Chapter VI
An Evidence-Based Health Information System Theory

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ABSTRACT

The aim of this chapter is to bridge the gap between what is known about IS theory and the specifics characteristics of health to develop an evidence based health information systems theory. An initial background first sets the significance for the need to have a solid information systems theory in health and then argues that neither the information systems literature nor the health sector have been able to provide any satisfactory pathway to facilitate the adoption of information systems in health settings. The chapter further continues by reviewing the common pathway to develop information systems theory and the knowledge foundations used in the process, and then proceeds to highlight how this theory was developed. Subsequently, the building blocks (constructs, premises, supporting evidence and conclusions) that underpins the constructs and a brief explanation of the relationships between them is included. A discussion and limitation section is then followed by a conclusion.

BACKGROUND

The importance of having information systems theories that will be conducive to the adoption of new technologies in health settings cannot be underestimated. To place it in context, the health-care sector is not only one of the world’s most knowledge-intensive industries but also one of the largest employers; for example the National Health Service (NHS) in the UK is the largest employer of staff in Europe and third largest in the world (Herzlinger & Ricci, 2002; Leitch, 2008).
More important is the worldwide, current and urgent need to improve the uptake of technology in health settings to improve clinical care and associated costs through the use of technology, as clearly defined in the literature (AIHW, 2006; Department of Health and Aged Care, 2003; Grol et al, 1998; Gross et al., 2003; HealthConnectSA, 2007; Nader, 2007; Schuster et al., 2003; WHO, 2008). This is currently occurring despite mounting evidence suggesting positive clinical care improvements due to the introduction health information systems (Celler et al., 2003; WHO, 2008).

This current failure to adopt technology in health settings appears to point to gaps in the understanding of technology implementation and adoption in the health sector.

The current literature on health information systems implementation and adoption suggests that perhaps the health sector suffers from a fixation with ‘technology driven implementations’ to the detriment of other factors (Aarts et al., 2004; Bates, 2005; Chaudhry et al., 2006; Humber, 2004). That is, the focus of change management strategies to implement these technologies in health settings is seen almost exclusively as a technical (computer/technology system) issue. Moreover, most information technology applications have centered on administrative and financial transactions rather than on the core business of health: the delivery of clinical care (Audet et al., 2004). The concept of clinical care is the central principle associated with the field of health and known these days as Evidence-Based Medicine (EBM). The most important aspect associated with Evidence-Based Medicine is the measure of clinical improvement on patients or a term also known as health outcomes (Heckley, 2004).

In summary, the health sector appears to lack solid theoretical knowledge in organizational change, workflow redesign, human factors, and project management issues involved with realizing benefits from health information technology to tackle the clinical and financial burdens in current health systems (Chaudhry et al., 2006). Moreover, and central to this paper, the health specific literature on information systems implementations appears to fail to acknowledge the role of Evidence-Based Medicine (and health outcomes specifically) in the implementation process.

Perhaps, the solution is to consult the information systems literature in search for theoretical foundations that would support the adoption of technology in health settings.

The Information Systems (IS) literature on the other hand, mainly focused on the business sector and having left much of the ‘technology-driven’ approaches failures behind, has long benefited from a much more humanistic and contextualized appreciation of non-technological factors (i.e. Human, environmental, Social, etc) to improve adoption; However, in spite of the availability of more than fifty information systems theories and many others form other fields to inform practitioners, implementation failures in health settings still continue unabated to this day (HealthConnectSA, 2007; Schneberger & Wade, 2006). It would appear that even the existing broad knowledge in the IS sector is still not enough to affect effective technological uptake in health settings. What appears to be missing is ‘specific’ knowledge that would support the adoption of technology in health settings.

As a conclusion, the preceding and very brief literature review suggests that neither the health nor the information systems sectors have succeeded in developing solid theoretical knowledge that would lead to the successful implementation and adoption of information systems in health settings.

This chapter will advance some theoretical constructs regarding observed phenomena that might help bridge the gap between existing knowledge and new knowledge gained in the field and through relevant information systems research in health settings by the author. This examination leads the author to believe that perhaps there is a misalignment in the understanding of current
information systems theories and health constructs; more specifically, that existing theories do not specifically focus on the ‘core businesses of health’ (Evidence-Based Medicine).

It must be also noted that this paper is not meant produce a definitive full-fledged theory, but contribute to the beginning of a theoretical discourse in information systems for health specific settings. Although initially built from an existing theoretical framework; it is intended to go above and beyond the founding theoretical frameworks as suggested recently by the editors of MIS Quarterly (Markus & Saunders, 2007).

THE KNOWLEDGE FOUNDATIONS OF INFORMATION SYSTEMS THEORY

The most common approach to developing or building on theory in the discipline of information systems is to use an established theory (authoritative knowledge) from a reference discipline, develop and adapt it to the information system context by ‘trial and error’; this is also known as ‘the logic of science’ (Popper, 1979). In this approach, an established theory is used to categorize and classify information systems phenomena through a deductive approach (Lind & Goldkuhl, 2006).

Another approach is the inductive analysis of empirical data for the creation of a theory; Grounded theory is perhaps the most widely known methods of inductive theory building (Glaser & Strauss, 1967). This form of theory building was called ‘logic of inquiry’ by philosopher John Dewey in 1938 (Dewey, 1938), and involves the idea of ‘application’ grounding, including observational grounding to develop theory (Lind & Goldkuhl, 2006). This method has lead to the creation of concepts and theory useful for practical workplace change and is in line with the notion of a ‘practical theory’ (Cronen, 2001). However, the lack of relationship to other existing theories and unclear epistemological basis have been sited as criticism of this approach (Bryant, 2002; Charmaz, 2000).

There is, yet another closely related logic called ‘logic of discovery’ and it seems to underpin abductive reasoning (Popper, 1979; Wirth, 2008). Wirth (1998) defines abduction as ‘the process of adopting an explanatory hypothesis’ and covers two operations: the selection and the formation of plausible hypotheses. He goes on further to explain that ‘as a process of finding premises, it is the basis of interpretive reconstruction of causes and intentions, as well as of inventive construction of theories’ (Wirth, 2008). It is motivated by the observation of a surprising fact or an anomaly that disappoints an expectation; abductive reasoning is a strategy of solving problems and discovering relevant premises. It is “inference to the best explanation”. However, from a logical point of view, Pierce (1958) suggested that reasoning backwards is no valid form of inference. It is conjectural, or presumptive thinking, aiming at matching pragmatic standards of plausibility, guided by the reasoner’s guessing instinct (Peirce, 1958; Wirth, 1998).

Further epistemological and ontological strengths and weaknesses of every approach can be discerned in a number of other resources (Bryant, 2002; Charmaz, 2000; Urquhart, 2001; Wirth, 2008).

Bob Zmud (1998), ex editor-in-chief of MIS Quarterly, suggested that to truly contribute to theory building, it is necessary to develop and describe a rich conceptual understanding of an information systems phenomena so that it serves to enhance the field’s collective understanding of the phenomena and as a basis for future empirical and theoretical work (Zmud, 1998).

More importantly — as the basis for the development of the particular theory to be examined in this chapter stands solely on the author understands of the phenomena, it is imperative that the phenomenon’s constructs are augmented compellingly (Zmud, 1998). Arguments, for the
purpose of this paper, are defined as set of one or more declarative sentences (or propositions) known as the premises along with another declarative sentence (or proposition) known as the conclusion. Premises are those statements that are taken to provide the support or evidence and the conclusion is that which the premises allegedly support (Fieser & Dowden, 2008). Furthermore, arguments can be deductive and inductive; according to Fieser and Dowden (2008), a deductive argument is an argument in which it is thought that the premises provide a guarantee of the truth of the conclusion. Conversely, an inductive argument is an argument in which it is thought that the premises provide reasons supporting the probable truth of the conclusion. In an inductive argument, the premises are intended only to be so strong that, if they are true, then it is unlikely that the conclusion is false. Moreover, Fieser and Dowden further clarify that even if the author of the argument does not think that the truth of the premises definitely establishes the truth of the conclusion, but nonetheless believes that their truth provides good reason to believe the conclusion true, then the argument is inductive (Fieser & Dowden, 2008).

Zmud (1998) further suggested a four step development pathway to developing sound theory including: (1) the description of the phenomenon, (2) the construct creation, development and explanation, (3) the identification of key relationships and (4) the development, justification and articulation of these relationships. (Zmud, 1998). These headings will be used to develop the theoretical discourse.

The Context of the Emerging Phenomena

The first stage in this examination evolved as the observation of emerging facts and anomalies (abductive approach) as a result of the development of the author’s PhD information system framework (Carbone, 2008); from where a set of new constructs or ‘by-products’ of the PhD emerged. The PhD study began its own development as a conceptual framework; a product of adapting existing theoretical constructs (authoritative knowledge) and the researcher’s own field experience and observations (abductive reasoning). Socio-technical theory provided the theoretical framework to guide the research processes (Clegg, 2000; Land, 2000; Liehr & Smith, 2001; Mumford, 2003, 2006a, 2006b; Williamson, 2002). The testing process itself was inductive in nature (logic of inquiry), aiming at the empirically provable coherence between the premises and experience, in order to derive a probable generalization (Wirth, 2008).

The PhD research focussed specifically on developing an information systems framework to support the prevention and management of chronic conditions (i.e. Asthma and Diabetes) in general practice following a pre-determined deduction/induction pathway. While this was satisfactory for the needs of the PhD study, it left a number of wider emergent constructs outside its limited scope. The limitation included the focus to just chronic conditions and to general practice settings only, even though the emergent premises observed were seen to be applicable to the wide clinical care continuum and other health settings as well.

The following graph in Exhibit 1 represents the knowledge foundations and research pathway just described above down to the emerging premises discovered in the study.

Phenomena Description

Successful implementation and adoption of information systems within the scope of chronic conditions and general practice were formally examined within the PhD study. Similar successful adoptions were observed by the author’s own work role as an IS practitioner in a variety of other health settings like Hospitals and Community Health Centres. Furthermore, the practical implementation of information systems outside
the realm chronic conditions provided additional opportunities to observe the same phenomenon in action.

This ‘logic of discovery’, based on abductive principals, requires a process of adopting an explanatory hypothesis covering the selection and the formation of plausible hypotheses (Wirth, 2008). To this effect a plausible hypothesis to explain the emerging phenomenon under examination here suggests broadly that:

Health settings will adopt information systems if a clear alignment of its core business with the proposed system outcomes is facilitated through the proper mechanisms.

More specifically, any implementation strategy must take into account the hierarchical socio-technical and clinical values exclusive to every health setting and the system development must be facilitated by catalyst that can clearly understands and align their value structures to the intended information systems.

Construct Creation, Development and Explication

Within this phenomenon, three distinct constructs are identified: The catalyst; the sub-system hierarchy and the evidence-based system. To strengthen the claim for each of these constructs, and avoid being based solely on the author’s understanding of the phenomena, inductive arguments will provide reasons (premises) supporting (via varied sources of evidence) the probable truth of the conclusions.

Due to space limitations, and bearing in mind that, as suggested earlier, this examination is not meant to be exhaustive or conclusive (but is meant to begin dialog and further empirical work), premises (or propositions) will be reduced down to short list of declarative sentences and its supporting evidence will also be presented in succinct table format to further reduce the length of the explanations. The conclusions are also provided in short declarative sentences (propositions).
The Catalysts Construct
This construct relates directly to individuals (acting as change/external agents) that find and analyse the evidence and facilitate and support the whole implementation and optimization of subsystems in health settings. The specific catalyst functions are identified through the argumentation that follows:

- **Premises:**
  - The skills required to find (research), analyse and feedback empirical evidence to clinicians (decision makers) are not readily available in health settings.
  - Research and information management skills are needed to produce evidence to drive change and measure outcomes.
  - Access to health seating electronic health records is necessary for local evidence.
  - External agents specifically trained have the skills but not the access to clinicians and health setting databases.

- **Conclusions:**
  - Most health settings have ‘key’ individuals (in health called referred to as ‘champions’) that have access to databases and the ears of the clinicians/decision makers.
  - External agents can work with champions produce local evidence and optimise subsystems.
  - External agents can train champions and other health setting members to become trainers of other members and improve monitoring and maintenance of the sub-systems.

The Sub-System Hierarchy Construct
The first phenomenon observed was perhaps not a new theoretical construct per se, but perhaps an extension of existing Socio-technical theory; nev-
An Evidence-Based Health Information System Theory

Nevertheless, the construct is seen as new in the sense that it exclusively applies to health context.

Socio-technical systems theory is theory about the social aspects of people and society and technical aspects of machines and technology. Socio-technical refers to the interrelatedness of social and technical aspects of an organisation. Socio-technical theory therefore is about joint optimization, with a shared emphasis on achievement of both excellence in technical performance and quality in people’s work lives (Ropohl, 1999).

The contribution by socio-technical theory should be self-evident albeit with some specific tweaks to reflect the ‘fit’ to health settings. The recognition of the need to harmonise all existing sub-systems has always been the cornerstone of the socio-technical approach (Schneberger & Wade, 2006). This authoritative knowledge was well supported during the testing phase in twenty eight case studies and well supported by the literature. The following premises were discerned during practice throughout the chronic diseases study further supporting the literature in informing the conclusions and augments in this construct:

• **Premises:**
  - All health settings are unique (i.e. structural and cultural complexity and variation)
  - There are many subsystems in health settings.
  - Sub-systems are interdependent in different measures to their own contexts
  - All subsystems need attention to maximise optimization.
  - Not all sub-systems are valued equally by everyone in health settings.
  - There is a well defined hierarchy apparent in health settings.
  - Patient Care is the most valued sub-system (a kind of health ‘bottom-line’).

• **Conclusions:**
Every health setting possesses a number of interdependent sub-systems that need to be optimised; that are value laden and unique to their context; and the most important is the ‘Patient Care’ sub-system.

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**Exhibit 3.**

<table>
<thead>
<tr>
<th>Premise</th>
<th>Intuitive knowledge (by author – field experience)</th>
<th>Empirical knowledge (Tested over 28 cases in the Chronic Disease study)</th>
<th>Authoritative knowledge (Literature Evidence)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>✔</td>
<td>✔</td>
<td>(Dickinson, 2002); (Fithgerald, 2002; HealthConnectSA, 2007); (Davis et al., 2004 ); (Grol &amp; Wensing, 2004 ); (Cockburn, 2004 )</td>
</tr>
<tr>
<td>2</td>
<td>✔</td>
<td>✔</td>
<td>(Hillestad et al., 2005); (Bates, 2005); (Stunberg et al., 2003); (Stunberg et al., 2003); (Dickinson, 2002)</td>
</tr>
<tr>
<td>3</td>
<td>✔</td>
<td>✔</td>
<td>(Lorenzi, 2003); (HealthConnectSA, 2007)</td>
</tr>
<tr>
<td>4</td>
<td>✔</td>
<td>✔</td>
<td>(Cherns, 1976); (Clegg, 2000); (Mumford, 2003, 2006a, 2006b); (Hillestad et al., 2005); (Bates, 2005)</td>
</tr>
<tr>
<td>5</td>
<td>✔</td>
<td>✔</td>
<td>(Audet et al., 2004); (Schuster et al., 2003); (Grol &amp; Wensing, 2004 ); (Grol, 2000 ; Grol &amp; Grimshaw, 2003 ; Grol &amp; Wensing, 2004 )</td>
</tr>
<tr>
<td>6</td>
<td>✔</td>
<td>✔</td>
<td>(Audet et al., 2004); (Ministry of Health, 2007)</td>
</tr>
<tr>
<td>7</td>
<td>✔</td>
<td>✔</td>
<td>(HealthConnectSA, 2007); (Ministry of Health, 2007)</td>
</tr>
</tbody>
</table>
Evidence Based System Construct
The concept of evidence is not new to health settings; however in health the use is normally reserved for medico-clinical endeavours only. The findings from this examination and the relevant authoritative literature suggest evidence to be the key conduit or foundation pathways where information system implementation are quickly accepted and sustainably adopted. The arguments are drawn on the following premises and conclusions:

- **Premises:**
  - Health settings are owned and/or run by clinicians (decision makers).
  - Patient care (sub-system) shortcomings are important motivating factors to clinicians.
  - Other sub-systems (risk management, financial, etc) are also of concern to decision makers.
  - Clinicians are trained in scientific thought (empirical-rational methods).
  - Empirical-rational change management strategies exist.
  - Evidence of care deficit in clinical practice is found in the local (electronic) health records.
  - Empirical-rational change management strategies using local data (evidence) affects behavioural change positively.
  - Sustainability of change and further change depends on the evidence of success.
  - Local empirical evidence and analyses is needed to measure success (patient health outcomes).

- **Conclusions:**
  Clinicians need empirical evidence that highlights care gaps to affect behavioural change in their clinical practice. Clinicians also need concrete evidence that their efforts are benefiting their patients (health outcomes) and all other subsystems are working efficiently.

### Exhibit 4.

#### The Supporting Evidence

<table>
<thead>
<tr>
<th>Premise</th>
<th>Intuitive knowledge (by author – field experience)</th>
<th>Empirical knowledge (Tested over 28 cases in PhD Study)</th>
<th>Authoritative knowledge (Literature Evidence)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>✓</td>
<td>✓</td>
<td>(Bodenheimer, 1999); (HealthConnectSA, 2007); (AMWAC, 2005)</td>
</tr>
<tr>
<td>2</td>
<td>✓</td>
<td>✓</td>
<td>(HealthConnectSA, 2007); (Schuster et al., 2003); (Grol &amp; Wensing, 2004); (Grol, 2000; Grol &amp; Grimshaw, 2003; Grol &amp; Wensing, 2004)</td>
</tr>
<tr>
<td>3</td>
<td>✓</td>
<td>✓</td>
<td>(HealthConnectSA, 2007); (Schuster et al., 2003); (Grol &amp; Wensing, 2004); (Grol, 2000; Grol &amp; Grimshaw, 2003; Grol &amp; Wensing, 2004)</td>
</tr>
<tr>
<td>4</td>
<td>✓</td>
<td>✓</td>
<td>(HealthConnectSA, 2007); (Hendy et al., 2005); (Littlejohns et al., 2003); (Grol &amp; Wensing, 2004; Piterman, 2000)</td>
</tr>
<tr>
<td>5</td>
<td>✓</td>
<td>✓</td>
<td>(Chin &amp; Benne, 1969); (HealthConnectSA, 2007); (Nickols, 2006)</td>
</tr>
<tr>
<td>6</td>
<td>✓</td>
<td>✓</td>
<td>(HealthConnectSA, 2007); (Chaudhry et al., 2006); (Piterman, 2000)</td>
</tr>
<tr>
<td>7</td>
<td>✓</td>
<td>✓</td>
<td>(HealthConnectSA, 2007); (Ward, 2003); (HealthConnect, 2005)</td>
</tr>
<tr>
<td>8</td>
<td>✓</td>
<td>✓</td>
<td>(HealthConnectSA, 2007); (Haines &amp; Donald, 1998)</td>
</tr>
<tr>
<td>9</td>
<td>✓</td>
<td>✓</td>
<td>(Horak, 2001); (Britt, 2007); (Donabedian, 1988)</td>
</tr>
<tr>
<td>10</td>
<td>✓</td>
<td>✓</td>
<td>(Davenport &amp; Pursak, 2001); (Ward, 2003); (Ward, 2003); (DoHA, 2008); (Chaudhry et al., 2006)</td>
</tr>
</tbody>
</table>
The Identification of Key Relationships

A sound theory must offer —besides arguments and conclusions for each construct, a compelling discussion on the phenomena resulting from the relationship between these constructs (Zmud, 1998). A complete discussion is in the scope of this paper is clearly limited; however a concise emergent dialog will follow:

The relationships between the three main constructs identified earlier can be readily represented as the analogy of a computer system: two concentric operating and application software systems over a set of interconnected hardware. As per diagram shown in Exhibit 5.

Where the evidence based system construct represents the core business of health (patient care). Identifiable by its twin concerns: input task (drivers) and output task (outcomes). It can be thought of clinical task (business) that needs to be performed or improved (though the adoption of information systems) like the management, prevention or treatment of clinical problem in any health setting. As such it subsumes all other concerns in this theory. The bottom line, to borrow a business term is: ‘the clinical improvement of patient care’.

The catalyst, as with an operating system is the enabler of that overall “clinical care” task. However, along the way (from input to output) the catalyst, like an operating system, must make sure that a set of circumstances or optimisation occurs to allow the clinical (input) task — driven by the expectation of improving the health of an individual or population is satisfactorily carried out (output), known in the health field as a clinical outcome. The tasks carried out by the catalyst (operating system) to enable the evidence-based system to succeed are multiple: for example, just to name a few of the potential sub-systems in health settings, it must allow members of the clinical team (Doctors, Nurses, staff, etc) to communicate with each other; it must make sure that risk management systems exist to follow up on patients that might

Exhibit 5.
miss out on clinical care; it must ensure that there is a sound financial systems underpinning the work being carried out and it must be capable of providing clinical information required on-time/every time to assist with clinical tasks. Perhaps the most important task that an operating system engages in a computer system is in “bootstrapping” (booting/starting) the system; this analogy essentially matches the first of the two principal role of the catalyst. The first task of this external (or internal if existing) change agent is to kick start the system by providing the initial “momentum” (data feedback) of what clinical business is at hand (what clinical care needs improving at the health setting by analysing gaps in care within its own patients). The second principal role is to measure the success in achieving that original task (improvement in health outcomes).

The hierarchical set of sub-systems construct represents in this analogy, the existing sub-systems that need to be optimized to allow for the core business (patient care) to be carried out successfully (outcomes). At this point in time, many of this sub-systems exist, however they can be paper-bases (in the case of financial records, recall and reminder letters, appointment books, to name but a few). It is important at this stage to recognize that any system being replaced must be “better”, whatever the meaning for users (time efficient, error free, economical, etc) than existing ones. This also will include having the skills and broad knowledge to affect clinical, financial, legal and organisational systems including the provision of education and training. Many important sub-systems, in the author experience, do not exists and need to be developed from scratch. More importantly, every setting is completely unique in almost every aspect (governance, culture, workforce, etc), hence the catalysts must be always willing to adapt and customize solutions that might not optimize a system, but will make individuals feel in control of their setting and their culture.

A key aspect of this theory is the relationship between catalysts and the human/workforce sub-system. This relationship needs to be built around principles of mutual trust and purposeful action between individuals that appear to share a common ‘end’ goal (health outcomes improvements). This connection between the catalyst and health setting is not always evident as sometimes ‘individual’s short term goals’ might no be the same; for example, the IS practitioner (catalyst) might be more concerned with training and technical processes while the practice champion might be more compelled to be financially and workforce savvy; each sharing their expertise to create a contextually customised and optimized health information system. This explanation is by no means comprehensive, but begins to discuss the basic assumptions behind the constructs’ relationship.

Development, Justification and Articulation of these Relationships

Presenting a complete theoretical treatise in the space of single chapter is at best misguided. However an attempt will be made to succinctly summarise the main thrust of this emerging theory.

The simplest approach to do this to follow the suggestion made by one of the greatest mind of our century when he said:

...unless a theory has a simple underlying picture that the layman can understand, the theory is probably worthless...

Einstein (Pescovitz, 2005)

The following graphic in Exhibit 6 represents the main components in this emergent theory, including some of the sub-systems and potential hierarchy. Further explanation follows.

While a picture can paint a thousand words, a misinterpreted picture can lead future researchers down the wrong path. In “reading” this conceptual framework it is important to define the
An Evidence-Based Health Information System Theory development and articulation of the relationships in this theory as it would apply to a “real world” situation. Let not forget that this theory is based on ‘real’ observed successful implementation and adoptions.

To start with, the intended implementation and consequent adoption of an information system in a health setting, according to this theoretical model, depends on the potential for that system to improve patient health. However, this position assumes that health settings are aware of their own deficiencies in patient care. In the author’s experience, via a purposeful PhD study and everyday observations, there has never been a single case when a clinician has been aware of such deficiencies. In this circumstance, possessing a great solution to a problem that is not perceived to exist is next to useless.

The key to this model then does not start with “the solution”, but finding “the problem”. That is having access to or securing access to the health setting’s medical records. This is in itself a challenging task, particularly in countries like Australia where patient health data in well protected by law and clinician’s own concerns for its use.

This has implications not just for being able to carryout further validating research in practice, but also for policy at the governmental level; as it suggests that health settings need to be supported by dedicated and well trained health information systems professionals to achieve any degree of success in implementing information systems in health settings. The amount of time resources needed by a well trained catalyst to support the health setting adopt information systems, including education and training and software support are considerable, although easily offset by the gains in health outcomes at the population level.

This is where the catalyst construct comes into its own, particularly as recognised earlier on, that there are no individuals in health settings that possess the multiplicity of skills needed to retrieve, review and analyse their own clinical data. This is further exacerbated when it is considered that there are financial, legal, communication and organisational skills still to be used in the optimization of all remaining sub-systems.
The catalyst would also have to build a high level of trust to be allowed impute (and optimization) in every sub-system; this is perhaps achieved in time as relationships develop. In my own experience it has taken me sometimes three to four years to develop enough rapport in some cases to truly affect the more sensitive sub-systems (i.e. financial and governance).

Perhaps the most important relationship a catalyst will make is with a “champion”; these individuals are more often than not the key to fully access every sub-system in health settings. These can be managers, nurses, doctors or staff members; they are the most valuable asset for a catalyst.

When looking at the sub-system hierarchical list on the diagram, it must be made clear that the hierarchy will change form setting to setting and country to country, and is probably time specific as certain development occurs (for example, laws might be passed that incline a health setting to value risk management more than patient care). In Australia for example general practices are private businesses, so there will be a lot more emphasis on financial sub-system outcomes compared to other countries where clinicians are paid a fixed fee.

**DISCUSSION AND LIMITATIONS**

There is a general awakening in the health sector that sustained behaviour change in clinical practice cannot be brought about solely by traditional dissemination methods (Peer-reviewed journals and re-education). Theoretical approaches to clinical change management require efficient and wide ranging change processes and implementation processes and procedures. These implementations must integrate the individual and existing inter-related human networks. These theoretical approaches must also acknowledge that organisations exist in unique contexts with unique structures and processes all supported by information systems of one type or another; all underpinning the ‘core business’ (clinical patient care) through evidence-based medicine.

The author sees in these developments an emergent opportunity for the field of information systems to take a leading role in the development and improvement of the health sector. However, to achieve this role, a solid theory of information systems in health is essential. This emergent theory is a small step towards a more empirically strong theory.

However, the limitations of this examination are many, the content of this chapter was never meant to be comprehensive or conclusive, what it does do however, is to begin a discourse in the hope that others join in its future development. Of the three constructs that were exposed here, only marginal coverage was provided with many premises (if not all) needing further research and critical appraisal; particularly over a broader population than originally studied (general practices). Although there is an emergent authoritative literature supporting some of the premises and conclusions in the constructs; the use of evidence to influence change and validate success and patient outcomes needs further investigation; as does the critical discussion of the extent and role and influence of the catalysts along the artisans-technician and internal-external consultant continuums. Furthermore, the proposition of hierarchical nature of socio-technical sub-systems in health settings needs further verification.

This theory would be better served by further purposeful quantitative and qualitative research that would test every construct down to every single premise. It should focus on a variety of health settings and across a number of countries and across a number of health conditions to better generalise its potential usefulness.

In summary, what was concisely offered here is the beginning of a unique discourse (Hassan, 2006); a theoretical introduction to a multidisciplinary fields not well understood by the information system discipline. In essence an
An Evidence-Based Health Information System Theory

evidence-based health information systems theory holds that: “an information system implementation approach in health setting must be guided, first and foremost by clinical evidence supporting the need for such change in that specific health setting. This evidence is predominantly focused on discovering gaps in local patient care populations to drive change management strategies. Secondly there is a hierarchical necessity to focus on the optimization of all contextual and interdependent subsystem. And thirdly, any measure of success must also be based on the evidence of specific patient health outcome and all other subsystems, keeping in mind their hierarchical importance to the health setting. The facilitation process for all this to happen is through the collaboration of an IS field expert and a site ‘champion’ that share common goals and objectives”.

CONCLUSION

The chapter provided a succinct summary of the context, immediacy and significance for the need to successfully implement information systems in health settings. It briefly discussed the need to consider the core business of health (patient care). The chapter also pointed to the influence that evidence-based medicine (EBM) exerts on health settings and physicians. It suggested mainly a lack of theoretical understanding in the fit between EBM and how it interacts with prospective information systems that are used to research and analyse patient data to improve patient clinical care.

The chapter continued providing the context and foundations for the new constructs discovered in the author’s own PhD study to then finally submitting the beginnings of a theoretical foundation to discuss the potentials for the further development of a new evidence-based health information theory. The emerging trends in the health literature suggest many opportunities for the information systems field if solid theories are developed. Future research needs to strengthen the findings that were outlined as well as the need to further expand on this exploratory chapter. It also suggested that a longer treatise with multiple and international contributors is perhaps a more desired approach for further development.

REFERENCES


Herzlinger, R. E., & Ricci, R. J. (2002). Dr. know: Can physicians share their experience? *Think Leadership Magazine from IBM*.


**KEY TERMS AND DEFINITIONS**

**Abduction:** Is the process of adopting an explanatory hypothesis (CP 5.145) and covers two operations: the selection and the formation of plausible hypotheses. As process of finding premises, it is the basis of interpretive reconstruction of causes and intentions, as well as of inventive construction of theories.

**Concepts:** A term or label to describe aspects of reality that can be consciously sensed or experienced; the term or description given to events, situations or processes. Evidenced that is sense-based or grouped together through thought connections.

**Conceptual Framework:** This is a structure of concepts and/or theories which are pulled together as a map for the study as opposed a ready made map (Theoretical Framework).

**Constructs:** Is a term or label invented by the researcher for a specific purpose to describe a phenomenon or group of phenomena. In other words, it is a summary of thoughts related to a phenomenon.

**Deduction:** Determines the necessary consequences, relying on logically provable coherence between premises and conclusion. Induction is aiming at empirical provable coherence between the premises and experience, in order to derive a probable generalization.

**Empirical-Rational theory of Change Management:** People are rational and will follow their self-interest - once it is revealed to them. Successful change is based on the communication of information and the offering of incentives. People can be persuaded AND ‘bought’ (‘carrot’ side of carrot-and-stick) (Chin & Benne, 1969).

**Induction:** Is aiming at empirical provable coherence between the premises and experience, in order to derive a probable generalization. Yet, induction only classifies the data.

**Inductive Argument:** Asserts that the truth of the conclusion is supported by the premises. (a deductive argument asserts that the truth of the conclusion is a logical consequence of the premises).

**Theoretical Framework:** This is the structure of concepts which exists in the literature, a ready-made map for the study; it provides the structure for examining a problem; serves as a guide to examine relationships between variables (Liehr & Smith, 2001).

**Theory:** A theory is an organized and systematic articulation of a set of statements related to questions in a discipline that are communicated in a meaningful whole. Its purpose is to describe (set forth what is -Descriptive), explain (account for how it functions - Explanative), predict (under what conditions it occurs), and prescribe (under what conditions it should occur) (Ingelse, 1997).