IT Adoption and Evaluation in Healthcare: Evolutions and Insights in Theory, Methodology, and Practice

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ABSTRACT

This article focuses on the evolution of theory, methodology, and practice regarding the role of adoption, implementation, diffusion, and evaluation factors, and the interaction of these factors at various levels, to healthcare system success. These topics continue to present challenges to organizations, the research community, and to society in general. The first place that new waves of thought are often aired is at conferences. This article explores the evolution taking place in this domain by looking back through the years over work presented at the longest standing conference track focused on adoption, implementation, diffusion, and evaluation factors in e-health and the interaction of these factors at various levels to healthcare system success. [Article copies are available for purchase from InfoSci-on-Demand.com]

Keywords: Evaluation; Healthcare; IT Adoption

INTRODUCTION

Although Information Technology (IT) is seen as an enabler of change for healthcare organizations both nationally and locally, adoption decisions are complex given a multitude of technologies, stakeholders, and potential levels of analysis. The research presented in this article conveys the complexity and breadth of issues explored by information systems researchers in addressing adoption, implementation, diffusion, and evaluation via a multidimensional review of articles accepted over the past six years at arguably the most noted minitrack conference focused on IT adoption, implementation, diffusion, and evaluation in healthcare.
information systems. This review shows that there are many disruptions in the innovations of healthcare information systems. Continuous learning, evaluation, and understanding in both practice and research can help to avoid these disruptions and help to smooth IT implementation in the future.

The following sections move back in time to grasp the evolution of e-health adoption and evaluation. We begin by introducing that background and the methods used to conduct this literature review. We then present an analysis of trends, and insight from this body of past work by exploring evolution in theory, methodology, and practice. We close by addressing the future of e-health diffusion and some major lines of thinking.

BACKGROUND AND LITERATURE REVIEW METHOD

The entry for “academic conference” on Wikipedia® notes, “together with academic or scientific journals, conferences provide an important channel for exchange of information between researchers.” For purposes of reviewing the evolution and developments in a new and emerging area of interest, such as e-health as explored by IT researchers, it is important to consider conference papers and their associated presentations. While we acknowledge the value and necessity of reviewing work published in refereed journals to understand the school of thought in a domain or sub-specialty, we focus this work on conference papers to emphasize three issues. First, conferences often serve as the first airings of studies and ideas that later make their way into journals. Given the extended turnaround times between first submission and publication in some journals, fresh directions in research may not make their way into press until years after having been presented at a conference. Thus, in work such as the current study, that seeks to look at the evolution of thought, method, and practice, tracing representation in conference proceedings may more closely follow the timeline of the completed studies and present a broader picture. Second, in an interdisciplinary field such as health information systems, the ultimate journal destination of work presented at conferences may scatter and fragment into various journal domains making it difficult to reconnect the threads of thought, method, and practice in the work going on in the domain. Thus, we hope to encourage researchers doing work in this domain to follow our example and visit the work from targeted conferences in their canvas of the literature, even if only to trace the destination of subsequent journal articles that might otherwise be missed in a multi-disciplinary field. Third, topically targeted conferences and tracks/minitracks at general conferences tend to attract “birds of a feather” and thus, promote multi-way dialog on presented research. This dialog may, in turn, influence the direction of colleagues working in the area of interest.

We focus our study on the Hawaii International Conference on System Sciences (HICSS) - IT Adoption, Implementation, Use and Evaluation in Healthcare minitrack within the Information Technology in Health Care (ITHC) track. HICSS is the oldest international system science conference, and the Health Care track is the oldest of the information system conference healthcare tracks. The IT Adoption, Implementation, Use and Evaluation in Healthcare minitrack has been one of the focal tracks in the ITHC. Per online search and review of the agendas and programs from major IT general conferences and targeted meetings since 2000, the IT Adoption, Implementation, Use and Evaluation minitrack appears to be the longest running consistent track dedicated to this focused topic in the field of information systems. This minitrack started in 2002 and has been on-going to date. The average acceptance rate for papers in this track is approximately 50%. One or more of this article’s authors participated in the presentations and ensuing discussions of all the papers reviewed as part of the current study. Thus, the authors of this article have not only individually or collectively
read each paper, but have dialoged with authors
and seen the various reactions and spontaneous
thought generated by these works. Therefore,
this review is a reflection and interpretation
of not only what was written, but also of what
was said and discussed among participants.
We readily admit there are some limitations
in exclusion with the approach chosen for this
study. However, this novel lens of using the
continuity of the forum from a long standing,
respected conference forum for full papers
dedicated to this targeted topic may yield insight
into early trends that other methods may not.
Specifically, we hope to garner insight through
the advantage of longitudinal continuity, the
screening process, and the ability to reflect on
the papers along with the associated presenta-
tions and dialog.

Looking at this long-running track also
provides the vantage for perceiving evolution in
growth and interest in this topic. Between 2002
and 2009, 43 manuscripts have been published
in what is in HICSS 42, the IT Adoption and
Evaluation in Health Care (AEHC) minitrack
within the ITHC Track at HICSS. Although
the number of research publications within the
minitrack equates to 5.6 per year, since 2005,
which is the second official year for the current
minitrack, the average between 2005 and 2009
has increased by 2 manuscripts to 7.6 accepted
papers per year. More recent years have yielded
up to nine papers suitable for presentation and
publication, with growing audience attendance.
Elaborated versions of the research presented
in AEHC have been published in established
journals as CAIS, MISQ and more specific
healthcare IS journals as IJHS, IJMI, IJHTM
and others.

We summarize papers accepted into this
track in Appendix A. To delve into the collection
of papers, we begin by discussing their evolution
and insights in thought and theory. We follow
with a discussion of evolution and insights in
methodology and then move to evolutions and
insights in practice as evidenced by the research.
It is our hope that this review will assist research-
ers interested in this area leverage past efforts in
advancing theory, designing the methodology
of their study, and providing relevance and
connection to healthcare practice.

**EVOLUTION AND INSIGHT IN
THOUGHT AND THEORY ON
LEVELS OF E-HEALTH
IMPACT**

In this section, we analyze the collection of
studies from the perspectives of levels of
interest. Table 1 summarizes the representa-
tion of papers in the collection at each level of
e-health impact.

**IT Adoption: Individual Level**

Hu, Liu Sheng, and Tam (1999) and Lapointe,
Lamothe, and Fortin (2002), with their ap-

<table>
<thead>
<tr>
<th>Level</th>
<th>Number</th>
<th>Per cent</th>
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<tbody>
<tr>
<td>Policy/Governmental</td>
<td>2</td>
<td>4.651%</td>
</tr>
<tr>
<td>Organizational</td>
<td>13</td>
<td>30.233%</td>
</tr>
<tr>
<td>Project</td>
<td>5</td>
<td>11.628%</td>
</tr>
<tr>
<td>Individual – Providers (Physicians, nurses, etc)</td>
<td>14</td>
<td>32.558%</td>
</tr>
<tr>
<td>Individual – Health Care Consumer</td>
<td>3</td>
<td>6.977%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>43</td>
<td><strong>100.00%</strong></td>
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plication of the TAM model on telecare and level of analysis on clinical care, inspired us to create the research track. Both research teams have a totally different research approach but come to the same conclusions that usefulness or benefits are the main drivers for IT success in healthcare. Relevance can be used to explain usefulness (Schuring and Spil, 2002). Dhillon and Forducey (2006) draw our attention to the topic of adoption relevance in their telemedicine case study. The authors report that by involving all stakeholders in the project at various stages, without causing perturbation of the basic rehabilitation services delivery process, providers were able to increase their revenue and profitability; the patients realized savings by avoiding travel to a healthcare facility, saved valuable time, and in many cases, avoided serious medical complications resulting from delays in the delivery of services.

Topcan, Basoglu, and Daim (2009) bring together the emerging field of information services with e-health by explaining why telecare applications are adopted by healthcare professionals. Padmanabhan, Burstein, Churilov, Wassertheil, Hornblower, and Parker (2006), also acknowledge the individual level and point out the need for both objective and subjective measures in an evaluation of a handheld support triage prototype called iTriage, speaking to its impact on the quality of the triage decision making process.

The Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Morris, Davis, and Davis, 2003) was referenced in multiple papers including work by Trimmer, Wiggins, Beachboard, and Woodhouse (2008). In this study, “Electronic Medical Records Use – An Examination of Resident Physician Intentions,” physicians who were experienced with an EMR provided their perspectives on future use and adoption of EMRs. The UTAUT is also applied to e-health by Goh and Agarwal (2008) in “Taking Charge of Your Health: The Drivers of Enrollment and Continued Participation in Online Health Intervention Programs.” In this study, the authors analyzed responses from an online health portal to assess adoption and post-adoption of an online program. Their analysis provides a discussion of direct and interaction effects of a theoretical model. Schaper and Pervan (2007) show us a large quantitative UTAUT study in Australia with over 2000 responses which found that a positive attitude has significant influence on the use behavior.

Other authors go back to one of the sources of the UTAUT model and use the psychological models of Ajzen and Madden (1986) to describe the impact on the individual level. Ilie, Courtney, and Van Slyke (2007) use the Theory of Planned Behavior in a qualitative way. They end in saying that while the use of an Electronic Medical Record may be mandatory for the physician-residents in their study, if they had a choice, the majority of physicians would use the paper chart. A new dimension for technology adoption is discussed based on personality traits and the way in which they influence computer anxiety in a study by Brown, Deng, Poole, and Forducey, (2005). Computer anxiety, of course, is an inhibiting factor in the adoption of, in this case, telemedicine applications. Horan, Tulu, Hilton, and Burton (2004) also root their work in UTAUT sources to develop a conceptual model for physician acceptance and test this socio-work structure via a survey. The model is a micro approach as it focuses on work-practice considerations of physicians, factors affecting physicians’ acceptance and use of decision support system in the clinical setting and task-technology fit.

Relevance and perceived usefulness can be studied from a psychological point of view or from an individual cost/benefit point of view. LeRouge and Hevner (2005) propose Use Quality as a refined construct to the DeLone and McLean (2002) model in response to the underlying IT research assumption that there seems to be an appropriate manner and flow for system use. Within the telemedicine context, they define use quality as the practice of applying appropriate processes and protocols in the use of high-end telemedicine encounters to fulfill the desired purpose of patient care.
Bhattacherjee and Hikmet (2007) provide a dual-factor (perceived usefulness and perceived threat) model for assessing the implications of IT threats on an individual’s IT usage. This empirical study supports their hypothesis that threats will negatively influence IT use. Cho, Mathiassen, and Gallivan (2008) focus on a telehealth innovation that enables physicians at a teaching hospital to access and diagnose strokes in rural environments. The perspectives of various stakeholders regarding the innovation and its adoption are presented in this longitudinal research. Another longitudinal study, also addressing issues at a teaching hospital, is presented by Ryan, Doster, Daily, and Heslin (2008). They discuss the eventual process improvements that came about after the implementation of a new information system for the hospital’s preoperative services.

Finally, many individual adoption studies apply the Technology Acceptance Model (TAM) (Davis, 1989) model in its original form. Raittoharju (2005) derives from a general study that IT stress is a major inhibitor of acceptance in healthcare. The development of IT scores that assess IT capacities in healthcare is a critical step forward toward addressing important research questions involving the relationship between IT capacities and outcome measures. “IT Capacities Assessment Tool: A Survey of Hospitals in Canada” by Jaana, Pare, and Sicotte (2009) presents the development of an instrument for scoring IT capacities in Canadian hospitals. “The Importance of Being Useful and Fun: Factors Influencing Intention to Use a Mobile System Motivating for Physical Activity” by Svendsen, Soholt, Munch-Ellingsen, Gammon, and Schurmann (2009) studies the impact of a mobile phone based motivation system on modifying health behaviors, focusing on health interventions as “fun.”

All of the studies in this section have one important thing in common. They focus on the individual level and they find that the value proposition is probably the most important dimension of successful adoption of e-health systems. The value proposition has many disguises, Rogers (1995) called it relative advantage, Davis (1989) called it perceived usefulness and Delone and Mclean (2002) called it net benefits. The individual level studies present a range of examples addressing the nature of value to individuals in the healthcare environment.

IT Adoption: Organization and Project Level

On an organization level, previous strategic choices, strategic priorities, size and location of the organization, information assurance, and many other factors may play a role. Maass and Eriksson (2006) highlight managerial challenges encountered during the adoption of a Picture Archiving and Communication System (PACS) at Turku University Central Hospital (TUCH). The results are based on a five-year survey consisting of statistical data, cost analysis, modeling, customer satisfaction inquiries, time and motion studies, observation and staff interviews.

On a project level, resources, and project management play a role. Kiura (2006) focuses on the need to explore the project level by reporting on a project establishment undertaking as proposed by the STEPS (Software Technology for Evolutionary Participatory System Design) Methodology. Project establishment in STEPS is aimed at getting an inner understanding of a project’s environment. This article focuses on evolving a ‘participatory culture’ to assist in better understanding the project environment.

The contribution by Gagnon, Lamotte, Fortin, Cloutier, Godin, Gagné, and Reinharz, (2004) “The Impact of Organizational Characteristics on Telehealth Adoption by Hospitals,” analyses adoption on organizational level. It is structured around hypotheses that are based on previous research and that are tested on the basis of research in 32 healthcare centres involved as telehealth services. The contribution by Maass and Suomi (2004), “Adoption-Related Aspects of an IS System in a Health Care Setting” focuses on adoption of a digital image (PACS) system. It particularly considers financial aspects of this implementation.
Reardon and Davidson (2007) discuss that there is not enough organizational vision to overcome physicians’ hesitance to adopt Electronic Medical Records systems (EMR). Questions about interpretability, plausibility, and discontinuity of this innovation and organizational vision remain.

More evidence of the troublesome implementation problems on group and organizational level can be found in section 4 and in reviewing the papers listed in appendix A. Even if, as suggested in the previous section, the relevance of the e-health system is clear, the complex structure and culture of healthcare organization can disturb the successful introduction of IT systems.

**IT Adoption: National Level**

On a national system-level, reimbursement structures, regulations, inter-organizational concerns, and the existence of standards may have an explanatory role in the slow adoption and acceptance of healthcare IT. To this end, Sherlock and Chismar (2006) argue that the airlines’ evolution of computerized reservation systems (CRSs) provide lessons learned to analyze problems and issues in the development of electronic health records. CRSs’ turbulent evolution was driven by environmental, technological, and structural factors within the airline industry, which these authors assert is analogous to current trends in the healthcare industry and they predict that similar patterns of adoption will occur in electronic health records.

A second paper with a national focus is “A Telemedicine Transfer Model for Sub-Saharan Africa” (Kifle, Mbarika, Tsuma, Wilkerson, and Tan, 2008). Focusing on Information Communications Technology (ICT) and infrastructure, the authors report the analysis of survey data provided by physicians in twenty-one different African Nations. The results of their analysis provide policy makers in Sub-Saharan Africa with a perspective on ICT projects. In addition, research from Sood, Nwabueze, Mbarika, Prakash, Chatterjee, Ray, and Mishra (2008), “Electronic Medical Records: A Review Comparing the Challenges in Developed and Developing Countries,” provides a perspective on barriers to adaptation and implementation between different countries. “The Effects of Culture of Adoption of Telemedicine in Medically Under-served Sub-Saharan Africa”, by Meso, Mbarika, Kifle, Okoli, and Nwabueze (2009) reveals that ICT infrastructure and national health services facilitate improved telemedicine capabilities. However, in countries underserved by ICT and national health policies, telemedicine, while highly valued, remains scarce.

Burley, Scheepers, and Owen (2008), present a case study focusing on stakeholders, effectiveness, and efficiency issues regarding mobile systems in Australia. They present the advantages and the balance between the internal system requirements and external systems.

Although the international and national studies are not yet numerous enough to draw valid conclusions, it seems that telecare is being embraced by underdeveloped countries as one of the answers to their knowledge and information management problems. To solve these problems, good theory and methodology, as demonstrated in the next section, will provide a solid basis for the learning process.

**METHODOLOGICAL EVOLUTION AND INSIGHTS**

We canvassed the papers to provide insight to future researchers regarding methodology in healthcare IT research. We address multiple methodological considerations below to highlight methodological considerations that may intrigue and perhaps, inspire readers of the current paper through what has been done, or perhaps, through what is absent.

**Epistemological Perspectives**

The collection of papers includes interpretivist, positivist, and interventionist studies demonstrating that health IT can be studied from multiple epistemological perspectives. In their
study on resident physicians’ intentions to use EMR. Trimmer, et al. (2008), illustrate that IT research in healthcare can be done using an interpretive paradigm. In contrast, that same year, Ryan, et al. (2008), demonstrated that a positivist methodology of case research may also be used, in their investigation of the impact of soft innovation within a hospital environment, from empowered and integrated individuals driven by integrated information.

Fruhling, Tyser, and de Vreede (2005), followed the interventionist perspective using the action research model to evaluate the use of extreme programming for developing and implementing a biosecurity healthcare application. “Action research has the dual intention of improving the practice and contributing to theory and knowledge” (Fruhling, et al., 2005, p. 5). This approach may have merit in healthcare IT studies where the research question is “how” oriented; a depth of understanding is needed of the complex environment, and aligns itself well with the general call for continuous learning in the healthcare environment.

Kiura (2006) also uses action research to gain an inner understanding of a project’s environment in the early stages of a systems development project for a hospital in a developing country. Kiura’s intervention was to introduce participatory design concepts through Joint Application Design (Wood and Silver, 1995) and the Software Technology for Evolutionary Participatory System Design (STEPS) methodology.

### Method Type

IT in healthcare research calls to qualitative, quantitative, design science, and conceptual studies as can be seen by the distribution of methods in Table 2.

We elaborate below on the details of Table 2 to provide further insight.

### Quantitative Methods

Survey research was by far the most prevalent method used for collecting data in the healthcare IT studies presented in this HICSS minitrack. Many of the studies scrutinized technology acceptance and used previously validated items from the UTAUT (Venkatesh, et al., 2003) and related predecessor models to compose some or all of the survey questions.

In most studies the survey instruments were distributed to survey participants in only one form. Kifle, et al (2008) remind us of the importance of checking for method bias in their study which used both a web and a paper based version of a survey instrument. This may be of particular concern in the healthcare environment where users may be more infrequent computer users and prefer to use paper-based methods for response.

Regression, partial least squares, basic statistics, and structural equation modeling were the most frequent statistical analyses performed. Factor analysis, Chi-Square tests, analysis of variance, and principal component analysis were

<table>
<thead>
<tr>
<th>Method Type of Study</th>
<th>Number</th>
<th>Percent</th>
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<tbody>
<tr>
<td>Qualitative</td>
<td>14</td>
<td>32.56%</td>
</tr>
<tr>
<td>Quantitative</td>
<td>11</td>
<td>25.58%</td>
</tr>
<tr>
<td>Quantitative and Qualitative</td>
<td>7</td>
<td>16.28%</td>
</tr>
<tr>
<td>Design Research</td>
<td>5</td>
<td>11.63%</td>
</tr>
<tr>
<td>Conceptual Paper</td>
<td>6</td>
<td>13.95%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>43</strong></td>
<td><strong>100.00%</strong></td>
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Table 2. Distribution of methods of study
each used in one study. A rather unique form of analysis was performed by Brown, et al., (2005). They use the survey method to gather data on various traits proposed as exogenous determinants of computer anxiety for physical therapists using telemedicine systems. The traits were measured using LaForge’s Interpersonal Checklist (ICL) (LaForge, 1977) and computer anxiety was measured using a scale inspired by Thatcher and Perrewe (2002). The research is distinguished in method from others in our pool of papers regarding the method of analysis. The researchers measured respondent trait position along the quadrants in the Interpersonal Circumplex Model and used multiple contrast tests to test the proposed hypotheses.

**Qualitative and Mixed Designs**

Many of the papers using qualitative methods indicate their choice was made due to the need to gain a rich understanding of the healthcare IT context and of the stakeholders in order to address the research question. Qualitative studies may be conducted in a number of ways including case studies, interviews, direct observations, and focus groups. The collection of papers in this review clearly demonstrates that healthcare IT can be researched using many qualitative methods.

Interviewing as a stand-alone method or as part of a case study, was the most frequently used method of collecting data. Qualitative data from interviewing is often analyzed by coding key words and phrases into themes and categories. However, Wiggins, Pumphrey, Beachboard, and Trimmer (2006) used a method of analyzing qualitative interview data that consisted primarily of the creation of a case narratives to develop an accurate and rich description of a phenomenon as seen through the eyes of the interviewees.

The majority of the qualitative studies used a case method and collected data from many sources to facilitate both understanding and breadth, as well as for triangulation. Qualitative methods of data collection represented, in addition to interviews, include workflow modeling, focus groups, review of archival data, direct observation, and usability testing. Though the general characterization of many of these studies is qualitative, data collection frequently included quantitative elements, such as survey data, quantitative analysis of operational data, and time and motion studies. The study by Shaper and Pervan (2007) serves as an interesting example of triangulation using qualitative and quantitative methods. Schaper and Pervan (2007) tested their proposed model quantitatively in a national survey sent to 6453 Australian occupational therapists to provide cross-sectional data on behavioral intention and acceptance of ICT and other issues surrounding utilization of ICT. Interviews, direct observation and other case study field methods were used to qualitatively support the proposed model and the national survey was used to qualitatively support the proposed model. Paré, Mirou, and Girouard (2008) chose to employ another form of mixed qualitative and quantitative design, namely a ranking-type Delphi survey. In this study, the opinions of a panel of experts (i.e., clinical information systems project managers) were elicited through iterative, controlled feedback to build an authoritative list of clinical information systems implementation risk factors and determine the relative importance of these risk factors. A three-phase process was used: phase 1: risk brainstorming; phase 2: the combined list was circulated to all panelists for recommendations, additions, and, eventually, validation; and phase 3: ranking of the risk factors in order of priority to the project.

There is a range of how long one should spend in the field to perform a case study. Some studies report a time frame as short as three months. Others, such as Maass and Eriksson (2006), advocate a much longer time frame for an implementation study, perhaps extending into years. They argue that infrastructures grow and develop over a long period of time in healthcare contexts and an information infrastructure is built through extensions and improvements to what already exists—rather than from scratch. What is implemented has to be hooked into the existing infrastructure, which supports the
extended longitudinal approach if the goal is
to really understand not only the initial imple-
mentation and training, but also what happens
as users gradually integrate the system in their
work practices and learn the possibilities and the
limitations of the system. Maass and Eriksson
(2006) illustrate this through their case study
which analyzes data consisting of statistical
information, cost analysis, modeling, customer
satisfaction inquiries, time and motion studies,
observation and staff interviews.

Schaper and Pervan (2007) provide anoth-
er example of a longitudinal case study that
exemplifies using an extended time period for
comparative data collection points. This seven-
month longitudinal multi-method field study
was designed to test a proposed ICT acceptance
and use model and the associated individual and
organizational impacts of use or non-use within
a small non-profit, community-based healthcare
organization. The questionnaire was adminis-
tered at three points in time: one week post-
training, three months post-implementation and
seven months post-implementation.

**Design Research**

In reviewing Table 2, one might be surprised to
see Design Research as a category in a healthcare
IT literature review. To validate the propriety
of this category, we reviewed seminal design
research pieces (particularly focused on defining
design research) such as those by March and
Smith (1995) and Hevner, March, Park, and
Ram (2004). We also consulted the Associa-
tion of Information Systems, which provides
a compendium of Design Research thought
and references (http://www.isworld.org/
Researchdesign/drisISworld.htm) and
provides an appropriate summary for the pur-
poses of the current paper. This compendium
indicates:

*Design research involves the analysis of the
use and performance of designed artifacts to
understand, explain and very frequently to im-
prove on the behavior of aspects of Information
Systems. Such artifacts include - but certainly
are not limited to - algorithms (e.g. for infor-
mation retrieval), human/computer interfaces
and system design methodologies or languages.
(Association of Information Systems, 2008)*

The intent of including this category in this
paper is not so much to debate the semantics
doing research, but to properly identify and
showcase a particular group of papers in our
collection that stood out from the more clas-
sic methodological definitions. The primary
purpose of the papers in our “design science”
category is to leave the healthcare IT research
community with an artifact for future work.
Thus, we reviewed the methods of the papers
included in this study for those with a primary
focus of identifying a problem, providing a
suggestion, and developing an artifact for ad-
dressing the problem for practitioners and/or
researchers to use. Some authors extended this
to include evaluation and results of using their
artifact in practice, thereby addressing additional
steps in the design research process.

To illustrate, the artifact in Fitch’s (2004)
work, the Ilities Application Method, has the
intended purpose of aiding communication,
closing the knowledge gap, correctly establish-
ing system requirements, and putting a system
into place that is fit for its purpose. The Ilities
Application Method and its associated templates
are stated to be tools for practice and research.
In another design science study, Mantzana and
Themistocleous (2006) design and evaluate (via
case study) a methodological artifact designed
to help (a) address the uncertainties related to the
actors in a healthcare setting during adoption,
(b) enhance existing adoption models, (c) facili-
tate healthcare organizations in making robust
decisions and (d) provide guidance to increase
adoption of innovations. Their study focused
on identifying actors involved in the innovation
process within healthcare organizations.

It is not surprising that many of the papers
that we classify as design research relate to tools
and algorithms used for assessment, as artifacts
which are needed for evaluating pre-existing
tools and processes may not work with emerging
technologies. The first of these types of papers appeared in 2006. Randomized control trials (RCT) are often referred to as the gold standard of evaluation for interventions in the healthcare sector. However, RCT’s may not always be possible or provide the complete picture when it comes to healthcare IT evaluation. As part of their contribution, Dhillon and Forducey (2006) develop and illustrate the execution and benefit of a methodology for evaluation that considers Access to Health Care, Quality of Care outcomes and satisfaction, and Cost of Care for evaluating telemedicine systems.

The collection of 2009 papers includes two design research papers related to evaluation artifacts. Jaana, Pare’, and Sicotte (2009) introduce an IT assessment scoring tool that aims at capturing the level of IT sophistication in hospitals on eight IT dimensions related to the implementation of computerized processes and emerging technologies with the level of internal and external systems integration. The instrument was validated through a survey of hospitals in two provinces in Canada (Québec and Ontario). The study by Roberts, Ward, Brokel, Wakefield, Crandall, and Conlon (2009) assesses the methods researchers use to evaluate health information systems and scrutinizes the recommended metrics and algorithms in the context of a case study that describes the introduction of a technically and systematically complex implementation of a healthcare IT system. They advocate that the analytical approach used should integrate: “(1) key engineering-derived tools such as statistical process control run charts designed to allow a visual examination of fluctuations in process over time and to help identify if those fluctuations are due to random events or a systematic change; (2) a human factors approach that considers the effect of an innovation’s implementation upon the human interactions within the system; (3) the capture of robust data that enables stronger analyses of system performance; and (4) appropriate quantitative statistical tools designed to analyze and interpret system models” (Roberts et al., 2009, p. 2). The researchers report on the benefits of using their linear piecewise spline mixed effects algorithmic model with a jump that the knot to address these concerns.

**Conceptual Work**

The conceptual papers in this collection provide an in-depth discussion of topics on which the authors have taken a position and want to point out issues which may be often overlooked in research efforts and in practice. Regarding the overlooked or missed, Raitoharju (2005) indicates that IT stress is an issue in the healthcare sector and should be taken into account in evaluating adoption and acceptance. Sood, et al., (2008) illuminate the unique challenges faced by developing countries toward the development, progression and sustainability of electronic medical records. Sherlock and Chismar (2006) use a compare and contrast approach to highlight lessons from the airline reservation system that may be applied to the future of electronic health records, but not readily recognized. Khoumbati, Themistocleous, and Irani (2005) illustrate both the advantages and disadvantages of various integration technologies (e.g. web services, enterprise application integration) that healthcare organizations are exploring and implementing that may be missed by practice and research. McCleod and Clark (2007) put the spotlight on issues of incorrectly identifying the user of health information systems. Yusof, Paul, Lampros, and Stergioulas (2006) review health information system evaluation studies and take the position that the current models are deficient. They then present a research framework that extends the then current models of health information system evaluation.

**Experimental Design**

Padmanabhan, et al., (2006) conduct a “two group post-test only” laboratory experiment to evaluate the extent to which a triage prototype used as a decision support tool, impacts the quality of the triage decision-making processes and outcomes. The twenty-nine participants in the experimental groups attempted ten test case scenarios in random groups of five using
the triage system. The control group attempted the same randomized case scenarios using paper and pencil. The “effectiveness” of the decision making process (degree of problem understanding, perceived clarity of choice strategy, perceived clarity of the problem solving process, user satisfaction, user confidence and perceived usefulness) and the “efficiency” of the process (accuracy, consistency and actual implementation) were compared for each group via the post-test.

The papers for the 2009 conference indicated in increasing interest in experimental design. Roberts, et al., (2009) use a longitudinal experimental design and analysis to study the trends in adverse drug events (ADEs) and the potential detection of them through HIT implementation. Another 2009 paper introduces the first field experiment by Paré, Sicotte, Chekli, Jaana, and De Blois (2009). The research team used a pre-post research design to evaluate the effects associated with the deployment of a telehome care system.

Sources of Data

One of the issues in designing a healthcare information systems research study is deciding what data to collect from whom. There are multiple resources in this complex environment and deciding on the best sources of data may be challenging.

The system user is the desired source of data in many of the studies on adoption, diffusion, use, and evaluation. However, identifying the user or knowing from which user to solicit data may not be as obvious as it seems in a healthcare setting. Regarding user identification, recent work by McLeod and Clark (2007) highlights the vulnerabilities of making incorrect assumptions regarding who is the health technology user and the impact user misconception can have on the results of the research. They indicate that multiple past studies in adoption and diffusion have focused on the physician as the primary user of health information systems technologies. However, by grounding our definition of use and performing closer inspection, the actual primary user that should be the subject of study in many cases may be another medical professional, such as a nurse or even support staff. Similar misconceptions may occur in designing studies when assumptions are made that a patient is the user of a consumer health web site or other technology. On closer examination, the system under study may actually be used more often by a caregiver in the home.

Multiple studies have also underscored the importance of soliciting data from multiple stakeholders, as there may be a variety of perspectives and pockets of complementary system knowledge when it comes to healthcare IT. Fitch (2004) contributed “Information Systems in Healthcare: Mind the Gap.” It considers the knowledge gap and communication ambiguities between healthcare professionals and information technology planners that can result in incorrect translation of user requirements into system requirements. LeRouge and Hevner’s (2005) work highlights the importance of data collection from all direct participants for health technology process design and evaluation. This team illustrated that the perspectives of multiple participants (patient, provider, presenter/medical personnel in the room with the patient) were needed to landscape a comprehensive picture of key attributes to assess quality in telemedicine encounters. Though the groups identified often share common attributes, each participant group possesses unique attributes, given their perspective and role in the process.

The research studies in our collection vary in their treatment of the various types of medical professionals (e.g., physicians, nurses, technicians) as one subject pool or distinct subgroups. Wu, Wang, and Lin (2005) do not distinguish these user groups in assessing what determines medical professionals’ acceptance of mobile healthcare systems. Mantzana and Themistocleous (2006) take the position that the factors affecting adoption may vary by stakeholder. This team illustrates a method that researchers and practice can use to identify and detail the complex network of stakeholders in a healthcare information system to illuminate different adopter categories and different per-
spectives on the role of an IT system in various parts of the healthcare delivery process.

Goh, and Agarwal’s (2008) work reminds us that primary data collection from human stakeholders is not the only source of data for healthcare IT. Their study used data analysis based on de-identified archival data from a health-program provider company that hosts its programs on a popular online health portal site. The data source was provided as a snapshot from the company’s database. The information that serves as the input for the analysis was drawn from the users’ responses to health risk appraisal (HRA), users’ activity logs, and users’ enrollment and participation in the health intervention programs.

Having reviewed the various levels of study and the methodologies employed, we turn now to evolutions and insights regarding the actual applications and uses of healthcare IT investigated in our collection of papers.

EVOLUTIONS AND INSIGHT IN THE USE OF TECHNOLOGY IN HEALTH PRACTICE

Electronic Medical Record Systems

There are at least three different, yet very closely related applications in this area. An Electronic Medical Record (EMR) is an active tool that provides access to decision support, resources, and alerts. Electronic Patient Records (EPR) goes one step further than EMR: it contains healthcare related information gathered across at least two health organizations. Finally, Electronic Health Records (EHR) is still broader in that it includes wellness information and information that is not routinely collected or kept by health facilities. These three terms, EMR, EPR, and EHR are often used interchangeably by health professionals to describe the same thing; however we would like to start this section with the acknowledgement that, at least technically, there is a slight ascending order among them.

We start with what might be an unusual parallel between the airline and healthcare industries. Sherlock and Chismar’s 2006 work points out a somewhat surprising number of analogies and similarities between these two very large and complex industries and predicts that, just as the airlines’ computerized reservations systems evolved into vertically integrated, interoperable systems, so with healthcare’s EMRs. Until that day, however, researchers continue to investigate the adoption, acceptance, and implementation of EMR throughout the world.

Of concern to many, is the attitude of physicians in regard to EMR. A 2007 study by Ilie, et al., investigated factors that most contribute to physicians’ attitudes about, and usage of, EMR. Using Theory of Planned Behavior and a case study approach, this research postulated that physicians’ EMR behavior would be primarily determined by their attitude and perceptions about EMR use. They found that a majority of the residents and attending physicians identified the complexities of using EMR as a major negative influence on their perceptions and that the EMR system that they were using was not compatible with the workflow of the physicians.

In a similar vein, Trimmer, et al., (2008) found that while overarching attitudes regarding the EMR were positive, a consistent concern voiced by residents was ease of use. Residents unanimously commented on the importance of the accuracy of patient documentation and the ability to easily locate data. Performance expectations related to either gender or age were not observed. In the next iteration of their inquiry, “Prior Experience and Physicians’ Intentions to Adopt EMR,” Wiggins, et al., (2009) investigate one specific mediating factor of the UTAUT theory: the impact of prior experience with EMR. This preliminary work demonstrates that at least among this group of residents and physicians, there is not necessarily a positive relationship between experience with EMR and a physicians’ intent or desire to adopt it.

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Finally, with private physician practices as the unit of investigation, Reardon and Davidson (2007) posed the question of how physicians perceive the organizing vision for EMR and found that stakeholders need to do a better job of communicating the plausibility of EMR and at presenting representations of the EMR before an independent physician practice will find the organizing vision as clear, consistent, rich, and as balanced as it needs to be to be approved for adoption.

Moving away from questions about physicians and their reasons for or against adopting and using EMR, MacKinnon and Wasserman (2009) ask “What are the critical success factors for EMR systems implementation?” and propose that an understanding of Enterprise Resource Planning (ERP) systems will contribute to the successful implementation of EMR systems. They yielded strong support for the proposition that treating EMR systems as a type of ERP was a success factor for implementation. Other insights include the necessity of choosing a CHIT certified and a KLAS evaluated EMR system.

Demonstrating that EMR adoption and implementation is a concern worldwide, “Electronic Medical Records: A Review Comparing the Challenges in Developed and Developing Countries,” by Sood, et al., (2008), indicates challenges faced in developing countries hinder the development and progression of EMR and the authors suggest that developing countries may need to build on current structures of healthcare data bases and with technologies which have already been shown to work and add only relevant and disease specific modules unique to each country’s needs over time.

In concluding this discussion of EMR, it is vital to point out that EMR has been, and continues to be, touted as the answer to any number of problems plaguing the healthcare industry. The studies above are a strong indication that this area of research is rich, with much yet to be investigated. EMR is a worldwide topic that can be viewed and investigated through a narrow user/organization lens or through a wide-angle national/global lens. As one of the primary impetuses for the use of EMR is to enhance and enable access to, and communication of, health information among caregivers, patients, health organizations, regional systems, and perhaps nations, many questions remain and much work remains to be done.

Clinical Systems

We move now from EMR to the investigation of IT systems used to support specific activities in clinical settings. The findings in this area are somewhat mixed. For example, the 2005 work done by Padmanabhan, et al., described an evaluation methodology for assessing a mobile triage support system on a handheld PDA. The researchers found few opportunities for improving the level of patient care by triage nurses using the decision support technology. More recent research by Burley, et al., (2008) on a similar topic asked in what way do mobile systems deliver internal value in emergency healthcare organizations? Their work indicates that the introduction of mobile services can support ambulance services by providing more efficient and effective information. Yet the authors caution that there is a delicate balance between internal data capture requirements versus external requirements of readability of the final electronic patient care record.

Indeed there is a well-established mythology in healthcare that describes failures in the implementation, use, and adoption of clinical IT. In their 2008 paper, Paré, et al., investigate the typical risk factors associated with clinical information systems, electronic patient record systems, picture archiving and communication systems (PACS), and computerized physician order entry system projects. The researchers then go on to ask “What is the relative importance of these risk factors?” Hypothesizing that the success of any given clinical information system project lies in the ability to identify the risk factors in order to reduce them and thus to improve chances of success, this work finds that failure rates due to unidentified and unanticipated risk factors still prevent clinical information system projects from being benefi-
cial. Managers need to recognize what typical project risks are and their impact of these risks on project success.

Perry (2007) considers the options for process-based systems as "assistants" to professional mental health staff, and considers the extent to which such systems can complement or manage types of tacit knowledge, such as 'know-how' or emotion. The central problems identified in this study are that mental health staff find that person-to-person knowledge transfer is reassuring, and trustworthy, while electronic methods are seen as untrustworthy. These findings underscore the idea that there is no evidence that IT-mediated knowledge transfer conveys social reassurance.

Still, all is not doom and gloom. The 2009 research, "On The Economic Role of RIS/PACS in Healthcare: An Empirical Study" from Ayal and Seidmann presents a case study measuring process times and revenues, as well as survey results from staff and customers about perceived operational benefits of integrating RIS/ PACS into a health system. It was hypothesized that RIS/PACS would improve billing, significantly reduce diagnostic exam times, and improve customers’ level of satisfaction of the diagnostic imaging service. Patterns in the surveys were identified using the Principal Components Analysis (PCA) methodology. Results show that physicians were satisfied with their level of interaction with departmental personnel, though customers were indifferent with the quality of the services.

What becomes abundantly clear when considering the clinical applications of healthcare IT is that this is an emerging area that will continue to grow and evolve. Indeed, it is an area that is at the very crux of multidisciplinary research. The places where disciplines intersect, such as nursing and quality, or clinical laboratory and patient satisfaction, are fertile and important areas for future research.

Administrative Applications of Health Information Technology

One could easily argue that EMR and telemedicine applications are excellent examples of administrative uses of HIT as they are seen as avenues to increased efficiency, access, and quality. These applications have been discussed above. The use of information technology in healthcare began with business applications such as accounting and billing and potential administrative applications of HIT continue to be investigated. A case in point is Fruhling, et al., (2005) work that examines the development and implementation of a biosecurity healthcare application. This paper focuses on programming and software engineering, but still makes the point that as terrorism, infectious agents, dirty bombs, and other chemical threats become more likely, healthcare as the largest information business in the US, needs to turn to technology applications such as telehealth to develop and implement biosecurity applications for healthcare.

Another example of research that addresses the administrative uses of IT is Khoumbati, et al.'s 2005 paper on Enterprise Application Integration (EAI). The integration of healthcare information systems with EAI is described with respect to the way they can be integrated at both an internal hospital level and externally with other hospitals, primary healthcare providers and with other stakeholders. The author identified technical, cost, medical errors, decision support system, security, and confidentiality of patients’ data as factors that motivate the adoption of EAI in healthcare organizations. The authors conclude that, from a business perspective, EAI reduces the overall integration cost due to the reduction in integration time and maintenance costs.

Telemedicine

A broad number of applications under the umbrella of telemedicine have been increasingly investigated over the years. Telemedicine is the use of telecommunications for the care of
patients and can involve a number of various electronic delivery mechanisms. The overarching research questions about telemedicine investigate its acceptance and effectiveness. For example, Wu et al., (2005) studied mobile applications asking what determines health professionals' acceptance of mobile healthcare technology, they conclude that compatibility and self-efficacy have significant influence on intentional behavior. Management support, as they had hypothesized, did not influence behavior in this study. Dhillon and Forducey's (2006) "Implementation and Evaluation of Information Technology in Telemedicine" reviewed effectiveness evaluation techniques of telemedicine systems. They report on the successful utilization of HIT in regard to access, quality, and cost in a rural telehealth system. LeRouge and Hevner (2005) indicate that the way technology is used may affect effectiveness in defining quality for medical video conferencing.

In 2008 three research teams investigated three very different and very specific applications of telehealth. Goh and Agarwal (2008) asked these research questions: 1) what factors affect an individual's initial enrollment in an online health intervention program, 2) what factors affect continued participation in the program, and 3) how do the drivers of initial participation differ from those of continued involvement? They found that individuals who are less satisfied with their life and their work are more likely to enroll in a program, social ties are not significant in predicting enrollment, and perception of individual risk of contracting the illness has a positive and significant effect on enrollment. In addition, they found a strong moderating effect of gender, which suggests that gender plays a central role in sustaining participation; site owners need to consider increasing their efforts in sustaining the participation for females more than for males.

Cho, et al.'s (2008) work investigated how a telehealth innovation evolved from its initial adoption by a small network of hub hospitals to wider diffusion into a larger population of rural organizations. Their study resulted in six specific recommendations for success: 1) Develop a long-term plan for post-pilot stages, 2) Position innovation as a win-win proposition, 3) Align with rural hospital processes, 4) Accommodate rural area technology infrastructure issues, 5) Consider institutional arrangements and legal issues and, 6) Build and manage the knowledge base from initial adoption.

Then, in a completely different vein, Kifle, et al., (2008) examined Information and Communication Technology Transfer (ICTT) as it applied to telemedicine in Sub-Saharan Africa. Positioning that telemedicine capabilities are positively related to social outcomes of telemedicine, this research found that social outcomes of telemedicine are positively related to value outcomes of telemedicine. Specifically, policies that favor the development of ICTs in general are positively related to telemedicine capabilities, policies specifically tailored to ensure data security and standards are positively related to telemedicine capabilities and to the level of ICT infrastructure, policies specifically tailored to promote the application of ICTs in healthcare are positively related to the level of ICT infrastructure, and that more reliable and readily accessible ICT infrastructure is positively related to telemedicine capabilities.

The investigation of telehealth and factors that impact its acceptance is an overarching theme for the 2009 conference. Are there specific characteristics that are related one's willingness to accept and use telehealth applications? For example, does culture play a role in the adoption of new telemedicine technology? Meso, et al., (2009) find that, among underserved communities, culture significantly influences individuals' intentions to use new technology prior to the implementation of the technology. However, once the telemedicine technology is in place and individuals become more familiar with using it, culture no longer plays a significant role in usage behavior. In a similar line of inquiry, Topacan, et al., (2009) interviewed potential users of telemedicine and asked semi-structured, open-ended questions to study and analyze their perceptions of a prototype service developed for the study.
These researchers found that characteristics of the potential users (such as age, education level), cost of services, security, time use, and social factors would influence the adoption of a health information service such as telemedicine among the study group participants.

Taking a slightly different approach, a 2009 study by Svendsen, et al., (2009) of mobile phone based, tailored motivational systems investigated whether they would help to combat growing health problems associated with a lack of physical exercise. Study questions were related to motivation, self-efficacy in regard to exercise, and TAM related issues. Behavioral intention and acceptance of the mobile system was driven by an individual’s intrinsic motivation and by the perceived usefulness of the application. The researchers suggest that mobile phone based motivation systems will work best if presented to the public as fun and game-like, and only secondarily if offered as a health enhancing tools.

One study asked, “What are the impacts of the implementation of software aimed at optimizing clinical services delivered at patients’ homes?” Paré, et al., (2008) concluded that the implementation of the telehome care software had positive effects on staff productivity and upon accessibility to care services. Specifically, the software allowed the allocation of an additional hour that was used on patient care. Nurses were able to increase the number of home visits as well as devote more time to patient care rather than on paperwork.

Overall, it appears that the use of telecommunications is increasing in healthcare. The important question remains, what is the overall impact of traditional telemedicine media and emerging devices such as mobile phones and hand-held instruments on quality, access and cost?

**FUTURE OF E-HEALTH ADOPTION AND EVALUATION**

This analysis roughly follows the diagonal of table 3 that highlights the results. For nearly more than two decades researchers on e-health have explicitly shown that value, benefits, perceived usefulness or relevance are the most important determinants for successfully implementing e-health systems in the clinical domain. For almost two decades, practice seems to ignore these scientific findings and continues to introduce standard software in a complex individual medical setting with many disappointments as a result. How can we break through this deadlock situation? Many researchers think that Business Process Management (BPM in table 3) will help to diffuse information systems in healthcare. We think that this will only be the case when e-health provides value driven from an individual perspective of the healthcare professional. Many e-health applications only deliver efficiency as net benefit (see Table 3) and often this efficiency is delivered on the wrong side of the organization. It is therefore important to identify the individual stakeholders (table 3) and know who the end user is (in Telemedicine often the patient) and who will exert the effort to implement the system.

On the group and organizational level, the main challenge is to integrate the back office and front office (see Table 3) of healthcare. Instead of EMR, here we are talking about ERP (enterprise resource planning) in healthcare or about enterprise wide systems combined with information services in the front office. Enterprise Application Integration is already widely used in business, but healthcare is just in its first steps toward integration. Another challenge on the organizational level is to manage the clinical systems and avoid unanticipated risks (see Table 3). In the future, integration in general, by using standards and building inter-operable architectures, will have to stabilize the turbulence in e-health implementations. Because Electronic Medical Records have a value beyond the individual end user, the organization must create vision on how to communicate this to the whole healthcare chain and back again to the end user. On even larger scale, an ICT infrastructure is needed to be able to bridge the digital divide.

Interorganizational systems and mass customization are buzzwords that have strong
Table 3. Overview analysis

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<thead>
<tr>
<th>LEVEL/APPLICATION</th>
<th>EMR</th>
<th>Clinical systems</th>
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<td>(Inter)national</td>
<td>Healthcare Databases</td>
<td>Knowledge</td>
<td>Standardization</td>
<td>Big Leap Forward</td>
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Influence on the globalization of e-health. Telemedicine is seen as a weapon to break down the digital divide in healthcare and promises a big leap forward (see Table 3). Global systems like Google Health seem to break open the market, but still the dangers at the individual professional level might inhibit the diffusion of these systems. In the end, these systems have to evolve into knowledge management systems that can leverage healthcare at the global level. On the international level, standardization and knowledge dissemination should go hand in hand to solve global healthcare problems.

CONCLUSIONS AND DISCUSSION

This comprehensive review of HICSS papers underscores our understanding that adoption decisions are complex given a multitude of technologies, stakeholders, and potential levels of analysis when technology is introduced into healthcare settings. The research reviewed spans different technologies such as telemedicine, telehomecare, enterprise wide systems including RIS/PACS and EMR, infrastructure, and capacity assessment. Research in this area addresses implementation, intention to adopt and use, culture, performance, interventions, and methodology. Individual, organizational, and (inter)national levels of analysis are represented.

Many studies focus on the individual level and concentrate on adoption rather than on implementation. Although perceived usefulness and performance expectancy in all quantitative studies are significantly related to e-health success and many qualitative studies report on value, benefits, and relevance to the professional, the value proposition remains under-developed in healthcare. Moreover, even if the value of e-health is evident, there is much difficulty in implementing these systems due to lack of participation and resources. The risks on the group, organizational and (inter)national level are high with many stakeholders with many different interests.

In recent years, the international level and specifically the digital divide, has become a theme in e-health evaluation. Transferring knowledge across the digital divide will be an important subject on the international calendar. Also international comparisons might strengthen national initiatives when cultural differences are considered.

Results show a multitude of methodologies varying from quantitative psychological studies to qualitative demographic case studies to design science. The span and divergence of research methods underscore the complexity of this context and the fact that a multitude of studies and methods are needed to gain understanding. Though the scope of each individual study is limited, the collection of studies call researchers to consider mixed methodologies. The presence of design science pieces demonstrates that tools, techniques, and frameworks acknowledge the need for a planned and organized method of approaching the challenges of, and many variables involved in, implementation and evaluation in practice.

In addition to the many messages discussed above, readers should interpret this communica-
tion as a welcoming call to the many opportunities that are available in e-health research. The wide range of research approaches and levels of analysis should be appealing to a broad set of researchers, as we work toward improving the adoption and evaluation of Information Technology and its eventual benefit to improved societal healthcare.

ACKNOWLEDGMENT

We would like to thank all authors and referees for contributing to our successful Hawaii International Conference on System Science minitrack and hope to work with you in the future.

REFERENCES


of the Hawaii International Conference on Systems Sciences, Hawaii.


**ENDNOTE**

1 This track has undergone some minor name changes over the years.
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Note: The table continues with similar entries for different domains and methods.
Ton AM Spil (1964) is researcher at the capacity group information systems and change management at the University of Twente. He did his PhD thesis on the effectiveness of IT governance and after that he specialised in the application area healthcare and professional organisations. In 2000 he was project manager on a big e-health research project on electronic prescription systems for general practitioners. He edited two books for the IDEA group and chaired the healthcare track on several major conferences on information systems (ECIS, HICSS, IRMA). The main subject of research in 2009 is the governance and inter-organisational aspects of information strategy and the user satisfaction of IT in healthcare (USE IT). He published in international journals on both subjects.

Cynthia LeRouge is an associate professor at St. Louis University in the decision sciences and information technology management department. Her current research interests relate to health care information systems, and in particular telemedicine and consumer informatics. She has over 60 publications including academic journal articles, including edited chapters in research-based books, and peer reviewed conference proceedings. Dr. LeRouge has co-chaired health care minitracks for various information systems conferences. She has also served as a special guest editor for the European Journal of Information Systems' special issue on Health Information Systems Research, Revelations and Visions. For the last year, she has actively worked as an executive board member of the Association of Information Systems special interest group for Healthcare Research and currently serves as the Chair. Dr. LeRouge has held various senior management roles in practice including roles in the software and healthcare industries prior to joining academia.

Ken Trimmer is an associate professor of computer information systems and accounting in the College of Business at Idaho State University in Pocatello, Idaho, where he is also a member of the Informatics Institute. He holds a PhD in management information systems from the University of South Florida, a Master’s of Accounting from Washington State University, a Master’s of Business Administration from Western Carolina University, and the Bachelor’s of Science in Business Administration with a concentration in Accounting from Bucknell University. His research interests include implementation and adoption issues with Electronic Medical Records, to Information Assurance issues in EMRs and systems design. Additional research issues, such as enterprise resource planning, database, and use of decision making tools are reflected in his pedagogical interests. He co-chairs a minitrack in adoption and evaluation of information technology in healthcare at the Hawaiian International Conference on System Sciences.

Carla Wiggins earned her undergraduate degree in Health Services Administration from Ithaca College, Ithaca, NY and her doctorate in Health Services Research, Policy, and Administration from the University of Minnesota, Minneapolis, MN. She has served as Program Director and Chair of Health Care Administration at Ithaca College, Franklin University in Columbus, OH, and at Idaho State University in Pocatello, ID. She is a frequent author and speaker both locally and nationwide. Her current research interests include the use of IT in healthcare, “green” sustainability for health organizations, and health organization management.