efforts to assure access to health care in poverty stricken regions is largely the result of the deficient or non-existent unified command and control. In multinational, highly intricate environments of global healthcare operations, issues of command and control are vastly more complicated and critical than at the national level. Contrary to the national legislative bodies, WHO does not have the mandate either to command or control, but merely to encourage and appeal. Command

and control are therefore reduced to a mosaic implemented by individual actors concentrating on their own segment of the entire effort. Coherence is hopelessly lost, and each involved component of global health care operations, be it a national or international agency (e.g., a national ministry of health or a WHO or UN element), a non-governmental organization (NGO) (such as Red Cross or Red Crescent), or a private or volunteer organization (faith-affiliated groups, private foundations, etc.) conducts its activities at its own tempo, adheres to its own guidelines and policy-dictated schedules, but with little or no coordination with other participating entities. "Global healthcare strategy" emerges as nothing but relatively loosely stitched and independently created plans, intentions, and ideas, all freely interpreted by the participating actors, but formally binding none. Instead of an orderly progression of effect-oriented actions leading toward clearly identified objectives, a chaotic series of forays emerges, all of them costly, most of them ineffective, only a few leading to even partly desirable outcomes, and most eroding the remaining vestiges of trust (Taylor-Goby, 2006). Meanwhile, the spill-over affects adversely non-health care elements such as regional economies, societal and political stability, etc. (Fonkowo, 2008; Garrett 2007a; Sachs, 2001; World Economic Forum, 2002).

In armed conflict, the failure to adhere to some of these fundamental principles and practices of warfare results in the inevitable rout. In health care, the failure to adopt, adapt, and follow similar practices either because they are "military" in nature and therefore evoke hesitation in many, or due to the unawareness that such principles may apply to the non-military setting, results in consequences that are much more subtle: one billion people worldwide have no access to health care (Carr, 2004), over 17 million people die from preventable cardiovascular disease (WHO, 2008), and more than 190,000 worldwide fatalities are caused by measles (mostly in non-immunized children). The latter, despite the existence of a very cheap vaccine (approximately USD 0.4) that has been available for the past 40 years (WHO, 2008).

The global span of e-based methods that transcend space and time was expected to change all that. However, in the environment characterized by the lack of coherence, implementation of technology both as a "force multiplier" and the creator of cohesion is subject to the influences of the environment in which e-based approaches are to be implemented. In the Third World, poor understanding of the nature of individual theaters of operations, inadequacy of personnel and materiel, uneven nature of support that largely depends on the good will of others contribute to the lacking cohesion of effort, and often lead to mediocre outcomes, simply because the underlying philosophies represent those who promote e-based solutions with the greatest vigor – the developed nations (Akhtar, 1991; Fernandez, 2002; Social Watch, 2008; World Health Report, 2008). Thus, while e-methods that could and should provide the matrix within which the military concept of C^3I (Command, Control, Communications, Intelligence, see Table 2) is executed in order to enhance coherence and health care relevance of all actions, the principal applications of technology concentrate on predominantly commercial tasks that are not always aligned with the health care needs of target populations (UNESCO, 2005; WHO, 2008).

Health Care among the People

In parallel to Smith's observation about war, access, and delivery of health care at the global level became the matter of "healthcare among the people." Realization of this fact is best reflected in the latest World Health Report (WHO, 2008) where, for the first time, the emphasis has been placed on the people, their perception of needs, and the essential role of primary health care as the fundamental platform on which to build the future of global health. Contrary to the past focus on internationalism, collaboration among often

*Table 2. Ideal and real role of advanced IT/IM/KM and e- based technologies in C^3I framework of large scale health care operations**

ROLE	IDEAL FUNCTION	REALITY
COMMAND	Facilitation of strategic/theater level supervision of the overall effort assuring uniformity and coherence of all actions, their conformity to and alignment with the political goals.	None in the context of the overall effort.
CONTROL	Facilitation of coordination of effort through the determination and implementation of "who, where, when, how." Important in development of "just-in-time work-arounds" in times of increased friction.	None in the context of the overall effort.
COMMUNICATIONS	Backbone of unfettered information and knowledge exchange among hierarchical (vertical), peer (lateral) chains of actors. Network-centric/ network-enabled principles particularly useful in assuring reliability of dissemination. Platform-independent implementation utilizing all forms of methods (from legacy to most advanced).	Extensive and highly efficient in the developed and some parts of the developing world; flexible utilization of all platforms and technologies, often in "fused" packages. Badly faltering in the underdeveloped world despite marked increase in web-based communications and wireless telephony
INTELLIGENCE	Collection of all strategic and theater relevant information (including non-healthcare sources) through all means available, e.g., grid/cloud computing, network-centric and network-enabled channels, social networks, and conversion into pertinent actionable knowledge.	Among developed countries extensive and productive within healthcare domain, moderate to poor in assimilation of relevant intelligence from health care unrelated domains. Collection often platform-centric with little cross-over/ exchange capability with other platforms. In the developing and underdeveloped countries all aspects sporadic to nonexistent. The exception is growing collection of public health data, where efficiency increases rapidly

*) Note that in the civilian (health care) context, the role of each function is distinctly different from that commonly seen in the military environment: roles may be identical, the functions and significance are not.

gigantic blocks of nations, corporations, and NGOs, the 2008 report places global health care among the people and emphasizes the critical role of the bottom of the health care pyramid – primary care - while underlining the complex vertical and horizontal interactions among the host of issues impacting the establishment of adequate health-care services at that level (WHO, 2008).

Difficulties notwithstanding, there is a lot of hope that advanced technology may greatly improve all aspects of healthcare access, delivery, and administration and help to eliminate the North-South cleft. Yet, the enthusiastic acceptance of IT, IM, and KM by healthcare professions and all healthcare-related disciplines led also to a paradox where the definition of "continuum of care" offered by the National Cancer Institute (http://ncim.nci.nih.gov/ncimbrowser/ConceptReport.jsp?dictionary= NCI%20 MetaThesaurus&code=C0009853) sounds similar to the definition of supply chain management (http://jpfarrell.blogspot.com/2008/08/glossary-of-terms-used-on-site.html).

While the implementation of already proven business methods may be both sensible and justifiable (Wickramasinghe & Schaffer, 2006), the uncritical acceptance of business precepts in healthcare practice may lead to the undesired effect of transforming healthcare delivery into an increasingly mechanized and commoditized process, where the ultimate goal of "people" will be swept aside by "technology and processes" of bureaucracy. In the end, although the present use of IT/IM and KM generated a vast amount of

healthcare-relevant, domain-specific "actionable knowledge" (von Lubitz et al., 2008a; 2008b) the cardinal transforming element is missing. The presence of this element has been shown to provide a catalyst transforming the wealth of pre-existing actionable knowledge into a clear strategy and coherent, effect-based theater and tactical operations aimed at the strategy-defined objectives (Bradford & Brown, 2008). Ultimately, it is the element that may transform global "healthcare operations" into the reality of "healthcare among the people."

THE CONCEPT OF "TEAMS OF LEADERS" (ToL)

The concept of *"actionable understanding"* was introduced several years ago by the US Army general Frederic Brown to denote the final "product" of all actions and activities performed within the broad realm of the "Teams of Leaders" (ToL) environment (Bradford & Brown, 2008; Brown, 2002). ToL is the direct outcome of the requirements faced by the US Army following the end of the Cold War when the expanded range and character of missions, spanning from combat to peace keeping and nation building, demanded introduction of a completely new readiness model. The new model, based on a clear understanding that in the new environment of global range operations the performance of an individual soldier could lead to strategic consequences, stressed flexibility and deployment readiness.

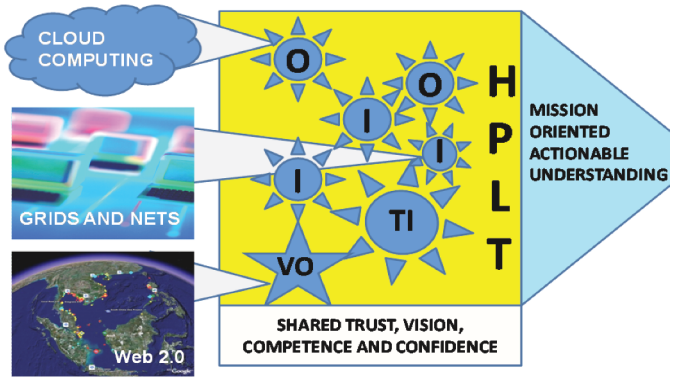
Today, decisions made by the "man on the spot" have the potential to influence national interests, the fate of alliances, and the difference between rebuilding broken societies and perpetuation of armed conflict. To fulfill such historically unprecedented demands a new breed of soldier-leaders was needed: flexible, adaptable, versatile, and comfortable in operating within the complex setting of Joint Interagency, Inter-government, Multinational (JIIM) operations in which military and civilian concepts intertwined into a tightly woven mesh (Bradford & Brown, 2008; Brown, 2002; Brown, 2008a, 2008b). In several aspects, the issues affecting the US Army were nearly identical to those still hampering large-scale health care operations today: organizational complexity; wide mission spectrum; the need for mission-centered cooperation of numerous local, national, and international agencies; and the need to adapt in order to address increasingly larger host of rapidly diversifying issues, while continuing simultaneous engagement in routine activities (Brown, 2008a). Overriding all that is the often critical role of the individual healthcare worker whose knowledge, intellectual agility, and the ability to make swift decisions may, indeed, decide the future of the world. SARS and avian influenza outbreaks have clearly indicated that.

WHAT IS ToL?

Conceptually, ToL centers on the active, platform independent fusion of advanced IM, KM and High Performing Leader Teams (HPLT; see Bradford &Brown, 2008; von Lubitz, in press; von Lubitz & Beakley, 2009; also see Figure 3). What distinguishes ToL from a specialized social network is the essential prerequisite for the development and functions of HPLT: the shared foundation of *skills, knowledge,* and *attitudes* (SKA) based on the previously acquired appropriate and universally high-quality professional preparation of individual team members. The preparation demands intensive training to *task, condition, and standard*, and the ability to demonstrate complete, practical mastery of performance.

The details of the required civilian training standards in health care and other fields of operations, and the broad availability of civilian training organizations that satisfy the unprecedentedly high demands have been extensively described elsewhere (von Lubitz, in press; von Lubitz & Beakley, 2009). In the present context it is however

Figure 3. A high performing leader team (HPLT) may consist of individuals (I), teams of individuals (TJ), organizations (O), and virtual organizations (VO)



necessary to underline the essential role of rigorous professional training that satisfies strictly defined metrics-based performance standards. Such training assures not only the general uniformity of education/training outcomes that are concomitant with the high professional capability of the participants, but also serves as the chief promoter in the development of shared confidence in mutual professionalism and ability to act appropriately under a very wide range of conditions both as individuals and teams of individuals.

Training alone is not sufficient: it must have roots in active learning which, in the context of leader team development, requires collaborative learning shown to significantly improve critical thinking and task performance (Cavalier & Klein, 1998; Gokhale, 1995; Lou, 2001). To assure the required task performance to a predetermined standard, the learning process is experiential rather than didactic. It also involves routine exposure to sudden, unpredictable scenario changes (confounders) necessary to develop the required mental flexibility and adaptability by individuals within the team and the entire team (Bradford & Brown, 2008; Brown 2002; von Lubitz, 2008). The training approach used in preparation of HPLT members has been pioneered and traditionally used as the cornerstone of professional education in medicine, nursing, etc. (Kyle & Murray, 2008; Wong, 1996) resulting in mastery of essential skills, knowledge, and the related mental and physical attributes that are employed as easily under routine circumstances as in the environments of maximum stress, uncertainty, and tempo.

Performance assessment under rigorous and highly demanding conditions constitutes the essential part of High Performing Leader Team development. Consequently, training turns into self-evaluation, and evaluation promotes further training: the teams attain pitch efficiency. Due to the standardized approach used in HPLT development, teams can be inserted as "modular elements" whenever and wherever required, and the standardized training/testing regimen assures that organizations, whether real or virtual, which co-opt HPLTs as part of their operational profile will have full confidence and trust in their capabilities. The latter is of possibly the greatest significance in the development of efficiency and cohesion that, in turn, serves as the critical lubricant in multi-organizational efforts (Smith, 2007). Conversely, it has been demonstrated on several occasions (Buck, Trainor, & Aguirre, 2006; McEntire, 1999; Perry 2006; van Rooyen, Hansch, Curtis, & Burnham, 2001) that absence of such trust and acceptance are among the primary reasons for failures dur-

ing complex humanitarian relief operations in which healthcare activities nearly always play a major role (Brennan & Nandy, 2001; Noji, 2005; Silenas, Waller, D'Amore, & Carlton, 2008; van Rooyen et al., 2001).

ToL as Knowledge Generator and Evidence-Based, Best Practices Generator

Continuing limitations in the use of sophisticated, technology-based methods in the process of generating actionable knowledge (see above, and von Lubitz, in press) may lead to inadvertent "stove-piping." Implementation of ToL avoids this issue through the horizontal spread attained by means of platform-independent, peer-to-peer exchanges, social and professional networks, text- and visual blogs, avatars, etc., whose increasing functionality, reach, and practicality of use are supported and expanded by the rapidly growing impact of Web 2.0 (Anderson, 2007). Combined with the enterprise-wide access to primary information and knowledge sources (e.g., WebMD, BMJ Portal, MDChoice, or CDC Portal or WHO Portal and the professional fora (e.g., NetDoc, DocGuide, or GlobalMedNet), the resulting pervasive, system-wide use of IT promotes generation of ad hoc collaborative entities (teams) needed to address common problems or develop just-in-time solutions. In the process of such interactions, and by fusing expertise of team members and teams with all available e-based resources and analytic tools, both new knowledge and best practices are created. Technology frees individual team members, and teams themselves, from the constraints of time, space, organizational/inter-organizational cultures, and – most importantly – the destructive influence of organizational status and rank. ToL and its inherent processes of action and interaction have been employed with great success by the US Army in a wide range of pilot projects involving both military and civilian affairs (Bradford & Brown, 2008; Brown, 2008a, 2008b; Dixon, Allen, Burgess, Kilner, & Schweitzer, 2005). Based on the already well-proven methods and techniques ToL is now vigorously implemented on the national and international/multinational scale by the organization of great complexity involved in a wide range of support and nation building missions that demand the closest possible cooperation with other, equally complex, organizations of national, international, multi-national, or even global level (e.g., EU, UN, WHO; see Bradford & Brown. 2008; Brown 2008a).

ToL as an "Action Swarm" Builder

The extensive use of IT, IM, and KM as the means of sharing information and knowledge serves as a powerful promoter of rapid development of shared vision, competence, confidence, and trust (Bradford & Brown, 2008) which, cumulatively, constitute the critical attribute of High Performing Leader Teams. The close relationship of team members to each other, and to members of other teams, is the chief mechanism transforming previously top-down bureaucratic and organizational structures into a bottom-up/lateral knowledge and "best practices" generator. Due to the pervasive nature of the exchanges within the lattice of the rapidly forming relationships, the process of transformation helps to demolish the existing organizational barriers. Instead, close socialization ensues, and fosters further growth of mutual confidence and trust among members of leader teams. The process becomes a chain reaction: professional and social relationships based on universal trust and confidence expand rapidly and freely, and teams of Teams of Leaders begin to emerge. Individuals and groups who have been isolated physically and/or organizationally now convert into "swarms" that converge whenever needed and whose constitution matches exactly the requirements of the task and mission at hand (see Figure 4). Such swarms are essential when addressing problems affecting performance at the level of "domain of domains," and the activities

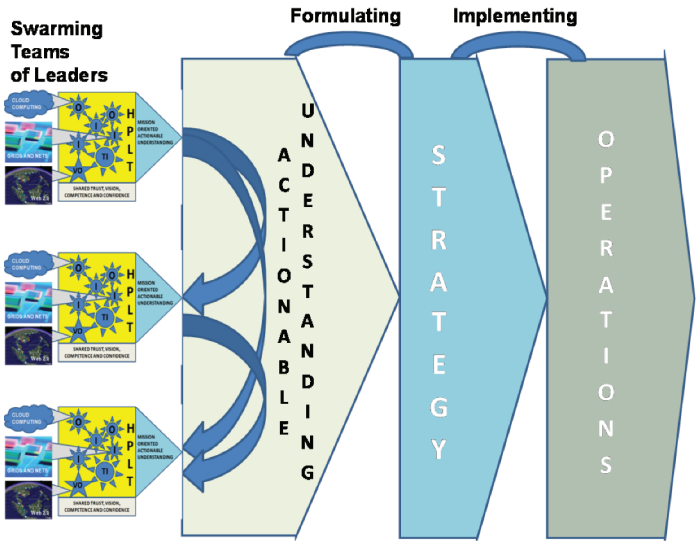
of Teams of Leaders have been shown to restore coherence to disorganized multi-organizational efforts (Bradford & Brown, 2008; Brown 2008a), and help in aligning them with the underlying strategies. Indeed, ToL has reached such a level of maturity and broad utility that its implementation and applications manual has been developed and disseminated by the US Army (Lipnack, Stamps, Prevou, & Hannah, 2010).

ToL as the Generator of "Actionable Knowledge"

Throughout the transition from HPLT to ToL a less tangible but critical advantage emerges: people who previously had no knowledge of each other, who might have been separated by distance, institutional or specialty barriers begin to rapidly form a network of close social relationships. Consequently, the development of collaborative spirit that often characterizes interactions between the local ambulance company and the countryside hospital can now emerge between physicians and first responders residing in different continents. The collaboration-building attribute of ToL is strengthened by the fact that teams can change their status from informal to formal depending on circumstances. Also, because of the intensity of the existing interactions, team members co-operate as readily and effectively in distributed environments as when the contact is based either on the mix of physical and distributed, or direct interactions. Actionable knowledge generated through network-centric activities that might have been shared between the two isolated groups (von Lubitz et al., 2008a) transforms through ToL-based interaction into a broad based "*actionable understanding*" which unifies several groups (Bradford & Brown, 2008).

Actionable understanding constitutes the most essential prerogative for operational efficiency in the environments of uncertainty and rapid, unpredictable change (Bradford & Brown, 2008) seen, for example, during responses to major disasters or rapidly escalating healthcare threats such as pandemics or incidents of bioterrorism (von Lubitz & Beakley, 2009; von Lubitz & Wickramasinghe, 2006a). Circumstantial evidence also indicates that the lack of such understanding was among the chief sources of errors in the response of national healthcare systems to such catastrophic events as the European heat wave of 2003 or

Figure 4. Operations of teams of leaders



Hurricane Katrina in 2005 (Ballester, Michelozzi, & Iniguez, 2003; Bouchama, 2003; Cooper & Block, 2006; Honore, 2009; Michelon, Magne, & Simon-Delavell, 2005).

Why ToL?

Global population growth, increasing poverty, large scale migrations, climate change, pollution, to name but a few of the host of other emerging issues, all pose new health care problems and risks whose solution, or its absence, may influence the stability of nations, regions, and even the entire globe (Garrett, 1994; Lewis, 2006; von Lubitz et al., 2002). These are issues that cannot be solved by mere per capita increase in the number of healthcare workers in the underdeveloped countries, improved immunization programs, or by promoting maternal health. Today, health care has become tightly intertwined with economy, politics, urban development, industrialization, military operations, and international travel. Suddenly, it became an integral part of the global societal mesh: from a simple concept of assuring health to a manageable number of patients, health care became one of the cornerstones of nearly everything we do. In truth, the efficiency of global healthcare networks may determine the future of the human race. Unless timely contained, an outbreak of a potentially pandemic disease will have a worldwide, destabilizing impact whose consequences are not only grim, but entirely unpredictable (Economist, 2003; Garrett, 1994; Osterholm & Branswell, 2005; PandemicfluGov; Vallat, 2007).

Dissemination and Synthesis of Multidisciplinary Knowledge

Modern health care is a "domain of domains." It is intensely complex, involves disciplines that, until recently, seemed to be entirely unrelated to health care (e.g., military operations or advanced computer technologies and methods, see Kulkarni & Nathanson, 2005; Kun, 2001; Silenas et al., 2009): it represents probably the only field outside military operations where success of missions (particularly when conducted on a national, international, or global scale) demands extraordinarily close cooperation of vast numbers of individuals, agencies, and nations.

Implementation of ToL throughout the entire spectrum of health care operations will have both an immediate and long-lasting effect (see Table 4) chiefly due to the nature in which information and knowledge are gathered, handled, and disseminated.

At peer-to-peer level, ToL promotes lateral spread and sharing of information and knowledge greatly extending beyond one's own professional specialty. Likewise, ToL supports downward migration of knowledge from more experienced/senior professionals within teams to the more junior ones. The direct advantage of such spread is the enhancement of distributed socialization across unrelated, but mutually relevant, intra- and inter-domain professional specialties. In similarity to within-profession trends, on-line communities of practice will form. However, from the outset, ToL promotes and consolidates interdisciplinary and trans-domain communities of practice. The latter facilitate/amplify innovation, contribute to the lateral/vertical dissemination of knowledge, and to the dissemination and development of evidence-based practices (Auf der Heide, 2006; McClure Wasko & Faraj, 2000; Seely Brown & Duguid, 1991; see also Ho, Peterson, & Masoudi, 2008; Kersten, Thompson, & Frohnal, 2008, Nash & Quigley, 2008; Seers, 2007).

ToL as a "Force-Multiplier"

The need for the closest possible cooperation among national and international entities in global health care efforts is evident: operational costs increase at a staggering rate, the access gap widens alarmingly, and almost uncontrollable human bioincursion into new habitats enhances chances

Table 3. Organizational and personal impact of ToL-based activities (after von Lubitz, in press)

TYPE OF ACTIVITY	IMPACT
OPERATIONS	Generates actionable understanding Supports strategy development Promotes mission definition Promotes actor cooperation and collaboration across disciplines and domains Speeds OODA Loop (for observe, orient, decide, and act) cycles Increases OODA Loop operational space and reach Promotes extraction and analysis of mission-relevant intelligence Promotes generation of alternative approaches ("workarounds") Serves as force multiplier Maximizes mission support through the employment of shared skills, knowledge and attitudes
RESOURCES	Promotes strategy-relevant resource assembly Promotes mission-centered, parallel use of intellectual and material resources Maximizes optimal resource exploitation Utilizes legacy and future IT/IM/KM platforms Maximizes resource deployment speed Promotes mission-relevant resource concentration Maximizes utilization of platform-independent CT/IT/IM/KM resources
ORGANIZATION	Promotes creation of collaborative actor grids Promotes ad hoc creation of collaborative virtual organizations and communities of practice Maximizes mission-centered utilization of actionable information and actionable knowledge Supports hierarchical and peer-to-peer interaction Maximizes information and knowledge sharing among all actors of the mission grid Generates bottom-up actionable knowledge generation and top-bottom actionable information flows Promotes interdisciplinary and inter-domain information and knowledge distribution and use
SOCIAL	Maximizes generation of trust and understanding among all actors Enhances mentoring Maximizes personal contacts Enhances personal knowledge and competence beyond boundaries of own discipline/specialization (promotes "generalist" education) Maximizes development of shared skills, knowledge, and attitudes

*The impact of ToL is made clearer by comparison with factors listed in figure 1

of the exposure to pathogens for which we are entirely unprepared (although HIV and Ebola are the best known examples, several other diseases and pathogens have been described in the past decade alone, e.g. Fonkwo, 2008; GAO, 2004; also see Garrett, 1994). Since September 2001 bioterrorism became an ever-present threat, while disasters such as the Tsunami of 2004, Hurricane Katrina, or the Myanmar Cyclone of 2008 showed that we are unable to deal adequately with catastrophic events. At present, the entire healthcare system of the world labors painfully, inefficiently, and very expensively under constraints imposed by conflicting bureaucracies, national politics, and divergent philosophies (Coulter & Ham, 2000; Fernandez, 2002; von Lubitz et al., 2002).

The absence of a clearly defined global strategy and foresight among the Western nations, and our failure to incorporate into future plans anything beyond the most obvious, are not typical of health care alone. The inability of the West to detect, analyze, and counteract the growing dissatisfaction with its policies is among the principal causes underlying the explosive emergence of anti-Western sentiment, religious extremism, and – ultimately – international terrorism as the sole means available to the populations of the "gap" to attain emotional if not economical "parity" with the developed countries (Barnett, 2004; Onen, 2004). In turn, the political destabilization that typically accompanies these extreme forms of protest weakens the economies in the underdeveloped

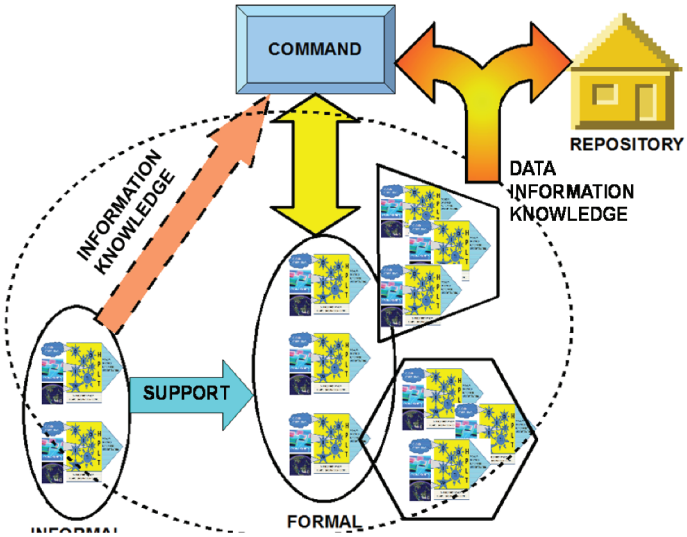
regions, promotes escalation of poverty, and leads to an even greater decline of their already meager (or practically nonexistent) healthcare systems (Akhtar, 1991). Consequently, despite substantial funds provided by multinational Western sources (Garrett, 2007a; Li & Eastman, 2003; Ma'ayeh, 1999; US Mission to the UN, 2002), attempts to establish comprehensive solutions to health care needs of the developing and underdeveloped world continue to fail (Afford, 2003; Attaran, 2004; Pal & Mittal, 2004; Zupan, 2003).

ToL may change all that. It brings to the forefront the fact that technology (such as grid or cloud computing), no matter how powerful it might be, serves nothing but the solution of tactical tasks whether simple or unimaginably complex. Processes (such as IM and KM) or their combination (network-centric operations) lead to the formulation and operational implementation of actionable knowledge, typically also in a very task specific (i.e., narrow) context. By bringing together people able to maximally exploit their mutual talents and expertise, able to efficiently implement technology and processes, and by rooting their activities in the maximum, platform-independent use of all tools and methods and processes offered by ITC, ToL permits to develop the strategy which serves as the guide and rationale of all subsequent theater operations (Figure 5).

Such strategy cannot be devised by even the most intense application of either technology or processes alone. ToL provides the needed catalyst and force multiplier. It is in that context that ToL, contrary to "within the profession" approaches, supports the development of both evidence-based methods and of best practices among a much wider range of professionals, disciplines, and agencies than has been possible previously. Creation of such best practices binds isolated bureaucracies, their agencies, and personnel into a coherent force operating under uniform "rules of engagement" that the jointly-created best practices represent.

Most importantly, however, ToL brings people to the forefront: it facilitates generation of locally appropriate solutions by the people on the ground. It transforms grand but unrealistic international schemes into a coordinated bottom-up effort whose ground effect becomes measurable, lasting, and aligned with the overall strategy - strategy that is devised on the basis of vertical inputs generated within the realm of ToL operations. All that relates directly to the manner in which e-tools,

Figure 5. Interactions within the ToL environment



methods, and processes are used in the operational environment of ToL-based healthcare operations: ToL transforms advanced technology from a Ferrari accessible only to a few into a hammer available to all.

ToL as a Builder of Flexible Strategies

In the ToL environment, results are generated at the practitioner level rather than at the level of executive policies (von Lubitz & Beakley, 2009). What emerges is the bottom-up spread of knowledge developed through consensus of practitioners, supported by joint practical experience and accepted by the involved professions far more willingly than directives descending from the executive level of bureaucracies (Tierney, 2006; Ward & Wamsley, 2007). Once thoroughly analyzed and tested within practitioners' communities, the generated best practices can be converted via a hierarchical process into a flexible and practical strategy with clear and attainable objectives. As such, it is a strategy that is acceptable and understandable to all involved actors at the horizontal and hierarchical levels of administration and operations. Continuous up-down-lateral interactions keep the strategy attuned to changes in the operational environment; knowledge ceases to be confined to vertical and often entirely separated channels of profession and bureaucracy, and spreads laterally. Strategy becomes actionable rather than bureaucratic (von Lubitz et al., 2008a). With the development of mutual confidence and trust, it turns into *actionable understanding* (Bradford & Brown, 2008) – the catalyst that transforms individual, often seemingly incompatible, components into a functional entity capable of effective action.

By promoting mutual trust, ToL furthers rapid development and coalescence of shared attitudes among all actors. It is a process of critical significance in international and multinational operations in any arena, be it civilian or military (Bradford & Brown, 2008; Brown, 2008a; Smith, 2007). It has been said that, in the context of issues facing health care at the global scale, mutual trust has eroded since the policies of the developed nations are rooted within their mono-cultural, ethno-centric concepts, and the remedies proposed by the rich may therefore be beyond the reach and without any relevance to the present and future problems of the poor (Fernandez, 2002). ToL not only allows for fully empowered inclusion and interaction of all affected groups – in order to be effective, the concept of ToL *demands* such inclusion since only then can problems be addressed effectively and efficiently. By its very nature, ToL brings health care among the people.

CONCLUSION

It would be exceedingly naïve to expect that consequent implementation of ToL practices will offer a dilemma-solving panacea. Nonetheless, in the realm of health care it may provide the launch pad for the needed remedies. ToL is endowed with a number of distinct and unique advantages. First of all, the essential physical constituents already exist, several of which have been discussed in this chapter. Furthermore, the ToL concept is already implemented with significant success and on a large scale by the US European Command (EUCOM) as part of its extensive interaction with the civilian authorities of several European and non-European countries (that also include health care issues, e.g., Bradford & Brown, 2008). Hence, "lessons learned" can be readily adopted into the purely civilian environment. Most importantly, however, ToL unifies the currently disconnected fields of health care and its technology support and fosters rapid development of actionable understanding rather than actionable knowledge. As argued in the preceding sections, it is actionable understanding rather than actionable knowledge that serves both as the prerequisite and the *essential* prelude to creating a solid foundation for the development of the badly-needed collaboration and

cooperation among all involved health care actors. Without such understanding, all efforts to relieve the mounting pressures of conflicting demands, inequities, and deficiencies will ultimately fail. The signs of the approaching collapse are clearly visible already, and the currently favored erratic application of ever larger amounts of money or increasingly complex, technology-based solutions to avert the inevitable is, equally clearly, utterly inadequate. ToL may be an important contributor in changing all that.

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