Implementation of Health Care Information Systems: Key Factors and the Dynamics of Change

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ABSTRACT

In Greece, the use of information systems in the public health sector is limited (Theodorakioglou and Tsiotras 2000). The Greek National Health Service has initiated reforms towards decentralization of health care services and development of integrated HCIS at a regional level. However, a large number of these plans have not been implemented. This paper addresses an initiative of the Foundation of Research and Technology (FORTH) in Crete. FORTH undertook the development of the information infrastructure for the public health sector of the region. This project is of particular interest because it is the first in Greece that spans all levels of health care across a region. Being a research project, use of the technology is not mandated allowing for the study of spontaneous change.

Eight case studies were conducted in primary care clinics in rural areas in Crete using a longitudinal interpretive methodology of multiple interviews, participant observation, and document analysis. Literature from the fields of implementation research, organizational change, and complexity theory are relevant to understand the process of implementation and the organizational change that occurs within these settings. The main points to be discussed in the paper include the experience HCIS implementation in Crete, and the implications for policy and practice for similar implementation initiatives.

INTRODUCTION

Health care information systems that are successfully developed and implemented can improve health care efficiency and effectiveness (NCVHS 2001; WHO 2002). However, their implementation is frequently resisted and results in failures (Anderson 1997; Kaplan 1997). The complexity and unpredictability of implementation efforts creates difficulties for organizations that attempt to implement technology-based change (Goldstein 1994). Often a discrepancy occurs between the planning of implementation and how it actually takes place in practice (Barley 1986; Sofaer 1999). The challenge of identifying techniques to ease the incorporation of information technology into health care organizations remains an important one (Sittig 1994; Aarts and Peel 1999).

In Greece, the National Health Service (NHS) has initiated reforms towards decentralization of health care services and development of integrated HCIS at a regional level. However, a large number of these plans have not been implemented. Use of information systems in the public health sector in Greece is limited. A common strategy for the development and implementation of HCIS is currently lacking. Health care institutions follow their own agenda and allocate budgets for IT development independently of Government’s plans. Initiatives are local based on the personal motivation of medical and technical personnel.

This paper describes the results of a study that investigated the experience of implementing HCIS in rural primary care clinics throughout Crete. The Foundation of Research and Technology (FORTH) undertook the design, development and implementation of the health information infrastructure for the public sector of the region. The particular focus of this paper concerns the factors that influenced the success of the implementation initiative as a process of change. The research involved longitudinal case studies that took place between 2001 and 2002.

The key reasons for this choice of research topic are twofold. First, primary care is considered to be the cornerstone of patient-centred health care delivery and therefore requires special attention. Second, the need for continuity of care and information exchange within the health care system has introduced an
imperative call for successful implementations of HCIS (WHO 2002). Studying the factors that influence implementation initiatives and the dynamics of the involved change in different contexts could contribute to appropriately manage future implementation efforts.

The paper is structured as follows. First, the research approach is described with details of methodology and theory. Next, a description and analysis of the initiative is provided with particular focus on the factors that influenced implementation, drawing on complex adaptive systems theory in the analytical sections. The implications of the research findings for “successful” HCIS implementation in the future, both in Greece and more generally, are described in the final section.

RESEARCH APPROACH

The research aimed to investigate how HCIS were implemented and used in primary care in Crete, whether use was successful, the reasons for success or failure and the organizational change that accompanied use. Thus, it was essential to gain an in depth knowledge of the HCIS technology, the views of stakeholders concerning the use of the technology and the changing contexts within which the technology was introduced. Empirical studies that collect such data are broadly classified as interpretive case studies (Walsham 1995). An increasing body of literature in information systems (IS) is based on this approach with methodological and theoretical differences (see Markus 1983; Barley 1986; Walsham 1993; Orlikowski and Hofman 1997). In HCIS literature on the other hand, the use of interpretive studies is limited. Social and organizational issues have not been extensively studied. The remainder of this section provides a description of the approaches adopted for the research study and the reasons for the choices.

Methodology

The research design aimed to capture the initiation, development and implementation of HCIS in particular field sites examining in detail the actions and perceptions of human actors and the context within which these actions took place and perceptions were formed. Emphasis was placed on both stability and change to try to understand how actor’s identity, relationships and behaviour resulted in particular outcomes in relation to history and context. The research followed a longitudinal approach. Data was collected over a period of two years as events were taking place. Such a design is particularly relevant in studies of innovation allowing the researcher to explore the processes of learning, adaptation, and progressive change that occur within IS research settings (Vitalari 1985; Pettigrew 1990). Historical reconstruction was used to capture events that occurred prior to the onset of the research.

Moving to the details of the research method, eight primary care clinics were examined throughout the island of Crete. The case study is the preferred choice of research strategy when the researcher wants to understand the dynamics within a setting (Eisenhardt 1989). Each clinic was considered a separate case study. The case studies were conducted in two distinct periods of six months, in the spring and summer of 2001, and winter and spring of 2002. Each clinic was visited two to six times. The clinics were selected out of eighteen public primary care clinics in Crete based on criteria of implementation completeness and use. All selected clinics had parts of the information system installed and at least one user. Clinics that did not get the system or did not have users were excluded from the study. The focus of inquiry was on factors that influenced implementation and transformation within clinics. Data collection was done mainly via face-to-face interviews. Questions started as open ended to
explore the implementation experience and identify issues for further discussion. Special attention was paid to the themes that the interviewees tended to concentrate on during the discussion. Overall, 85 interviews were conducted with 54 respondents. Interviewees included senior management, designers and system administrators, and clinic personnel including directors, health care providers and support staff.

The research examined the way training, motivation and interactions influenced the process of IT implementation and use. In addition, to employee behaviour, the research focused on the history, staffing, and operations of each HC. These characteristics help define the context in health care institutions (Ash, Gorman et al. 2001). The common characteristics of health centres as well as their unique character shape their experience with HCIS implementation. Implementation refers to technical aspects of development, installation and maintenance as well as the organizational change involved in using the system.

**Theory**

Theory is used in the research in two ways, as a theoretical basis to inform early empirical work and as an attempt to “come to terms with the infinite complexity of the real world” (see Walshaw 1993: 478). The theoretical basis of the study evolved in response to a deepening understanding gained through data collection and the investigation of IS, HCIS and complexity theory literatures. Aspects of these three fields were considered in an attempt to shed light to the complexity and unpredictability of implementation efforts.

Antecedents of implementation success have been a significant focus of IS and HCIS research. Lists of factors and recommendations provide a sensitising device for implementation assessments. Theoretical constructs developed in IS research are readily applicable to the less theoretically informed HCIS research. The social nature of information systems is particularly important in health care. Orlikowski’s (2001) observations about IS rarely being “stable, discrete, independent and fixed”, also apply to HCIS. Acknowledging the volatile nature of technology introduces a social element that has not been considered in HCIS implementation. The idea that individuals interact with the same technology in different ways, and that technology carries the assumptions and interests of its designers introduces a dynamic element to design, implementation and use.

The dynamic nature of technology helps explain implementation complexity uncovering issues of culture and history. Considering the social nature of technology brings forth the combination of both ‘social’ and ‘technical’ issues as important to implementation success. ‘Individual’, ‘structural’, ‘technology’, ‘process’ and ‘environmental’ variables identified in IS research (Kwon and Zmud 1987; Larsen 2001), are used to understand the conditions that influenced the implementation effort in Crete.

Despite the importance of factors in influencing implementation success, controlling, anticipating and predicting factors won’t avoid the occurrence of unpredictable events (Goldstein 1995). The assumption of causal relationships presented in numerous models of implementation process does not account for the numerous unknown or unpredictable factors that influence implementation initiatives. Rather than linear relationships between variables, organizational reality suggests multidirectional influences. The highly uncertain character of implementation is subject to contingent factors unlikely to be simply a success or a failure. Straightforward explanations of cause and effect are simplistic and often inappropriate for different contexts (Lyytinen and Hirschheim 1987; Heeks,
Mundy et al. 1999). Implementation researchers encourage studying success and failure as situation-specific events for a particular HCIS (Poulymenakou and Holmes 1996; Heeks, Mundy et al. 1999; Walsham and Sahay 1999).

Particular emphasis should be placed to the change process that accompanies the introduction of new technologies. Traditional models have treated change as an external force that can and should be managed (Scott-Morton 1991; Garrity and Sanders 1998). Recent years have witnessed an alternative view of change as an on-going process of anticipated, emergent and opportunity-based events (Orlikowski and Hofman 1997; Pettigrew, Woodman et al. 2001). Causality is attributed to actions and interactions within various contexts. Everything is interconnected and continuous change is a natural and productive feature of organizations.

In a quest for an “improved theory […] relevant to the issues of our time” (Walsham 1993: 478), the research uses complexity theory to address the complexity involved in HCIS implementation efforts. Complexity theory studies the behaviour of complex adaptive systems: a collection of agents that interact in a non-linear way [for a detailed analysis of complexity theory concepts see ‘(Dooley 1997; Plsek and Greenhalgh 2001). The relevant complexity theory concept to address change is self-organization. Self-organization is a self-generated and self-guided process of transformation that does not need to be externally driven or hierarchically controlled (Goldstein 1994). Self-organization helps explain the nature of change as a process of emergent and opportunity-based events. Emphasis is placed on history, context and the environment as important factors in shaping the behaviour of a complex adaptive system.

Complexity theory advocates that resistance to change is not an inherent characteristic of organizations, but rather a temporary state of the system able to change in the presence of far-from-equilibrium conditions. Far-from-equilibrium conditions trigger the inherent capacity of agents to self-organize. Information is said to be the ‘nutrient’ of self-organization (Wheatley and Kellner-Rogers 1996). Information flow perturbs a complex adaptive system from equilibrium to a far-from-equilibrium state where the system can self-organize (Goldstein 1994). Information flow enriches the organization and may even inform conflicting viewpoints, shaping new understandings (Ashmos, Duchon et al. 2000). The extent of information flow within an organization depends on organizational factors, education, contact with professionals, cultural trends and the media (Allery, Owen et al. 1997). Increase of information flow often precedes transformation, while low information flow characterizes resistance and equilibrium (Goldstein 1994).

CASE STUDIES

Overview of case history

Crete is the biggest island in Greece with a population of half a million that doubles over the summer months. It is a rich and prosperous island with abundant resources that has managed to be highly autonomous. Crete is a region where individuals with strong visions, initiative and knowledge have initiated several innovative projects. Innovation occurs in both health care and technology sectors.

One of the leading institutes of the region is the Foundation of Research and Technology (FORTH). The Institute of Computer Science at FORTH undertook the development of the regional health infrastructure of Crete providing high quality health care information systems and computer training to public institutions throughout the island. HCIS in
primary care health centres (HCs) was among the first to be implemented. The information system included an electronic medical record (EMR), a laboratory information system, a radiology information system and telemedicine services.

The implementation initiative was part of a research and development pilot project. The effort included the design, development and installation of hardware, software and network infrastructure and the provision of training on basic Windows applications to all interested employees. Implementations took place between 1997 and 2001. Implementation efforts were research pilots with budgetary and time constraints. Nonetheless, they resembled production level projects implemented in the entire region of Crete, aiming at securing regular use of the technology beyond the end of the project.

Contrary to typical implementation initiatives, use of the technology and the associated organizational change were not mandated. The decision to use the technology lied with the individual employees who took the initiative to attend training, use the HCIS, and therefore, introduce a voluntary change in everyday work practices. For this reason, change incidents are treated in the research study as self-organization events.

As mentioned previously, in practice, the outcome of technology development and use cannot be reliably predicted (Cibbora 1996; Orlikowski 1996). It emerges locally through the interaction of social and technical elements. Barley has concluded that an implementation outcome depends “as much on the historical and social-specific context as it [does] on the technology itself” (Barley 1986: 103).

Similarly to these observations, in Crete, implementation outcomes emerged in each clinic through social-social and social-technical interactions. Key factors, in addition to the history and character of individual clinics, shaped the experience of HCIS implementation. Individuals decided consciously or unconsciously how to respond to the technology. Their response varied, as did the context and conditions of their actions. The innovative activity of using HCIS was usually coupled with already established ‘best practice’ activities such as teamwork, health care research, patient information recording and community activities.

The HCIS was not implemented at the same time or to the same degree in all clinics, training did not include all employees and extent of use differed. The variable experience of clinics strengthens the suggestion of Pettigrew (2001) not to look at implementation outcomes as simply a success or a failure. Implementation in primary care clinics had elements of both success and failure. The intention of the production organization was to implement HCIS and train a large part of the employee population. Both objectives were met successfully. Components of the HCIS were used in all clinics, another element of success. Partial implementations, insufficient training and use that did not extend to all health care providers were elements of failure. Overall however, the HCIS was well received and used in all eight clinics. The main users of the HCIS were physicians and laboratory technical personnel. Other health care providers who used the system included midwives, dieticians and health visitors. Non-medical personnel used the system for administrative purposes or leisure. Users felt that the HCIS introduced efficiency and effectiveness to their work.

**Key Factors**

The research identified five key factors contributing to the variation of implementation experience including technology, education, leadership, organizational structures and the environment. These factors are similar to those identified in the IS and
HCIS implementation literature (see Lorenzi, Riley et al. 1997; Larsen 2001). Complexity theory concepts such as far-from-equilibrium and information flow are used to highlight the influence of particular factors. The following sections offer a general overview of the main issues involved in the implementation effort.

Technology

The ‘technology’ factor in combination with the other factors determined the degree of HCIS implementation success. The introduction of the HCIS in HCs acted as a far-from-equilibrium condition that increased the information flow available to the clinics and initiated self-organization. The technology was a novelty for HC staff introducing opportunities for improvement of daily activities. Employees responded in a variety of ways towards the technology. Some employees used the technology even without training to improve efficiency and effectiveness of health care activities, others used it for leisure, to browse the Internet or play games, and others did not use it at all.

Occasionally, practical aspects such as incomplete installations, installations in inappropriate places, or inadequate maintenance hindered the occurrence of self-organization. Employees who wanted to use the technology were not able to do so. In addition, the nature of technology influenced the response of employees. For example, the introduction of the EMR assumed that health care providers recorded patient information and were interested in primary care research to assess the health status of the population. However, these assumptions were not always congruent with the aspirations of HC employees. Health care providers did not maintain paper-based records except out of personal initiative. Officially, they were only required to record a minimum amount of patient information in casebooks. In some cases, the incongruence between the assumptions inherent in the technology and the habits of health care providers facilitated self-organization by introducing new information. Employees were stimulated to incorporate new ways of working into their practice.

Education

The ‘education’ factor refers to the participation of employees in computer training and primary care education and research activities of the Department of Social and Family Medicine in Crete. The degree of participation of HC employees in training and primary care activities was related to the extent of technology use and related change.

The Department of Social and Family Medicine has developed a network of HCs to promote the patient information recording and health assessment research to medical students and collaborating physicians. It is an effort unique to the region of Crete that has resulted in the visibility of ‘best practices’ in primary care. These practices include teamwork, paper-based records and community research and are not part of the usual functioning of health centres. Individual physicians incorporate these practices out of personal initiative. Primary care activities of education and research set the foundations for the introduction of HCIS.

All educational activities increased the information flow in HCs. Information about primary care ‘best practices’ circulated throughout health centres creating a critical mass of health care providers interested in improving their daily work and unleashed their capacity to self-organize. National trends of computerization raised the interest of the public who sought to acquire new skills. Training on basic computer skills was useful to employees even if they did not intend to use the computer for health care activities.
The ‘education’ factor occasionally hindered self-organization. Computer training was sometimes inappropriately timed occurring before the installation of equipment or was insufficient for the needs of the employees. In these occasions, employees who were willing to use the technology did not feel adequately prepared. Also, primary care activities were not independent of personal politics leaving some physicians out of the research network.

Leadership

HC employees blamed the shortcomings of the public health care system for the inadequate organization of primary care services. Despite these complaints, innovative activities did occur and health centres remained a major source of care in the Greek NHS. This paradox is attributed partly to the culture of *philotimo*. *Philotimo* is a Greek word that cannot be easily translated into English. It literally means ‘friend of honour’. The word *philotimo* describes the feeling of self-esteem and a sense of duty that governs day-to-day behaviour. It was the most commonly heard word among HC employees when they wanted to explain why things worked in the clinic.

Relying on *philotimo* implies trusting that employees will show the sufficient interest and responsibility to perform their work. Several employees considered the culture of *philotimo* as a negative aspect of the Greek public sector. Relying on the good will and interest of employees introduced a high element of uncertainty. However, considering *philotimo* as a positive attribute often facilitated change. Trusting the capacity of individuals for creative change to improve their work and facilitate their life was essential for successful change initiatives among case studies.

The culture of *philotimo* can be best expressed under appropriate leadership. Leadership, however, is particularly lacking in the Greek primary care sector. Research findings indicated that the majority of directors lack the basic leadership skills and the capacity to effectively manage the provision of health care services in health centres. HC directors were physicians without specific training on management of health care organizations. As a result, leadership was scarce in HCs. When present, formal and informal leadership created an atmosphere of collaboration and learning that focused on improving the efficiency and effectiveness of patient care. It succeeded in incorporating ‘best practices’ throughout the organization. Physicians who exerted leadership did so out of personal initiative. To involve employees in improving patient care, leaders developed their own strategies that included aspiring to the employee sense of *philotimo*.

HC Structures

Other factors identified in the case studies referred to HC structures such as department integration, culture, regulations, incentives and staffing. HCs faced several shortcomings such as loose or scant regulations, lack of formalization of activities, and limited resources that acted against the optimal functioning of the clinic. Some of these shortcomings were partially overcome in occasions of strong leadership.

Staffing was one of the most influential ‘structural’ factors for the implementation effort. The introduction of HCIS relied on interested health care providers. Employees who showed sufficient interest for the HCIS were among the first to receive equipment and training. In turn, interested employees influenced other health care providers into using the technology.

Both the type of health care providers and their number played a role in implementation. Health care providers with training on primary care ‘best practices’ were familiar with the importance of the
HCIS and promoted its use. In some cases, there were no personnel to use the equipment or the small number of employees had a large workload that did not allow them to spend time on learning the technology. In occasions when additional staff was hired, the number of employees that became involved with the technology increased. In general, HCs are notoriously understaffed, which hinders the overall provision of health care services.

Environment

The relationship between the clinic and the environment is the final factor identified in the case studies. The environment of the case studies included the patient population and the National Health Service. Both patients and the Greek NHS had the capacity to influence technology-based change. Clinics that focused on patient-centred care and provided improved services such as community outreach and complete patient records increased the expectations of the community and set standards that had to be followed independently of staff turnover. The formal requirements of the Greek NHS such as reporting of statistical information challenged employees to use computers to facilitate reporting processes.

Implementation in relation to change

The implementation of HCIS in health centres related to organizational change in two ways. Installation and use of the HCIS was either part of an ongoing organizational change, or triggered organizational change. Organizational change occurred in health centres when operations deviated from the basic functions to incorporate elements of primary care ‘best practice’. Organizational change took place at the individual and group level.

The introduction and use of the technology contributed to the transformation of relationships among some employees. Collaboration was the exception rather than the norm in HCs. However, the introduction of the technology established collaborations for research, education and daily activities. Contrary to the popular belief that presents physicians as ‘notoriously’ resistant to change, case study findings revealed otherwise. The majority of physicians and other health care providers were ready to learn, collaborate and transform their daily work under the appropriate conditions. Appropriate conditions were identified as the adequate capacity in terms of technology, education and staffing, in addition to conditions that provided freedom, fostered responsibility, generated connections and cultivated relationships.

IMPLICATIONS FOR POLICY AND PRACTICE

The implementation efforts in the region of Crete are unique in breadth and scope throughout Greece. The research took place at a time of governmental reforms and global shifts towards organized health systems and strong primary care services. Policy and practice are intertwined in helping and informing each other. In Greece, policy for implementing HCIS systems is currently under development. Case study findings indicated that similar environments differ in their response to HCIS. Change may occur spontaneously and does not need to be extensively planned or controlled. The implications of the research for policy and practice focus on the larger context of health care systems organization, implementation of HCIS and change.

Health care systems

Health care systems can be defined as “a set of connected or interdependent parts or agents – including care givers and patients– bound by a common purpose and acting on their knowledge” (Institute of Medicine 2001: 68). Health care organizations, vendor organizations, and regional
authorities are important components of such systems. The rising of chronic illness and the continuous aging of the global population requires a reorganization of health care systems based on relations and exchange of information to address patient needs in the community.

The introduction of health care information technologies in an organized health care system requires interconnected changes. Peckham (1999) points out the importance of good communications within the organization to achieve such an interconnected change in health services. Currently, vertical and horizontal communication in the Greek NHS is imperfect. In Crete, the region-wide implementation of HCIS allowed for better exchange of information and communication across sites.

The Ministry of Health in Greece has recognized the importance of primary care and information systems in the organization of the health care sector. However, policy does not explicitly address the development of primary care sector and information systems in parallel. In Greece, elements of underdevelopment coexist with advanced characteristics of integrated health care systems. Little information exchange, lack of health care teams and patient records, and organizational shortcomings, may coincide with community-based health care, exclusive use of electronic medical records and extensive primary care research. Integration of the ‘old’ with the ‘new’ towards the vision of the future is required to accelerate progress. Considering existing components could help build on already available technology and alleviate part of the budgetary load of such efforts.

A ‘high performing health sector’ needs to have the following critical features according to Coye (1998):

- Information technology to support patient care
- Transfer of knowledge about best practices and generation of new knowledge without “reinventing the wheel”
- Aligned incentives for improved performance
- Encouragement of innovation
- Willingness to collaborate with academic enterprises
- Community-based interventions to alter fundamental determinants of health
- Purchaser and consumer education
- Accountability

In Crete, the implementation of HCIS and the innovative primary care activities observed these critical features and had an impact on the organization of health centres. However, to sustain regional wide efforts, it is important to account for ongoing maintenance and financial support, currently lacking in the region of Crete. Also, ‘critical features’ should be incorporated in national policies to impact health care practice at a large scale.

HCIS implementation

Health care information systems are “a prerequisite for coordinated, integrated, and evidence-informed health care” (WHO 2002: 37).

Early support of GP computing contributed to over 70% of GPs using electronic medical records at point of care in Britain and the Netherlands. In 1990s the NHS in UK, increased the requirements for data collection, auditing and reporting. Physicians were obliged to use the computer to collect the required information. In the Netherlands, physicians who used one of the systems evaluated by professional organizations and provided data for health policy planning were reimbursed for 60% of practice automation expenses. The experience in the UK and the Netherlands indicates that physicians are willing and able to integrate information technology in their
practices when provided with the necessary incentives.

In Greece, similar initiatives are not taking place. However, case study findings support the fact that government can play an important role in promoting the use of HCIS. Governmental requests for patient data were an incentive to accumulate computerized data. Developing an integrated policy that provides incentives may significantly facilitate the introduction of HCIS in primary care in accordance with the experience of the UK and the Netherlands. Managers and decision makers may be able to support HCIS uptake through requirements of appropriate information collection and specific activities in addition to the provision of financial incentives.

**Technology**

Exact directives on appropriate technology and its implementation at primary care level needs to come directly from physicians (Hackney, Dhillon et al. 1997). Particular attention should be placed on the development of HCIS. Primary care information technology should be easily installed, maintained and supported locally, easily understood and controlled by local users, flexible and adaptable to the needs of different GPs, and organizationally simple, requiring low investment at each site (Clegg 1988). Case study findings support these imperatives, in addition to other factors such as training based on individual needs, formal and informal leadership, teamwork, and adequate human resources. Systems in health care settings should be available and functional in the place and time of decision-making (Nussbaum 1998).

The use of a system “continuously escapes the ordering intentions of its designers” (Jones 1998). The need to examine the specific interactions in particular contexts is essential in understanding and anticipating technology outcomes. Detailed examination on what employees are most attracted to in an information system may provide a way to tap onto user aspirations. For example, first time users are often attracted to the Internet for personal interest. Dansky (1999) argues that enabling physicians to use computers for communications, word processing, and Internet searches long before instituting the EMR will allow for computer comfort and minimize anxiety.

HCIS should ultimately benefit the patient. The patient’s direct contact is the primary care team. Patients as customers will play an important role in the future. It has been acknowledged that consumers are becoming increasingly educated about their own health. Patients with chronic conditions are likely to shop for high quality health care services. Consumer demands for information and participation in decision-making will eventually transform the nature of clinical management and the respective roles of providers and patients in ways that could not be anticipated (Coye and Detmer 1998: 766). Physicians will have to comply with these new trends to accommodate changing consumer demands. Providers will need the support of appropriate databases and communication technologies to stay up to date with the vast amount of information that is gradually becoming available to all audiences through the Internet. Successful systems are most likely to be the ones that offer opportunities for “ongoing professional involvement, relative stability and security, and the capacity to support improvements in practice with useful and timely information” (Coye and Detmer 1998: 765). These concerns will become important for Greece as more and more people become familiar with information technology and access the Internet.

**Education**

One of the major components involved in successful implementation of HCIS is education. To improve primary care services and facilitate the incorporation
of primary care information systems, education in both primary care and information systems is important. The research identified the following components of education as important in the implementation of HCIS in primary care: the incorporation of primary care and information systems education in medical school, continuing education for health care providers and computer training based on the specific needs of individual employees. Primary care education in medical school will help raise the esteem of primary care as a specialty in Greece and might increase the number of general practitioners. Information systems education will introduce medical students to the applications of technology in medical practice and provide them with the basic computer skills.

Continuing education for health care providers will provide the opportunity to improve health care services. Continuing education is particularly relevant in Greece because of the limited training of physicians in general practice. It will allow exposure to the holistic essence of primary care, community awareness, and management of chronic diseases. In addition, educational programs on the benefits of detailed recording of patient data in paper and electronic format would help introduce the habit of keeping medical records to primary care physicians. Continuing education should also provide information to health care providers about best practices and future health care trends. Finally, health care personnel in leading positions, such as directors of HCs need to attend management and leadership training to be able to manage their organizations better.

Computer training needs to include hands-on practice on Windows applications and HCIS and on-the-job training during the first days of operation to facilitate integration of the computer into the actual workday. High priority should be placed on demonstrating the usefulness of the technology and the way it supports individual services and work performance (Chau and Hu 2002). Physicians in primary care must become convinced that HCIS offer desirable tools (Clegg 1988). “Response to implementation is shaped by physician perceptions of the usefulness of the system as well as of the changes it will bring to the performance of everyday jobs in the organization” (Anderson 1997).

Education increases the information flow in organizations and provides opportunities for self-organization. Exposure to information would benefit health care organizations and allow them to change in a proactive way to improve performance (Garside 1999). Learning organizations have a sense of direction and a vision. They pay attention to each individual within them. They are led and managed in a way that the learning of the individuals is harnessed towards improved ways of working.

Management of influential factors

Management of HCIS implementation requires attention to multiple success factors that have been identified from research and experience (Tan 1995). However, it has been noted that implementation lessons are not readily transferable to multiple contexts. Case study findings indicate that, although recommendations for successful implementation of HCIS are also relevant for health care settings in Crete, their meaning may differ according to the specific context. The education variable, for example, differs from the way it has been used in HCIS literature. Education in the literature refers to the number of years of formal education, while in the case studies education refers to the extent health care providers received training in general practice. In other words, it is essential to consider the meaning of success factors and recommendations to the particular implementation effort. Instead of developing exact
implementation plans to cultivate the necessary conditions for generating change from within, implementation methods can focus on loose control, encouragement of innovation, and direction setting. These methods appear to produce faster results than the traditional plan and control mentality. In contrast, plans may take too long and are usually not accurate or not followed.

**Change in health care**

Organizing primary care services, improving communication throughout the NHS, and implementing information systems, requires a considerable degree of change. In the traditional models of organizational change, all systems have the tendency to oppose change and seek equilibrium. When change does occur it is considered the result of imposition that disturbs the equilibrium. Organizational change efforts must struggle against this innate inclination.

The commonly unquestioned assumption, that successful organizations are attracted to a stable state of optimal efficiency of performance, creates the dominant prescription for securing organizational change, which is, the detailed identification and analysis of processes of resisting change. A major part of implementation initiatives concentrates on removing resistance through educational programs, establishment of new priorities and patterns of behaviour. Alas, this essentially linear view of governance that assumes the possibility of identifying logical links between cause and effect has resulted in comprehensive prescriptions that do not work (Beer, Eisenstat et al. 1990; Smith and Stacey 1997). In practice, change may occur rapidly or slowly; it may accumulate linearly or nonlinearly; it may be resisted or encouraged; it may take little or many resources; it may have a profound or no effect on system outcomes (Dooley 1997).

Case study findings demonstrated that health care providers have the ability to spontaneously self-organize in order to use a health care information system. Managing change as a process of self-organization requires noticing, encouraging, and amplifying departures from equilibrium. These departures from equilibrium are instances of novelty such as new ways of doing things. Under this view of organizational change, planning is no longer based on the accurate assessment of the current status of the organization, nor should it occur necessarily before an intervention. Planning involves the ongoing assessment of an organization while it changes looking simultaneously at its present state, its previous states and its future directions. Eventually novel processes may be incorporated into the way the work group or organization operates.

The nature of the medical profession has an inherent component of uncertainty and transformation (Heeks, Mundy et al. 1999). According to its philosophical foundations set in ancient Greece, it is a profession in flux, where continuous education and improvement occurs to face the spectrum of human condition (Pellegrino 2001). Hence, if health care providers view their profession as a vocation, the assumption of ‘reluctance to change’ is a mere paradox. The traditional view that the best way to improve care is to eliminate variation (Fineberg, Funkhouser et al. 1985; DeMott 1997) is being questioned (Miller, McDaniel Jr et al. 2001; Plsek 2001). The current competitive environment in health care calls for approaching change as no longer a problem to resolve but an opportunity to improve health care delivery and customer care. Non-linear change requires non-linear methods. Life is an ever changing and unpredictable process just as self-organization is. Thus, a model of change based on self-organization has the advantage of incorporating the unexpected.
The need for continuous transformation applies especially to primary care. General practice is one of the specialties with the largest range of variation in health conditions. In addition to keeping up to date with new advancements in medicine, primary care providers need to be involved in other aspects of health care such as health promotion, health prevention and community outreach. With the current global increase of chronic conditions (WHO 2002), primary care providers are called to be particularly flexible, to work in teams, and incorporate activities geared towards long-term care.

**Leadership**

The natural tendency of agents to change can be greatly influenced through leadership. The complex adaptive systems approach to leadership introduces the notion of facilitation rather than hard control and planning (Anderson and McDaniel 2000). To illustrate the new role of leadership in complex adaptive systems, leaders of health care organizations are said to resemble an orchestra conductor (Mintzberg 1998). Similar to the orchestra conductor, health care leaders are called to coordinate rather than control processes that occur within the organization. In health care organizations, this kind of leadership becomes particularly important because of their professional nature (Anderson and McDaniel 2000).

A complex adaptive systems view of health care leadership helps alleviate the anxiety introduced when strategies and planning encounter uncertainty. Health care leadership could be a process of unlocking the capacity of transformation within the health care team in facing global health care challenges (Anderson 1999). Leaders should create the conditions to effectively support self-organization through availability of information, relationship building, and identity formation. Leaders need to express strong intentions without necessarily having a set of action plans. They should be confident in the organization’s intelligence. Because dependency runs so deep in most organizations, employees often have to be encouraged to exercise initiative and explore new areas of competence. To promote effective care in general practice, leadership should be addressed as a priority. The education and training of leaders requires a broad vision and a pragmatic approach, which takes into account practitioners’ concerns and is compatible with the complex nature of their work.

**CONCLUSIONS**

The particular nature of this implementation effort provided an environment to study change springing from within. The timing of installations and the organizational context in individual sites influenced implementation. Analysis arrived at the same realizations with other authors (see Barley 1986; Sofaer 1999) that the nature and extent of organizational change varies across sites in implementations of the same intervention.

Taking this implementation effort as a model could facilitate similar implementation efforts in other regions. The unique character of health care settings prevents the direct application of lessons to different contexts. The autonomous cultures that comprise health care settings add to the complexity of implementation efforts. The changing and unpredictable nature of health care delivery and the organizational variation of health care institutions require an approach to implementation that is flexible and takes into account the autonomy of the agents involved. Emphasis is given on the impact of individual enthusiasm, commitment, and personal ability of individuals as the active conduits of information and cooperative resources. Individuals within a system disseminate knowledge, skills, and best practice so that the whole organization may become more technologically aware and competent.
In addition, emphasis is placed on the management of relationships as the foundation of the emergent behaviour in a complex adaptive system.

Complexity based thinking suggests that policy and operations should treat health care systems as a whole rather than as individual parts (Zimmerman, Lindberg et al. 1998). To influence change, leaders need to create systems “that disseminate rich information about better practices, allowing others to adapt those practices in ways that are most meaningful to them” (Plsek 2001).

BIBLIOGRAPHY


