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Why is Family Medicine Different?

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Article

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Abstract

An understanding of the role and function of Family Medicine in the healthcare system can provide important insights for Enterprise Architecture. It is often stated that the thought process utilized by Family Medicine physicians is different from that of specialty physicians, but heretofore there has been little or no analysis of what that difference is. This article examines that difference from the perspective of the complex adaptive system that is healthcare today, and shows how it is that Family Medicine physicians perform the vital function of decreasing the entropy or disorder in the patient care system via decision loops, as opposed to the decision trees of linear or classical logic. The generalist function of Family Medicine physicians results in the integration and coordination of the various specialty functions in healthcare.

Keywords

Complex systems, entropy, generalist, Family Medicine

INTRODUCTION

Family Medicine physicians frequently state that the thought process involved in the practice of Family Medicine is qualitatively different from that of other medical disciplines, and discussions along this line typically move into the realm of problem-solving judgment and a "holistic" view of the patient. This article examines how that holistic judgment of Family Medicine differs in that it is a quantum logic of decision loops that decreases the disorder and uncertainty of a system, as opposed to a sequential or classical logic that is based upon a Boolean system associated with decision trees and flow charts. Such generalist judgment is vital in the complex adaptive system that is modern healthcare, and decreasing of such generalist function will result in the increasing costs and disorders that are now seen in the US healthcare system.

THE COMPLEXITY PROBLEM

In a published case report by two dermatologists from Yale University (Stavert & Lott 2012), a 32-year old male patient was admitted to an intensive care unit after a three-day history of non-specific prodromal (early) symptoms and then became acutely ill. A firm diagnosis remained uncertain throughout the patient's hospitalization, with the differential diagnosis of the patient's overall problem including such relatively uncommon conditions as Still's disease, drug-induced hypersensitivity syndrome, and macrophage activation syndrome, to name a few. During the patient's 11-day stay in the intensive care unit he experienced renal, hepatic, and pulmonary failure, was seen by over 40 physicians, and on average had over 25 diagnostic tests and two imaging studies performed daily. The authors reported an ambiguity about the "ownership" of the patient that resulted because there were multiple diagnoses but no single definite diagnosis could be made that would determine who the patient should belong to. They reported that:

"… multidisciplinary discussions regarding his diagnosis and potential plan of care soon devolved into fragmented, narrow, and internal deliberations within each specialty."

They stated that:

"None of us were certain what was wrong with him, and therefore each of us continued to wait for someone else to do something."

The confused goal orientation resulted in reluctance to assume responsibility as:

"… each covering clinician was understandably reluctant to initiate changes absent a blessing from the primary team."

They reported that it was:

"… easy to assume a passive role and conclude that another physician will bear the burden of authority and patient responsibility … [until] … acute decompensation [worsening of the patient's condition] occurred, forcing the doctor-of-the-moment to act decisively."

The patient eventually recovered but his diagnosis was never confirmed.

Contemporary medical care increasingly involves a proliferation of practice guidelines and treatment protocols, the development of which is motivated by a desire to standardize medical care in order to build "economies of scale" that can "mass produce" health for individuals at lower cost. Another recent paper (Hughes et al. 2012) from the UK is illustrative of the unintended negative consequences of such attempts. The authors applied the UK National Institute of Health and Clinical Excellence (NICE) clinical guideline recommendations to hypothetical patients and examined the likely results. What they found was that explicitly following those guideline recommendations:

"…would lead to a considerable treatment burden, even when recommendations were followed for mild to moderate conditions. In addition, the follow-up and self-care regime was complex potentially presenting problems for patient compliance."

The authors concluded that:

"…in people with multimorbidity current guideline recommendations rapidly cumulate to drive polypharmacy, without providing guidance on how best to prioritize recommendations for individuals in whom treatment burden will sometimes be overwhelming."

Significant adverse guideline interactions arose even if a hypothetical patient had only two chronic medical problems (a 75-year-old man with type-2 diabetes mellitus and chronic obstructive pulmonary disease), but following all of the guideline recommendations for a hypothetical patient with five chronic medical problems (a 78-year-old woman with previous myocardial infarction, type-2 diabetes, osteoarthritis, chronic obstructive pulmonary disease, and depression) became completely unworkable. Such adverse interactions of guidelines and protocols are nothing new for Family Medicine physicians, who frequently encounter such situations and adjust patient care regimens appropriately, but examining this problem and how it is overcome is illustrative of just what it is that a Family Medicine physician does that is so necessary, and so different from a specialty physician.

To further illustrate, consider the hierarchical or pyramidal organization of the administration of a hospital with the CEO at the top and two or more layers of upper and middle management between the CEO and the actual healthcare operations of the hospital (which is not an unusual situation today). The CEO needs information by which to make decisions about the function of the hospital, but any information about a particular operational healthcare matter in the hospital must traverse multiple layers of the organizational structure as it moves through the prescribed channels and procedures before finally reaching the CEO. Each time that information moves up the hierarchy and passes a junction point or "node" in the system, it acquires more entropy or uncertainty. That entropy must then be overcome so that an appropriate decision can be made by the CEO. A specialty physician can provide information about a particular specialty area directly to the CEO, and thus reduce the number of nodes traversed by the information as it reaches the top of the decision-making system. So a specialty physician can "bridge" information vertically from a specific patient care area directly to upper management and thereby reduce the entropy carried by that information, but the specialty physician is limited in lateral movement across the base of the pyramidal structure because the specialty physician only functionally participates in a few areas of patient care. The Family Medicine physician, on the other hand, cannot only "bridge" information vertically, but can do this laterally as well, because the Family Medicine physician is capable of function in virtually every clinical division of the hospital. If the CEO, in order to make a decision, needs information from more than one area of the hospital, the Family Medicine physician can supply it with the least amount of associated entropy or uncertainty. While the CEO of the hospital has ultimate authority and responsibility for every division or "node" in the hospital, the CEO is limited to functionally participating with only the upper levels of management. Because the CEO does not functionally participate in the patient care areas of the hospital, the CEO is unable to personally obtain the dynamic information necessary for decision-making. It is only the Family Medicine physician that can function across the entire system to lower entropy appropriate to decision-making information by reducing the number of nodes traversed by a particular piece of information. The concept involved in this example of a Family Medicine physician functionally involved both horizontally and vertically to lower entropy in hospital decision-making can be generalized to illustrate how it is that a Family Medicine physician can integrate and coordinate the information involved in the care of a particular patient across the multiple dimensions involved in such care.

THEORETICAL CONSIDERATIONS OF ENTROPY

Various guidelines and treatment protocols can be thought of as decision trees or flow charts. Such representations can be used to depict diagnostic strategies and organizational relationships, as well as treatment strategies. Each branching point of such a flow chart can be thought of as a "node" at which a decision is to be made, with the branches coming from each node representing the various decisions. As the number of nodes in such a system increases arithmetically, the potential for disorder (i.e., entropy) compounds logarithmically (as per the Boltzmann equation). Thus, increases in the complexity and number of patient care protocols bring logarithmic increases in potential disorder to the system of an individual patient's healthcare, and resultant complexity of potential interaction of those various protocols or decision trees.

Per Bak was a physicist who explored what increasing entropy can do to a system (Bak 1996). He and his associates developed a computer-generated sand pile by dropping one computer-generated grain of sand at a time onto the sand pile, understanding that each grain of sand would carry with it an amount of entropy or unpredictability. As the sand pile built up from the increasing number of grains of sand, there would be occasional "landslides" within the sand pile. What Bok and his associates found was that they could not with statistical certainty predict the time or the place or the amount of a landslide, because the entropy of the system by its definition made such certain predictions impossible, and thus the logarithmic buildup of entropy in

a system eventually leads to an unpredictable catastrophic collapse(s) of the system.

John Bodnar examined the effects of entropy in human organizations (Bodnar 2003). He said that the complexity of a pyramidal organizational chart indicates the number of possible interactions required to perform a task, and this reflects that organization's "degree of assembly" or entropy. In order for the leader of the organization to make an effective decision that would release the power of the organization, a "decision energy" of activation must be reached that is analogous to the "activation energy" of a chemical reaction. Just as in a chemical reaction where an energy of initiation must be overcome so that the reaction can proceed and release the chemical energy contained in the system, in an organization a leader must attain a sufficient "decision energy" to overcome resistance to a decision that would release the power of the organization toward a certain end. So the degree of assembly of an organization raises the "decision energy" necessary to initiate an action of the organization, in the same way that entropy raises the energy of initiation of a chemical reaction.

A chemical reaction can occur at a lower energy of initiation if a catalyst is present. A catalyst operates by providing information to the system that lowers the entropy and thereby lowers the energy of initiation of the chemical reaction. In an analogous manner it is the Family Medicine physician that lowers the entropy of the healthcare system around the individual patient. The Family Medicine physician brings the information to the system that integrates and coordinates the various aspects of healthcare (e.g., vital signs, medication list, physical exam, nursing care, specialist opinion, family support, pharmacist input, etc.) to enable the best decision regarding the healthcare of an individual patient. In this way the Family Medicine physician acts as a type of information bearing catalyst, in much the same way that an enzyme operates within a milieu of biochemical reagents to select a reaction pathway that is appropriate to a particular place and time within a biological system.

GENERALIST FUNCTION

Family Medicine physicians must seamlessly consider all of the dimensions of a patient's existence, and this "biopsychosocial model" not only includes consideration of biochemical and intracellular processes, but also the emergent organization of tissues, organs, and organ systems into the individual organism. But optimal medical consideration of this human organism must also include simultaneous consideration of the psychological, social, and spiritual dimensions of a patient's existence. At the same time the Family Medicine physician must seamlessly consider all of the dimensions of healthcare that can be utilized in patient care. Such healthcare dimensions include various diagnostic modalities, the multiple medical specialty consultations available, a myriad of pharmacological manipulations, allied health providers such as nurses and physical therapists, and the many "alternative" treatments available, etc. So the Family Medicine physician must integrate and coordinate all of the dimensions of the biopsychosocial model with all of the dimensions of modern healthcare, and to diagram the interconnections of such interactions would obviously produce a tangled entropic mess with everything connected to everything else. Such a network is a complex system and requires complex adaptive decision-making. Just putting several specialty physicians in a box and shaking them together won't provide the integration, coordination, and innovation necessary to make optimal individual decisions about the individual aspects of an individual patient's health. This was demonstrated in the case report discussed earlier. What is required for such optimal decision-making is for a generalist physician to be functionally involved in each and all of these dimensions of patient existence and care, to bridge across multiple nodes of the network in order to lower the entropy and enable the best decision(s) to be made for that particular patient's particular situation at that particular time. This is the global or "holistic" function of the generalist Family Medicine physician, which functions beyond the simple serial logic of a decision tree, rather, the decision-making of the generalist Family Medicine physician includes such serial logic capability and incorporates it into an emergent consideration of the entire system simultaneously. (In the parlance of complex adaptive systems "emergent" phenomena cannot be understood by examination of the individual parts of the system in isolation, but can only be understood by consideration of the entire system as a whole.)

The generalist function of the Family Medicine physician differs from the specialist function of other physicians. The basis of such functional differences has analogous correlation to cellular differentiation in an organism, in that cells differentiate by blocking portions of their DNA source code. This is analogous to the function of the generalist Family Medicine physician whose source code of practice scope has not been limited, but rather has been purposefully kept unblocked and unspecialized to enable adaptable medical function in any situation (Blake & Stockton 2005). So a specialist physician function involves a relatively blocked source code for a narrowed scope of practice which enables the very efficient performance of a relatively few specific tasks, while the relatively open and unblocked source code for a broad scope of practice of the generalist Family Medicine physician enables performance of multiple tasks, but overall less efficiently than a specialist and sometimes to the effect of not performing a particular specialized task at all, and hence the need for specialty consultation and referrals.

While this article considers specialty decision-making as different from generalist decision-making, it is important to understand that all physicians do both in their normal

process of function, but it is illustrative for the purposes of this article to hypothetically consider the decision-making process and function of the specialist agent as being distinct from that of the generalist agent. So the decision-making process of the specialty agent can be seen as one of the serial logic of decision trees and protocols, while the decision-making process of the generalist agent must integrate and coordinate multiple such decision trees simultaneously. The specialty agent function fits nicely into a pyramidal organizational structure, while the generalist agent is able to "migrate" throughout all of the "nodes" of a pyramidal organizational structure. This makes the specialty agent more resource-oriented in function, while the generalist agent is more information-oriented in function. Consequently, the specialty agent becomes a source of stability for the system, but that stability might also be considered as rigidity. On the other hand, the generalist agent can be seen as a source of flexibility or adaptability, in much the same way that genetic diversity increases the resilience of an ecosystem but loss of genetic diversity makes that ecosystem less able to adapt to a perturbation (Gunderson & Holling 2002). The broadly open and unblocked source code of the generalist agent also allows the generalist agent to maintain orientation toward the overall concept of the system and its goals that are described by the system's source code, so the generalist agent maintains the purpose of the entire system and source code rather than just maintaining the purpose of a specialized part of the system.

DECISION LOOPS IN COMPLEX SYSTEMS

While specialty decision-making is best characterized by decision trees, generalist decision-making is best characterized by decision loops. Decision loops have historically been associated with performance jumps and breakthroughs, as exemplified by the Scientific Method's loop of research-hypothesis-experiment-conclusion which was first published by Sir Francis Bacon in 1620 (Bacon 1620). Many such decision loops have since been published, such as the Quality Control Management loop of plan-do-check-act (Deming 1986) and John Boyd's "OODA Loop" of observe-orient-decide-act (Coram 2002). Such decision loops are implemented in spirals that increase knowledge and enable appropriate innovative decision-making. The generation and testing of hypotheses taking place in such decision loops represents a holistic or quantum logic that is enabled by the broadly open source code of the generalist agent allowing for broad-scope functional participation across the system to reduce entropy between disparate nodes (Mihelic 2012).

A complex adaptive system that is deficient in generalist agent function will likely exhibit pathologies related to poor hypothesis generation and confused goal orientation, and such pathologies are evident in the contemporary US healthcare system as a result of the diminished presence of functional primary care physicians. The results of generally poor hypothesis generation within the healthcare system intuitively present as the lack of innovation and consequent reliance on protocols and decision pathways, but operationally this lack of hypothesis generation and associated judgment also translates into dysfunctional risk analysis and stratification. Contemporary medicine's increasing reliance on protocols and decision trees is motivated by a risk-averse orientation that seeks to minimize uncertainty by giving all patients the tests and treatments available for a given situation while potentially minimizing physician judgment to the contrary, and while this is an obvious exaggeration, many not-so-exaggerated examples can easily be found in emergency room protocols, specialty decision trees, and various payer-mandated clinical pathways. As society becomes increasingly intolerant of individual physician judgment decisions being made for individual patient circumstances, such protocols become more numerous and increasingly rigid, and the involved cost of healthcare increases in order to develop such protocols and to enforce them. Protocols, checklists, guidelines, and decision trees are not bad, but are necessary for highly reliable organizations. It must be recognized, however, that they do have associated costs to generate, teach, maintain, and enforce, and more often than not such costs exceed any savings generated by envisioned efficiencies that are projected because of "economies of scale". But even beyond the rapidly increasing cost involved, there is an increasing lack of resilience or flexibility in the system that comes about due to enforcement of protocols without room for sufficient and appropriate judgment. Certainly the healthcare results of the current US medico-legal situation exemplify such systemic pathologies.

Without the presence of effective generalist agent function in a complex adaptive system, there is a lack of integration and coordination between specialty agents. This can lead, not only to confusion regarding medical team care responsibilities, but also to confusion regarding the proper course for diagnosis or treatment. This is because, when placed in group situations, people will make decisions and form opinions to more of an extreme than they would if they had not interacted with the group (Lewis 2017). This group polarization can lead to a "risky shift" in decision-making, but can also polarize the group toward risk avoidance, with all of the expected concomitant results (Myers & Lamm 1975). An effective generalist Family Medicine physician can neutralize group polarizing influences by maintaining communication and lowering any potential disorder between all of the decision-making influences.

Generalist agents maintain a broadly open source code that enables a more complete view of the concept and goals of the entire system, while the overall system concept and goals viewed by specialty agents are limited by blocked portions of their source code. In the contemporary US healthcare system, the confused goal

orientation that results from diminished or dysfunctional generalist physician activity is evidenced by the numerous episodic care clinics that have proliferated due to the lack of availability of primary care physicians. Such confusion as to ultimate goal orientation is evident when such episodic care clinics are located within a specialty physician office or a pharmacy, and such confused goal orientation often leads to diffused responsibility in patient care. The example of successful generalist function that is provided by the Family Medicine physician involves considered interventions to lower the disorder in an individual patient's health. Such preventive and/or early interventions are typically unspectacular when considered in comparison to remarkable surgical procedures or the dramatic electrical defibrillation of a cardiac arrest, yet such interventions are obviously vital for an individual's health, and in controlling healthcare costs. A quote from Sun Tzu from 3,000 years ago provides further insight into the importance of competent generalist function in complex decision-making (Sun Tzu as translated by Giles in 1910):

"To see victory only when it is within the ken of the common herd is not the acme of excellence. Neither is it the acme of excellence if you fight and conquer and the whole Empire says, "Well done!". To lift an autumn hair is no sign of great strength; to see the sun and moon is no sign of sharp sight; to hear the noise of thunder is no sign of a quick ear. What the ancients called a clever fighter is one who not only wins, but excels in winning with ease. Hence his victories bring him neither reputation for wisdom nor credit for courage. He wins his battles by making no mistakes. Making no mistakes is what establishes the certainty of victory, for it means conquering an enemy that is already defeated."

The successful generalist Family Medicine physician wins battles against disease by quietly lowering the potential disorder or entropy around a certain circumstance, but these victories generally bring little or no reputation for wisdom or credit for great skill because those physicians make it look easy in their often flawless function. Consequently, many have envisioned the future of US healthcare without the significant influence of generalist Family Medicine physicians, and have anticipated replacing them in large part with physician extenders such as nurse practitioners or physician's assistants. However, as our healthcare system has witnessed waning functional participation of such generalist physicians in full primary care practice, it has also witnessed the increasing costs and confused redundancies that naturally follow from the lack of integration or coordination that can be provided by fully functional generalist physicians. The function of Family Medicine physicians in the integration and coordination of medical care can serve as a successful template for such generalist function within the Enterprise Architecture and other complex adaptive systems.

CONCLUSION

The generalist function is an important organizing factor in complex adaptive systems and as such should be a consideration in Enterprise Architectural design. A frequent criticism of large organizations is that they become very rigid in their processes and decision-making, which inhibits innovation, as is exemplified by many established large corporations and institutions. Such rigidity inhibits the sharing of information between segments of such organizations and this can lead to deleterious consequences. The *9/11 Commission Report* is noted for its criticism of a "failure of imagination" within the intelligence community that led to failure to bring together the pieces of information that could have (or should have) predicted the terrorist attacks of September 11, 2001. In that document the Commission stated that:

"The agencies are like a set of specialists in a hospital, each ordering tests, looking for symptoms, and prescribing medications. What is missing is the attending physician who makes sure they work as a team."

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